# Revegetating medusahead (*Taeniatherum caput medusae*)-invaded rangeland.

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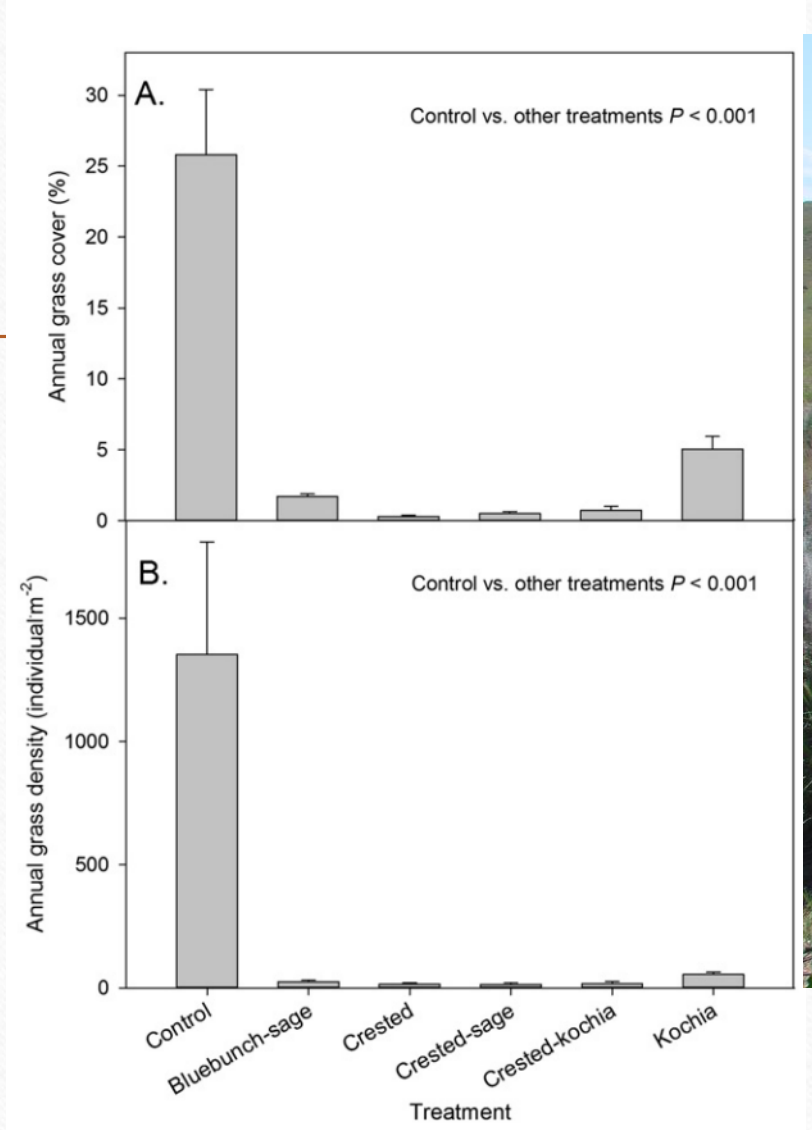
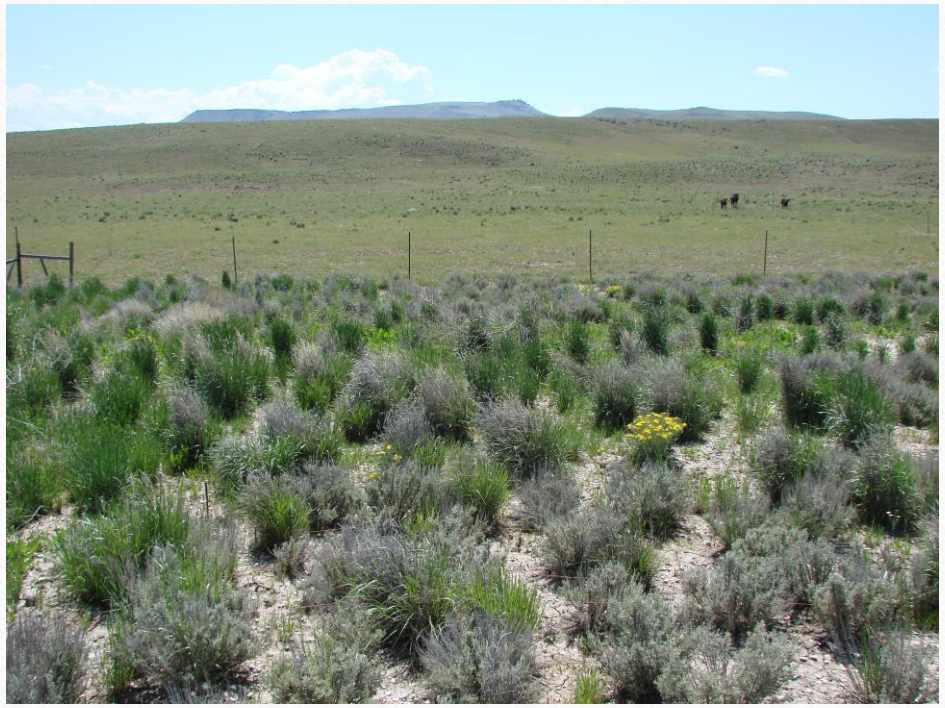
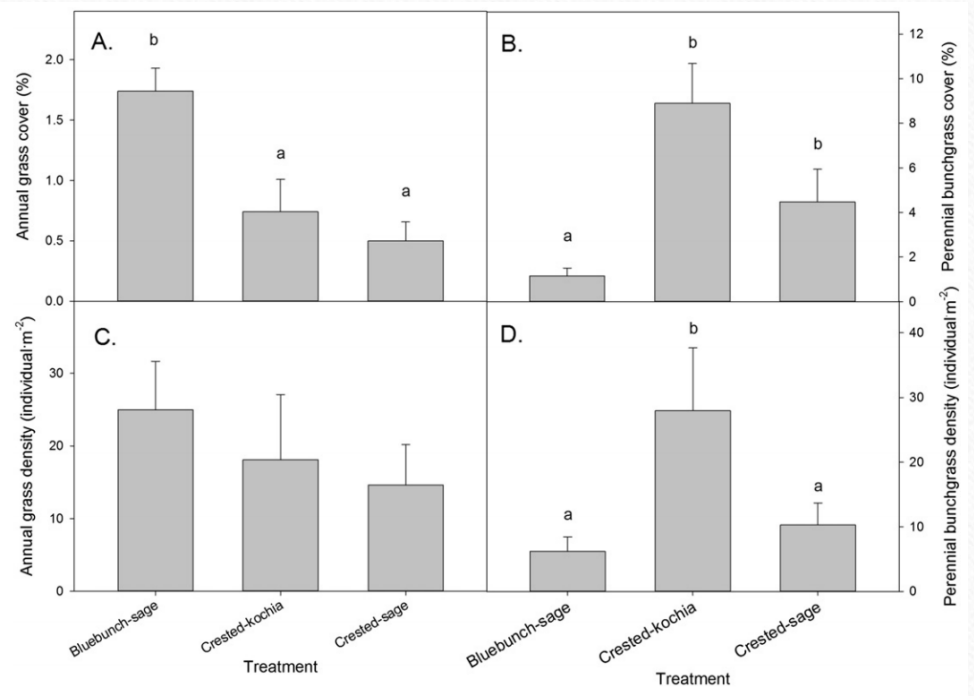
(Photo credit: Steve Dewey, Utah State University, Bugwood.org)


A.
Control vs. other treatments P < 0.001
Annual grass cover (%)
30
25
20
15
10
5
0
B.
Control vs. other treatments P < 0.001
Annual grass density (individual m-2)
1500
1000
500
0
Control
Bluebunch-sage
Crested
Crested-sage
Crested-kochia
Kochia
Treatment

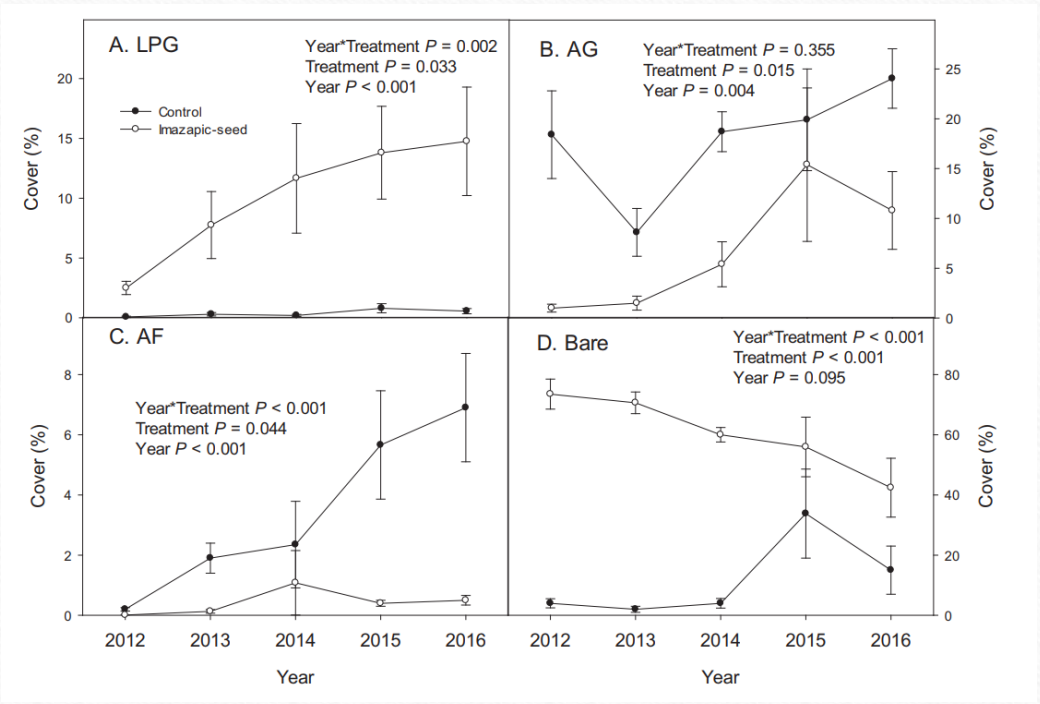
# Perennial Vegetation & Community Resistance



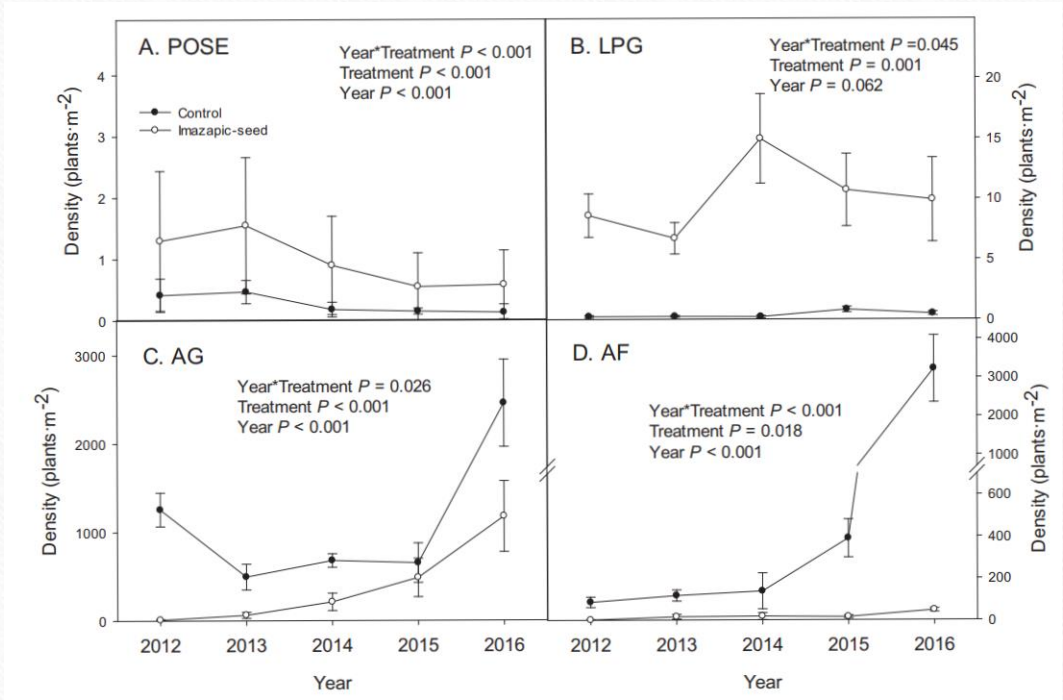


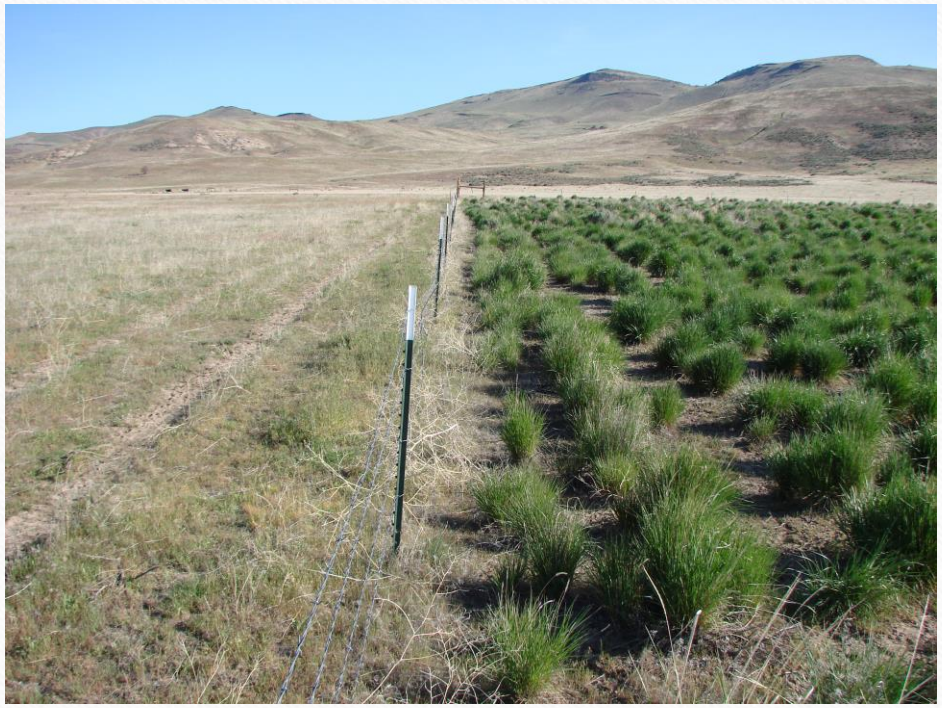
# Perennial Vegetation & Community Resistance

# 5+ Years of Reduced Annual Grass Cover



# 5+ Years of Reduced Annual Grass Density



# 5 Year Results Summary

- Annual grass was still 2x lower in treated/seeded plots than untreated controls
- Perennial bunchgrasses were 17-59x higher in treated/seeded plots than untreated control
- Bare ground was still 3x higher in treated plots than untreated control.

# How do we get seeds to establish?

- Single-entry treatment/seeding often unsuccessful
- Waiting 1 year helps but requires multiple entries and can allow annual grasses to get a head start

# Carbon Coating Seed Pellets

- Species seeded simultaneously with pre-emergent herbicides will likely experience nontarget damage
- Activated carbon can be used to protect seeded species from herbicide damage because it has a high absorption capacity that can deactivate many herbicides

# Goldilocks and Activated Carbon

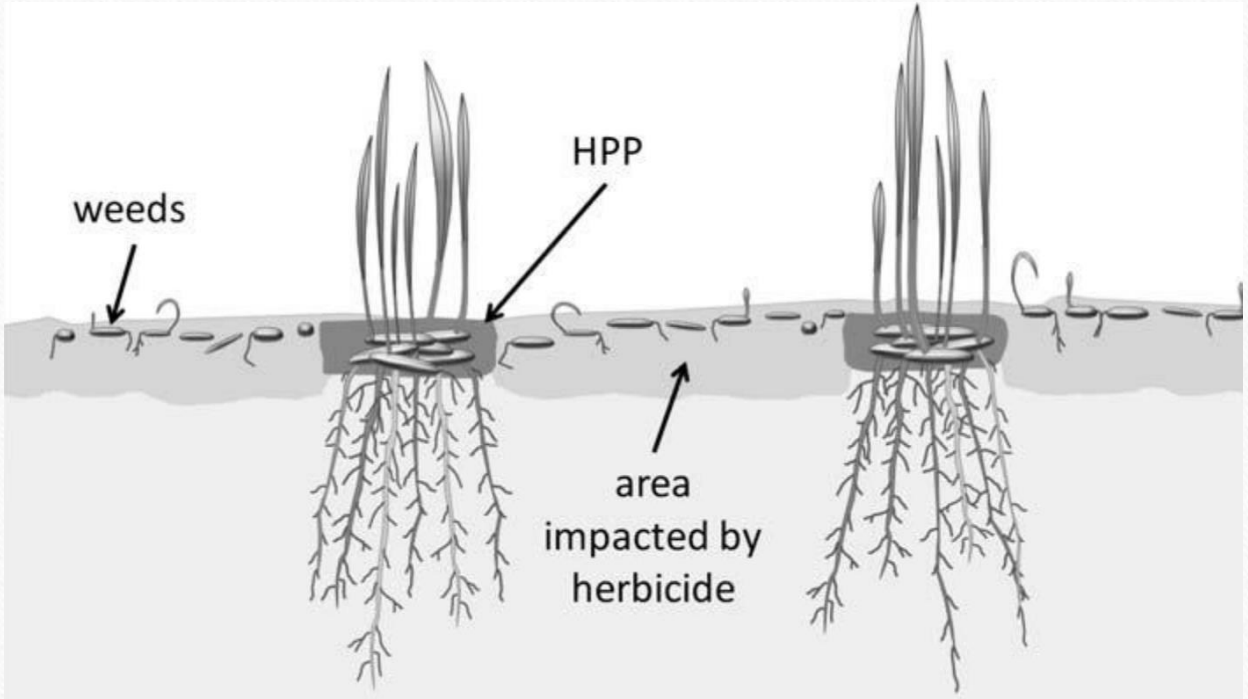

https://en.wikipedia.org/wiki/Biosolids

https://www.brettyoung.ca/west-canada-seed-crop-inputs/forages/ultracoat

# Goldilocks and Activated Carbon


https://en.wikipedia.org/wiki/Biosolids

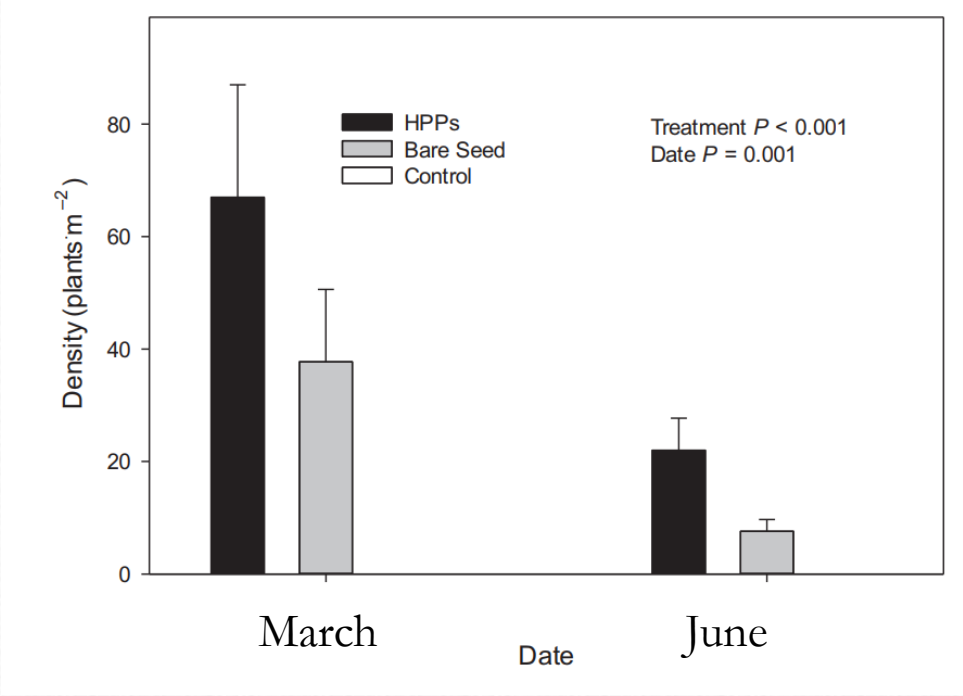
# Herbicide Protection Pods (HPP)




- Activated carbon is incorporated into a dough mixture containing seeds, water-sensitive binders, and other additives and then extruded through a rectangular die

# Crested wheatgrass HPP

- Crested wheatgrass seedling density was 300% greater at the end of the study when seeded in HPPs compared with seeded as bare seed when exotic annual grasses were simultaneously being controlled with imazapic



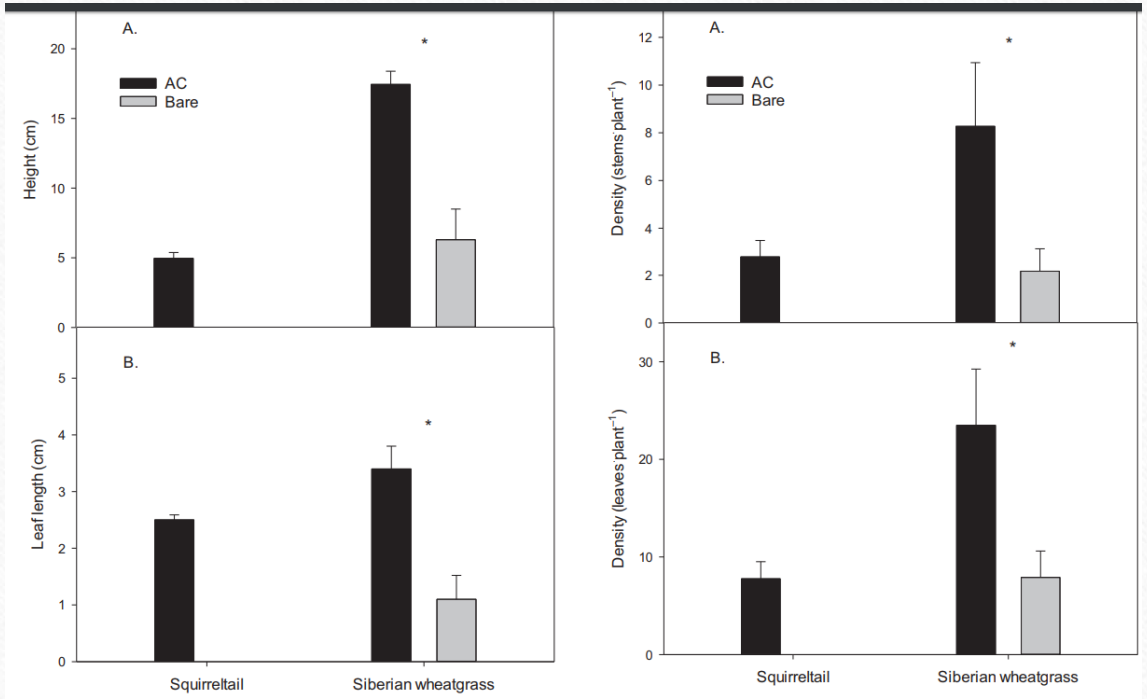

87.5 g ai·ha−1

# Herbicide Protection Pods and Seedlings

- We expect that the benefits of HPPs over bare seed are primarily the result of activated carbon deactivating the preemergent herbicide around seeds.
- However, agglomerated seeds can improve seedling performance compared with seeds planted individually
- Activated carbon may also increase plant growth by increasing nutrient availability and
- Activated carbon may limit allopathy

# More Field Testing

- Bottlebrush squirreltail (Elymus elymoides [Raf.] Swezey),
- bluebunch wheatgrass (Pseudoroegneria spicata [Pursh] Á. Löve),
- Sandberg bluegrass (Poa secunda J. Presl),
- Siberian wheatgrass (Agropyron fragile [Roth] P. Candargy),
- Wyoming big sagebrush (Artemisia tridentata Nutt. subsp. wyomingensis Beetle & A. Young), and
- forage kochia (Bassia prostrata [L.] A. J. Scott).




175 g ae·ha−1

# Conclusions

- Simultaneously seeding vegetation with exotic annual grass control with an imazapic application would also allow seeded species 1 more yr of growth while exotic annual competition is reduced compared with the traditional approach.
- Once perennial bunchgrasses are established, they can be quite competitive with exotic annuals and are critical to limiting exotic annual grasses in the sagebrush ecosystem

# Questions?


- K.W. Davies (2018) Incorporating Seeds in Activated Carbon Pellets Limits Herbicide Effects to Seeded Bunchgrasses When Controlling Exotic Annuals. Rangeland Ecology & Management, 71(3):323-326.
- K.W. Davies and C.S. Boyd. (2018) Longer-Term Evaluation of Revegetation of Medusahead-Invaded Sagebrush Steppe. Rangeland Ecology & Management, 71(3):292-297
- K.W. Davies and D.D. Johnson (2017) Established Perennial Vegetation Provides High Resistance to Reinvasion by Exotic Annual Grasses. Rangeland Ecology & Management 70: 748–754
- K.W. Davies, M.D. Madsen, A. Hulet. (2017) Using Activated Carbon to Limit Herbicide Effects to Seeded Bunchgrass When Revegetating Annual Grass-Invaded Rangelands. Rangeland Ecology & Management 70: 604–608.