Diversity in Rangeland Seedings: Beyond Grazing and Grouse

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Microsoft
MapPoint
Great Falls
Seattle
Spokane
MONTANA
45°
Portland
Walla Walla
Billings
S. DAK.
IDAHO
Sheridan
OREG.
Eugene
Boise
WYOMING
NEBR.
Salt Lake City
40°
Denver
Pit
GREAT BASIN
Reno
UTAH
Sacramento
San Francisco
UNITED STATES
Colorado Springs
St. George
NEW MEXICO
PACIFIC OCEAN
Fresno
Las Vegas
35°
Albuquerque
Bakersfield
130°
Phoenix
Los Angeles
Gila
Ciudad Juárez
Tucson
San Diego
Mexicali
Ensenada
Cananea
30°
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120°
115°
110°
105°

It has been estimated that roughly 1/3 or 25 million acres of the Great Basin are Cheatgrass dominated

Other concerns beyond Grazing and Grouse

3 desert plant communities

Trap arrays

Funnel traps

Pitfall traps

Each array consists of 4 pitfall traps and 3 funnel traps

4 arrays in each site = 28 traps/site

Additional species that are present in the Great Basin

Horned lizard
(*Phrynosoma platyrhinos*)

Northern Sagebrush Lizard *(Sceloporus graciosus)*

Eastern Collared Lizard (*Crotaphytus collaris*)

Long-nosed leopard lizard (*Gambelia wislizenii*)

Western Fence Lizard (*Sceloporus occidentalis*),

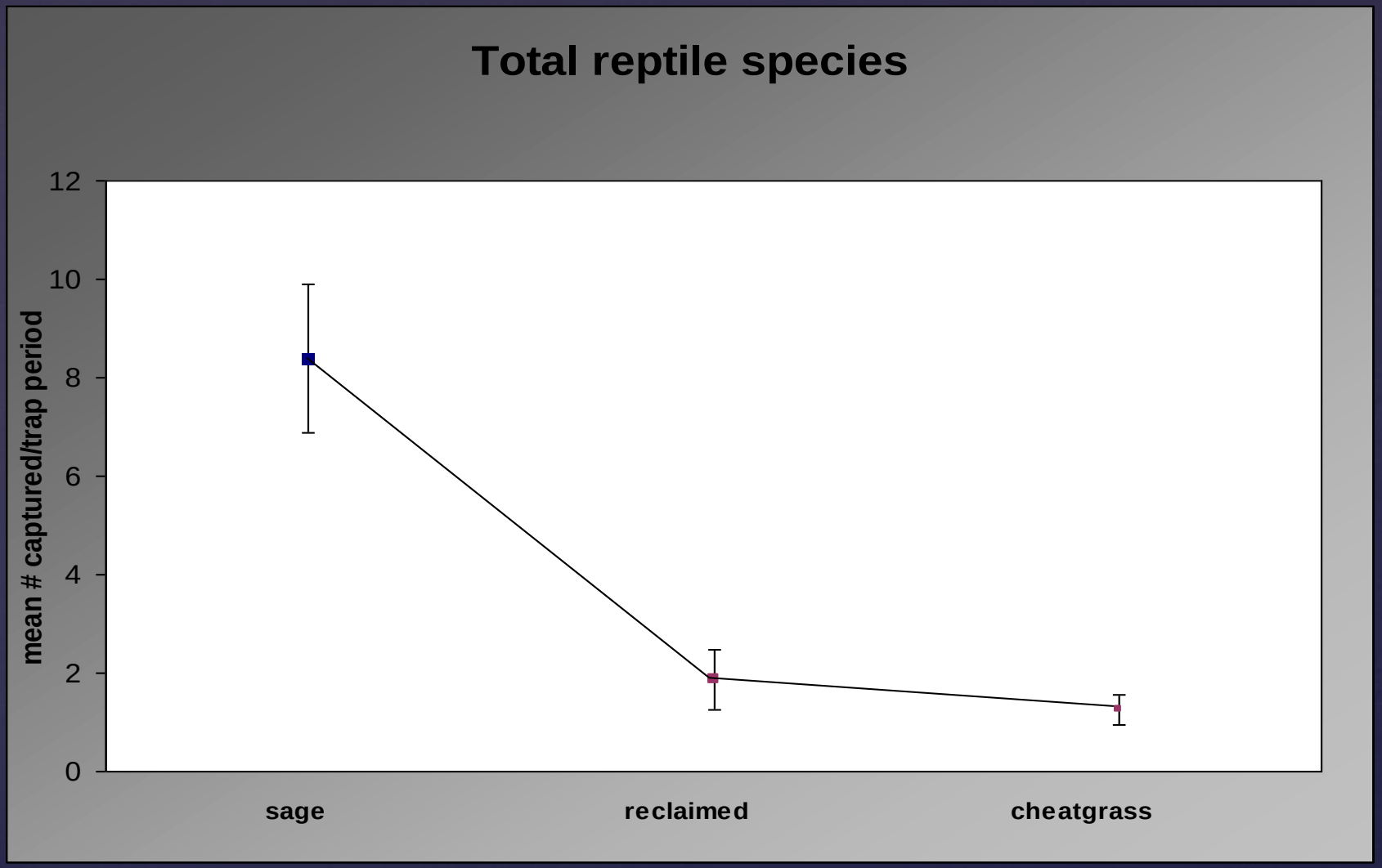
Gophersnake (*Pituophis catenifer*)

Desert Striped Whipsnake *(Masticophis taeniatus)*,

Great Basin Rattlesnake (*Crotalus viridis*)

Western Yellow-bellied Racer *(Coluber constrictor)*

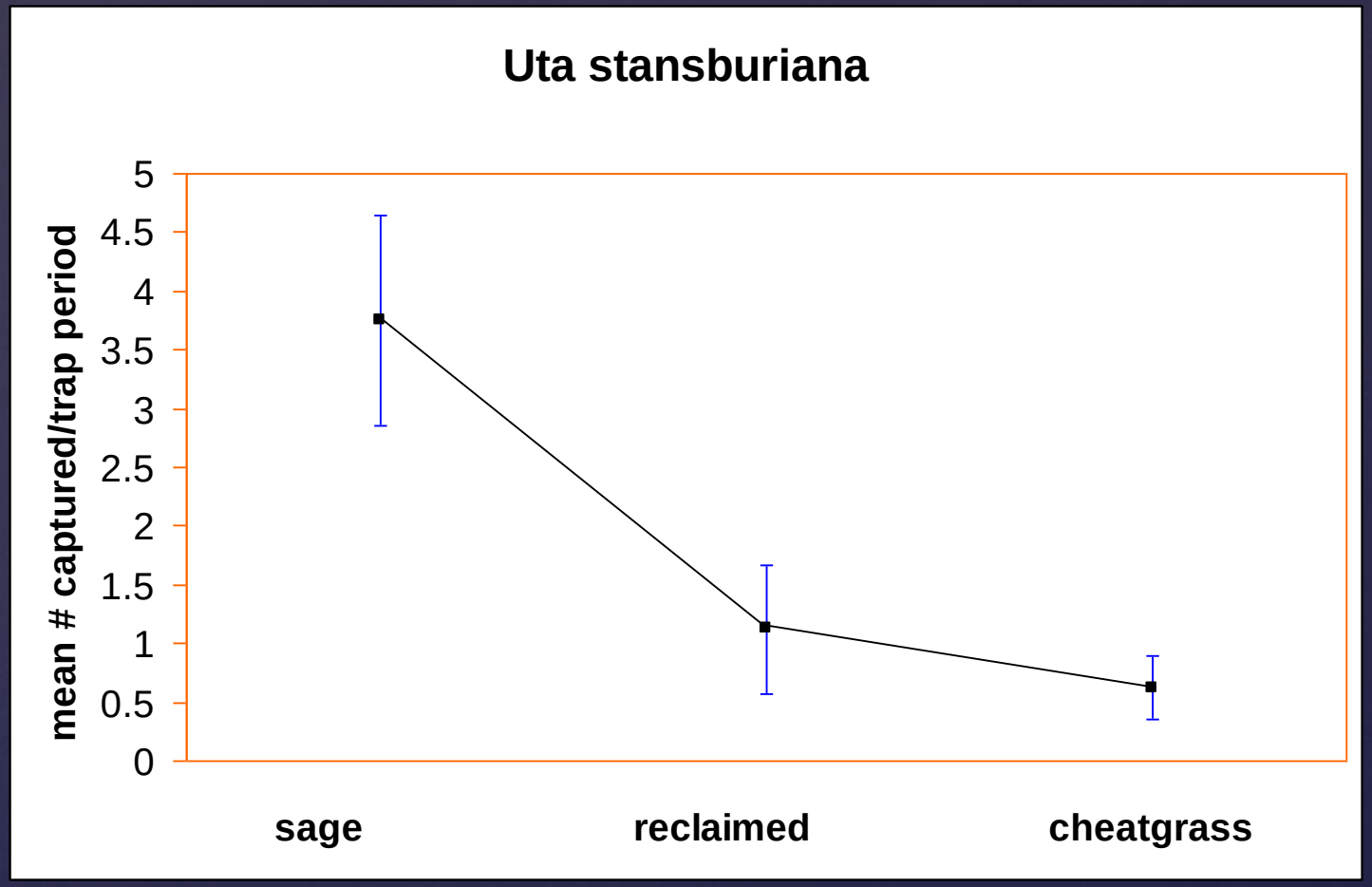
Longnose snake *(Rhinocheilus lecontei)*



* P values derived from using the Kruskal-Wallis Test of statistical significance.

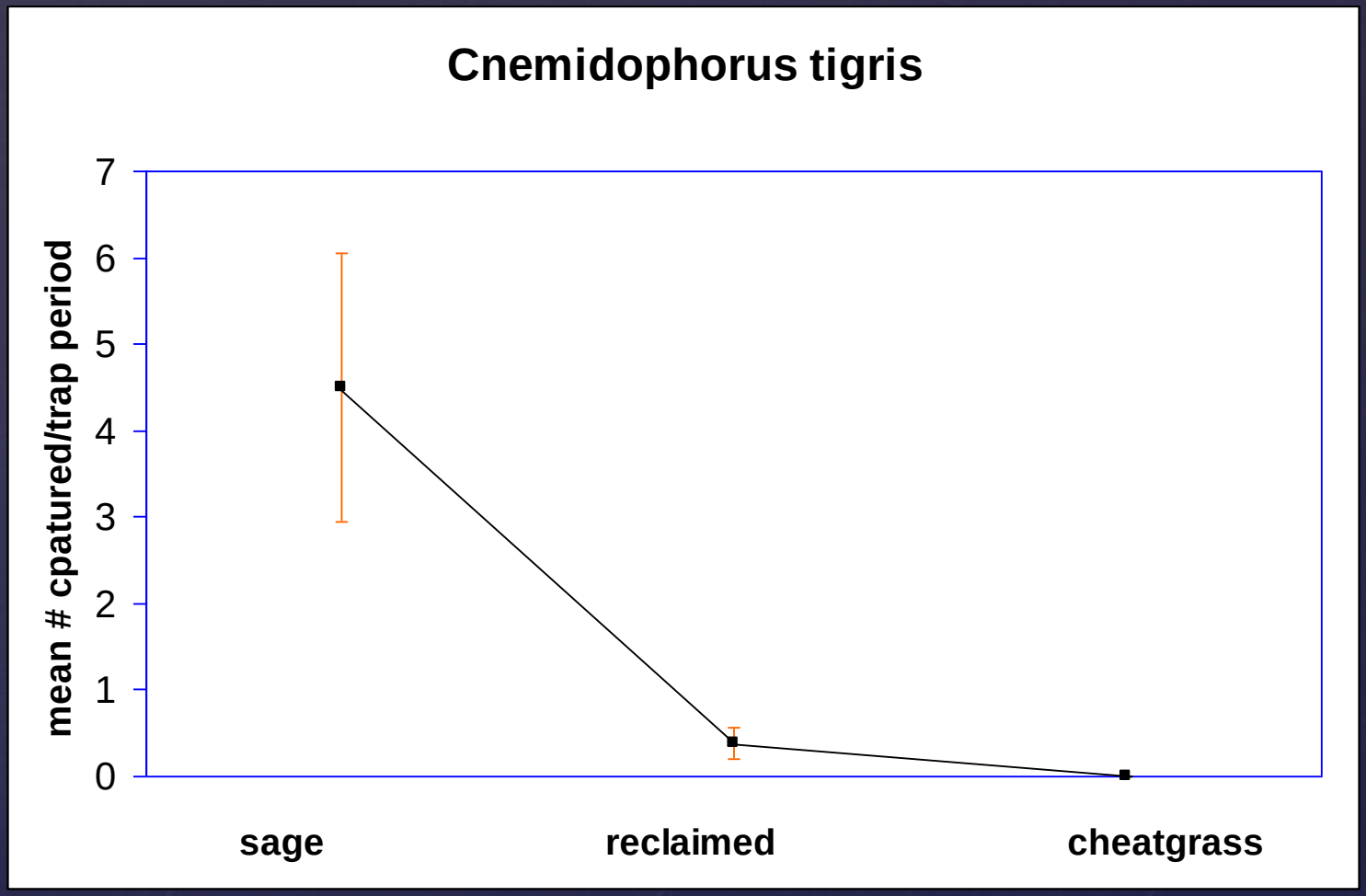
Side-blotched lizard

(Uta stansburiana)


Uta stansburiana
mean # captured/trap period
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
sage
reclaimed
cheatgrass

Western whiptail

(Cnemidophorus tigris)


Cnemidophorus tigris
mean # cpatured/trap period
7
6
5
4
3
2
1
0
sage
reclaimed
cheatgrass

Small Mammal Response

	Cheatgrass		Restoration		Native Sage	
	1998	1999	1998	1999	1998	1999
Peromyscus maniculatus	37	12	11	3	20	15
Dipodomys ordii	12	0	6	0	2	1
Dipodomys microps	0	0	0	0	10	7
Perognathus parvus	0	0	5	0	3	2
Reithrodontomys megalotis	0	0	0	1	1	4
Neotoma lepida	0	0	0	0	1	0
Ammospermophilus leucurus	0	0	0	0	2	0
Total	49	12	22	4	39	29

Impact of Habitat Alterations to Bee Diversity in Sagebrush and Pinyon/Juniper Communities of the Eastern Great Basin

sagebrush

pinyon/juniper

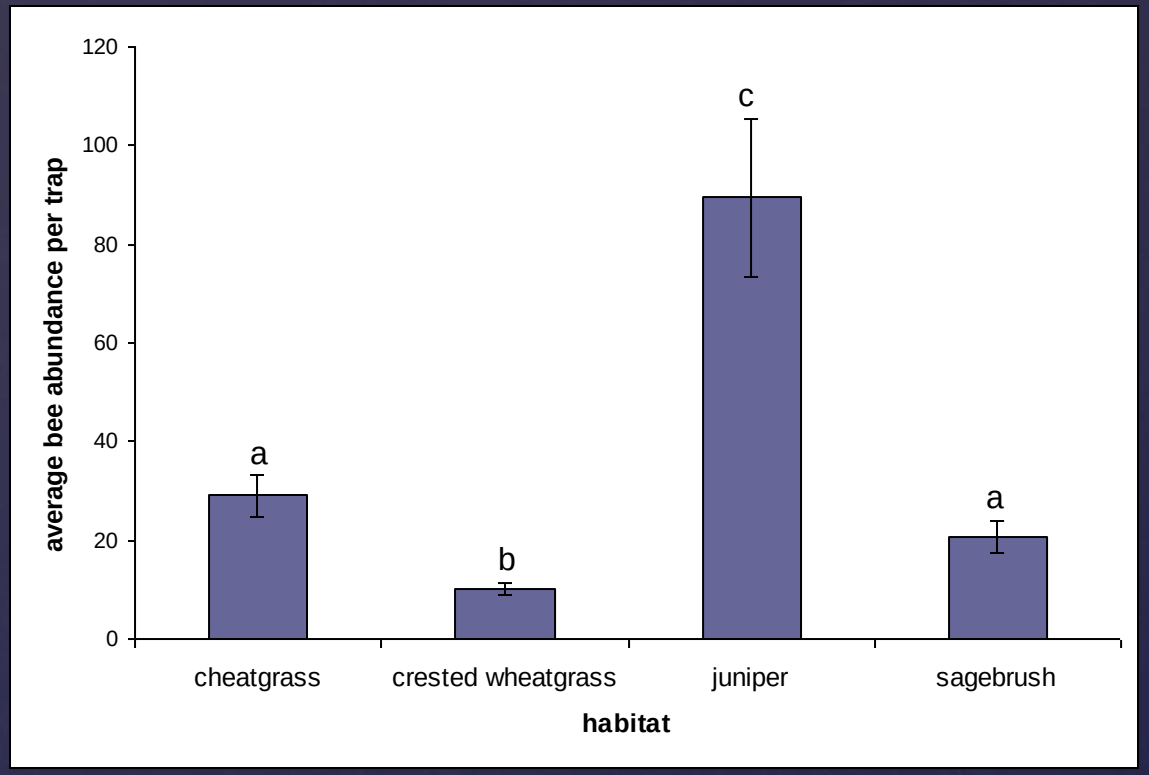
cheatgrass

crested wheatgrass

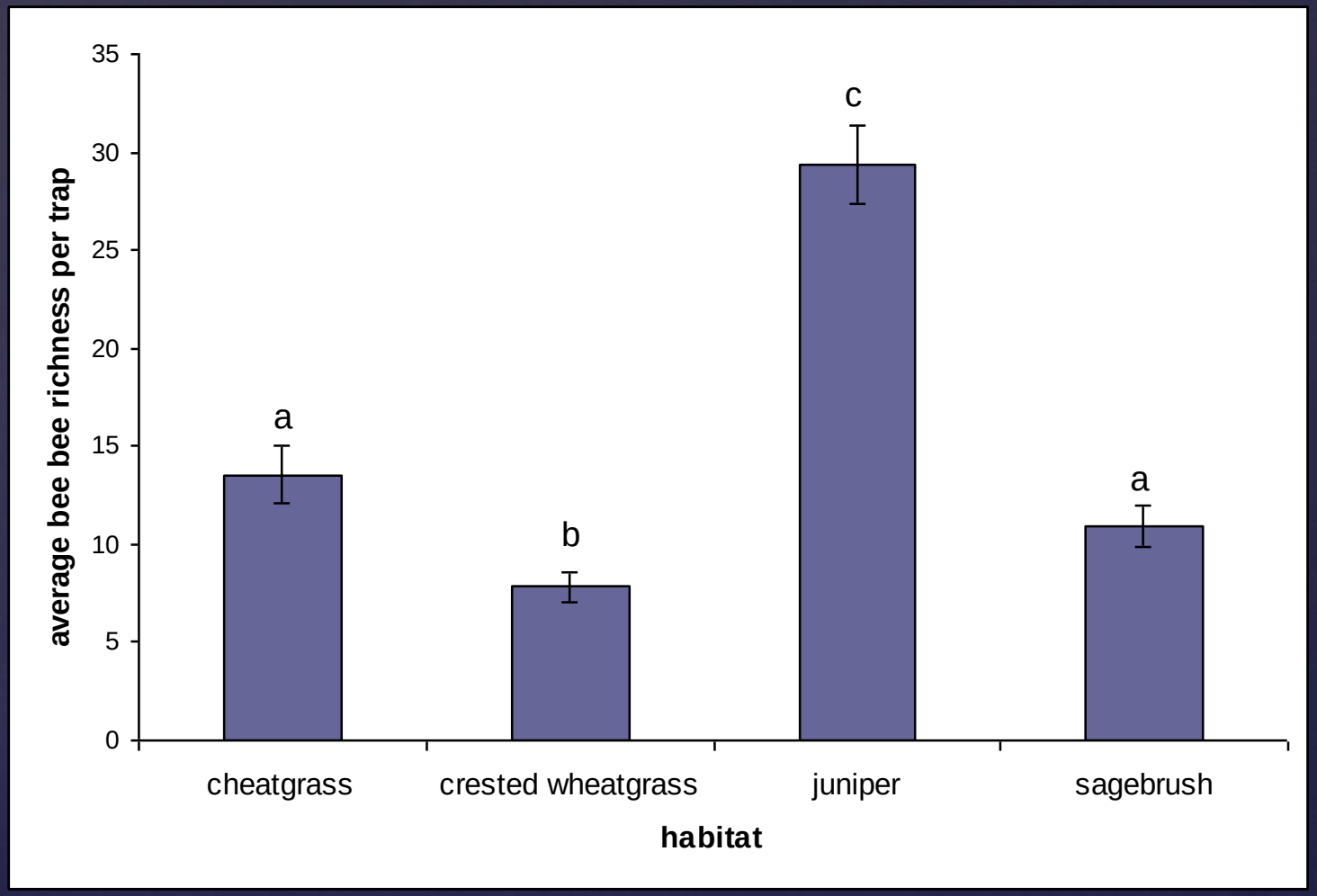
Results

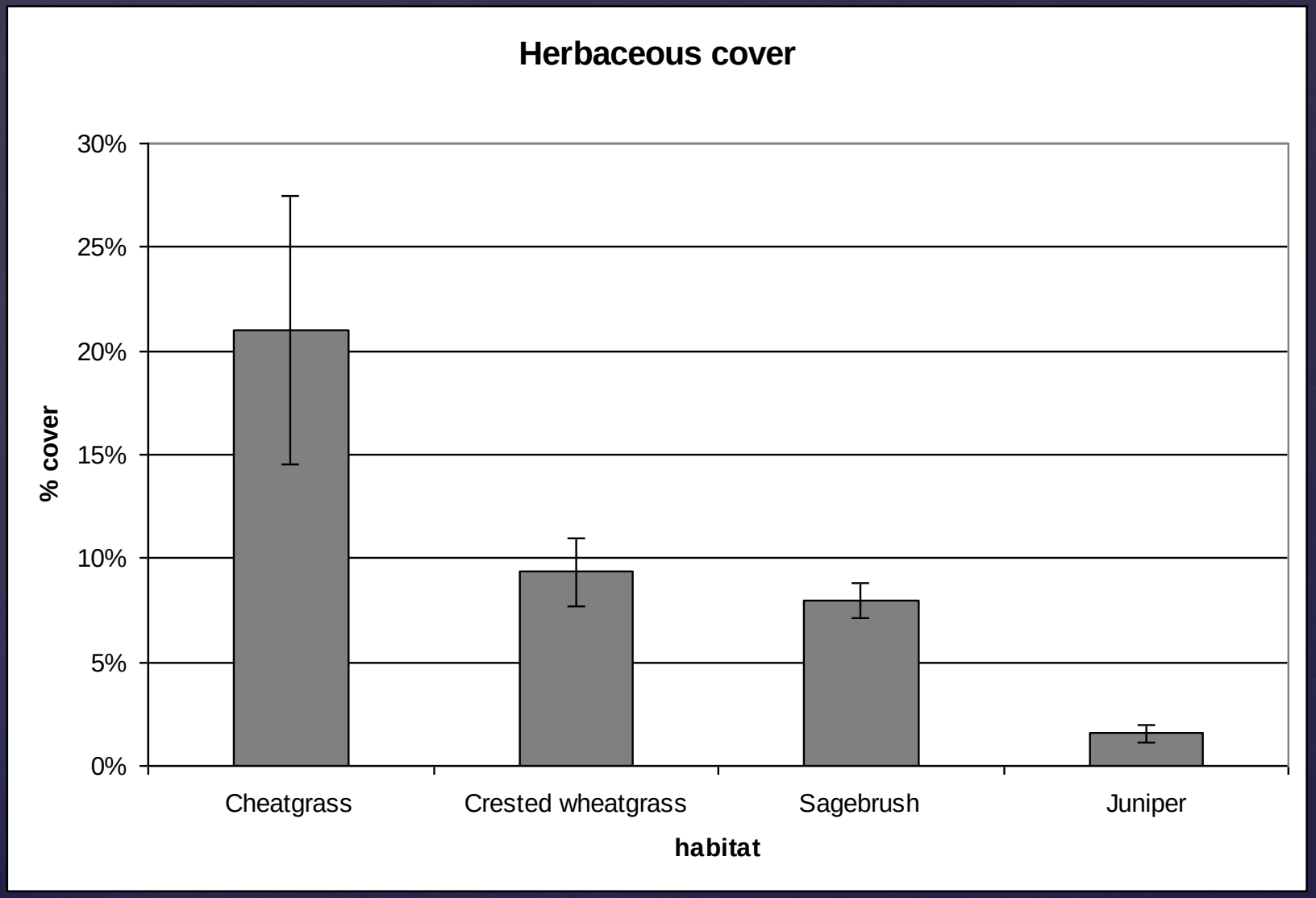
- 162 taxa
- 44 singletons
- 21 doubletons
  - 40.1 % rare

Bee abundance by habitat ($p<0.01$)



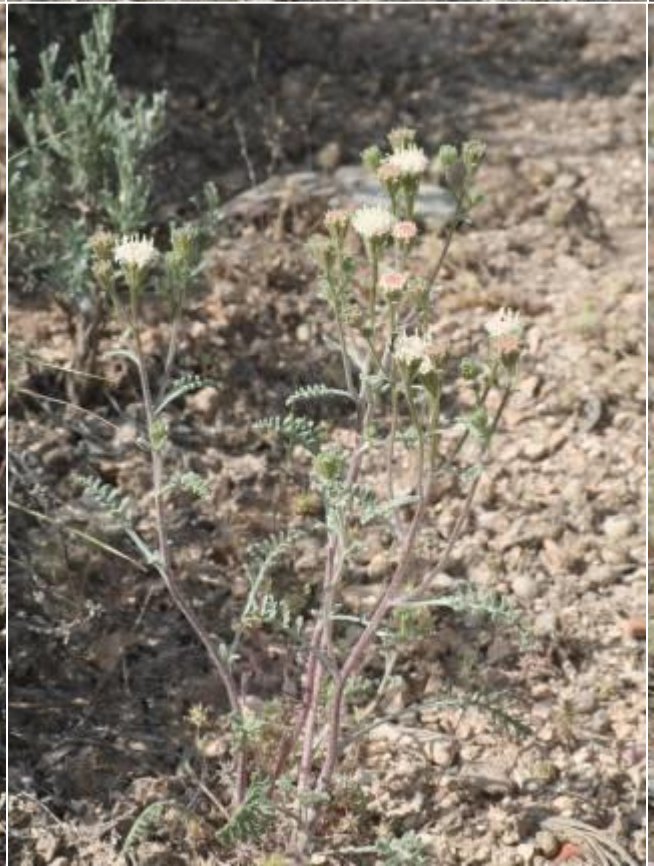
Bee richness by habitat ($p<0.01$)




Herbaceous cover
30%
25%
20%
15%
10%
5%
0%
% cover
Cheatgrass
Crested wheatgrass
Sagebrush
Juniper
habitat

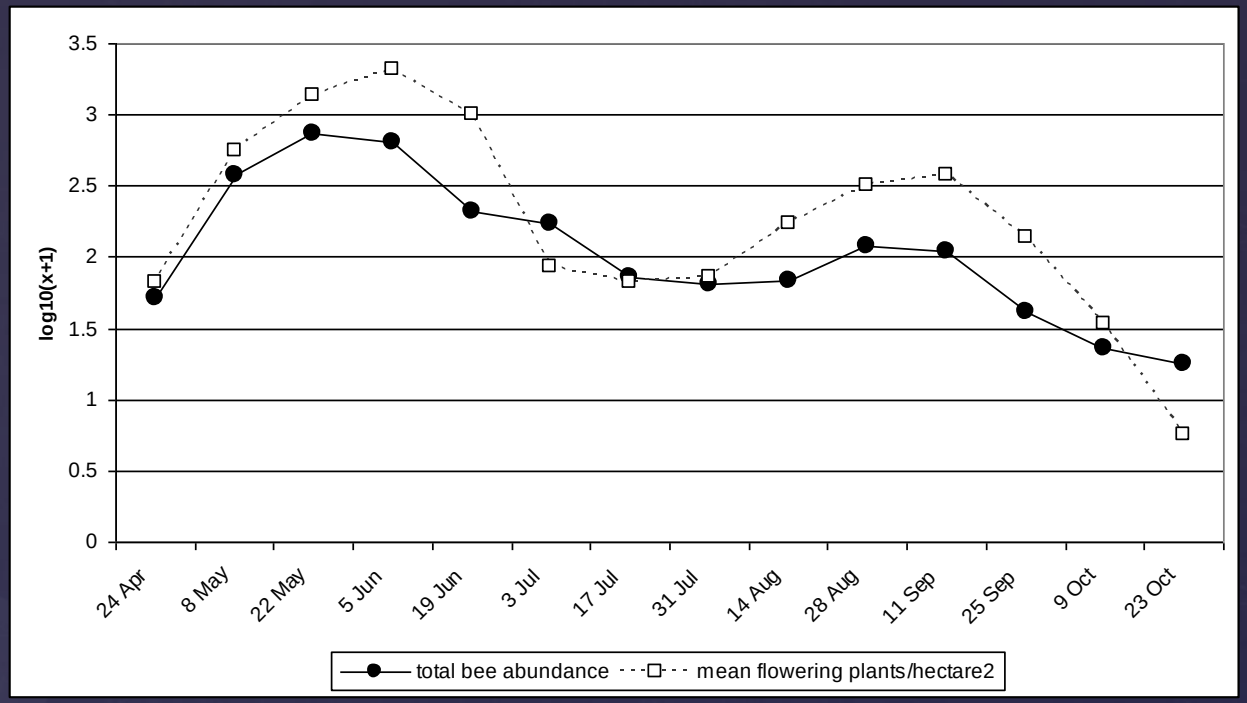




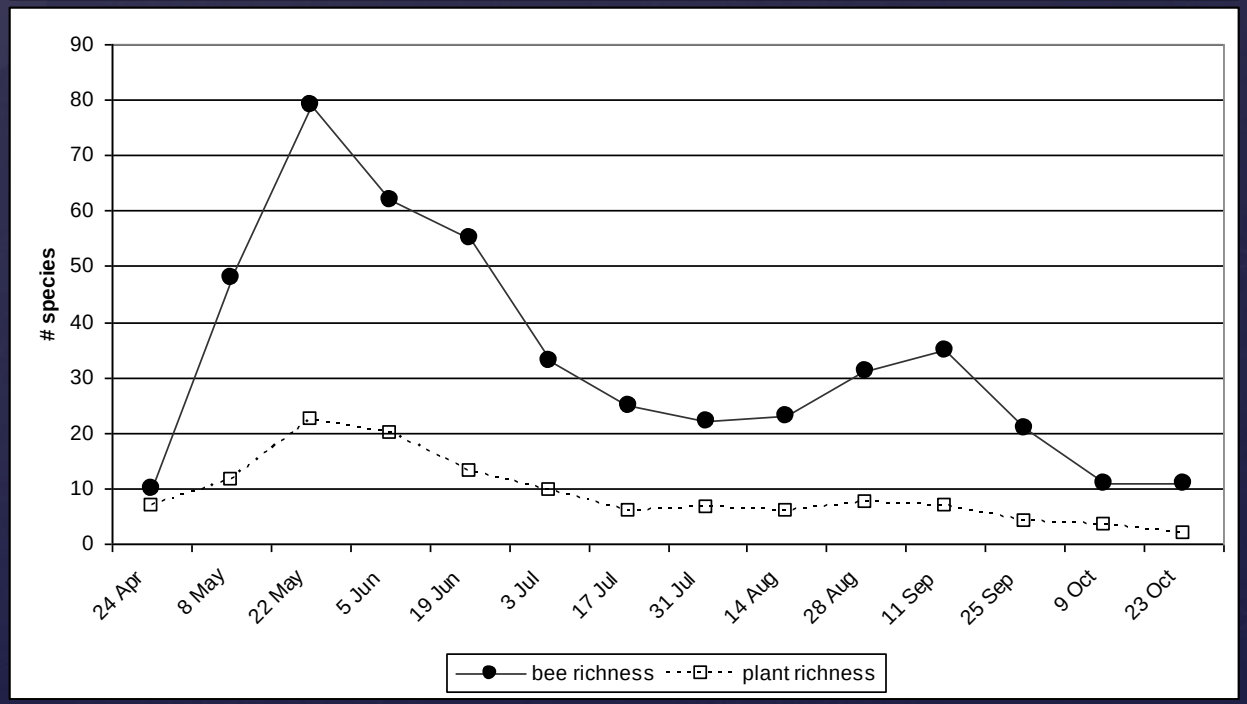



Bee and flowering plant phenology

abundance



richness



Conclusions

1. Bee diversity is influenced by habitat, site, and year
2. A strong relationship exists between flowering plant diversity and bee diversity
3. Pinyon/juniper habitat generally supports the greatest flowering plant and bee diversity
4. Crested wheatgrass supports the lowest bee abundance and diversity
5. Mature pinyon/juniper stands have high conservation value for bee populations
6. Metrics for restoration success should factor in forb abundance

Research objectives are intended to establish protocols so government agencies can encourage private growers to begin native seed production.

Production elements proposed for investigation and protocol development:

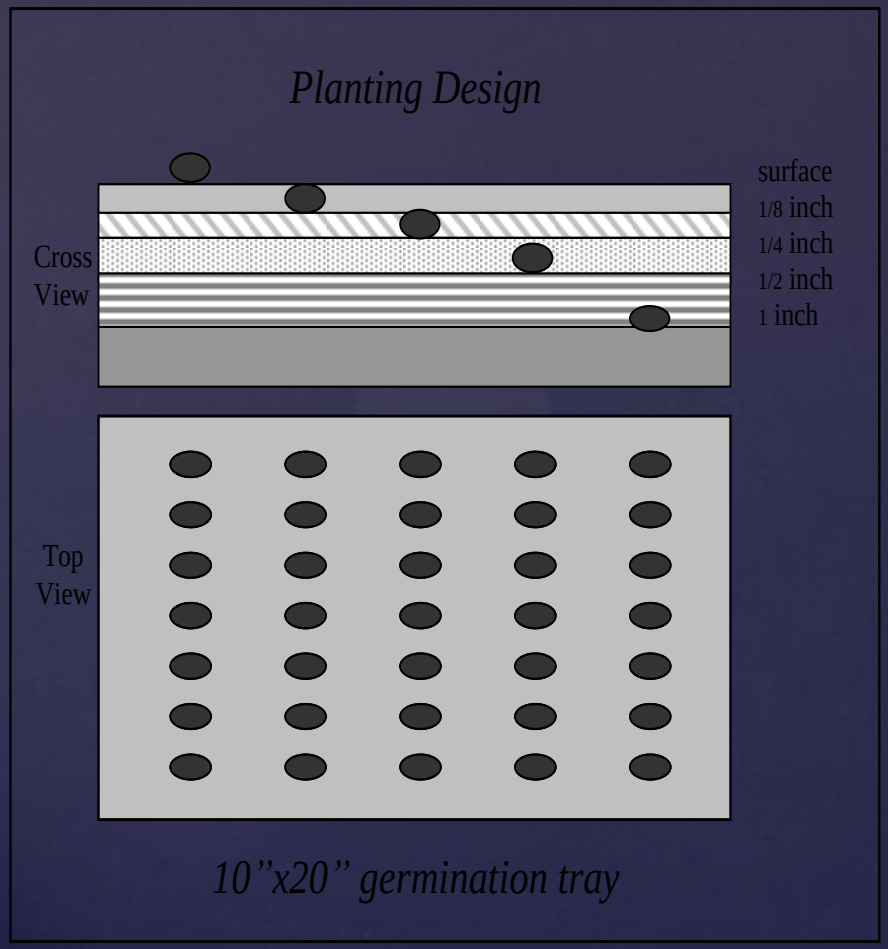
germination barriers
seeding depth
seeding rate
plant spacing
fertilizer regiment
irrigation system/timing
mulches
herbicide sensitivity
mycorrhizal inoculation
seed harvest methods
seed cleaning methods
seed storage

In addition:

Elements of competitive matrix research:

species interactions
germination
establishment
water relations
mortality
biomass
matrix manipulation
chemical biomass/density reduction
mechanical reduction
defoliation
bridge species
species introduction enhancement
mychorrhizal inoculation
water binding additives
fertilizer

Planting Design



Layout and Watering Method

Grasses

- Great Basin Wildrye
- Bluebunch Wheatgrass
- Salina Wildrye
- Bottlebrush Squirreltail
- Fendler's Bluegrass
- Thurber's Needlegrass
- Mountain Brome

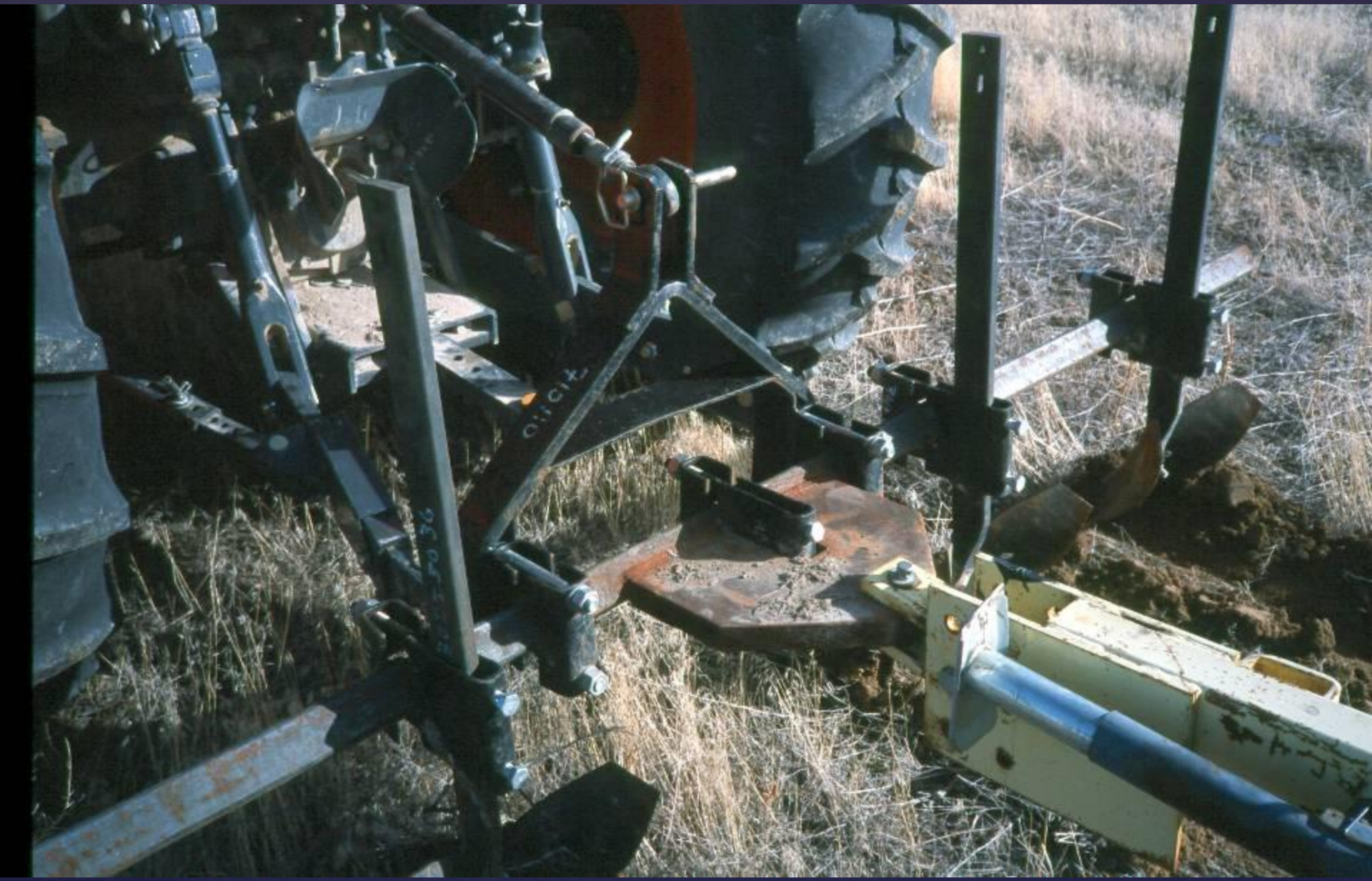
Shrubs

- Service Berry
- Mexican Cliffrose
- Little Leaf Mountain Mahogany
- 4-Wing Saltbush

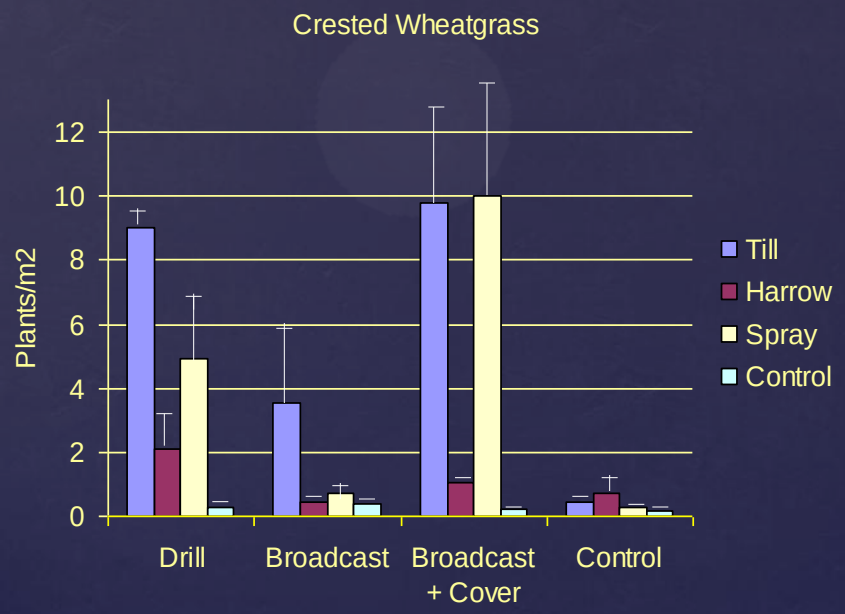
- Big Sagebrush
- Rubber Rabbitbrush
- Winterfat
- Gardner's Saltbush

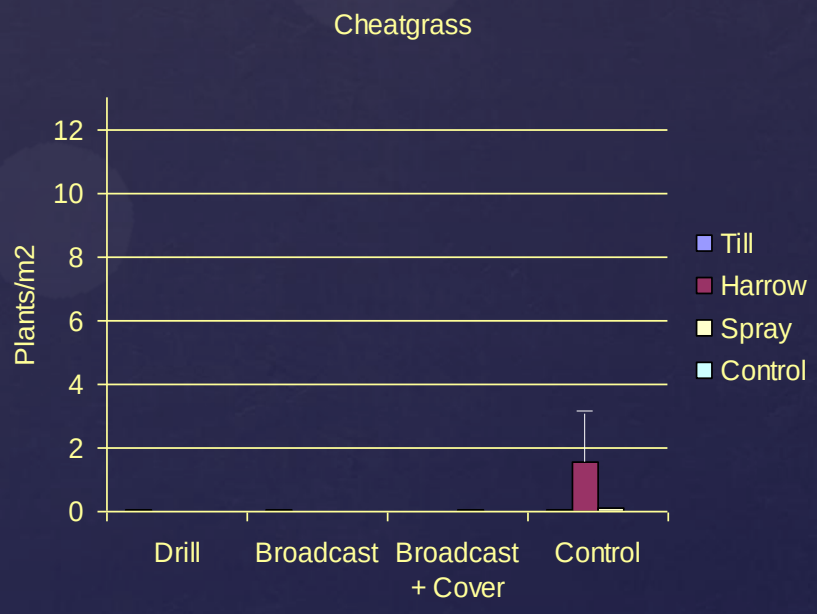
FORBS: Astragalus utahensis
Phlox longifolia
Eriogonum ovalifolium
Sphaeralcea grossularifolia
Sphaeralcea coccinea
Crepis Acuminata
Agoseris glauca

Seeding Practices to improve likelihood of seeded plant emergence and establishment

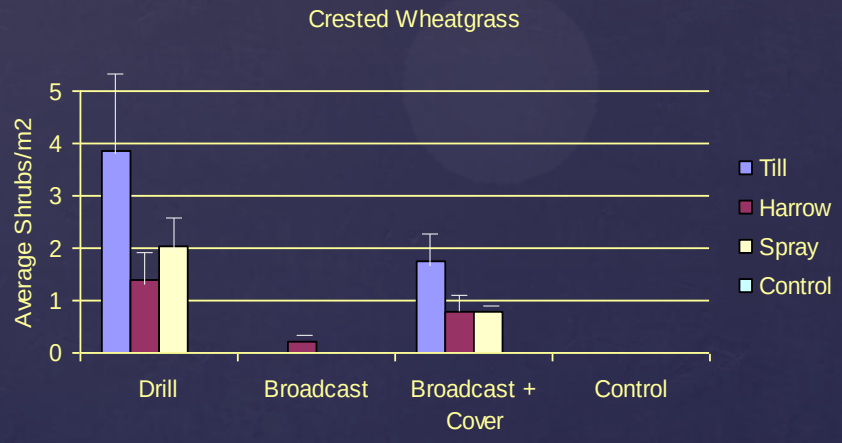


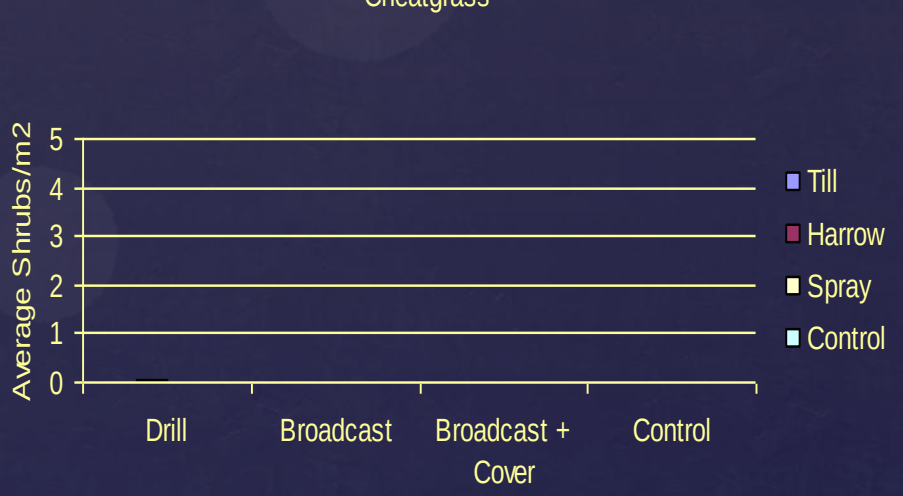
Native Grass Survival: site X soil treatment X seeding method (p=0.016)





A. tridentata & C. nauseosus Survival: site X seedbed preparation X seeding method (p=0.001)

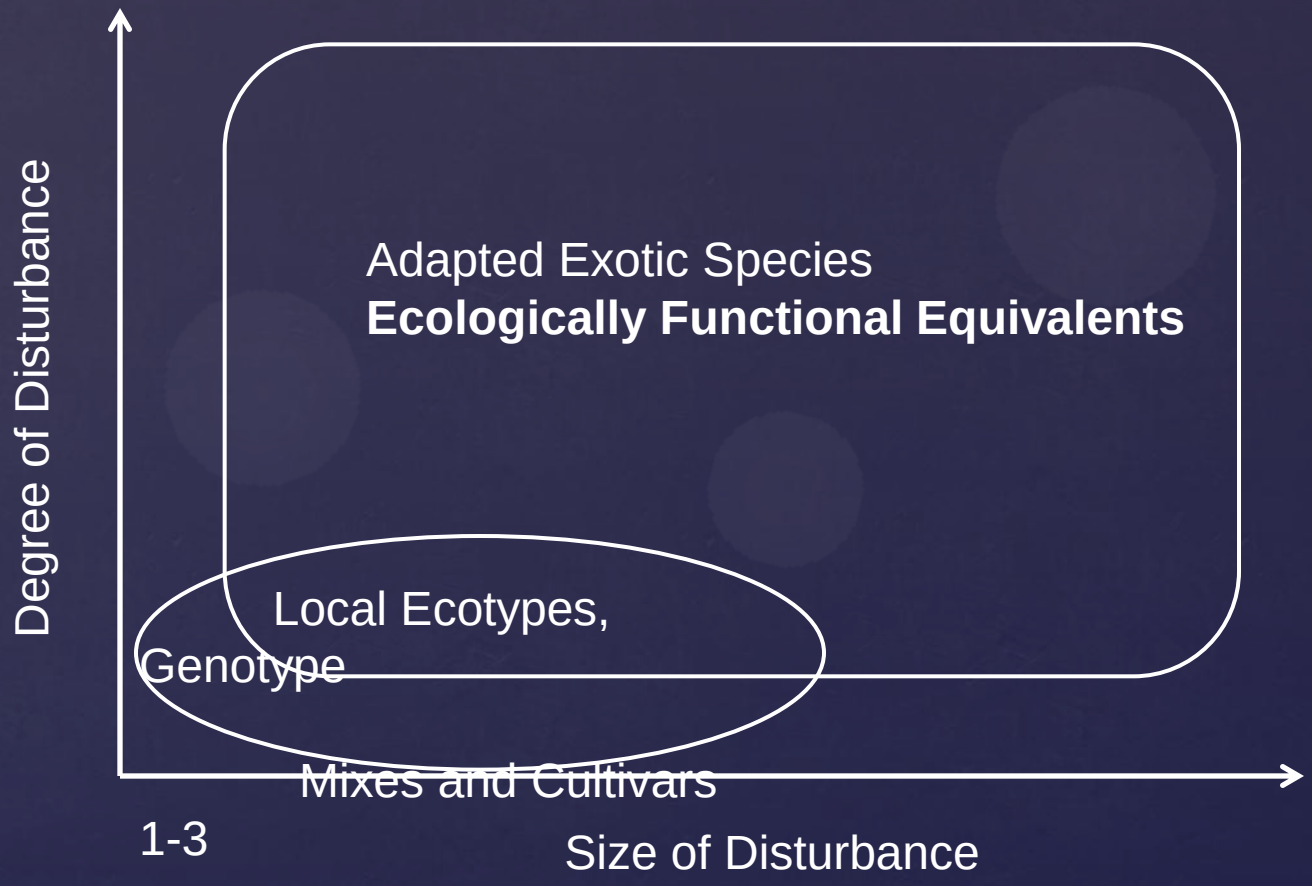




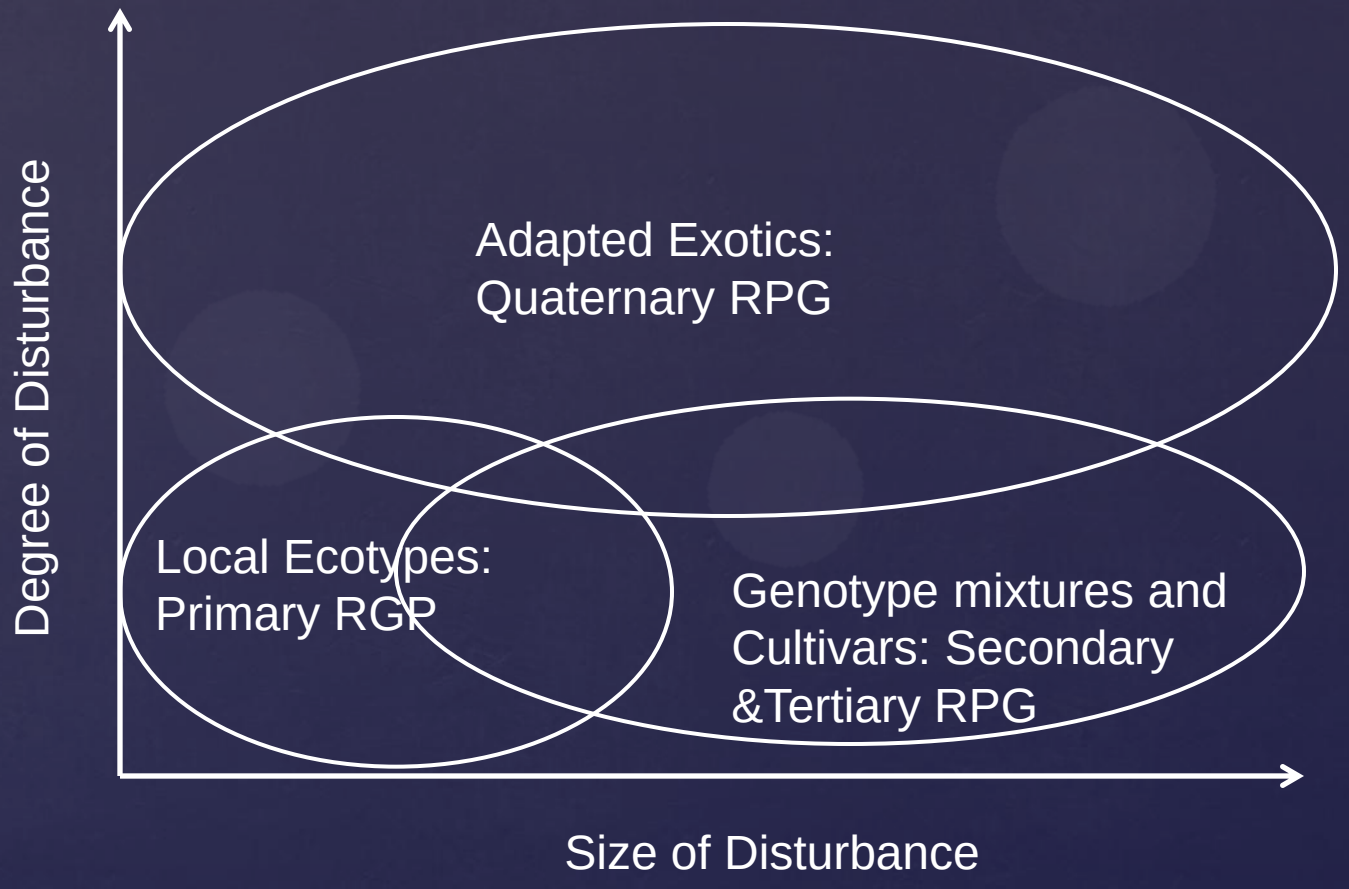
Discussion

- Site Capture
  - Better establishment of natives
    - Reduce fire frequency
    - Establish perennial resource allocation patterns

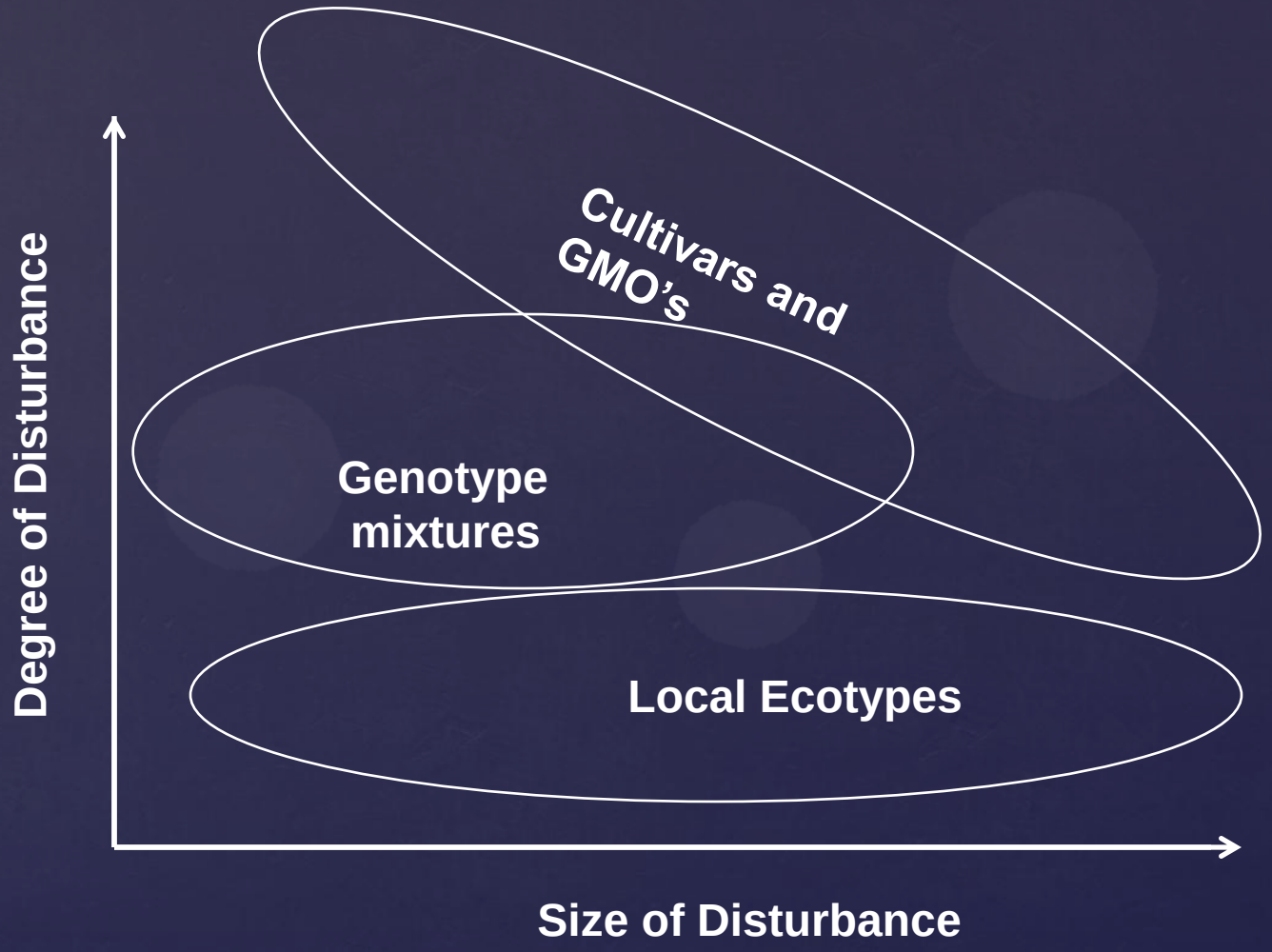
Historic Use



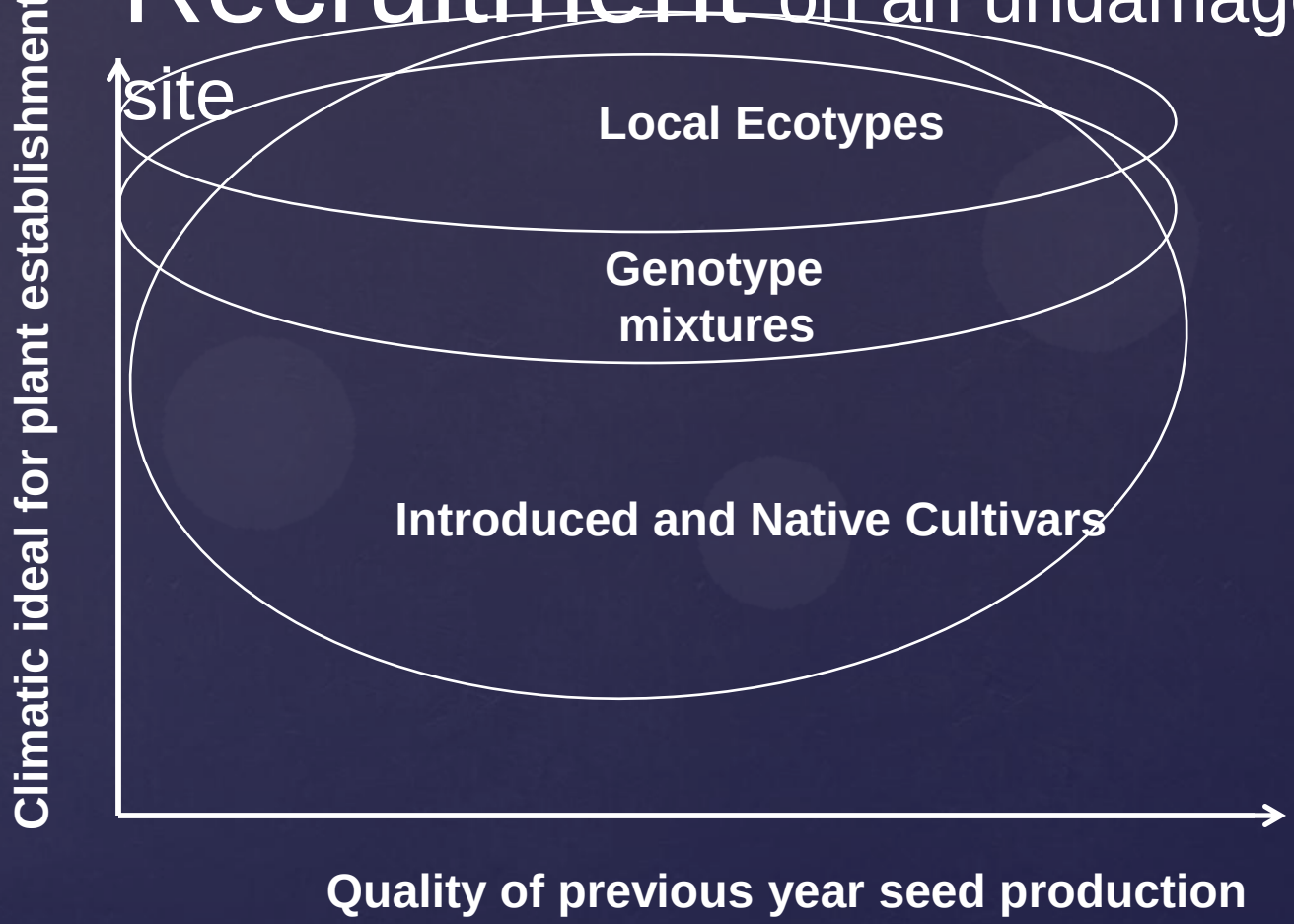
Present Use


Degree of Disturbance
Adapted Exotics:
Quaternary RPG
Local Ecotypes:
Primary RGP
Genotype mixtures and
Cultivars: Secondary
&Tertiary RPG
Size of Disturbance

Preferred Future Model



Episodic Plant Recruitment on an undamaged site



Ecologically Functional Restoration using Novel species combinations

- **Keynote Address for International Society For Ecological Restoration**
  - **Native plant community restoration may not be possible**
    - **Loss of soil**
    - **Invasive species**
    - **Human uses**
    - **Climate Change**

THE DILEMMA

- **PROGRESS**
- WE KNOW WHAT WE WANT (genetic integrity)
- A LATEST BEST THEORY TELLS US WHAT TO USE (Native plants -- local ecotypes)
- RESEACH HAS BEGUN – Ongoing

- **PROBLEMS**
- Relatively FEW Native Plant Materials with PROVEN Records
- AGENCIES PRESSING FOR NATIVES (Impatient)
- $$$$ THE INITIAL SHIFT: Traditional to Natives >>Ecotypes (restructuring of seed industry and demand)
- FAILURE ADDS ENORMOUS LOSS (weed invasion and loss of ecological function)

WHAT TO DO?????

Use what works (PROVEN RECORD)

- It is professionally irresponsible to make recommendations/policy to managers for materials that do not have a record of success in the field!

Evaluate Functional Restoration using Novel Species (both native and introduced) as Ecological Equivalents for Community Composition and Structure

Continue Investigating Native Species

- Need to understand and meet the underlying factors for plant establishment for every material.
- The values or genetics of any seeded plant material is irrelevant if it can't be significantly established.

TESTING

- Traditional multiple site and multiple year trials for either native or novel species/community complexes

- Evaluation of past seeding treatments
  - Compare established plant density, cover and composition relative to seed mix

NEED REPEATED SUCCESS BEFORE:

1) Approve extreme seed costs for local ecotypes

2)Require restructure of our seed industry

3) Risk ecological function by weed invasion on failed seedings