30 Years Of Medusahead: Return To Fly Blown-Flat

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Researchers revisit a site once free of the invasive grass medusahead to see what lessons can be learned.

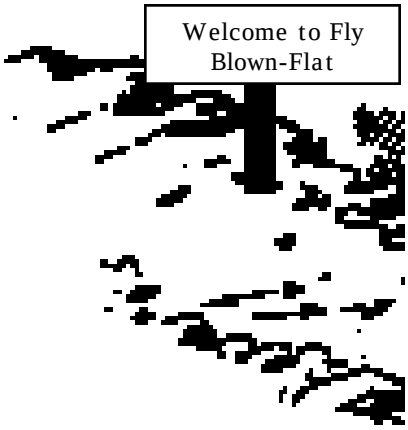
In 1967 near Adin, California an experimental study site was established to study the invasive exotic grass medusahead. As a part of the original experiments, which were conducted in cooperation with the US Department of Interior, Bureau of Land Management (BLM), a fenced exclosure to exclude cattle was established in 1967. The BLM has helped to keep the fence in repair for the past 30 years.

To the best of our knowledge, the site has not been grazed by cattle during that period, although locals have gleefully reported the sighting of pronghorns within the exclosure and there is no protection from jackrabbit grazing.

How Fly Blown-Flat Got It's Name

A logger, in the early 1960s, parked a trailer house on a low sagebrush flat along the highway east of Adin, Lassen County, California. Low sagebrush flats are not the most desirable soil environments to pick for a homestead. In the spring the impermeability of the soil turns the flats into slick soiled quagmires. By late summer the soil is baked brick hard. The new home owner put a large sign above his mail box proclaiming, "Welcome To Fly Blown-Flat". In 1967, with the cooperation of the U S Department of Interior, Bureau of Land Management (BLM), the third author established an experimental site near the homestead for research on the invasive exotic grass medusahead.

When this work was published (Young and Evans 1971) he used Fly Blown Flat to identify the site and the local ranchers have not yet forgiven him.



The site was originally chosen because medusahead had not yet invaded the site, but based on the soils and plant community present on the site and the immediate adjacent infestation of medusahead, it appeared the site would soon be invaded. Otherwise, the site represented the millions of acres on the margin of the Great Basin that appeared susceptible to medusahead invasion and many of which have subsequently been invaded by the annual grass.

The treatments applied (shrub or herbaceous vegetation control with herbicides) were designed to test correlations between plant community composition (shrubs, perennial forbs and grasses) and invasion by medusahead. This relationship had been developed from extensive sampling of medusahead communities for about 100 miles north and south of the Fly Blown Flat area, along the western margin of the Great Basin (Young and Evans 1970).

Our purpose was to compare the vegetation inside and outside the exclosure now that medusahead had established on the site for about 30 years.

The Site

Fly Blown Flat is located on the volcanic plateaus that reach down into northeastern California from the Pacific Northwest. The hills above the flat support mountain big sagebrush/bluebunch wheatgrass plant communities or western juniper woodlands. In many ways the environment is similar to the upper sagebrush zone of the Great Basin to the east, but it generally has more rainfall and better growing conditions. The town of Adin, California, 3 miles from the study area, receives 18 inches of annual precipitation.

The soils of the exclosure site have a biscuit and swale micro-topography. The mounds or biscuits have about a foot of silt-loam soil above a very hard duripan. In the swales the duripan comes to the surface.

The late range scientist, Jerry Klomp used scientific reasoning for the exact location of the exclosure once we settle on Fly Blown Flat as the representative site. He looked for four mounds or biscuits in roughly the right locations for corner post. He only found three and had to build a rock-jack (timber frame filled with rock) for the last corner post.

Four Original Treatments

The original treatments were applied in 1967 to change the composition of the community. They include:

1) A control where nothing was done.
2) Application of 2 lb per acre of a low volatile ester of the herbicide 2,4-D to kill the low sagebrush.
3) Application of 1 lb per acre of atrazine to control annuals, and
4) Combined 2,4-D and atrazine applications on the same plot.

Common and Scientific Names

Low sagebrush	*Artemisia arbuscula*
Mountain big sagebrush	*Artemisia tridentata* ssp. *vaseyana*
Medusahead	*Taeniatherun caput medusae* ssp. *asperum*
Bluebunch wheatgrass	*Pseudoroegneria spicata*
Western juniper	*Juniperus occidentalis*
Cheatgrass	*Bromus tectorum*
Japanese brome	*Bromus japonicus*
Rattlesnake brome	*Bromus briziformis*
Willow herb	*Epilobium ciliatum*
Big head clover	*Trifolium macrocephalum*
Sanberg bluegrass	*Poa secunda* ssp *secunda*
Pine bluegrass	*Poa scabrella*
Bulbous bluegrass	*Poa bulbosa*
Columbia needlegrass	*Achnatherum lemmonii*
Squirreltail	*Elymus elymoides*
Hooker's balsam root	*Balsamorhiza hookeri*

All plots were 20 by 20 feet, with 4 replications in a randomized block design. They were applied in and outside the new constructed grazing exclosure.

Extensive sampling had shown that the presence of low sagebrush plants and perennial grasses and forbs was negatively correlated with the abundance of medusahead. Killing the shrubs favors the native herbaceous perennials. The rate of atrazine applied eliminates annual grasses like medusahead, but does not kill the native herbaceous perennials. An appropriate analogy would be a chemist trying to understand the function of a complex organic molecule by selectively removing or substituting groups of atoms on the molecule and exposing the results to a reactive reagent. Our highly reactive agent was medusahead and we offered a community with four different structures.

Original Results

By the early 1970s, medusahead had reached the experimental site. As with most invasive weeds, we do not know how medusahead reached the site. The seeds are not preferred by bird and small mammal granivores and are too heavy to be wind blown. Vehicle movement on the adjacent roads (un-surfaced on two sides of the site) may be the means of infestation.

The initial results were that as long as the low sagebrush stand remained in place, medusahead invaded, but remained a minor part of the community. Removal of the shrub cover with 2,4-D applications did not automatically result in an increase in medusahead dominance. In the case of Fly Blown Flat, there were sufficient native perennial grasses in the understory to initially suppress medusahead even with the shrubs removed.

The major initial difference between inside and outside the grazing exclosure occurred with the application of atrazine. Inside the exclosure the atrazine treated plots were free of medusahead and other annual grasses for the first year after application. The perennial grasses increased in apparent vigor and density. Outside the exclosure the combination of atrazine and heavy grazing removed the native perennial grasses and resulted in total medusahead dominance.

When the exclosure was originally built, the surrounding area was open range that was used as the location for spring turn-out and for gathering cattle as they drifted down from the hills in the fall. During the 1970s the area was fenced and the pasture around the exclosure went into a three pasture rest-rotation grazing system. The plot area is currently on the Butte Creek allotment (BLM) and has been used as a spring range (April 15 to May 15) since the late 1970s.

Sampling 30 Years Later

The corners of the original treatment areas inside and outside the exclosure were re-located in May 1998. May corresponds to the peak flowering of ephemeral species at the site. The percentage cover for shrubs, perennial, and annual grasses was ocularly estimated on each treatment in the original randomized block design with four replications. The spring of 1998 featured an excellent periodicity and amount of spring rains with great growth of herbaceous species. We re-sampled cover at the maturity of the annual grasses in 1998, but unfortunately the data was lost. We repeated the sampling at annual grass maturity in 1999, but the spring growing conditions were much drier in 1999. In 1999, mid and late spring rains did not occur. Species composition inside and outside the exclosure was estimated by frequency sampling using the step-point method (Evans and Love 1957).

Table 1. Herbage cover (%) for shrubs, perennial and annual grasses estimated for entire area inside and outside exclosure and for 4 treatments inside and outside a grazing exclosure built 30 years previously. Cover estimates made in May 1998.[1]

Treatment	Plant growth form					
	Shrubs		Perennial grass		Annual grass	
	Exclosure	Grazed	Exclosure	Grazed	Exclosure	Grazed
	(%)					
Comparison of entire area inside and outside exclosure						
Total area	5b	13a	8a	4b	7a	6a
Comparison of individual treatments inside and outside exclosure						
Control	35b	62a	23a	9b	43c	29c
2,4-D	1c	20b	9b	4b	90a	76ab
2,4-D + Atrazine	8c	25b	8b	3b	85ab	74ab
Atrazine	26b	53a	9b	5b	65b	43c
Mean	18z	40y	12y	5z	71	56

[1]Means within total areas or plant growth form type followed by the same letter, a through c, or overall means within plant growth form type followed by the same letter, y through z, are not significantly different at the 0.05 level of probability as determined by Duncan's Multiple Range Test. No letter indicate no significant differences.

Table 2. Herbage cover (%) for shrubs, perennial and annual grasses estimated for 4 treatments inside and outside a grazing exclosure built 31 years previously. Cover estimates made in June 1999.[1]

Treatment	Plant growth form					
	Shrubs		Perennial grass		Annual grass	
	Exclosure	Grazed	Exclosure	Grazed	Exclosure	Grazed
	----------(%)----------					
Control	30b	55a	29a	11b	64c	40c
2,4-D	1c	18bc	14b	6b	95a	30d
2,4-D + Atrazine	3c	25b	12b	8b	95a	85b
Atrazine	24b	48a	14b	8b	85b	48c
Mean	15z	50y	17y	8z	85y	51z

[1]Means within plant growth form type followed by the same letter, a through c, or overall means within plant growth form type followed by the same letter, y through z, are not significantly different at the 0.05 level of probability as determined by Duncan's Multiple Range Test.

Medusahead Persisted With Or Without Grazing

Averaging cover data taken in May 1998, from all the old treatments, revealed that shrub cover was nearly double outside the grazing exclosure as compared to inside (Table 1). The reverse was true for perennial grasses, there was no difference for annual grass cover. The annual grass cover was primarily medusahead.

These simple results speak volumes about complex ecological processes that occurred during the previous three decades. The native perennial grasses are the preferred forage species so it is logical that their cover would be higher within the grazing exclosure. Apparently, the reduced perennial grass cover outside the exclosure enhanced the establishment and growth of low sagebrush.

Extensive studies conducted on low sagebrush communities 30 years previously suggested that increased perennial grass or low sagebrush cover was negatively correlated with medusahead dominance. In the case of Fly Blown Flat time has proven this to be a false premise. Medusahead was the dominant herbaceous vegetation both inside and outside the exclosure. An often repeated truism is that removal of grazing on sagebrush/bunchgrass rangelands results in the disappearance of exotic, invasive grasses such as medusahead. Obviously, in the case of Fly Blown Flat, medusahead invaded and persisted with or without grazing

For the individual treatments, the old control plots had similar results to the overall average (Table 1). The 2,4-D treated plots had similar cover results except for shrub cover where shrubs were rare in the exclosure and much more abundant outside, but not nearly as much cover of shrubs occurred outside on the 2,4-D plots as compared to the control. Similar results were obtained for the 2,4-D plus atrazine treatments. The atrazine treatments did not have shrub cover different from the control inside or outside the exclosure. The cover data taken at maturity of annual grasses in 1999 (Table 2) was similar except annual grass cover was slightly higher within the exclosure and lower outside.

Frequency sampling conducted in May produced similar results to the average of cover data inside and outside the exclosure (Table 3). Medusahead was the most frequent plant. The second most frequent species was willow herb outside the grazing exclosure. In the companion study on plant communities infested and resistant to medusahead invasion (Young and Evans 1970) willow herb, a creeping rooted native perennial forb was negatively related to medusahead invasion. The signature native forb for these low sagebrush flats in the spring is big head clover. This colorfully flowered species was about equally frequent inside and outside the exclosure.

Table 3. Frequency (%) of herbaceous vegetation inside and outsite the grazing exclosure at Fly Blown Flat in May 1998, 30 years after the exclosure was established.

Species	Frequency	
	Inside exclosure	Outside exclosure
	-------(%)-------	
Medusahead	32	37
Cheatgrass	2	4
Sanberg bluegrass	20	6
Squirreltail	2	2
Bulbous bluegrass	2	T[1]
Hooker balsamroot	T	0
Big head clover	12	8
Willow herb	13	28
Misc. forbs	17	15

[1]T indicates less than 1 percent.

Considering the potential of the site, the plant community contains a remarkable number of species, especially native annual forbs. No single species appeared to be absent from within or outside the exclosure.

Sandberg bluegrass was the most frequent perennial grass. There was a readily apparent vigor difference between the grazed and un-grazed bluegrass plants with those inside the exclosure being much more vigorous in appearance.

Especially interesting was the abundance of Sandberg bluegrass plants on the swales within the exclosure where the duripan reached the surface. The plants were growing on pedestals 2 to 5 inches high. Such pedestal plants are found outside the exclosure, but not in such abundance. If you were not aware that in this case the pedestals are a developed feature, it would be easy to interpret them as remnant example of accelerated erosion of a surface soil that existed on top of the duripan. Apparently, in this case Sandberg blue grass seedling become established on the duripans and then subaerial deposited dust and sediments during the spring surface water impoundment period became entrapped to build the pedestals.

Conclusions

In the case of Fly Blown Flat, medusahead successfully invaded the site with or without grazing. Remember that the site had been heavily grazed for many years before the exclosure was constructed. We do not know if a similar site in very high ecological condition would have been invaded to the same extent by medusahead without grazing. This is really a mute question, because such high condition low sagebrush/bunchgrass sites virtually do not exist any more.

The short lived native perennial grass greatly increased in abundance on control plots within the exclosure during the 30

years the exclosure was in place, but this increase did not dampen the frequency of medusahead in the communities.

The important question is what if any long-lived native perennial grass was a component of the original plant communities that occupied these sites before they were grazed by domestic livestock? The choices are bluebunch wheatgrass or Columbia needlegrass or perhaps Sandberg bluegrass was the potential species. We noted apparent different ecotypes of Sandberg bluegrass, especially within the exclosure. A robust form, probably would have been classified as pine bluegrass under older treatments of the genus.

We conducted a reconnaissance survey of the larger area surrounding the exclosure. There are several microtopoedaphic environments on the flat. Limited areas with a deep vertisol clay soil have been totally converted to medusahead. Portions of the flat have burned one or more times in the 30 years since the exclosure was established. Low sagebrush re-establishment has been very slow in these burned areas and again medusahead dominance is apparent.

The most apparent change in Fly Blown Flat besides the invasion of medusahead was the invasion of the margins of the flat by western juniper woodlands.

The bottom line is that for Fly Blown Flat 30 years of protection from grazing did not prevent medusahead invasion and prolonged persistence of the weed. It is also apparent that except for specific soils (deep churning clays) of limited extent, grazing did not lead to the total dominance of medusahead.

References

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