

# IMPACT OF INVASIVE PLANTS ON RANGELAND AND GRASSLAND ECOSYSTEMS

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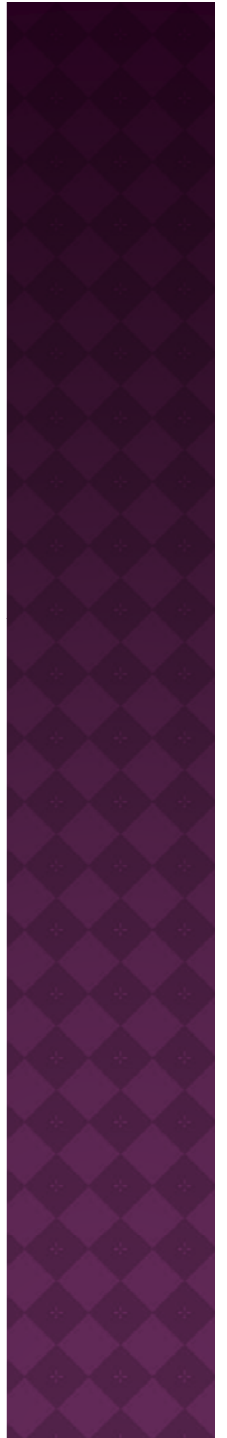
# IMPACTS ON HUMAN ACTIVITIES

- Lower livestock forage quality and quantity
- Physically interfere with grazing
- Compromise livestock, horse or human health
- Increase cost of managing and producing livestock
  - slow animal weight gain
  - reducing the quality of meat, milk, wool, and hides
- Impede recreation activities
- Reducing land value



# ECONOMIC IMPACTS

- ◉ Noxious weeds cause more economic loss in rangeland than all other pests combined
- ◉ Estimated impact of rangeland weeds to be at least \$2 billion annually
- ◉ Direct and indirect losses due to poisoning of cattle and sheep estimated at \$340 million 20 years ago



# IMPACTS ON BIOTIC ASPECTS OF NATURAL ECOSYSTEMS



- Reduce wildlife forage
- Alter wildlife habitat
- Lower plant and animal diversity
  - natives or endangered species

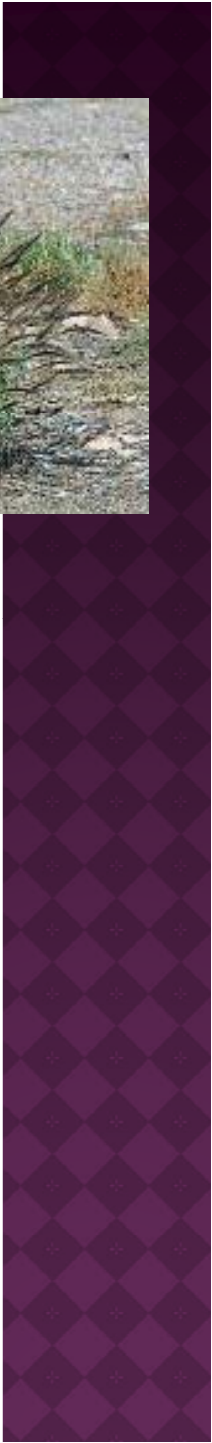


## IMPACTS ON PLANT AND ANIMAL DIVERSITY

- ◉ In spotted knapweed-infested range, Rocky Mountain elk use reduced by 98% compared with bunchgrass-dominated sites. Elk use increased 266% with removal of invasive.
- ◉ Areas dominated by leafy spurge had between 70 and 83% less forage value for bison and deer in Theodore Roosevelt National Park in North Dakota.
- ◉ Leafy spurge infestations reduced most native species and decreased species richness by 75%.
- ◉ Number of plant species present in California rangelands increased 35% following biological control of klamathweed.
- ◉ In Montana, spotted knapweed reduced germination and establishment of the rare endemic *Arabis fecunda* and in North Dakota leafy spurge has threatened the endangered prairie fringed orchid.



Impacts of increase in rodent populations on Saguaro cactus due to buffelgrass (*Pennisetum ciliare*)

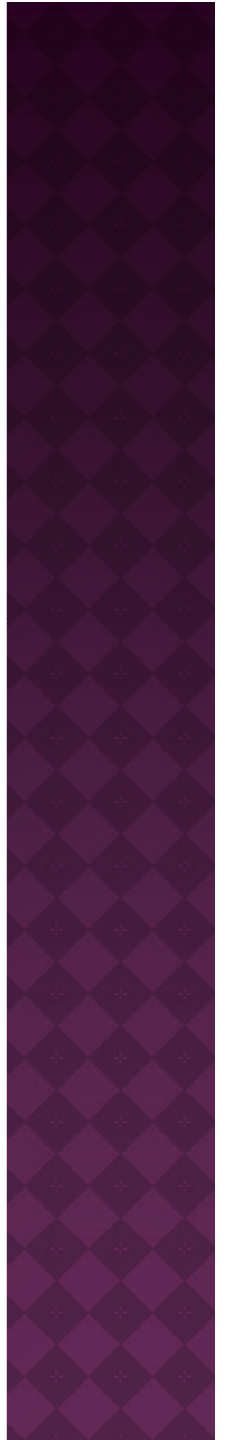


# NATURALIZED SPECIES

Non-native species that overcomes survival and reproductive barriers within an environment and can survive without human intervention for an extended period (>25 years). Species known as waifs are similar but do not persist for an extended time.

# INVASIVE SPECIES

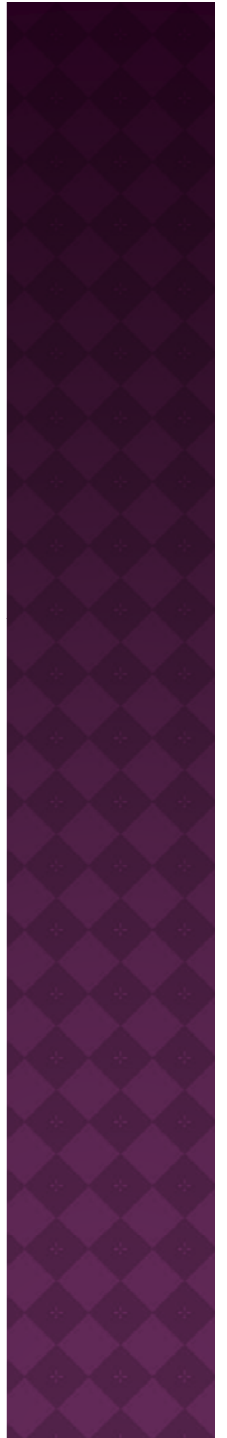
Non-native naturalized species that enters, overcome environmental barriers, and spreads into ecosystems outside its native range to become a substantive member of the new community. Most invasive species are not considered significant ecological threats.





# TRANSFORMER SPECIES

A subset of invasive species (perhaps 10%) that change the biotic or abiotic character, condition, form or nature of a natural ecosystem over a substantial area. These species are considered significant ecological threats.



# LANDSCAPE TRANSFORMERS

- Excessive users of resources
  - light
  - water
  - CO<sub>2</sub> and O<sub>2</sub>
- Donors of limited resources
  - nitrogen
- Fire promoters and suppressors
- Sand stabilizers
- Erosion promoters
- Colonizers of intertidal mudflats/sediment stabilizers
- Litter accumulators
- Salt or heavy metal accumulators

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# INVASIVE TRANSFORMERS

- ◉ Excessive users of resources
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Leafy spurge  
(*Euphorbia esula*)



# INVASIVE TRANSFORMERS

- ◉ Excessive users of resources
  - Water



Saltcedar

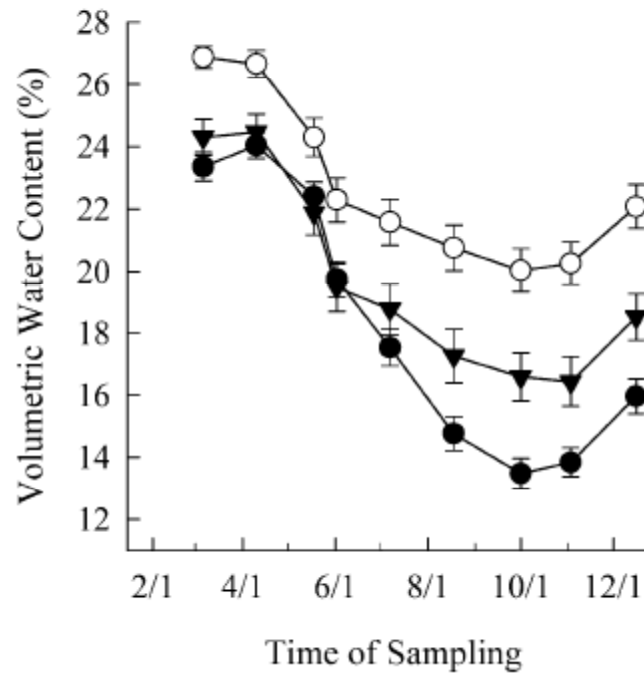
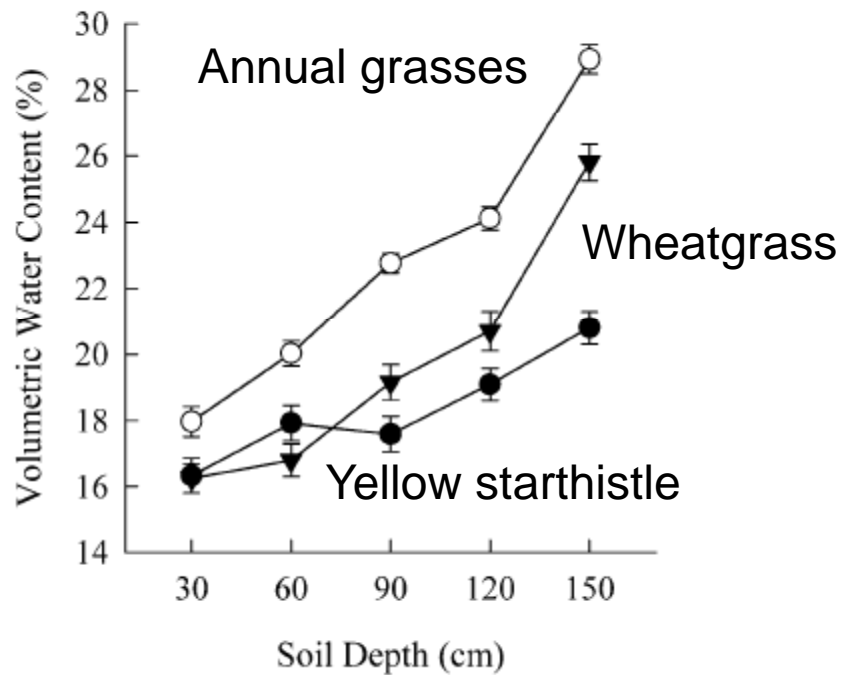
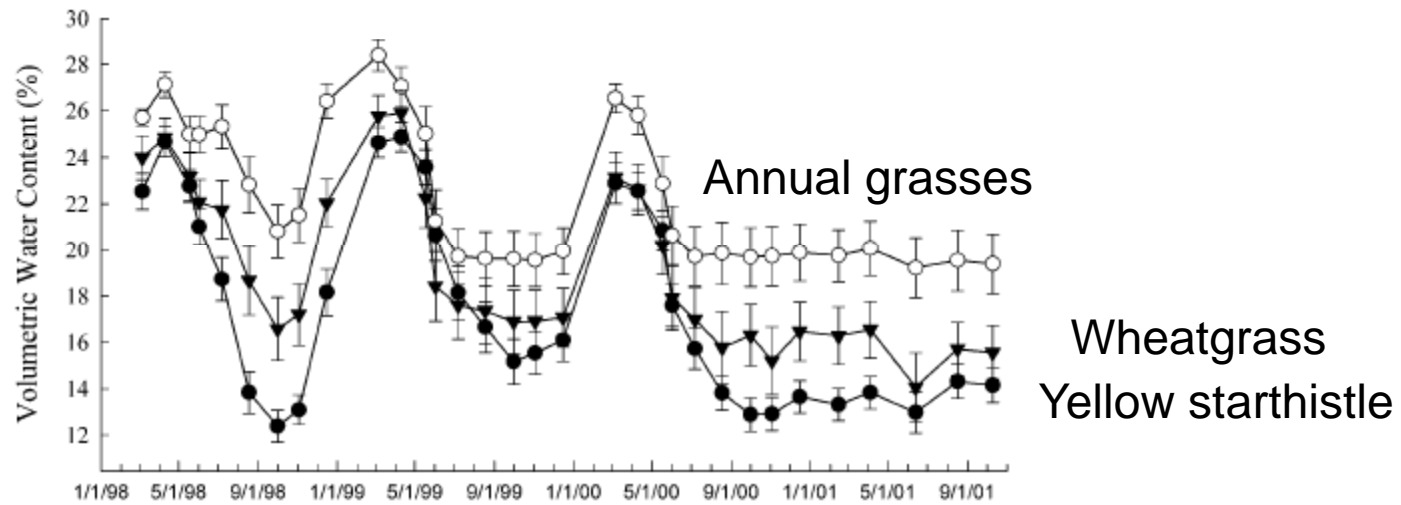
A large tree can absorb 760 L of water a day.



**Yellow starthistle**  
*(Centaurea solstitialis)*



From Enloe et al., 2004. Weed Sci. 52:929-935





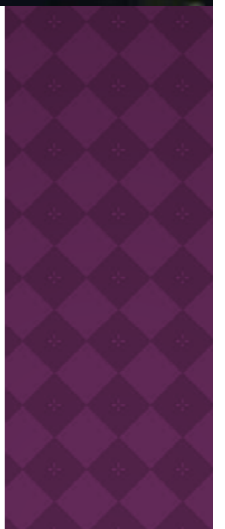
# INVASIVE TRANSFORMERS

- ◉ Donors of limited resources
  - Nitrogen





**Scotch broom**  
**(*Cytisus scoparius*)**



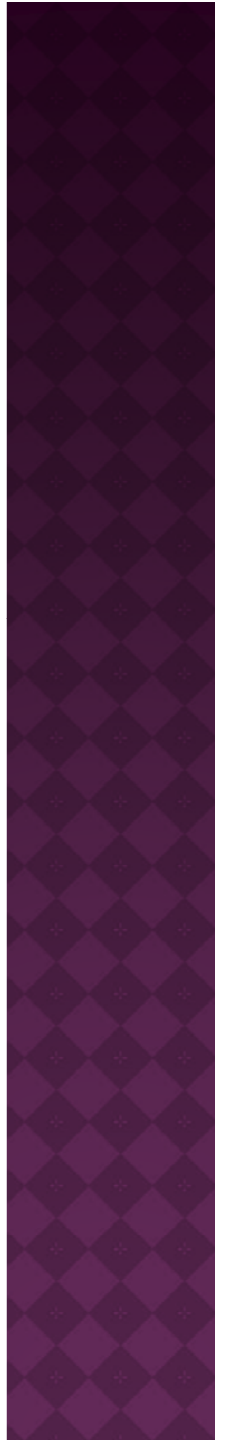
# INVASIVE TRANSFORMERS

## Fire promoters or suppressors

- Suppressors
- Promoters



# JUNIPER



# THE CHEATGRASS (DOWNY BROME) STORY

## ○ Impacts on fire regime

- Historically community composed of bunchgrasses interspersed with long-lived perennial shrubs
- Historic fire regimes infrequent (>50 yrs) or non-existent because of insufficient biomass to carry the fires from shrub to shrub
- With invasion, yearly fine fuel accumulation was far greater than shrub/perennial grass communities
- Biomass accumulates over several years under arid conditions inhibiting rapid decomposition
- Dry fuels extended fire season by one to three months
- End result, cheatgrass fires became common, occurring at <5 yrs intervals



# THE CHEATGRASS (DOWNY BROME) STORY

## ◎ Impacts on vegetation change

- Native vegetation susceptible to changes in vegetation composition after a burn
- Cheatgrass quickly filled an unoccupied resource niche following fire
- Most native perennials unable to re-establish in cheatgrass dominated sites
- Native perennial shrubs (e.g., big sagebrush and shadscale) are non-sprouting following fire and revegetate only through seeds. Short interval fires excludes these common shrubs of the Great Basin
- End effect is native vegetation replaced with pure patches of cheatgrass or swaths of cheatgrass and short-lived perennial shrubs



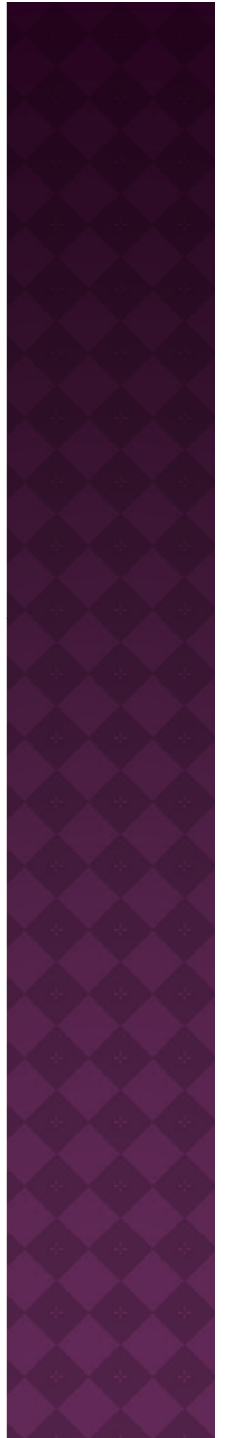
# THE CHEATGRASS (DOWNY BROME) STORY

- **Impacts on livestock, wildlife and economy**
  - Undependability of cheatgrass as a source of forage for cattle and sheep
  - Reduction in native shrubs important for wildlife habitat
    - Sagebrush is the main food or shelter for 170 native bird and mammal species, including sage grouse, pygmy rabbits and pronghorn antelope.
    - Drop in rabbit population has secondary impact on birds of prey (e.g., bald and golden eagles) that utilized rabbits as food



# FIRES IN THE WEST

- ◉ The largest blaze in Utah history in 2007 burned the 363,000 acres. Murphy Complex fires in Idaho and Nevada burned 653,000 acres, largest burn in Idaho in 97 years.
- ◉ In Nevada, 6 million acres of sagebrush have burned since 1999.
- ◉ 397 large wildfires in Great Basin from 1995 to 2007
- ◉ BLM estimates 2 million acres burned in the sagebrush steppes of the Great Basin in 2007.
- ◉ BLM and USFS wildfire suppression costs exceed \$1 billion/yr in 4 of 7 years from 1999 to 2006
- ◉ Suppression costs taking increasingly larger shares of agency budgets - less remains for treatment

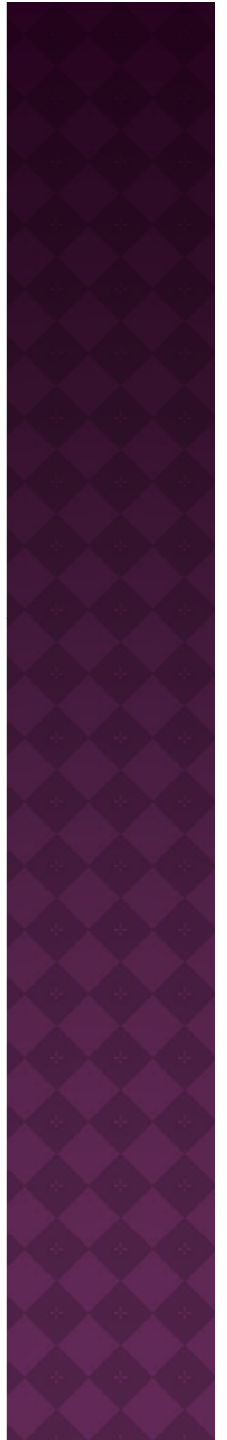


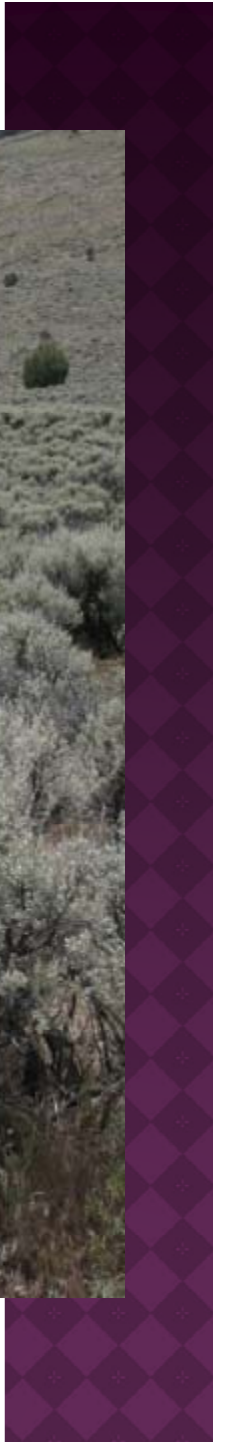






**Downy brome (cheatgrass)**  
**(*Bromus tectorum*)**











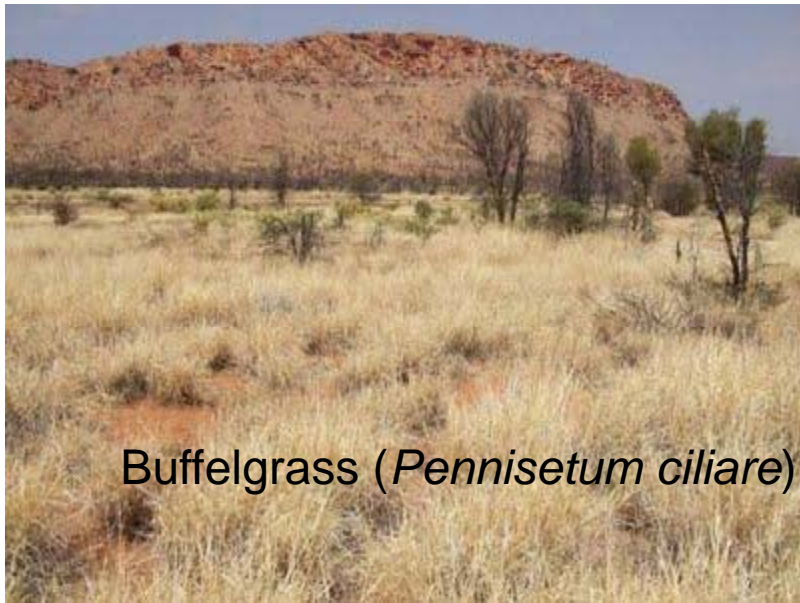
**Medusahead**  
**(*Taeniatherum caput-medusae*)**



Barb goatgrass  
(*Aegilops triuncialis*)



In Hawaii, invasion of perennial grasses provides abundant fuel and increases fire frequency. This leads to dominance by more fire-tolerant non-native species.



Buffelgrass (*Pennisetum ciliare*)



©2010 Aaron Flesch

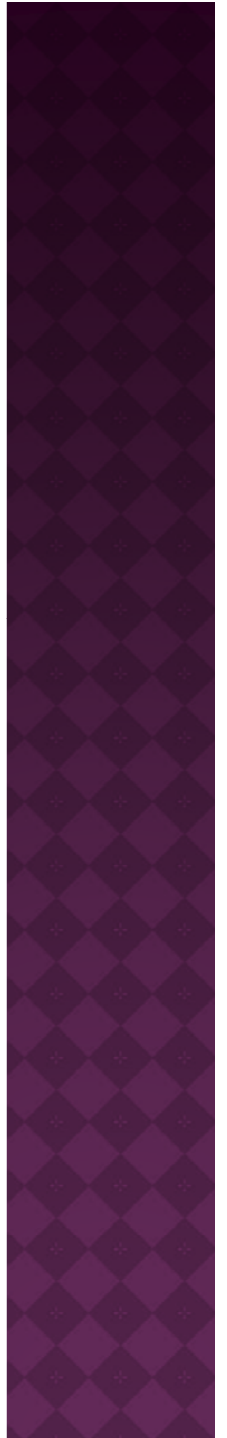


Crimson fountaingrass  
(*Pennisetum setaceum*)



# INVASIVE TRANSFORMERS

- ◉ Erosion promoters



**Scotch thistle**  
(*Onopordum acanthium*)



**Musk thistle**  
(*Carduus nutans*)





**Spotted knapweed**  
(*Centaurea maculosa*)



**Diffuse knapweed**  
(*Centaurea diffusa*)

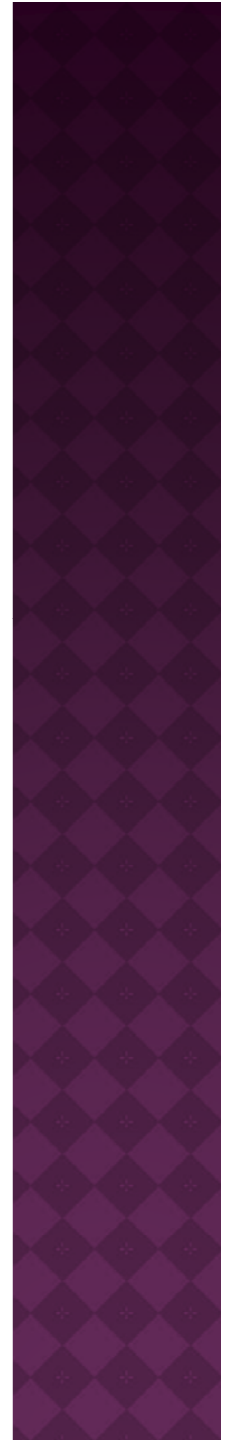
**Squarrose knapweed**  
(*Centaurea squarrosa*)



Surface water runoff increased 56%, stream sediment yields were 192% higher, and water infiltration rates were reduced in a spotted knapweed dominated site compared with adjacent native perennial grassland.

# INVASIVE TRANSFORMERS

- ◉ Litter accumulators





**Perennial pepperweed**  
***(Lepidium latifolium)***

## Control of perennial pepperweed with herbicide



# Winter Burning



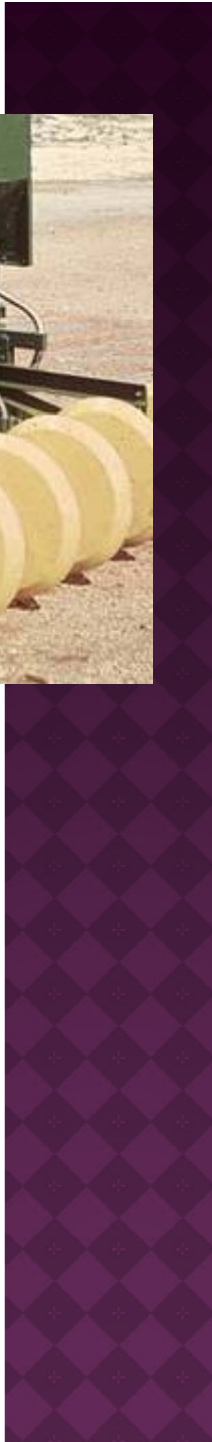
# Fall Disking



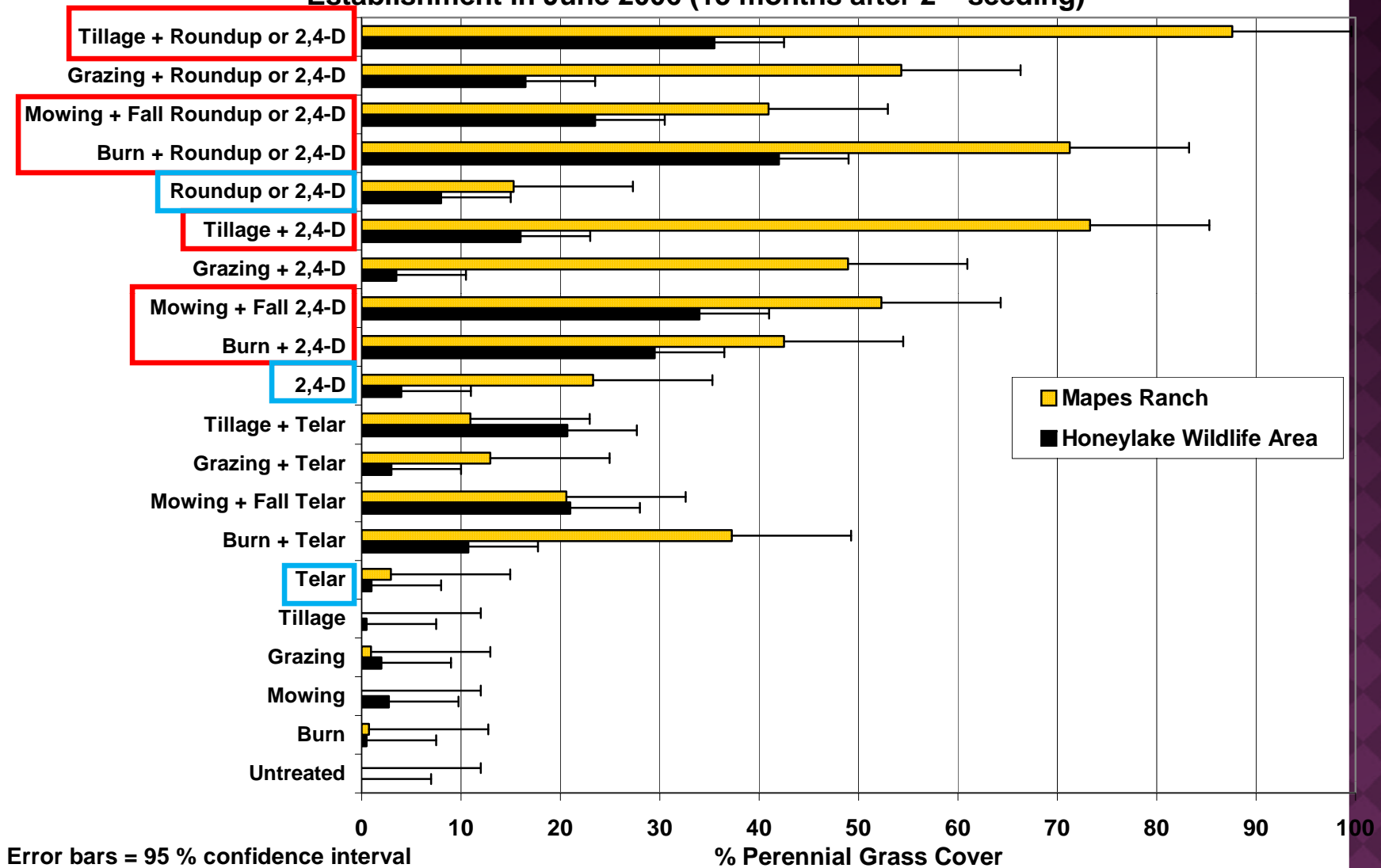


# Winter grazing, or trampling





## The Influence of Site Preparation Treatments and Herbicides on Perennial Grass Establishment in June 2006 (15 months after 2<sup>nd</sup> seeding)



# Burn + 2,4-D + Reseeding (4 years after treatment initiation)



# INVASIVE TRANSFORMERS

- Salt or metal accumulators/redistributors
  - Salt
  - Metals



# SALT CEDAR



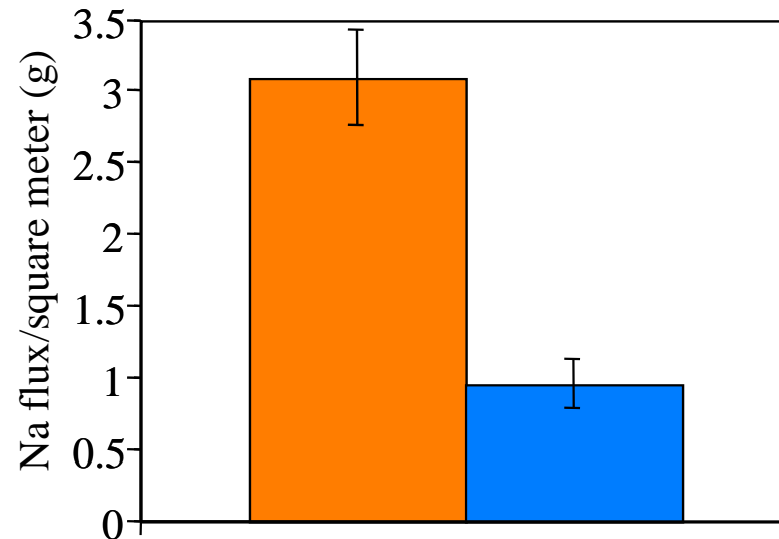
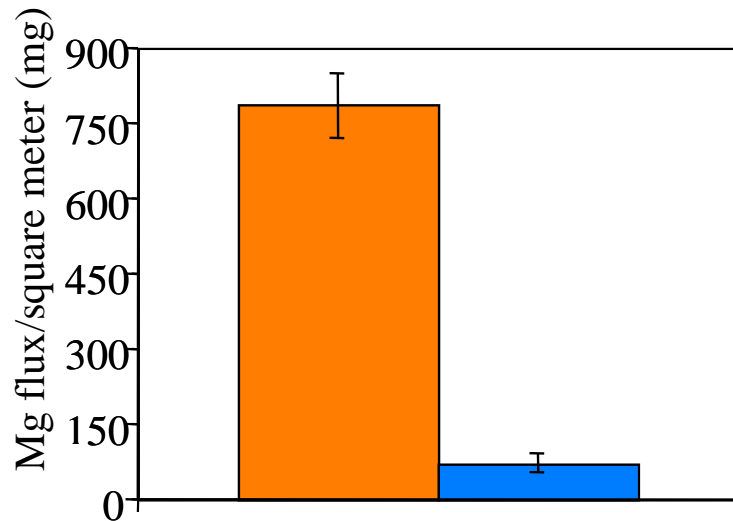
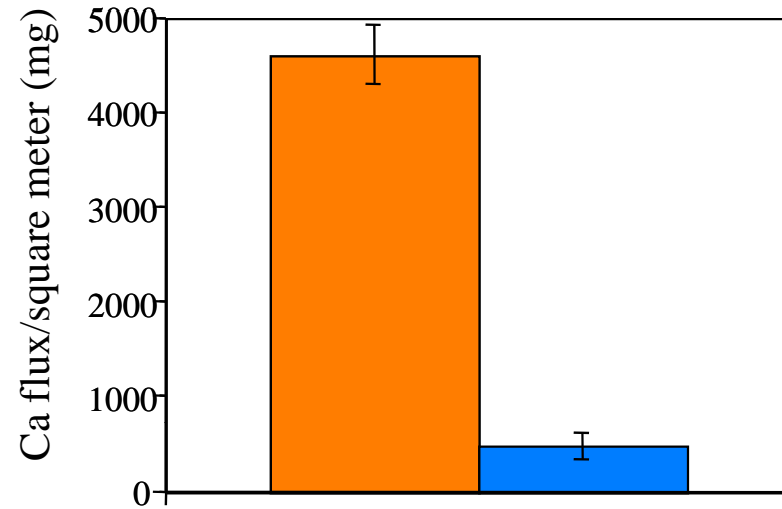
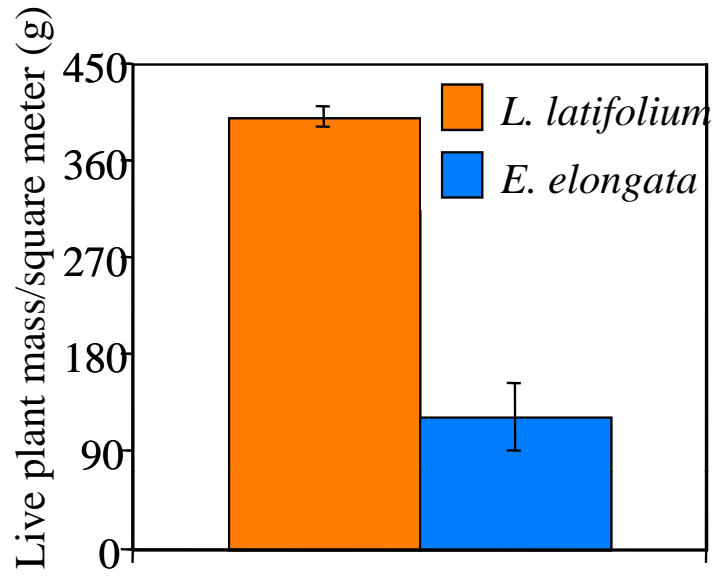
- Tolerate soil salt concentrations from 650 to 36,000 ppm (avg. 6,000 to 8,000 ppm)
- Salt gland exudate up to 41,000 ppm in the guttation sap
- Salts deposited on the soil surface under the plant
- Cottonwood and willow inhibited by salinity >1,500 ppm



**Perennial pepperweed  
(*Lepidium latifolium*)**

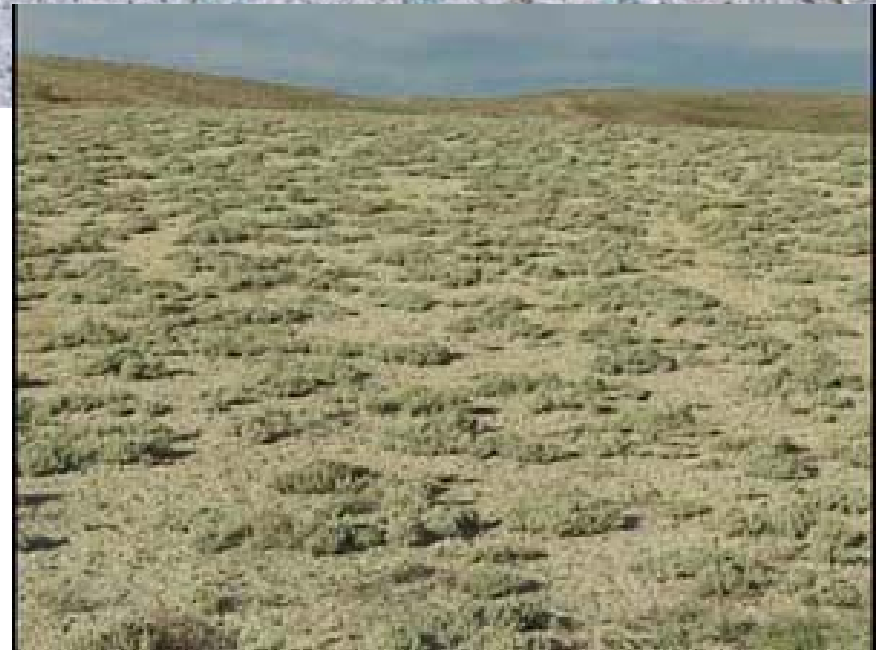


## *Perennial pepperweed: Salt accumulator*



From Bob Blank, USDA-ARS, Reno





**Halogeton [also called saltlover]  
(*Halogeton glomeratus*)**



Russian knapweed  
(*Acroptilon repens*)



# CONCLUSION

- ◉ Impacts of invasive plants in rangelands and grasslands are substantial both economically and ecologically
- ◉ Species of primary concern are those invasives that are capable of transforming the landscape
- ◉ Management and restoration efforts need to consider the processes by which invasive plants transform landscapes and strive to develop communities resilient to invasion and change

