

Information and tools to conserve and restore Great Basin ecosystems

Reestablishing Perennial-Dominated Plant Communities in Medusahead-Invaded Sagebrush Rangeland

Purpose: To provide managers with tools and strategies to reestablish perennial-dominated plant communities in medusahead-invaded sagebrush rangelands.

Reestablishment of perennial-dominated plant communities in sagebrush rangelands that have been invaded by medusahead (*Taeniatherum caput-medusae*) (Figure 1) is needed to reduce the risk of landscape-scale wildfire, increase forage for livestock, improve habitat for wildlife, prevent reinvasion after medusahead control, and protect adjacent uninvaded areas.

An effective plan for reestablishing a perennial-dominated plant community should consider the following: 1) feasibility of native plant community restoration (restoration vs. revegetation), 2) selection of control treatments that maximize the likelihood of perennial plant response, and 3) commitment to post treatment monitoring and adaptive management.

In Brief:

- Medusahead invasions increase the risk of wildfire, decrease forage for livestock, reduce wildlife habitat quality, and are at risk of spreading into adjacent areas.
- Sites with surviving native perennial vegetation have the best chance for successful restoration.
- Medusahead control treatments should be chosen to boost perennial plant communities. Appropriate treatments vary depending on plant community characteristics, plant phenology and logistical constraints.
- Revegetating medusahead-invaded rangeland represents a significant investment, so committing to long-term effectiveness monitoring ensures that the investment is paying dividends.

Restoration vs. Revegetation

One of the most important decisions made when developing a plan for reestablishing perennial-dominated plant communities in medusahead-invaded sagebrush rangelands is whether or not restoration of the native plant community is practical. If the original native vegetation is markedly reduced or absent, revegetation may be necessary.

Site and plant community factors to consider

- Sites with residual native vegetation provide the highest likelihood for successful restoration of the native plant community. A rule of thumb to follow is if infestations have three or more large, mature native perennial bunchgrasses and three or more native perennial forbs per yard², they are good candidates for native plant community restoration (Davies et al. 2013a).
- Recruitment of native species from seed is sporadic and medusahead dominated sites may require multiple seeding events to establish a perennial-dominated community.



Figure 1. Medusahead in an invaded area.

- Native species mixes perform poorly when seeded after medusahead control in low elevation (warm/dry) Wyoming big sagebrush sites. When seeded on these sites, native vegetation has failed to establish, and reinvasion by medusahead has occurred (Davies et al. 2015).
- Seeding native plants after medusahead control is more effective in higher elevation sagebrush communities that receive more precipitation.
- On low elevation (warm/dry) Wyoming big sagebrush sites, rather than attempting restoration, one option is to drill-seed introduced seed mixes of crested and Siberian wheatgrass varieties to promote establishment of perennial plants sufficient to prevent reinvasion of medusahead (Davies et al. 2015).

Selecting Control Treatments

Medusahead control treatments should be selected to maximize the probability of reestablishing a perennial-dominated plant community, either from seed or from residual native vegetation. Appropriate treatments vary, depending on plant community characteristics, plant phenology and logistical constraints.

Infestations that have desirable residual perennial vegetation:

- When properly applied, soil-active pre-emergent herbicides (e.g., imazapic) can selectively control annual plants while minimizing damage to established, desired perennial vegetation. Such selectivity can be accomplished if pre-emergent herbicides are applied during the fall when desired perennial vegetation is dormant, and prior to fall moisture stimulating the emergence of medusahead.
- Low rates of 41% glyphosate (0.75 to 1 pt product/acre), applied at the tillering stage of medusahead, can achieve post-emergence control of 90-95% without injuring native perennial forbs and shrubs (Kyser et al. 2012). It is unclear how such applications of glyphosate may impact established native perennial grasses. In addition, a multi-year commitment will likely be required to deplete medusahead in the soil seedbank and prevent new seed production.
- Prescribed spring or fall burning followed by a fall imazapic application (6 oz. per acre) has provided the best control of medusahead and promoted residual perennial vegetation (Davies and Sheley 2011). Burning removes vegetation litter, which improves control effectiveness by increasing herbicide contact with the soil surface. Burning may also play a role in improving control effectiveness by directly removing medusahead seed.
- Focusing medusahead control efforts on infestations with residual desired perennial vegetation may reduce or even eliminate the need for seeding, and probably offers

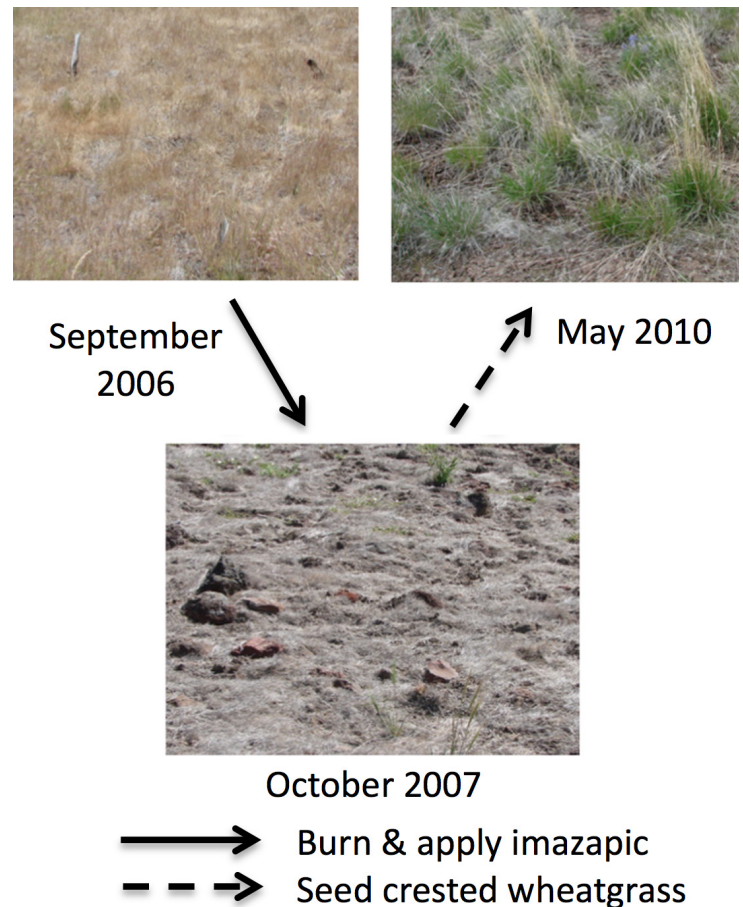


Figure 2. Example of management to revegetate medusahead-invaded sagebrush plant communities.

the highest likelihood of restoring a native-dominated plant community. However, it is important to realize that medusahead invasion is an indication of a functional deficiency or a management problem in the plant community. Therefore, multiple selective control treatments and careful management may be necessary for the plant community to recover its resistance to invasion.

- Carefully managed livestock grazing is critical for maintaining and promoting residual native perennials. Livestock grazing during the growing season should be moderate (~40% utilization) or less, and should avoid repeated growing season use. It should also incorporate periods of grazing rest.

Infestations lacking sufficient desirable residual perennial vegetation

- Prescribed burning in the spring or fall, followed by a fall imazapic application (6 oz per acre) has provided the best control of medusahead and promoted establishment of a perennial-dominated plant community from seed (Davies 2010, Monaco et al. 2005, Kyser et al. 2007) (Figure 2).

- Seeding should be delayed one year after applying imazapic to reduce the phytotoxic effects of the herbicide on seedlings (Davies et al. 2014).
- Integrated burning and pre-emergent herbicide treatments often improve medusahead control compared to individual treatments. Applying spring burning, fall burning, or pre-emergent herbicide as a standalone treatment is not effective for promoting establishment of a perennial-dominated plant community (Davies 2010).
- Because burning prior to pre-emergent herbicide application increases the overall treatment and potential liability costs, capitalizing on opportunities created by wildfires in medusahead-invaded areas can reduce the cost of treatments by eliminating the need to apply a prescribed burn (Davies et al. 2013b).

Effectiveness Monitoring and Adaptive Management

Even the best planned endeavors to reestablish perennial-dominated plant communities in medusahead-invaded sagebrush rangelands carry a high risk of failure (Young 1992). Therefore, it is critically important to begin monitoring treatment effectiveness, and use this information adaptively early in the treatment implementation process.

The reality of implementing a large scale medusahead control and revegetation project using the techniques described above can yield harsh and expensive lessons. There can be many sources of error, including herbicide mixing inaccuracies, skips in the application pattern, undetected weed emergence, etc. Therefore, it is imperative that control effectiveness be evaluated the year following treatment to determine if follow-up treatments will be necessary. The growing season following treatment is also a good time to evaluate response in residual perennial vegetation; this is an opportunity to adapt by incorporating or canceling a seeding treatment depending on responses of the plant community to medusahead control.

Controlling and revegetating medusahead-invaded rangeland represents a significant investment. Therefore it makes sense to commit to long-term effectiveness monitoring to ensure the investment is paying dividends over time. A strong negative correlation exists between perennial grass density and medusahead abundance (Figure 3). Perennial grass density also serves as a key indicator for several important plant community functional responses and forage availability. So, perhaps the single best indicator of longer-term treatment effectiveness is the trend in mature perennial grass density over time.

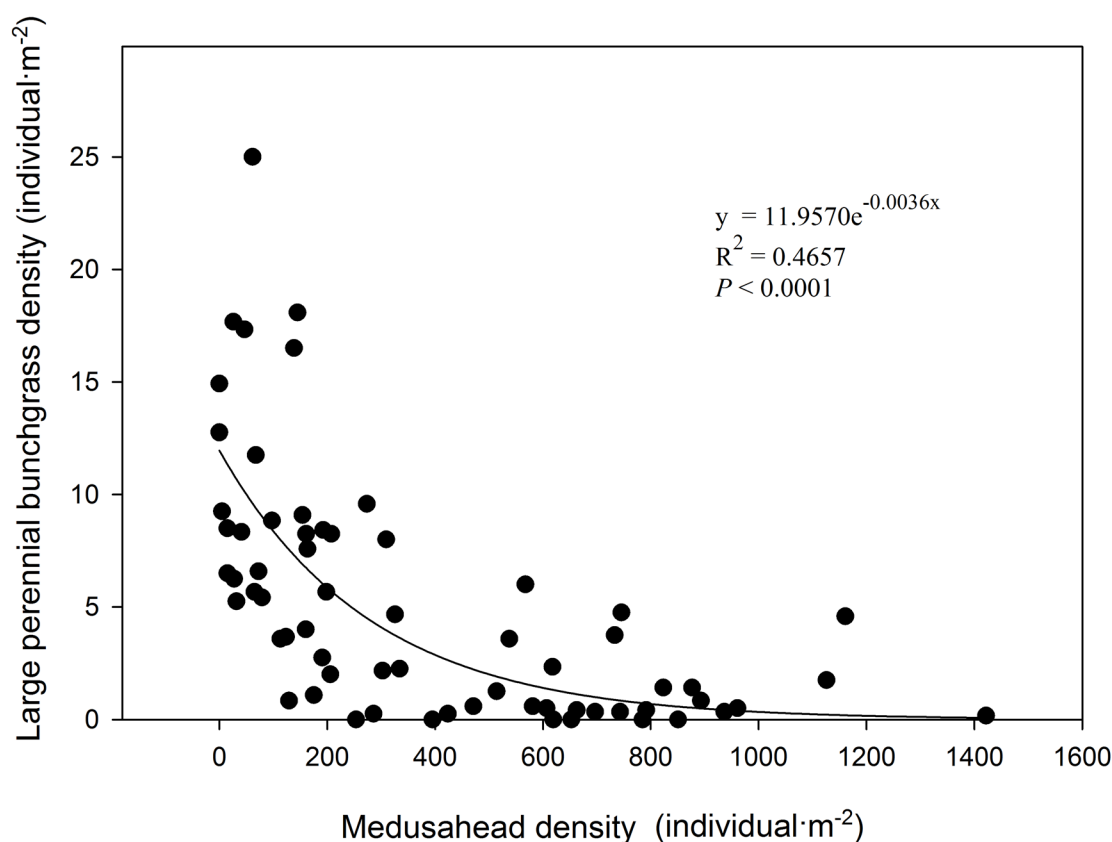


Figure 3. Relationship between medusahead density and perennial grass density. Adapted from Davies 2011.

Authors

Dustin Johnson
Department of Animal and Rangeland Sciences
Oregon State University
dustin.johnson@oregonstate.edu

Kirk W. Davies
Agricultural Research Service, Burns Unit
kirk.davies@oregonstate.edu

References

- Davies, K.W. 2010. Revegetation of medusahead-invaded sagebrush steppe. *Rangeland Ecology & Management* 63:564-571.
- Davies, K.W. 2011. Plant community diversity and native plant abundance decline with increasing abundance of an exotic annual grass. *Oecologia* 167:481-491.
- Davies, K.W., C.S. Boyd, D.D. Johnson, A.M. Nafus, and M.D. Madsen. 2015 Success of seeding native compared to introduced perennial vegetation for revegetating medusahead-invaded sagebrush rangeland. *Rangeland Ecology & Management* 68:224-230.
- Davies, K.W., A.M. Nafus and D.D. Johnson. 2013a. Medusahead management guide for the Intermountain West. Natural Resource Conservation Service. 12 p.
- Davies, K.W., A.M. Nafus, and D.D. Johnson. 2013b. Are early summer wildfires an opportunity to revegetate exotic annual grass-invaded plant communities? *Rangeland Ecology & Management* 66:234-240.
- Davies, K.W., M. Madsen, A.M. Nafus, C.S. Boyd, and D.D. Johnson. 2014. Can imazapic and seeding be applied simultaneously to rehabilitate medusahead-invaded rangeland? Single vs. multiple entry. *Rangeland Ecology & Management* 67:650-656.
- Davies, K.W., and R.L. Sheley. 2011. Promoting native vegetation and diversity in exotic annual grass infestations. *Restoration Ecology* 19:159-165.
- Kyser, G.B., J.E. Creech, J. Zhang, and J.M. DiTomaso. 2012. Selective control of medusahead (*Taeniatherum caput-medusae*) in California sagebrush scrub using low rates of glyphosate. *Invasive Plant Science and Management* 5:1-8.
- Kyser, G.B., J.M. DiTomaso, M.P. Doran, S.B. Orloff, R.G. Wilson, D.L. Lancaster, D.F. Lile, and M.L. Porath. 2007. Control of medusahead (*Taeniatherum caput-medusae*) and other annual grasses with imazapic. *Weed Technology* 21:65-75.
- Monaco, T.A., T.M. Osmond, and S.A. Dewey. 2005. Medusahead control with fall- and spring-applied herbicides in northern Utah foothills. *Weed Technology* 19:653-658.
- Young, J.A. 1992. Ecology and management of medusahead (*Taeniatherum caput-medusae* ssp. *asperum* (Simk.) Melde-ris). *Great Basin Naturalist* 52: 245-252.

Great Basin Factsheets are developed and produced collaboratively by the following groups:

