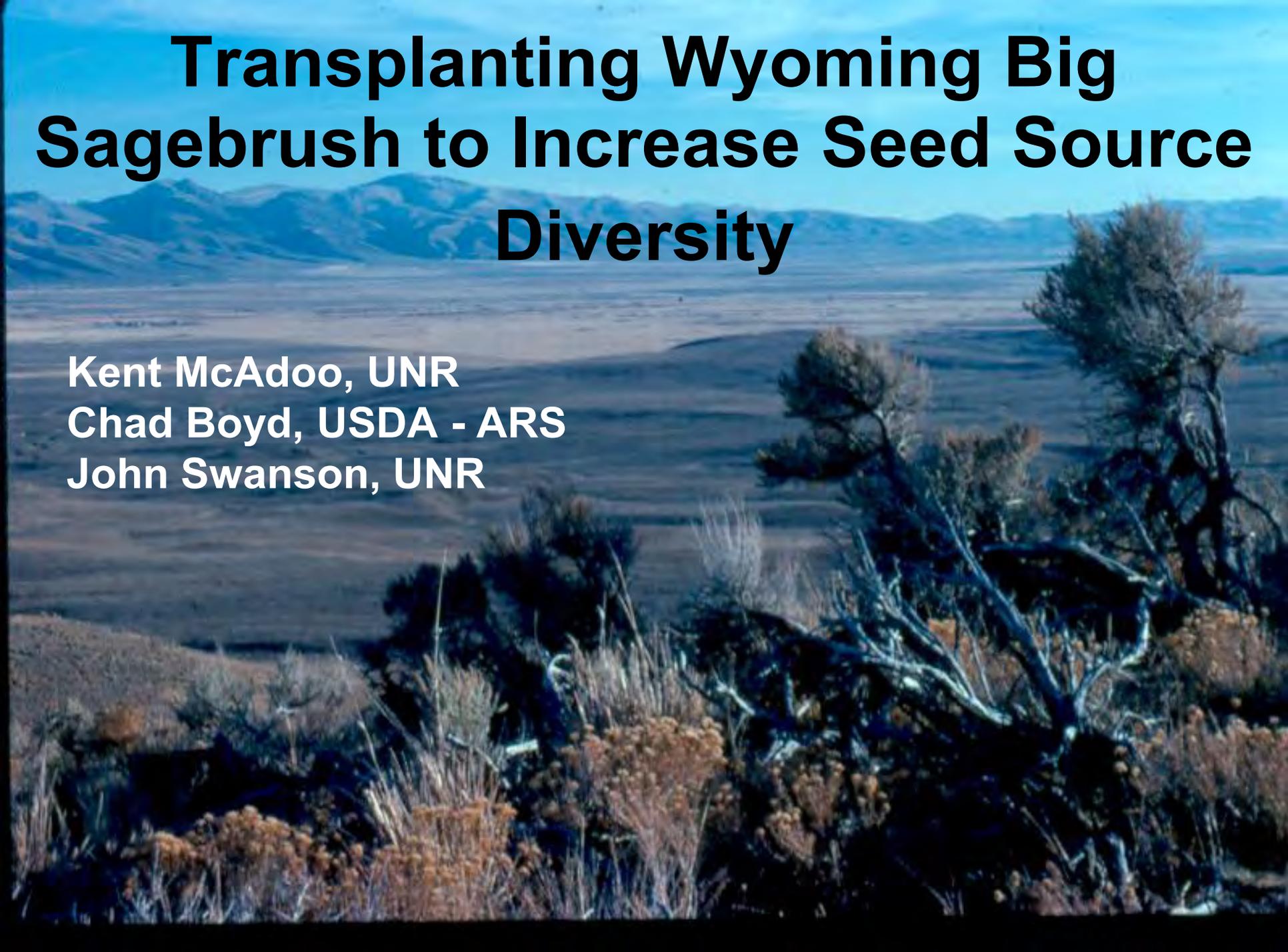


Transplanting Wyoming Big Sagebrush to Increase Seed Source Diversity

A landscape photograph of a Wyoming desert. In the foreground, there are several large, gnarled sagebrush bushes with yellowish-brown flowers. The middle ground shows a vast, flat, brownish desert plain. In the background, there are blue-toned mountains under a clear blue sky.

Kent McAdoo, UNR

Chad Boyd, USDA - ARS

John Swanson, UNR





**Crested Wheatgrass Seedings
With 10% Successional Sage Cover
(18 - 28 yr after shrub control & seeding)**

48% Sage Obligate Birds

52% Grass-nesting Birds

(McAdoo et al. 1989 J. Wildlife Manage.)

Seeded Species Establishment (*grasses, forbs, no sagebrush*)



Rationale for Planting “Island” Sagebrush Plants

- **Recruitment from existing seedbanks unreliable/episodic (Perryman et al. 2001)**
- **Successfully planting seeds is unreliable (Shaw et al. 2005)**
- **But seedlings can be readily transplanted (McArthur et al. 2004)**
- **Shrub “islands” can serve as dispersed seed sources, accelerating site diversification (Longland & Bateman 2002)**

Objectives - to determine the influence of:

- **Site (3 plant communities)**
 - **Reduction of herbaceous competition**
 - **Plant source (wildings vs. nursery stock)**
- ...on survival of sagebrush transplants**

Collecting Wildings with a “Weed Wrench”[®]









Study Sites

- **Cheatgrass monoculture**
- **Crested wheatgrass monoculture**
- **Post-fire native herbaceous community**

Cheatgrass Monoculture



Crested Wheatgrass Monoculture



Post-fire Native Herbaceous Community



Treatments

- **Treatments in randomized block design with 5 replications**
- **Spring-applied treatment of glyphosate (64 oz/ac) to reduce herbaceous cover.**
- **Each block includes eight 5m² plots representing factorial combinations of herbicide treatment, no herbicide treatment, year of planting, and plant source (native or nursery stock).**
- **Ten sagebrush plants were planted in each plot.**

Sampling & Analysis

- **Sagebrush survival measured in Sept. by direct count**
- **Seedling height recorded for each surviving transplant**
- **Data analyzed for treatment effects using mixed model analysis of variance with block and treatment x block considered random and other effects fixed.**

Timeline

- **2009, spring - establish plots, spray herbicide, pull and plant sagebrush wildings, plant sagebrush nursery stock**
- **2009, fall – collect survival and height data**
- **2010, spring & fall – repeat as described above**
- **2011 – collect estab. data, complete data analysis, and prepare manuscript**

Directing Successional Change (Applied EBIPM Principles)

- **Disturbance/Site Availability – glyphosate**
- **Colonization/Dispersal – shrub transplants**
- **Species Performance –**
 - * **competition reduction**
 - * **plant source provision**



87% Herbaceous Vegetation Control with Glyphosate





Preliminary Results



Cheatgrass Monoculture Site - 2009

Sagebrush Transplant Survival

<u>Source</u>	<u>Herb. Control</u>	<u>% Survival*</u>
Nursery	Untreated	38 ^a
Nursery	Glyphosate	50 ^a
Wilding	Untreated	6 ^b
Wilding	Glyphosate	18 ^c

* Means followed by differing letters are significantly different @ $p < 0.05$

Cheatgrass Monoculture Site - 2010

Sagebrush Transplant Survival

<u>Source</u>	<u>Herb. Control</u>	<u>% Survival*</u>
Nursery	Untreated	8 ^{cd}
Nursery	Glyphosate	16 ^{bd}
Wilding	Untreated	10 ^c
Wilding	Glyphosate	34 ^a

* Means followed by differing letters are significantly different @ $p < 0.05$

Crested Wheatgrass Monoculture Site - 2009

Sagebrush Transplant Survival

<u>Source</u>	<u>Herb. Control</u>	<u>% Survival*</u>
Nursery	Untreated	40 ^a
Nursery	Glyphosate	46 ^a
Wilding	Untreated	4 ^b
Wilding	Glyphosate	10 ^c

* Means followed by differing letters are significantly different @ $p < 0.05$

Crested Wheatgrass Monoculture Site - 2010

Sagebrush Transplant Survival

<u>Source</u>	<u>Herb. Control</u>	<u>% Survival*</u>
Nursery	Untreated	4 ^{ab}
Nursery	Glyphosate	12 ^a
Wilding	Untreated	2 ^b
Wilding	Glyphosate	4 ^{ab}

* Means followed by differing letters are significantly different @ $p < 0.05$

Native Herbaceous (Post-fire) Site - 2009

Sagebrush Transplant Survival

<u>Source</u>	<u>Herb. Control</u>	<u>% Survival*</u>
Nursery	Untreated	68 ^a
Nursery	Glyphosate	68 ^a
Wilding	Untreated	6 ^b
Wilding	Glyphosate	22 ^c

* Means followed by differing letters are significantly different @ $p < 0.05$

Native Herbaceous (Post-fire) Site - 2010

Sagebrush Transplant Survival

<u>Source</u>	<u>Herb. Control</u>	<u>% Survival*</u>
Nursery	Untreated	14 ^b
Nursery	Glyphosate	36 ^a
Wilding	Untreated	12 ^{ab}
Wilding	Glyphosate	20 ^{ab}

* Means followed by differing letters are significantly different @ $p < 0.05$

All Sites Combined - 2009
Sagebrush Transplant Survival

<u>Source</u>	<u>Herb. Control</u>	<u>% Survival*</u>
Nursery	Untreated	49 ^a
Nursery	Glyphosate	55 ^a
Wilding	Untreated	5 ^b
Wilding	Glyphosate	17 ^c

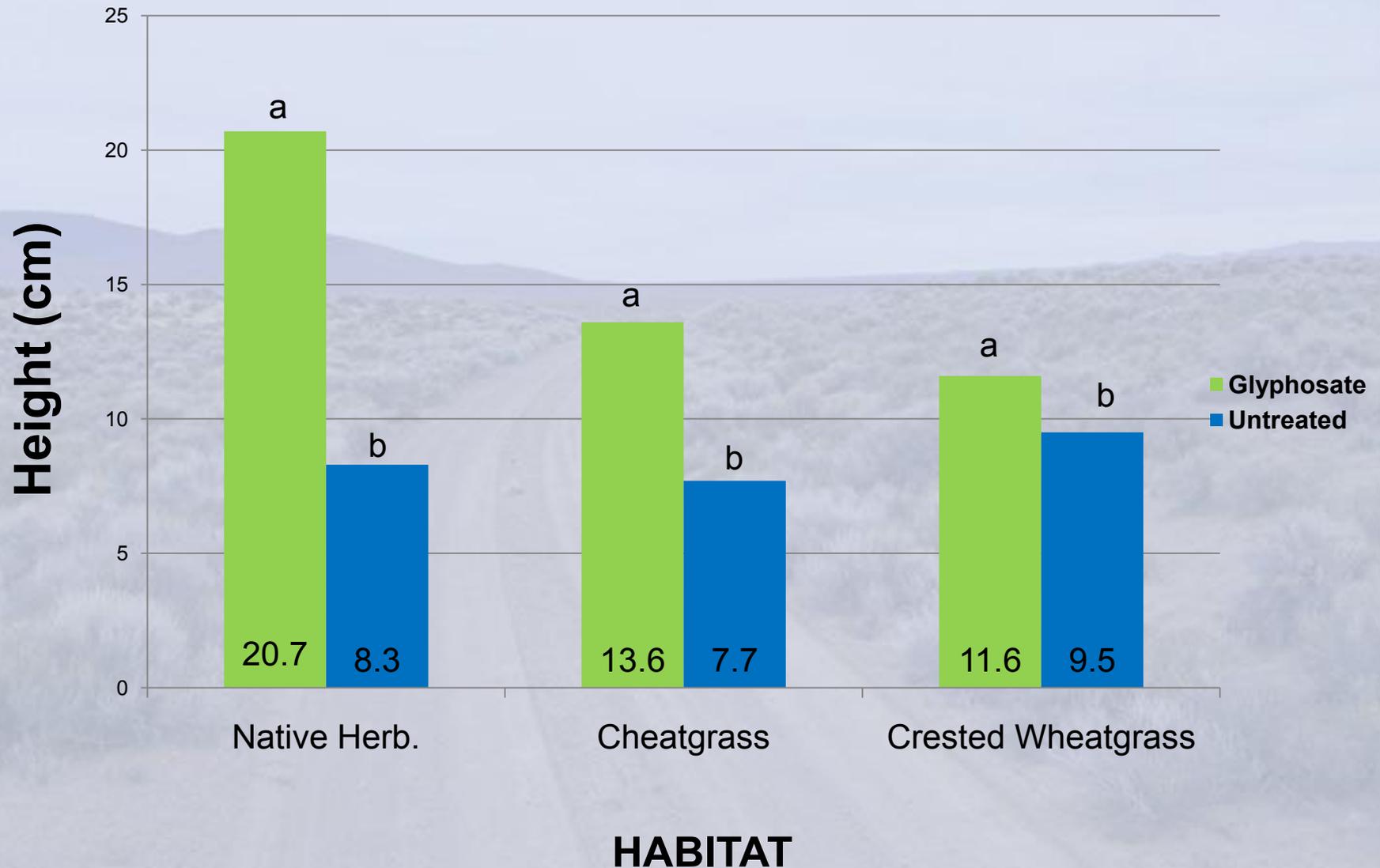
* Means followed by differing letters are significantly different @ $p < 0.05$

All Sites Combined - 2010
Sagebrush Transplant Survival

<u>Source</u>	<u>Herb. Control</u>	<u>% Survival*</u>
Nursery	Untreated	10.0 ^a
Nursery	Glyphosate	21.3 ^b
Wilding	Untreated	8.7 ^a
Wilding	Glyphosate	19.3 ^b

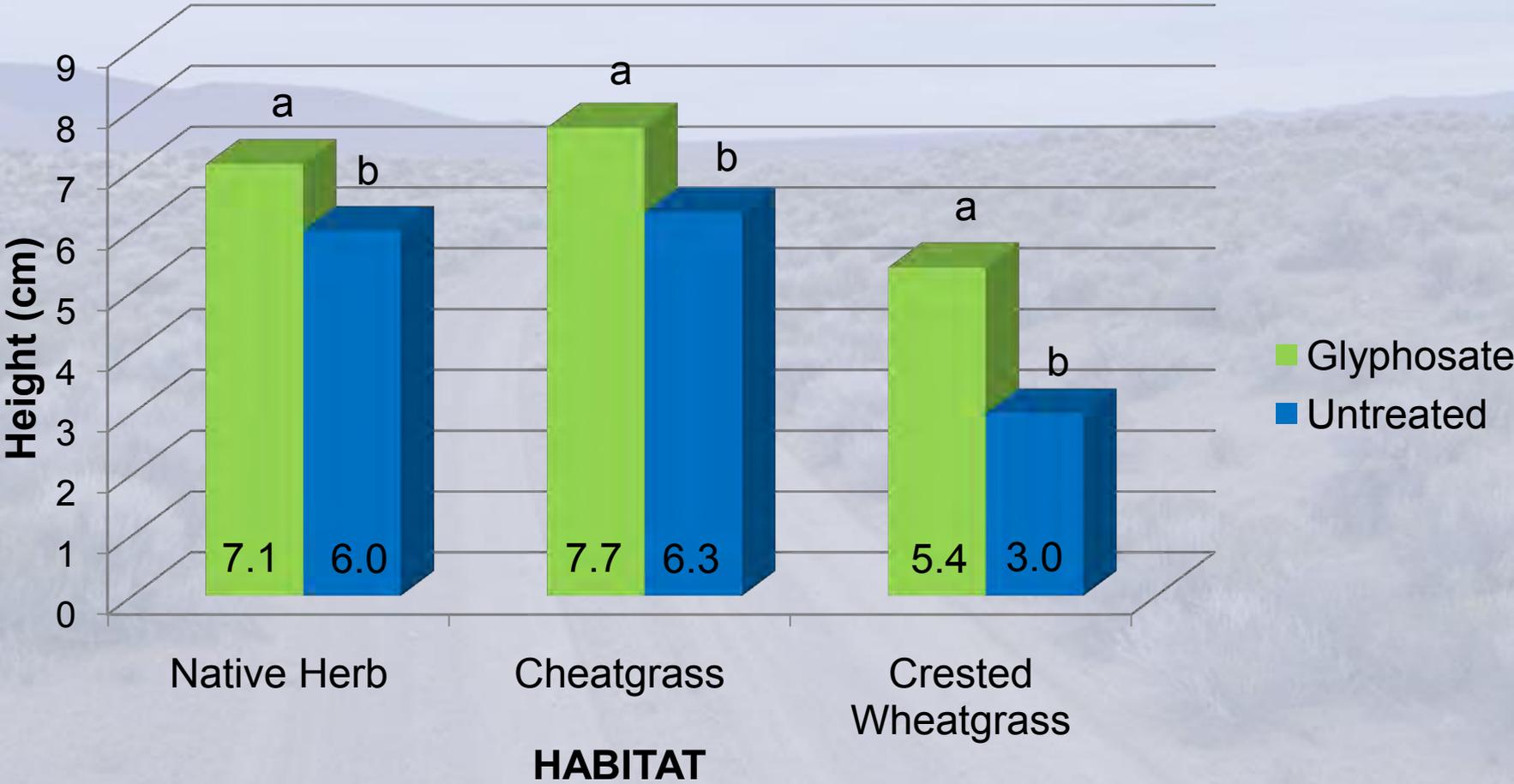
* Means followed by differing letters are significantly different @ $p < 0.05$

Sagebrush Nursery Stock Robustness - 2009



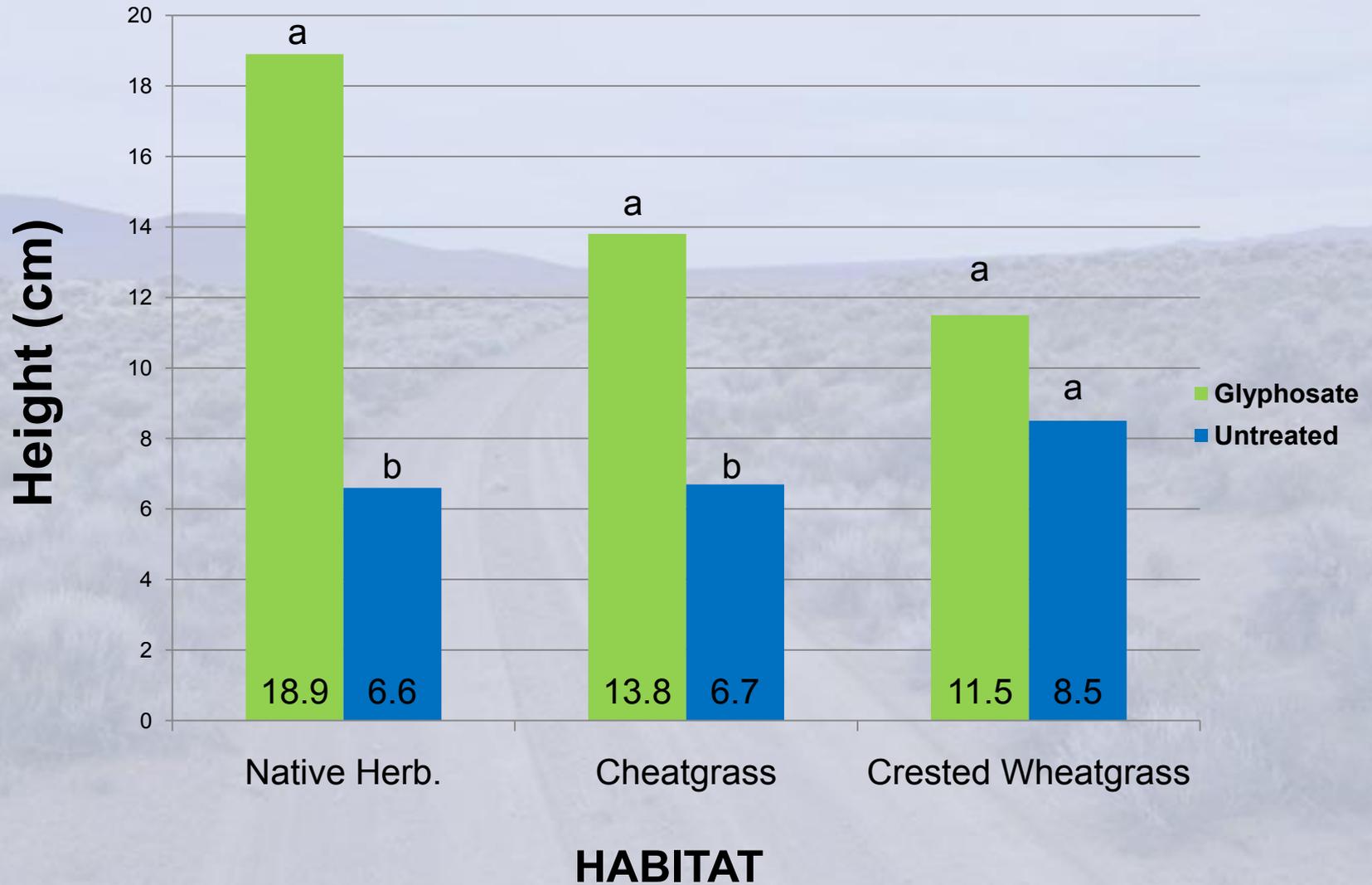
*Means within a habitat followed by differing letters are significant @ $p < 0.001$

Sagebrush Nursery Stock Robustness - 2010



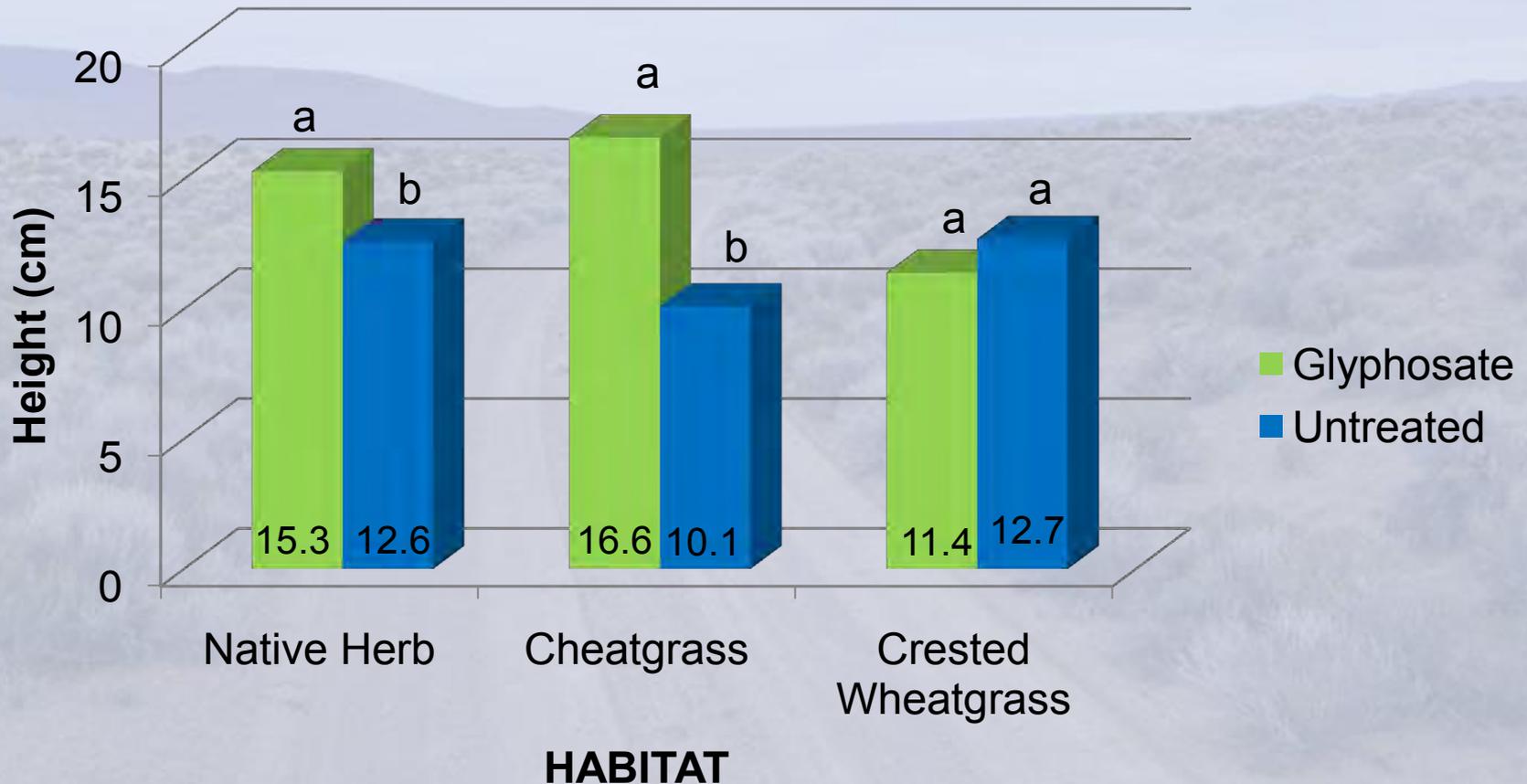
*Means within a habitat followed by differing letters are significant @ $p < 0.001$

Sagebrush Wilding Transplant Robustness - 2009



*Means within a habitat followed by differing letters are significant @ $p < 0.001$

Sagebrush Wilding Transplant Robustness - 2010

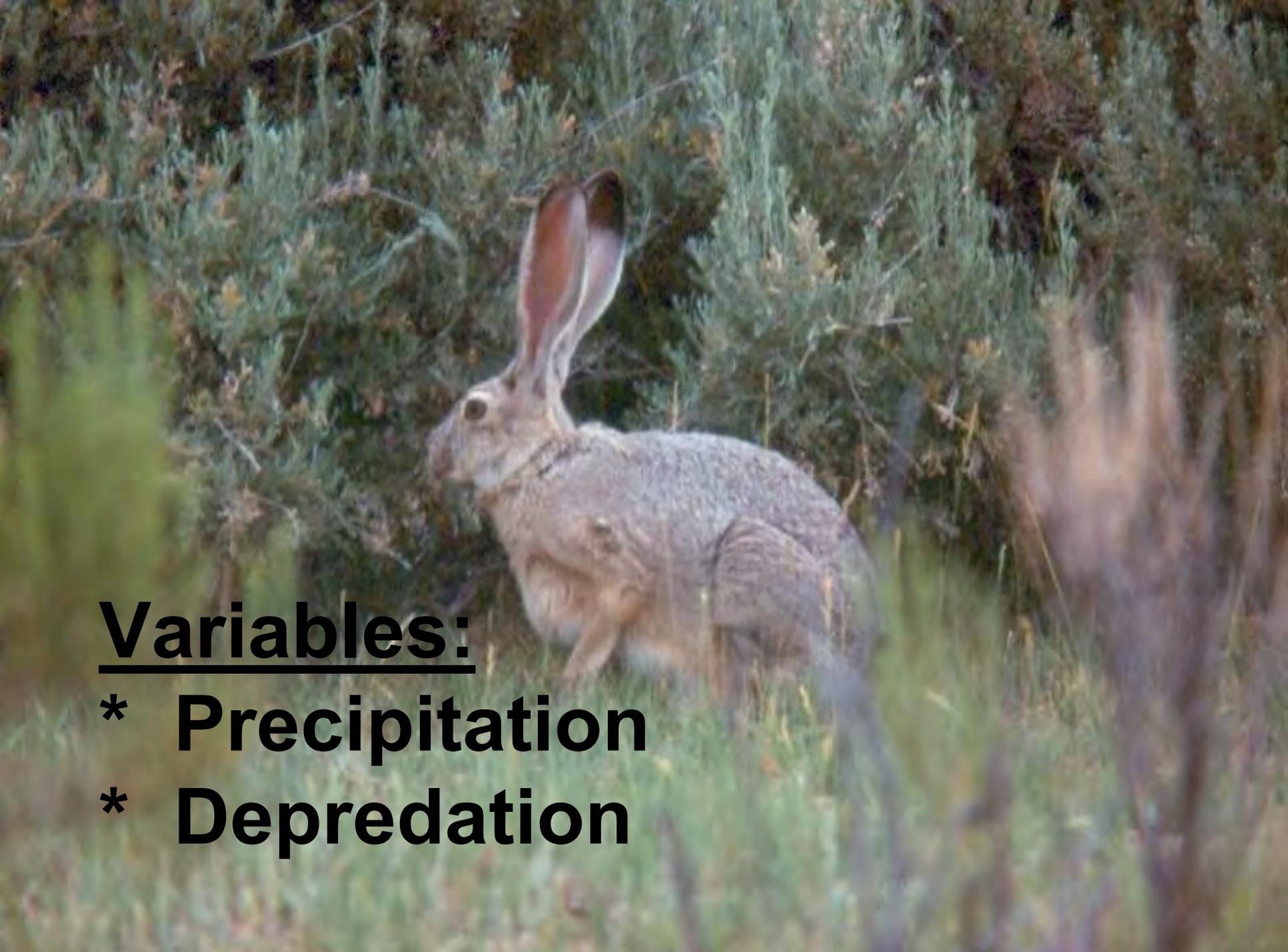


*Means within a habitat followed by differing letters are significant @ $p < 0.001$

Second Growing Season







Variables:

- * Precipitation**
- * Depredation**



Jackrabbit Impacts?

McAdoo et al. 1987. Use of new rangeland seedings by black-tailed jackrabbits. J. Range Manage. 40:520-524.





Jackrabbit Depredation

Summary

- **Nursery stock out-performed wildings first yr**
- **Overall survival variable by year (precipitation-related?)**
- **Control of herbaceous cover benefitted wildings more than nursery stock**
- **Control of herbaceous cover produced more robust sagebrush plants**

**A special thanks to Steve Monsen,
retired USFS range ecologist, for his
advice & encouragement**



