

Seed Bank Dynamics of an Oregon Montane Meadow:
Consequences of Conifer Encroachment and
Implications for Restoration



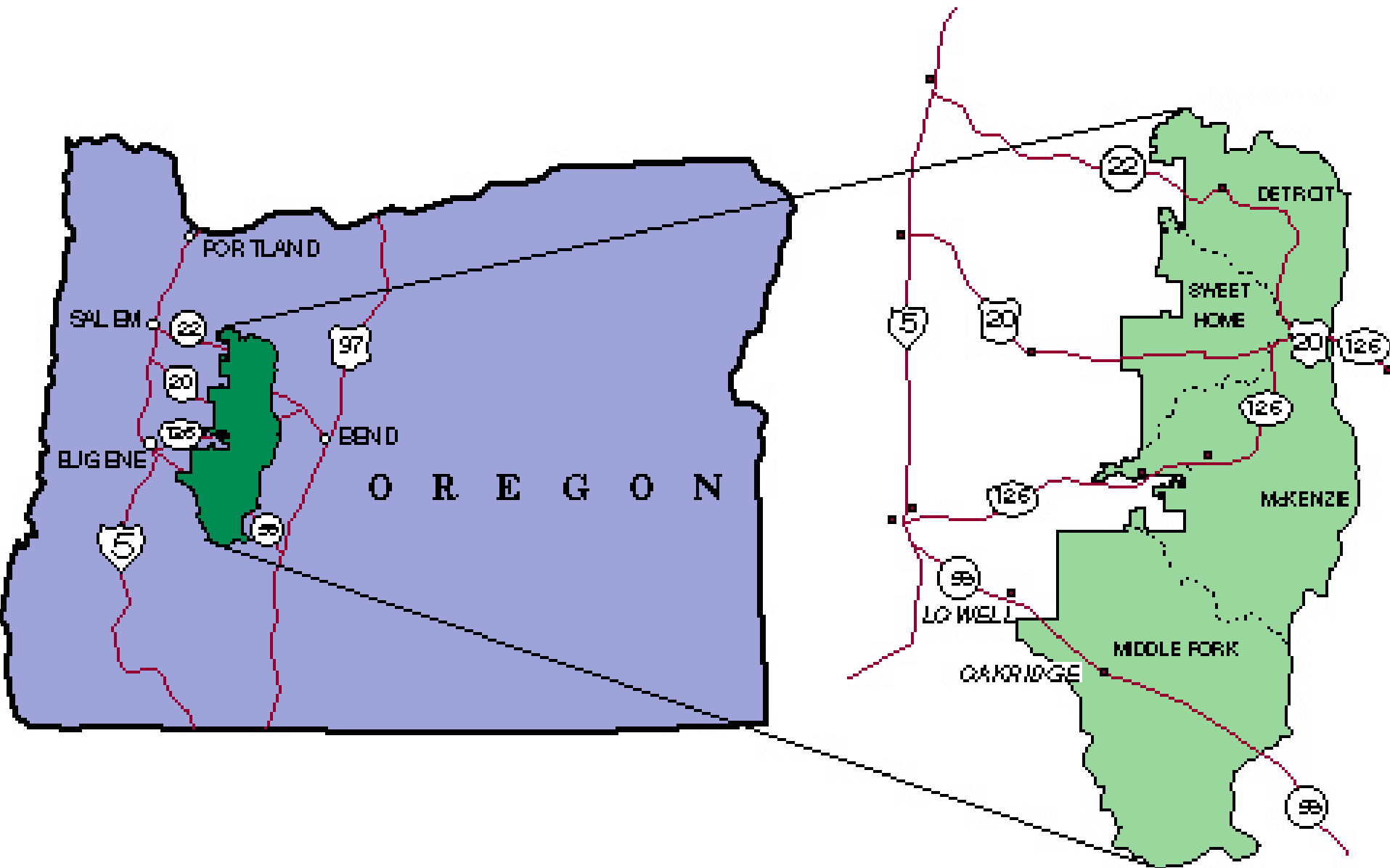
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16 March 2006

Study Site: Bunchgrass Meadow, OR



Study Site: Willamette National Forest, Oregon



Study Site: Dominant Vegetation at Bunchgrass



Overstory:

Abies grandis (Grand Fir)
Pinus contorta (Lodgepole pine)

Understory:

Smilacina stellata
Achlys triphylla
Galium oreganum
Anemone oregana
Asarum caudatum

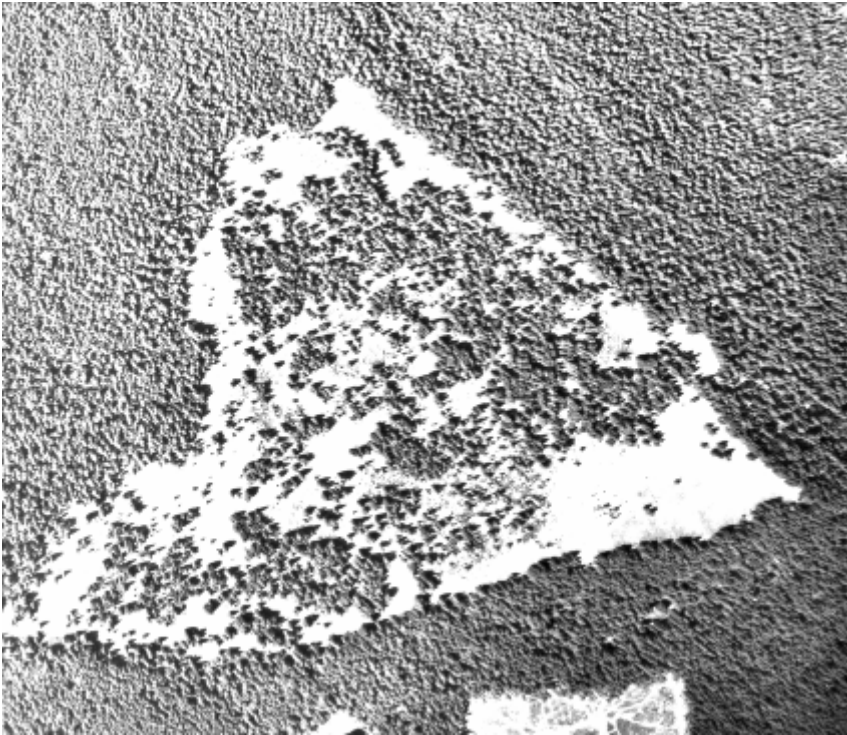
Meadow:

Festuca idahoensis
Bromus carinatus
Achillea millefolium
Fragaria vesca
Lupinus latifolius



Study Site: Conifer Encroachment at Bunchgrass Meadow

1946



1997



Study Site: Potential Consequences of Conifer Invasion

- Loss of floral diversity supported by meadows



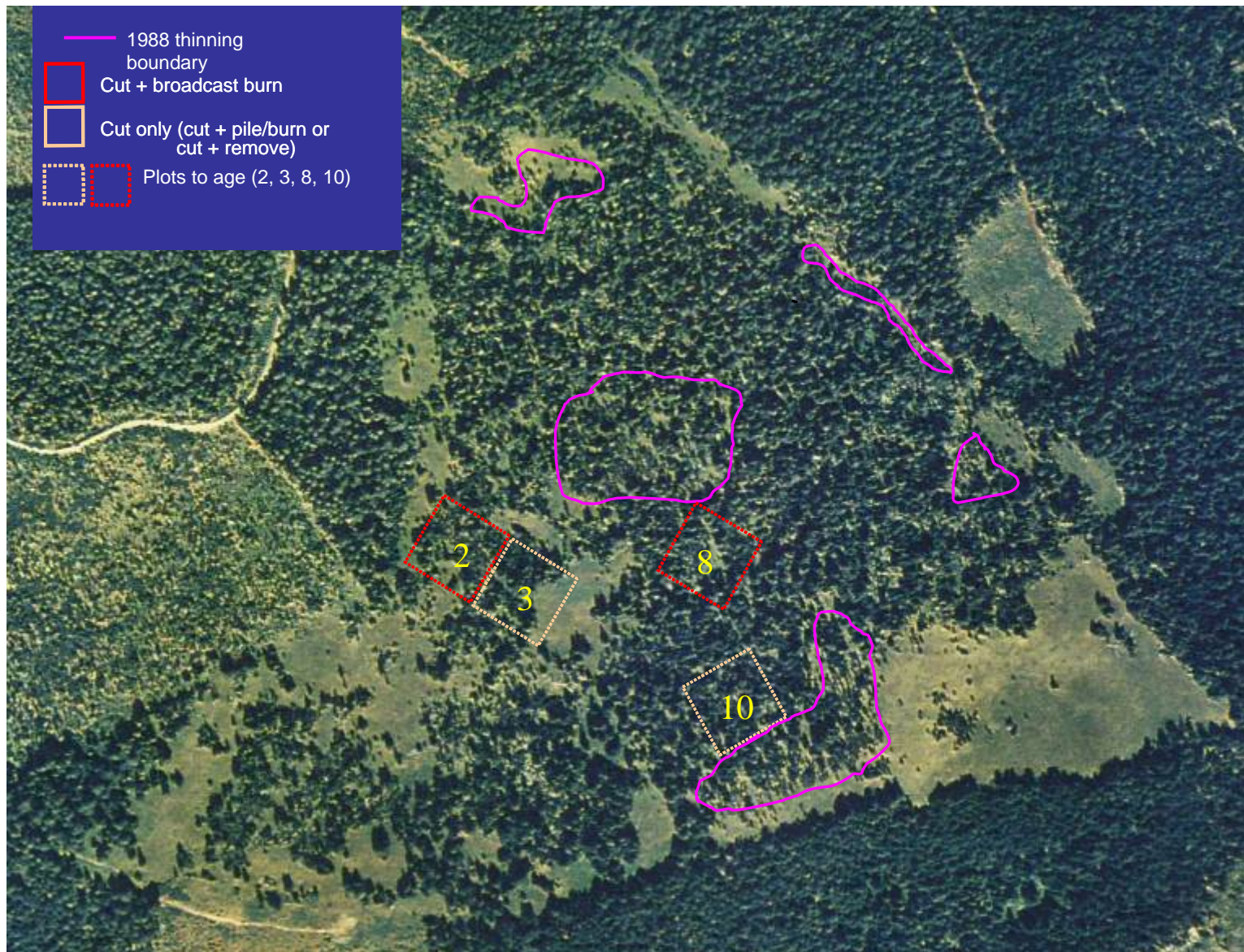
- Loss of habitat for wildlife



- Loss of recreational opportunity



Study Site: Plot Layout and Treatment Designation

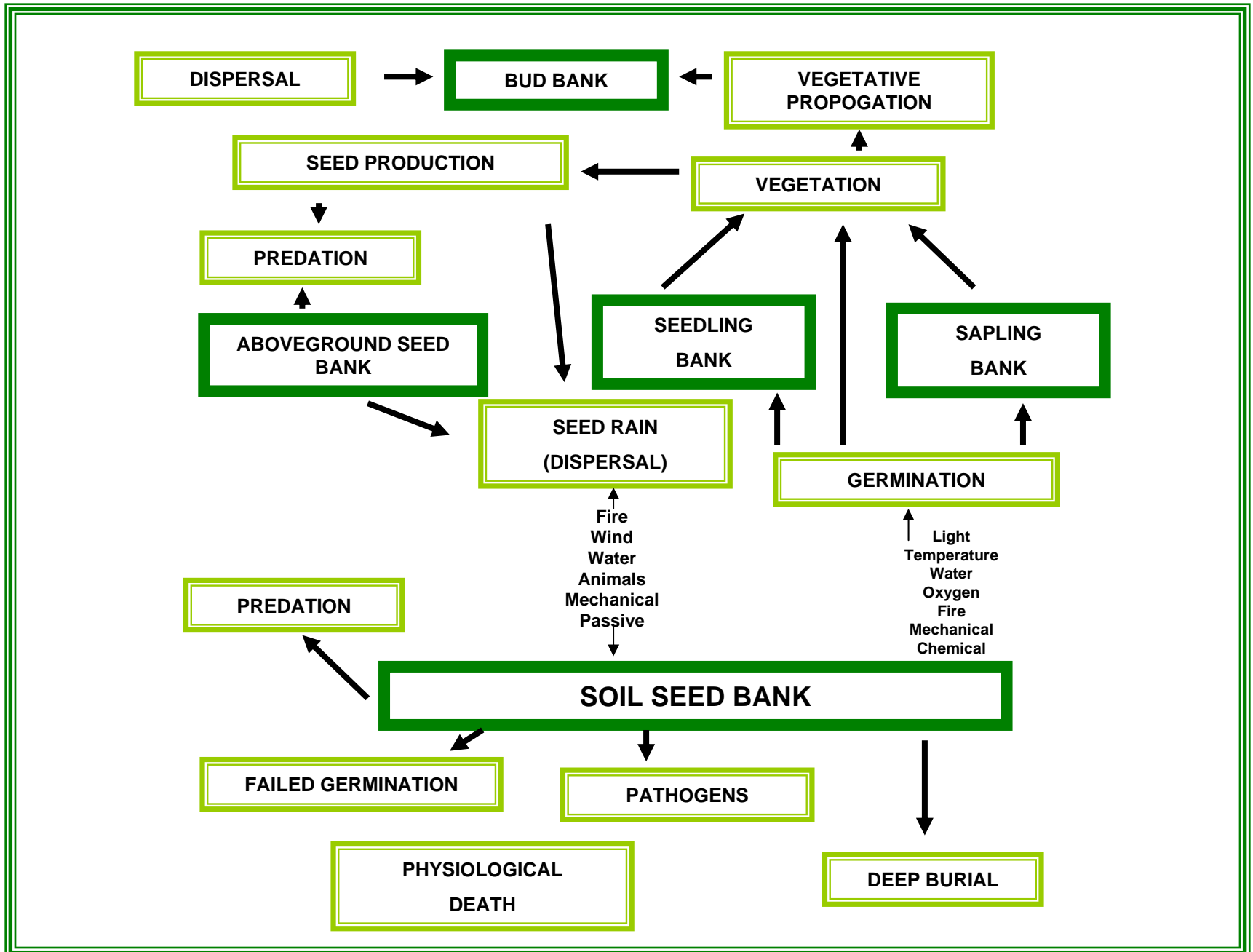


Seed Banks 101:

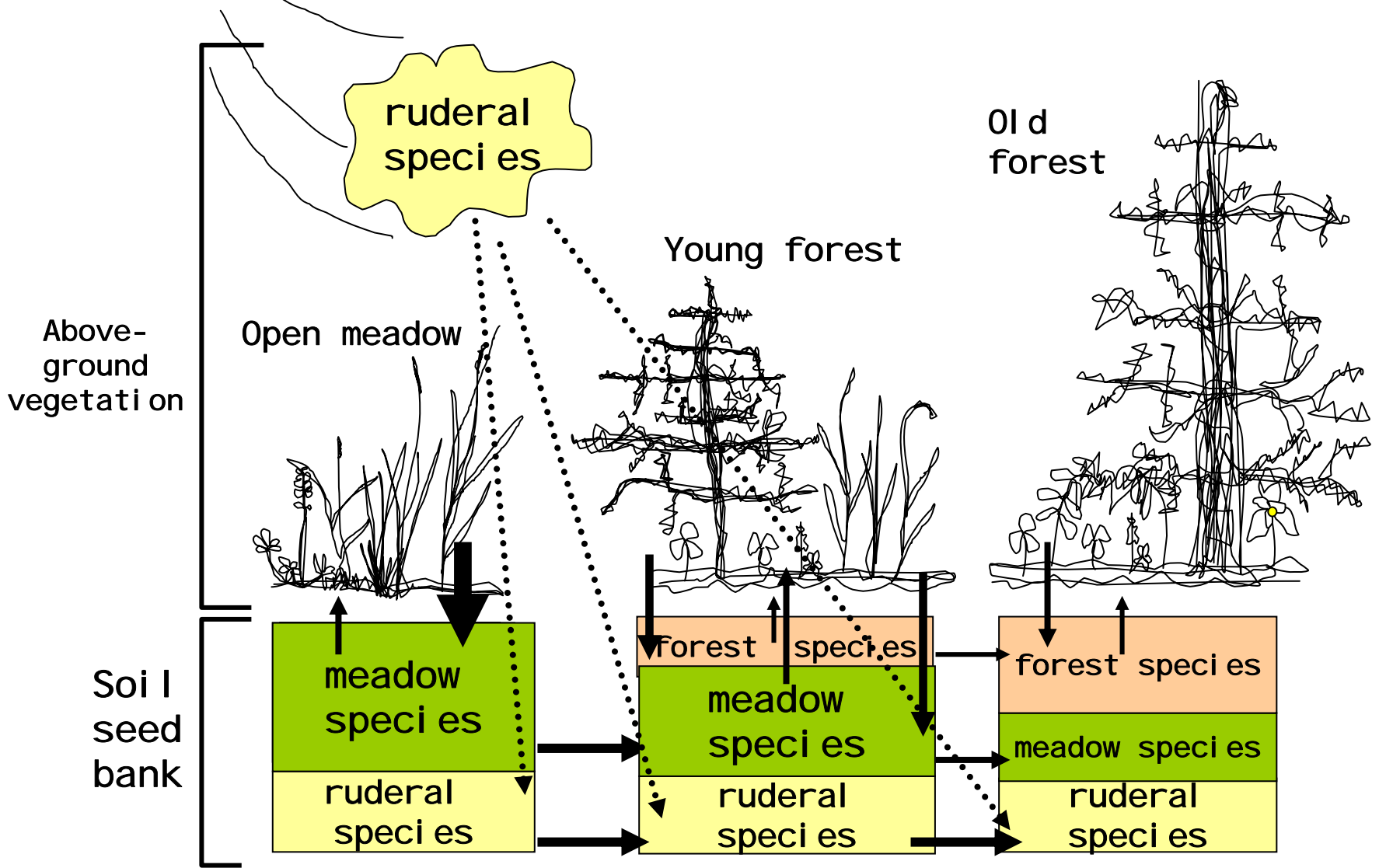
- Accumulation of viable seed in the soil
- Transient vs. persistent
- Space vs. Time
- Disturbance
- Implications for restoration



General Seed Bank Model : (Adapted from Simpson et al., 1989)



Conceptual Diagram of Seed Bank Dynamics at Bunchgrass





What are my objectives?:

- To investigate composition of the soil seed bank along a chronosequence from open meadow to closed forest
- To examine whether patterns of density, diversity and richness can be explained by variation in forest structure or ground layer vegetation.

Methods: Data Collection

Overstory (summer 2003):
tree measurement

Canopy cover (summer 2004):
digital images

Seed Bank (spring 2004):
soil samples

Understory (summer 2004):
% cover by species

Methods: Overstory Sampling



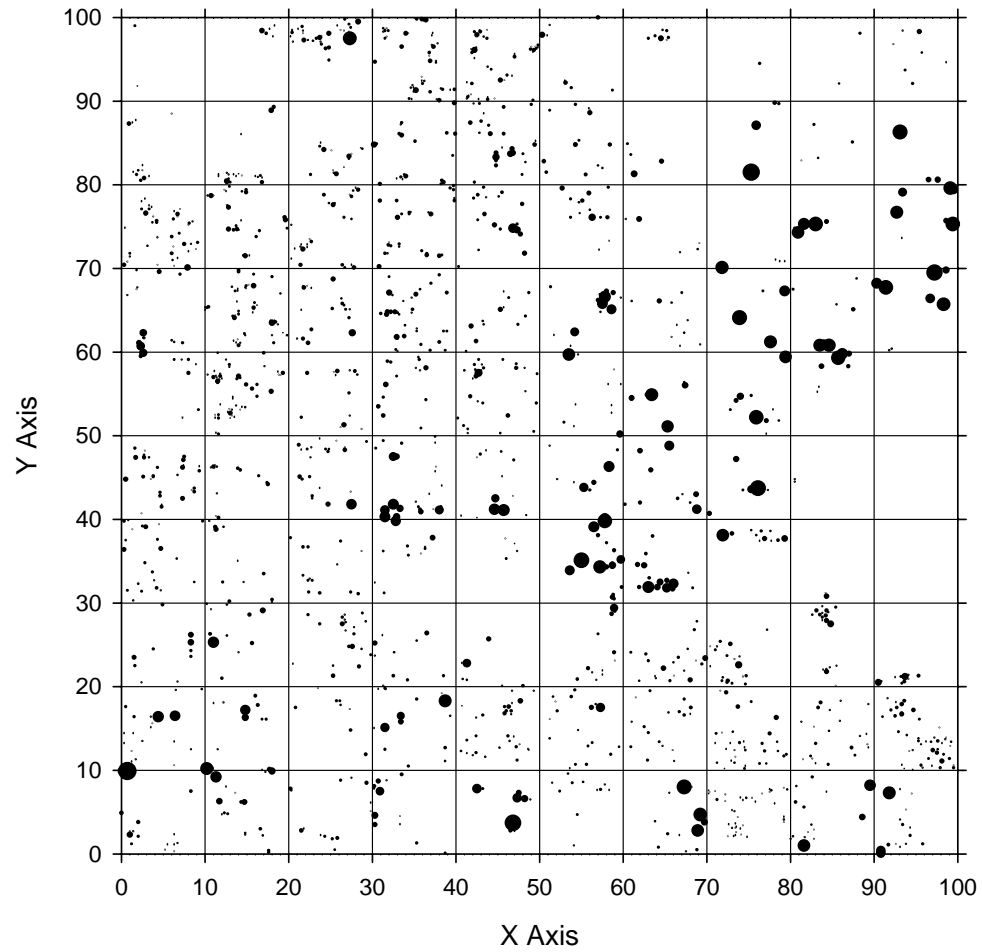
-Plot Establishment

-Tree measurement

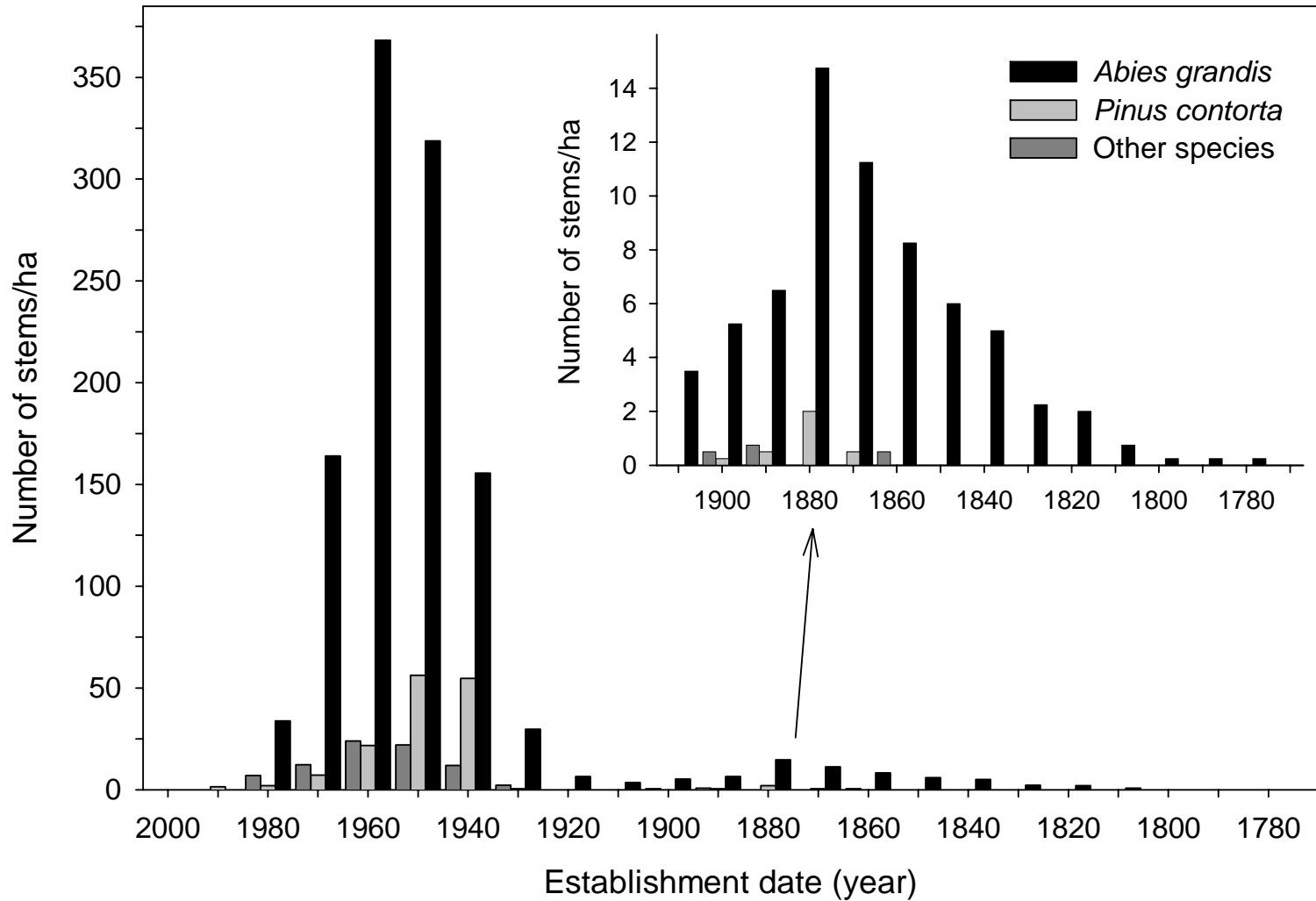
-Tree aging

Methods: Overstory Sampling

Plot 3 - Live and Dead Trees



Results: Overstory Sampling



Methods: Data Collection

Overstory (summer 2003):
tree measurement

Canopy cover (summer 2004):
digital images

Understory (summer 2004):
% cover by species

Seed Bank (spring 2004):
soil samples

Methods: Canopy Photos



Methods: Data Collection

Overstory (summer 2003):
tree measurement

Canopy cover (summer 2004):
digital images

Seed Bank (spring 2004):
soil samples

Understory (summer 2004):
% cover by species

Methods: Field Sampling

May 22-25, 2004



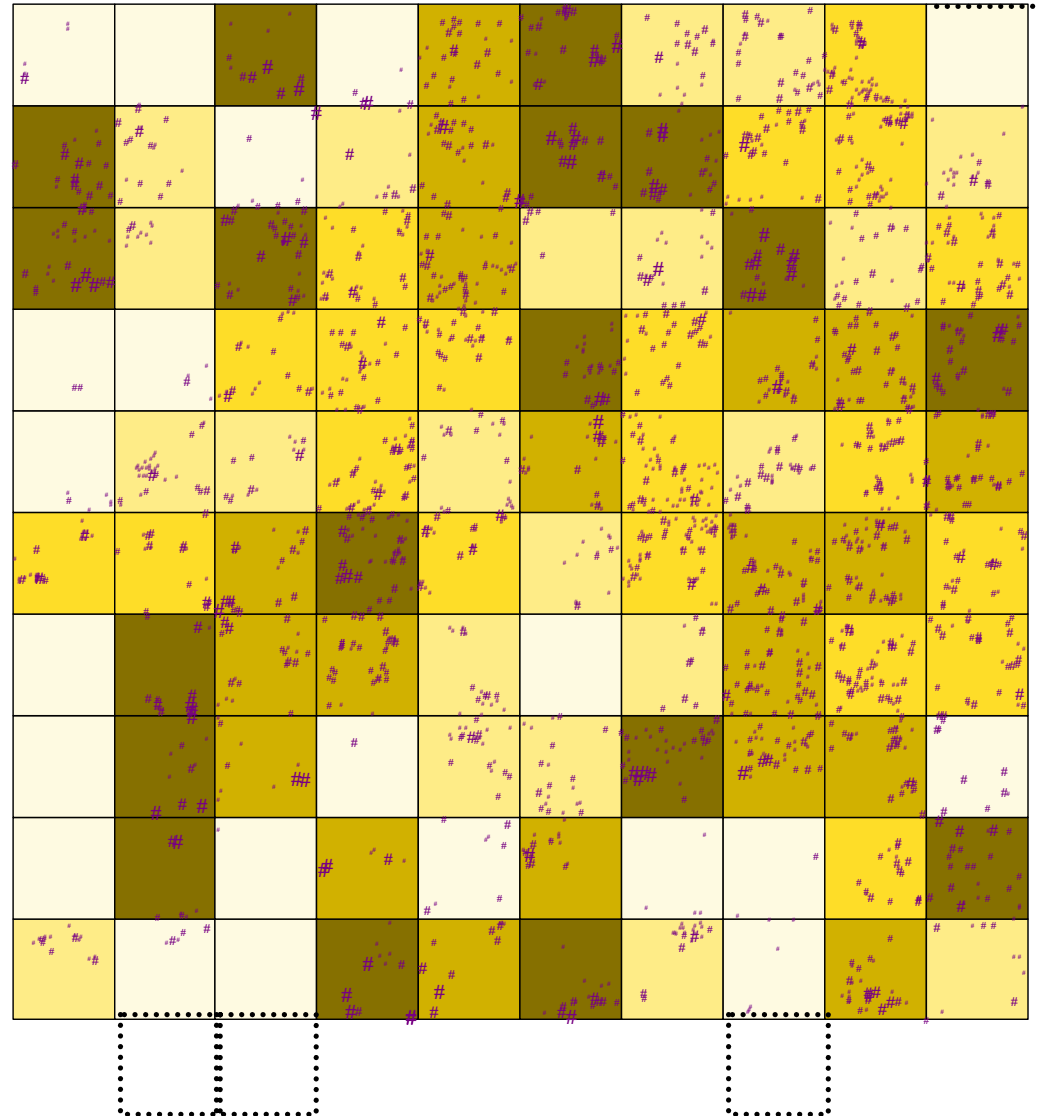
Methods: Seed Bank Sampling

- 50 subplots in each plot

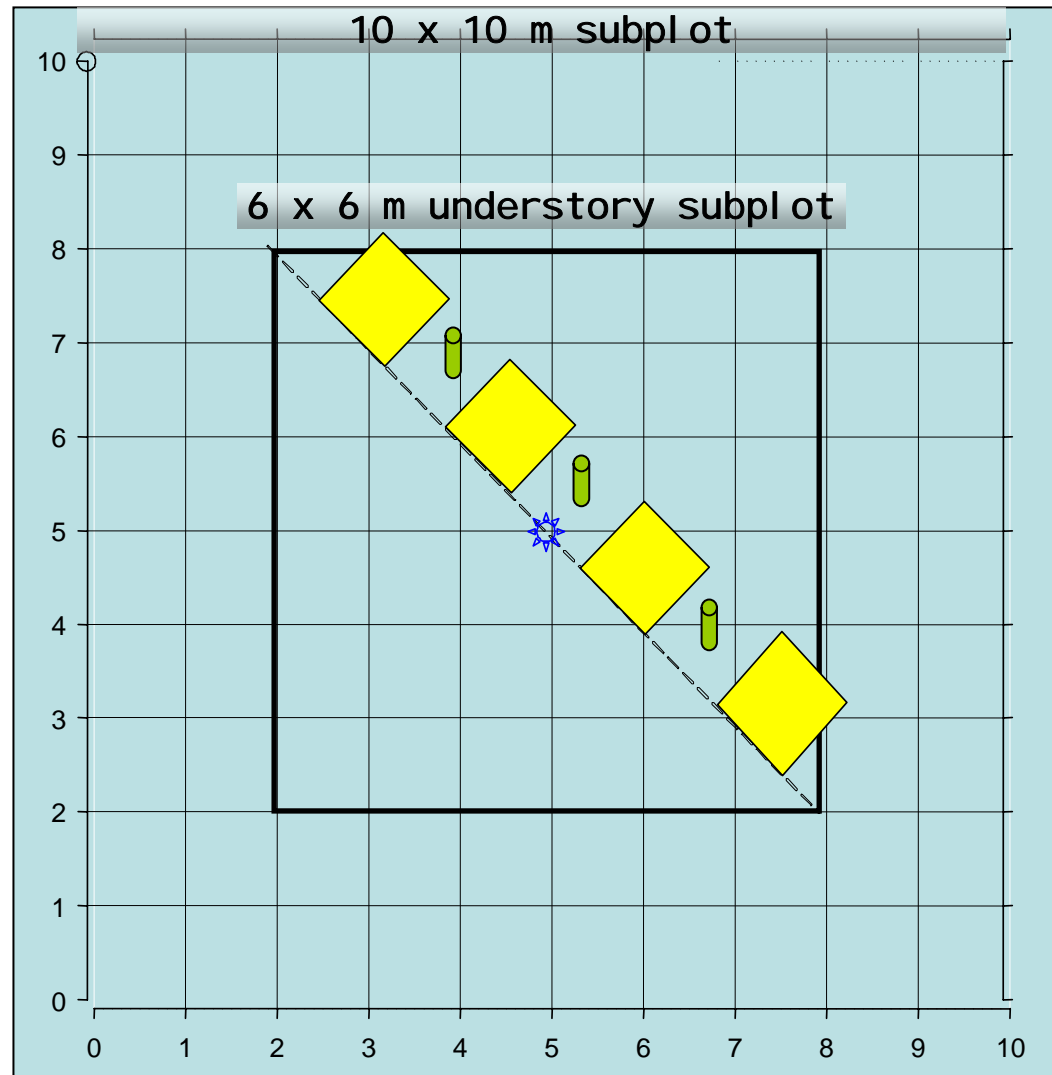
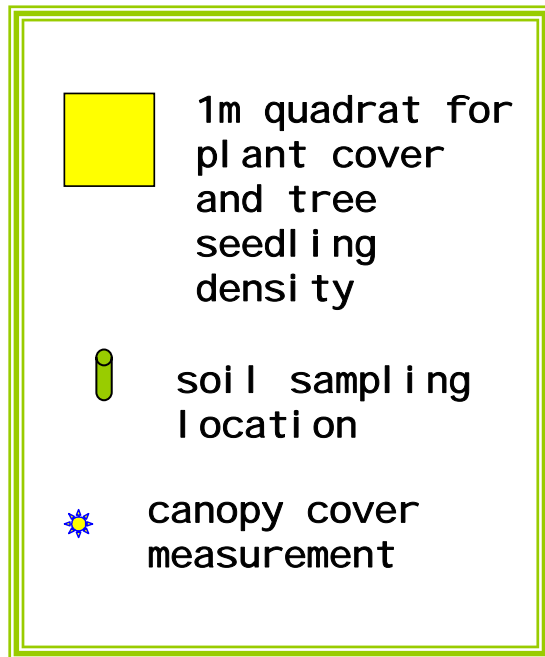
- Stratified random sampling in each plot according to basal area

- 12 additional subplots in open meadow areas

Plot 2 Stand Map



Methods: Sampling Layout



Methods: Greenhouse

- UW Biology greenhouse
- Germination flats
- Sub-irrigated using capillary mat
- Germinants marked upon emergence, removed upon identification





Results!



Methods: Data Collection

Overstory (summer 2003):
tree measurement

Canopy cover (summer 2004):
digital images

Seed Bank (spring 2004):
soil samples

Understory (summer 2004):
% cover by species

Methods: Understory Sampling

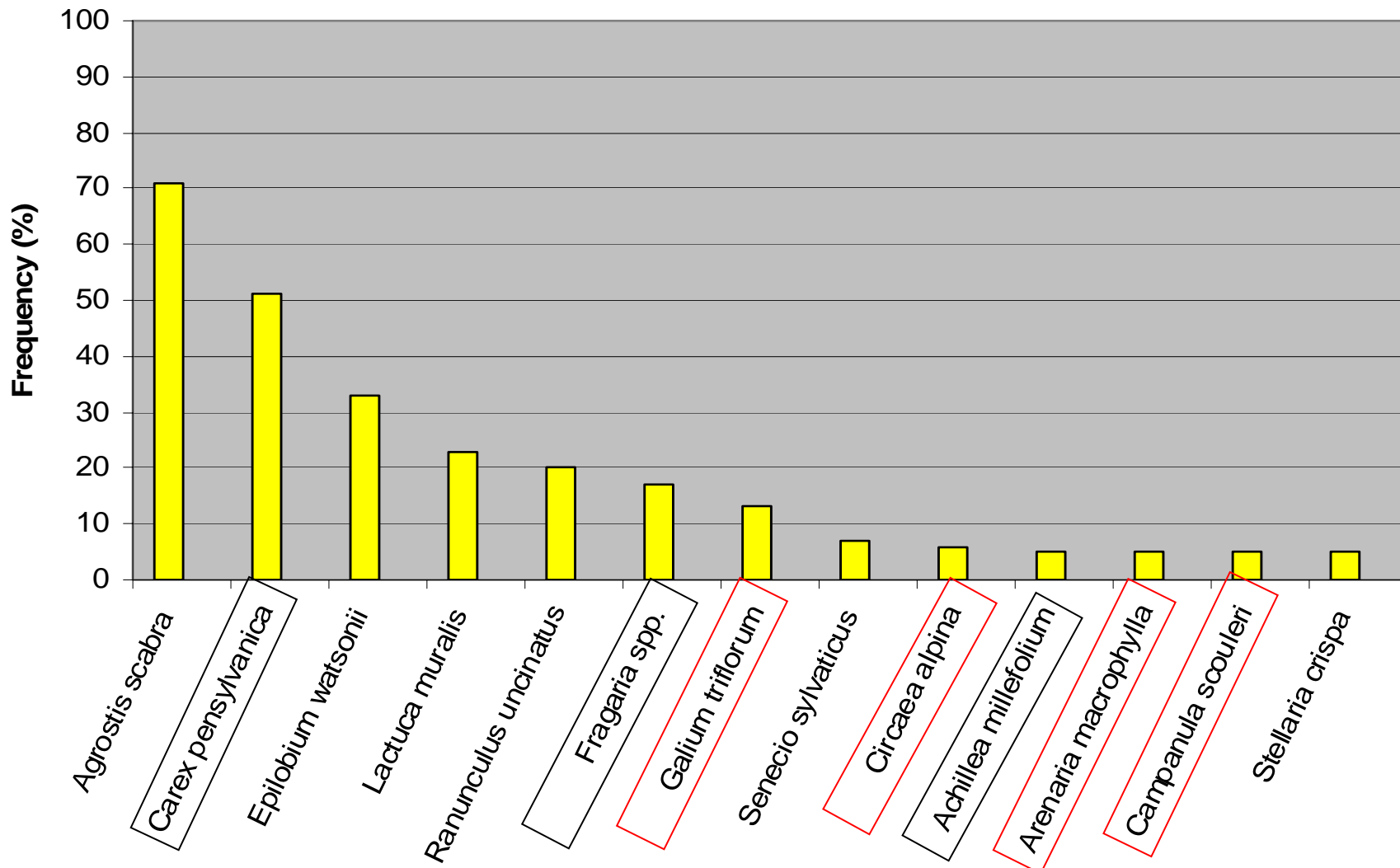


- Percent cover was visually estimated for each species present.

- Four quadrats were averaged for each subplot.

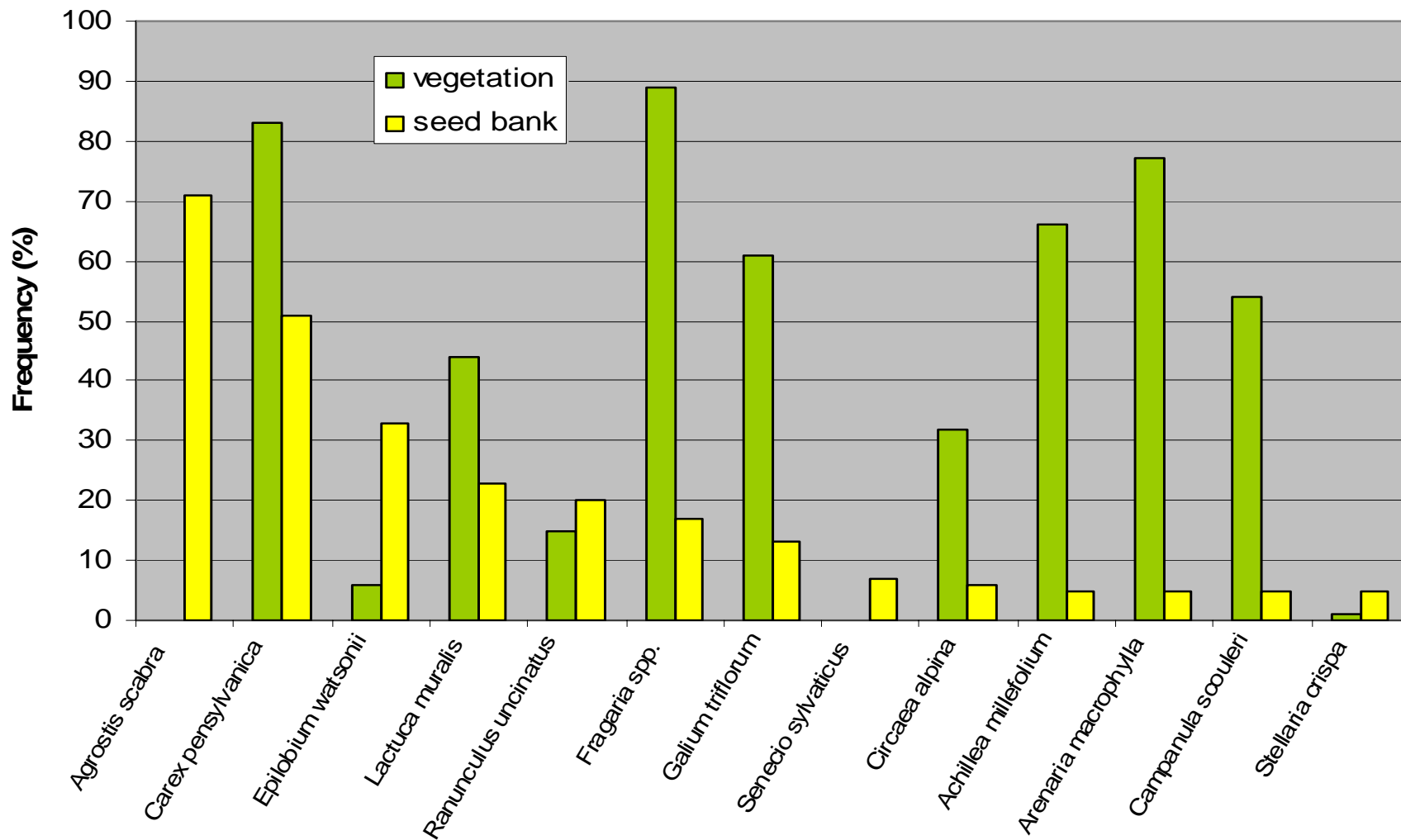
Results: Seed Bank

Primary Seed Bank Species



Results:

Primary Seed Bank Species and Occurrence in the Vegetation

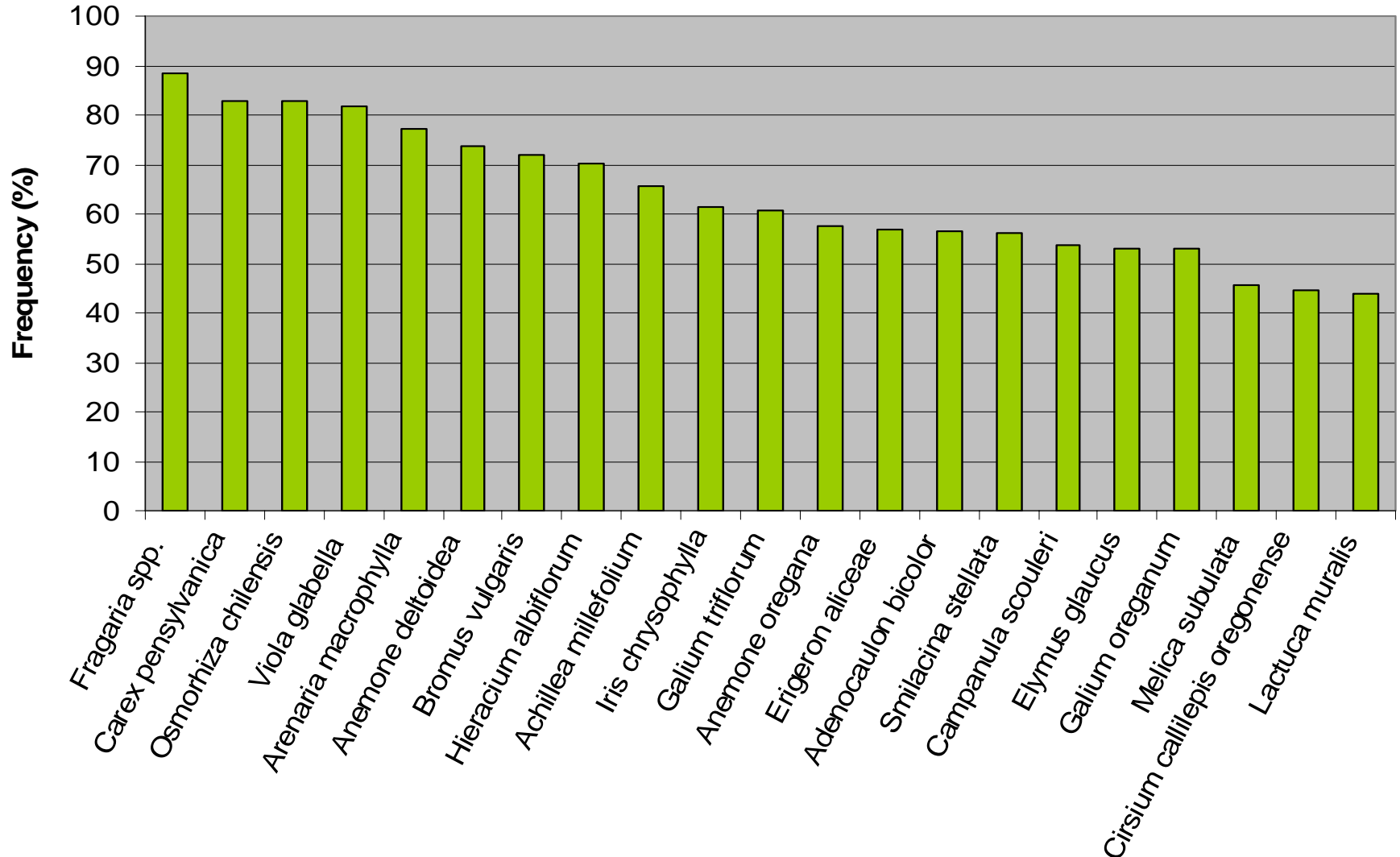


Conclusions:

1. The seed bank composition is dominated by ruderal species, with limited contribution from meadow and forest species.

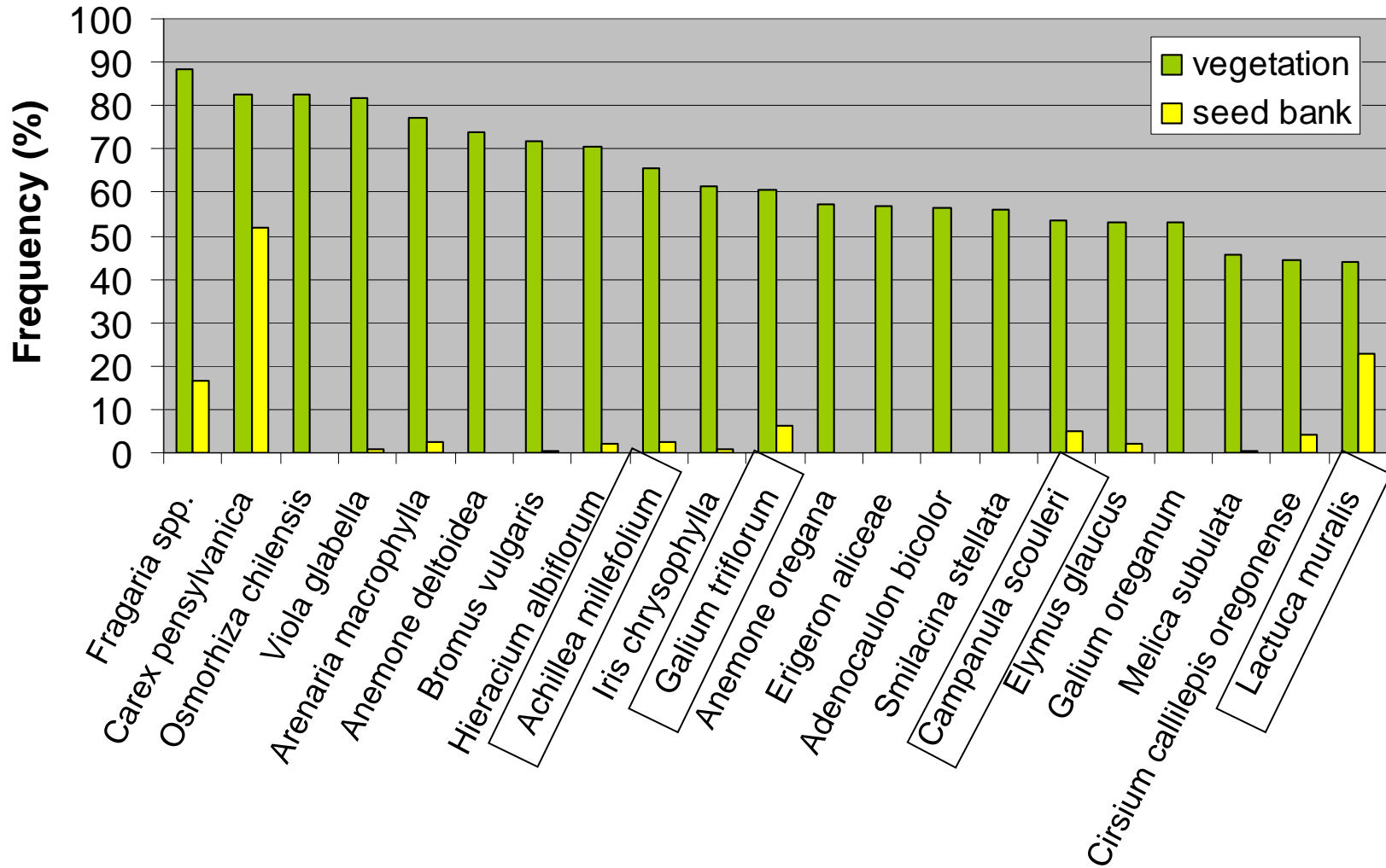
Results: Understory Vegetation

Dominant Understory/ Meadow Vegetation



Results:

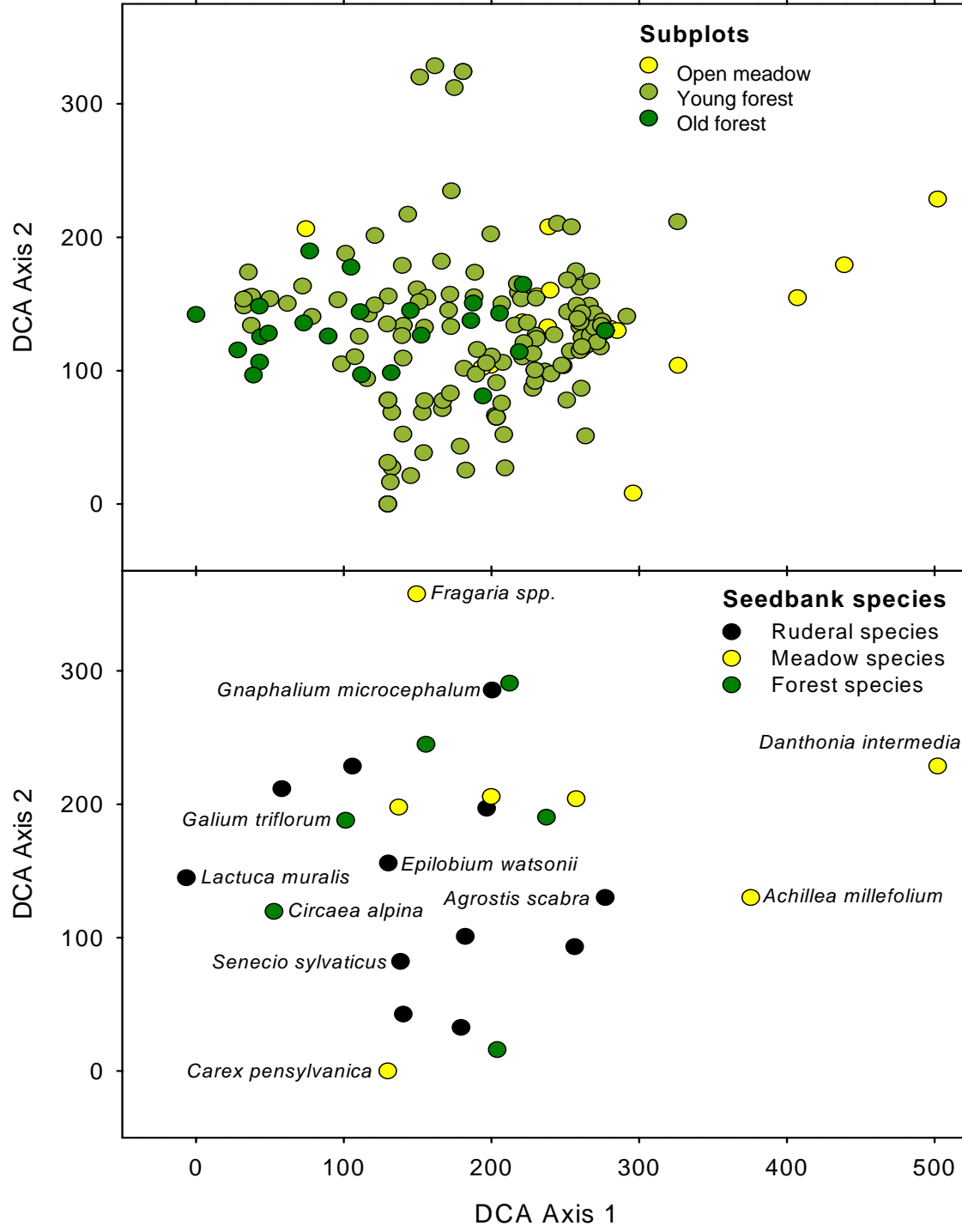
Dominant Understory/Meadow Vegetation and Occurrence in the Seed Bank



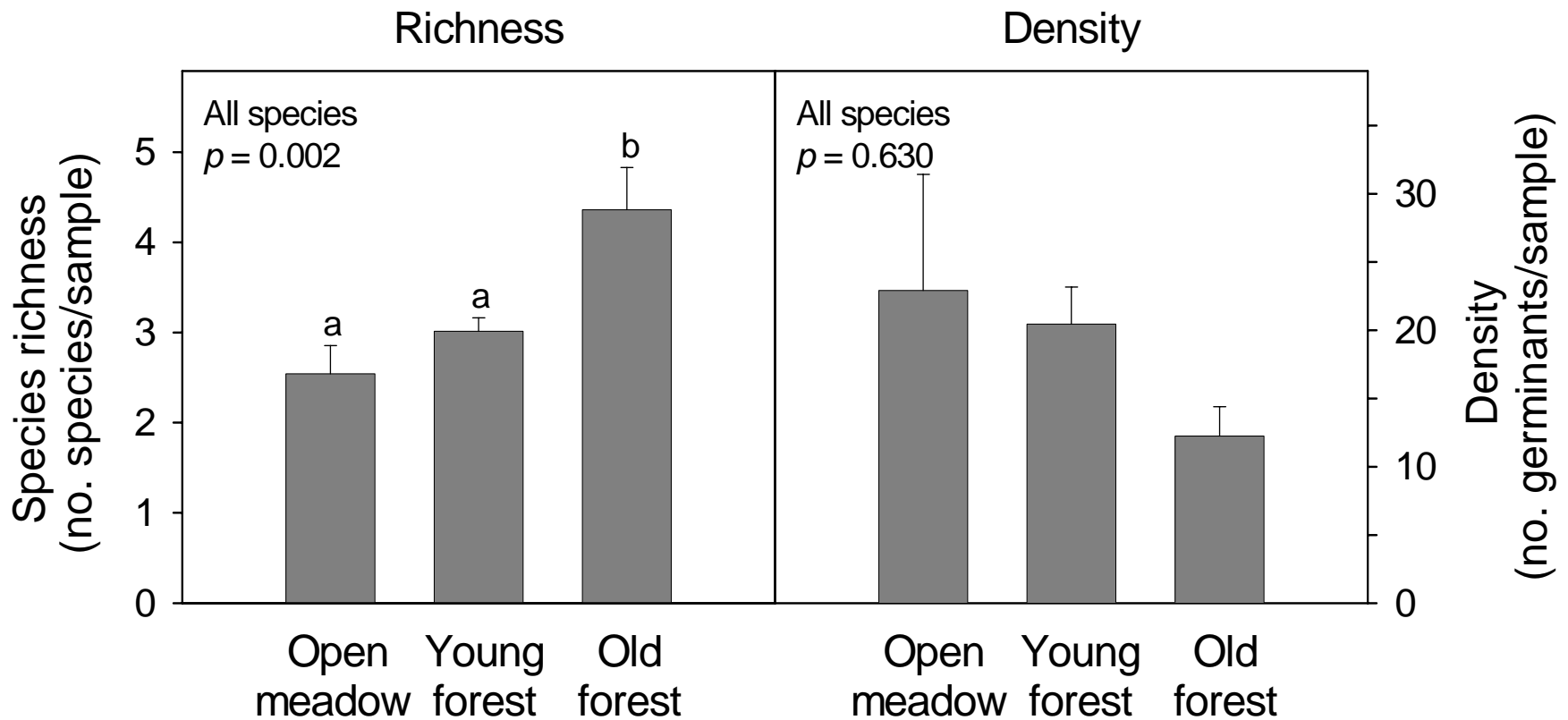
Conclusions:

1. The seed bank composition is dominated by ruderal species, with limited contribution from meadow and forest species.
2. The seed bank does not closely resemble the above-ground vegetation.

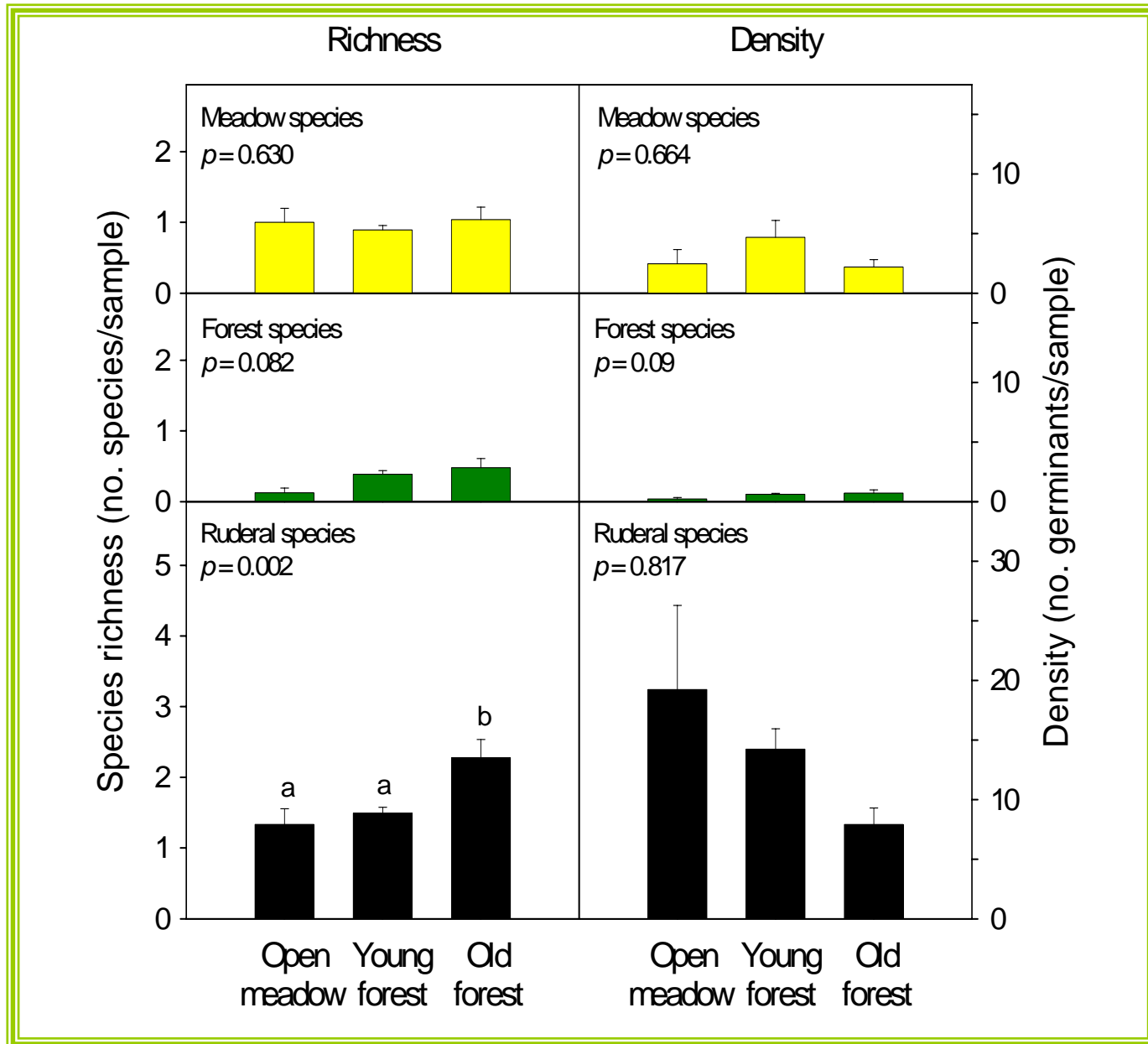
Results:



Results: Total richness and density



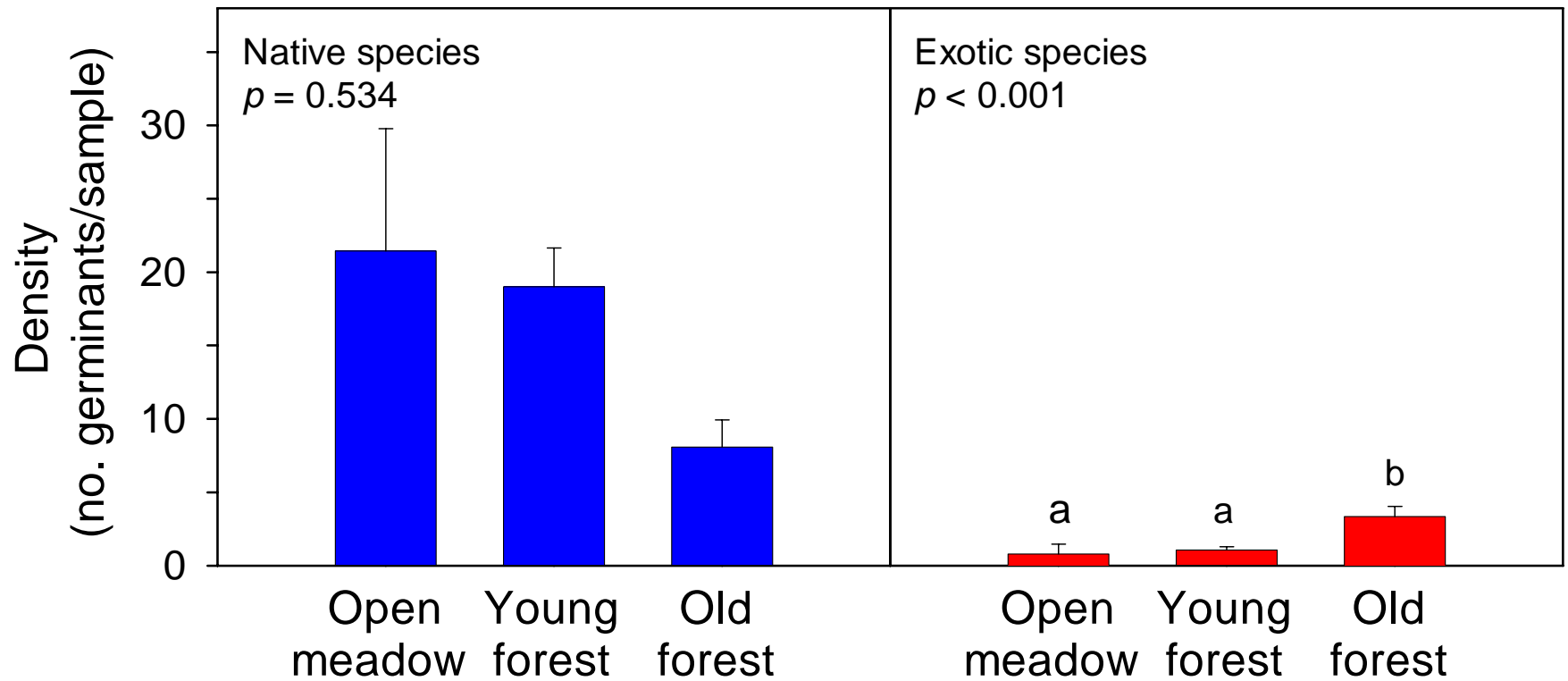
Results: Meadow, Forest, and Ruderal Species



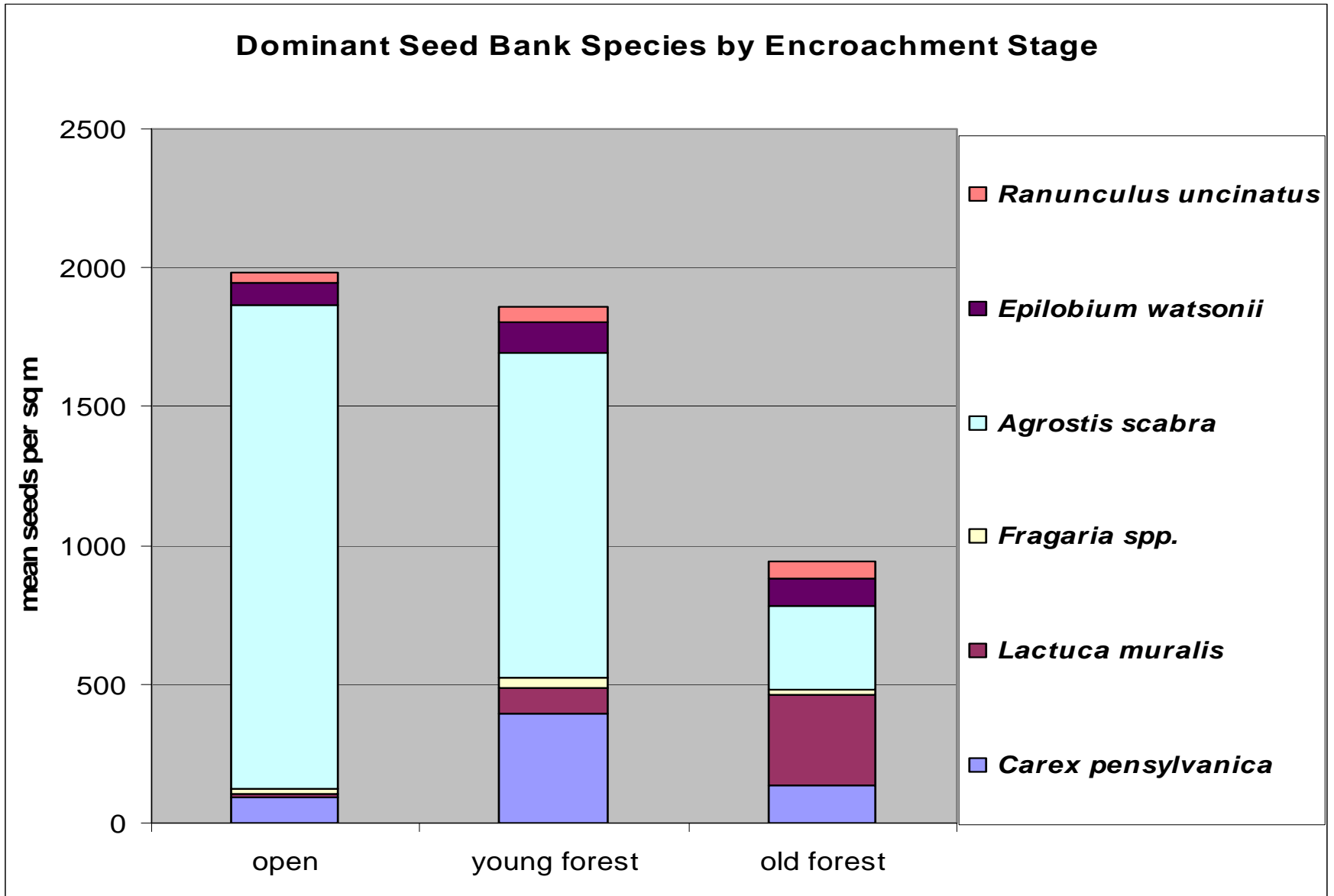
Conclusions:

1. The seed bank composition is dominated by ruderal species, with limited contribution from meadow and forest species.
2. The seed bank does not closely resemble the above-ground vegetation.
3. Few meadow species persist under meadow or forest vegetation.

Results: Density of Exotic and Native Species



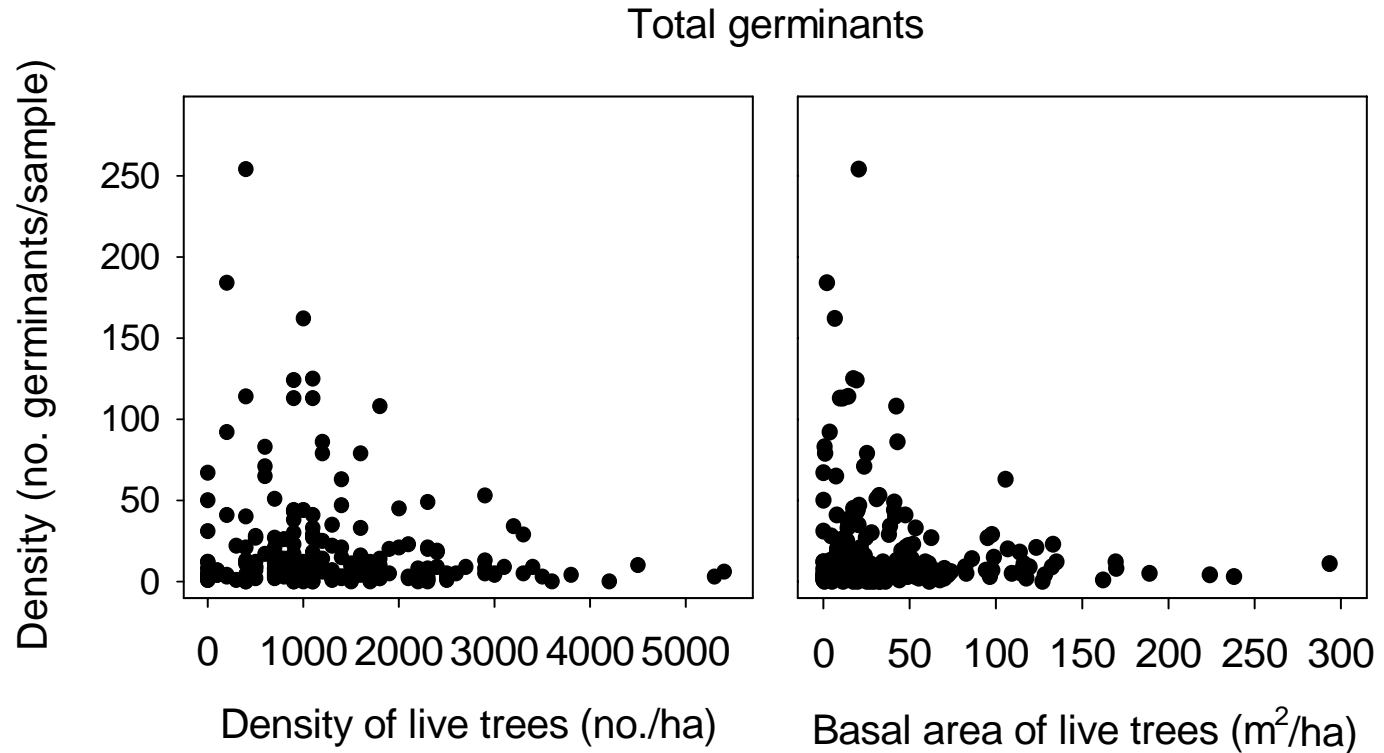
Results: Composition



Conclusions:

1. The seed bank composition is dominated by ruderal species, with limited contribution from meadow and forest species.
2. The seed bank does not closely resemble the above-ground vegetation.
3. Few meadow species persist under meadow or forest vegetation.
4. Density of exotic species is greatest in old forest.

Results: Overstory



Conclusions:

1. The seed bank composition is dominated by ruderal species, with limited contribution from meadow and forest species.
2. The seed bank does not resemble the above-ground vegetation.
3. Meadow species do not persist under meadow or forest vegetation.
4. Density of exotic species is greatest in old forest.
5. Forest structure has a limited impact on seed bank composition.

Implications: What does this mean for restoration?

- Contribution of target species from the seed bank will be limited.
- Focus should be on outside propagule sources.
 - Seeding of target species
 - Vegetative spread of clonal species from existing meadows
- Soil conditions may determine species establishment
 - Dependent on type of disturbance

Implications:



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Questions?

