Cheatgrass: Changing Perspectives and Management Strategies

F.L. Emmerich, F.H. Tipton, and J.A. Young

Since the turn of the century, cheatgrass has spread across the Intermountain West, permanently altering the flora of the sagebrush steppe. This extremely adaptable species has created much controversy because of its negative and positive attributes. Our purpose is to show how one ranch located in north-central Nevada successfully uses cheatgrass for a significant portion of its forage base. Ranchers and land managers may want to reevaluate their attitudes towards cheatgrass and implement management strategies to make beneficial use of this grass.

Ranch Description

The T Quarter Circle Ranch, located in Humboldt County, Nevada, is a cow/calf operation and runs 1,100 head of brood cows in its base herd. This ranch is currently a year-long grazing operation in which the brood cow herd is maintained on salt desert range during winter, sagebrush foothills in spring, and river bottom pastures during summer.

Ownership and management is held by third (Jane and Hank Angus) and fourth (Nancy and Frosty Tipton) family generations. During interviews for a project involving ranch and range changes (Emmerich et al. 1992), the Tiptons and Angus' exhibited significant attitudes towards the impact of cheatgrass on the T Quarter Circle rangeland. They are aware of benefits of cheatgrass and its less desirable qualities, yet cheatgrass has become one of the most important forage species for their livestock.

Important Attributes of Cheatgrass

In reviewing cheatgrass literature, three relevant attributes were pinpointed. First, cheatgrass is an abundant forage (Fleming et al. 1942). Sufficient precipitation allows cheatgrass to grow and produce relatively abundant herbage, harvested by grazing animals as forage. Second, forage production can be unstable from year to year. It is highly dependent on amount and timing of moisture (Stewart and Young 1939). Cheatgrass yield can vary from near zero production to exceeding the harvest needs of the livestock herd. Third, fire is a significant factor in the extension and perpetuation of cheatgrass. This species is highly flammable and prompts range fire. This in turn results in the loss of native shrub species and may convert the shrub/grass rangelands to cheatgrass-dominated range (Young et al. 1987).

First and third authors are research technician and research scientist, U.S. Department of Agriculture, Agricultural Research Service, 920 Valley Road, Reno, Nev. 89512. Second author is co-owner and manager of the T-Quarter Circle Ranch, Winnemucca, Nev. 89445.

Our appreciation to the T Quarter Circle family ranchers who were willing to discuss changing aspects of the rangeland. Oral interviews during 1989 and 1990 with family members provided the basis of material used in this article. Typed transcripts of the interviews from the T Quarter Circle Ranch Project are located in the Oral History Archives, University of Nevada, Reno. Our gratefulness to the reviewers of this article who took thought and care in suggesting improvements.

An Abundant Forage

According to range studies in Great Basin communities, cheatgrass can average from 800 to 1,400 pounds/acre of air-dried forage (Hull and Pechanec 1947). Exceptional moisture can produce 4,000 pounds/acre of cheatgrass, as noted at Emigrant Pass, near Elko, Nevada, during the 1964 growing season (Young et al. 1987).

Cheatgrass has primarily impacted the sagebrush steppe. Yet, the T Quarter Circle range provides an example of cheatgrass in the more arid portions of the sagebrush zone and even on the upper margins of the salt desert (Young and Tipton 1990). As cheatgrass encroaches into the salt desert shrub community, it colonizes bare ground amongst established perennial plants. Cheatgrass appears to continually adapt to a variety of different range types, even those with less moisture. Because it has a low tolerance for soluble salts, cheatgrass plants occupy sites of lower salt content as they migrate into the salt desert shrub environment.

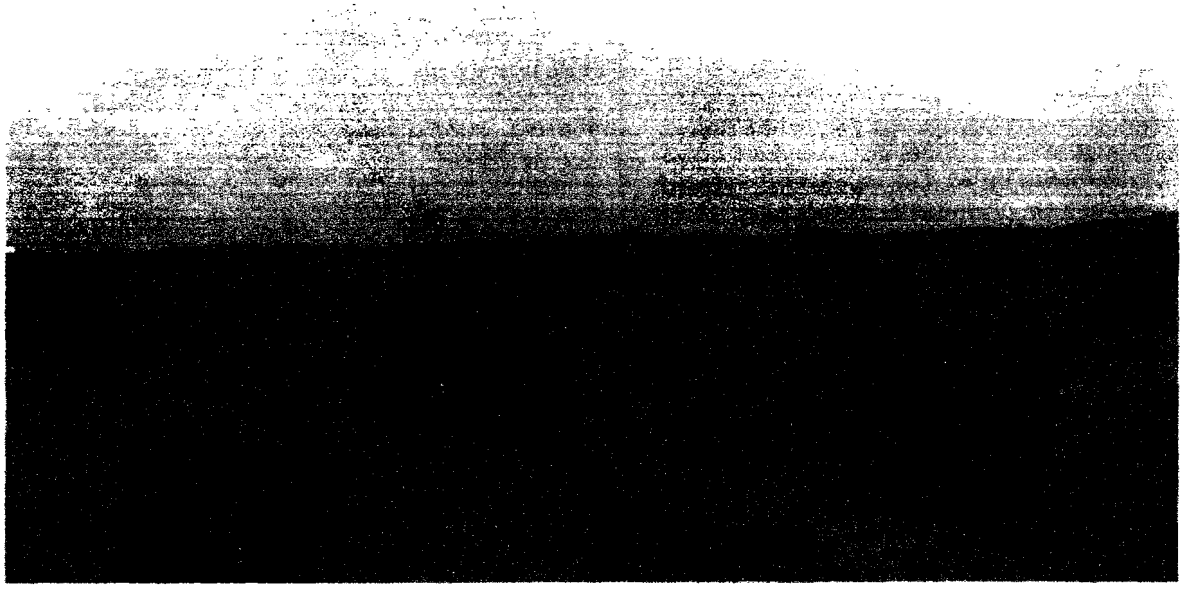
On the salt desert rangelands of the T Quarter Circle, the cheatgrass plants retain their seeds late into the cooler months. In October 1986, cheatgrass seeds were collected on the T Quarter Circle winter range and analyzed for nutrient content. The analysis revealed cheatgrass seed was nutritionally similar to feed grains (Table 1).

On the T Quarter Circle, calves are generally weaned by October, and the main herd is turned onto winter desert range. Frosty Tipton stated that the cheatgrass seed on this range is comparable to turning their cattle onto a grain field, as the herd fattens for the winter months.

By November, with cooler weather approaching, the cattle spread across the desert range. The livestock wintering in this type of environment browse on shrubs such as winterfat and fourwing saltbush. The shrubs provide a digestible protein source, while carbohydrates in cured grass species supply energy to complete a balanced maintenance ration (DeFlon 1986).

In spring, cattle graze on the fresh growth of cheatgrass and other species, as they slowly progress from the desert valley into the foothill country. Water sources are shut off in the lower winter areas by April. Control over water in the desert valley ensures cattle move towards water sources at higher elevations, and permits re-growth and seed production on the winter range areas.

As grasses mature in the high country, some cattle



T Quarter Circle cattle passing through winter range. Photo by Nancy Tipton, 1991.

begin to drift toward the home meadows. The ranchers drive the rest of the herd down to river bottom summer pastures starting in late June. As the cattle move through the shadscale winter range, they readily graze, often favoring mature cheatgrass plants rather than mature native perennials. The ranchers commented that in the past the cattle never grazed these shadscale flats in summer since little or no cheatgrass was available amongst native shrubs.

Cheatgrass has increased in the desert community type the past few decades, and the ranch owners consider cheatgrass a positive change in the range forage composition. They observe their cattle selecting this species, and cheatgrass provides a suitable feed where bare ground existed previously. When cattle utilize cheatgrass, the intensity of use on native grasses may decrease, benefiting the rangeland condition.

Frequently, cheatgrass intrusion is considered a result of overgrazing or disturbance to the land (Hull and Pechanec 1947). Frosty Tipton, however, indicated that the recent encroachment of cheatgrass into the desert rangeland used by the T Quarter Circle was not due to excessive grazing. Their desert range has been continuously winter use, with cattle brought on after seedripe and moved off by spring. There have not been years of intensive overuse on this land. Instead, it was the aggressive, adaptive characteristics of cheatgrass to occupy open ground. Research by Svejcar and Tausch (1991) indicates that cheatgrass can appear in pristine areas or stable communities never grazed by cattle. Research by Melgoza and Nowak (1991) suggests that cheatgrass can

Table 1.

		Concentrates**					
	Cheatgrass* seed	Barley feed high grade	Corn feed meal	Corn and oat feed good grade	Rye grain	Wild oats	Wheat, soft Pacific Coast States
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Protein	9.0	13.5	9.1	10.9	12.6	12.7	9.9
Fat	1.6	3.5	4.2	4.0	1.7	5.5	2.0
Crude Fiber	11.0	8.7	2.1	6.1	2.4	15.2	2.7
N-free Extract	62.0	60.5	70.8	64.9	70.9	50.9	72.6

*Information for cheatgrass seed obtained from Dr. James A. Young. Analysis conducted by Agritest Commercial Lab., Twin Falls, Idaho, 1986.
**Concentrate percents obtained from Morrison, Frank B. 1956. *Feeds and Feeding: A Handbook for the Student and Stockman*. 22nd ed. The Morrison Publishing Co., Ithaca, New York. 1156 p.

successfully compete with established perennial plants.

Variability in Forage Production

Cheatgrass production varies from year to year, often dependent upon amount and distribution of moisture. Cheatgrass is considered a winter annual, but it may not germinate until spring in Nevada. Germination occurs in the fall in northern Nevada about once every 5 years. With sufficient fall moisture, seeds germinate and produce a basal rosette of leaves that provide succulent forage. If this germination occurs in the fall and temperatures permit growth, the leaves can provide considerable forage during fall and winter. If germination occurs late in fall, the plant remains in the rosette stage during winter and produces little harvestable forage. The ground portion of these plants is virtually dormant, yet the root system is actively growing. Such over-winter root development allows cheatgrass to exploit soil moisture once temperatures moderate in late winter/early spring.

During low precipitation years when poor cheatgrass crops are produced, the seedlings of native grasses seem to be favored. This tendency has been noted during evaluation of the monitoring studies on the T Quarter Circle rangeland. Thus, if cheatgrass provides the bulk of a seasonal forage base, there is need to buffer the uncertainty of cheatgrass production. Extra forage in the form of leased pasture or hay is a prudent option available to ranches when confronted by fluctuating cheatgrass yield.

Modern range management practices have also led to better condition rangeland, thus lessening the impact of a poor cheatgrass year. The benefits of good condition rangelands are particularly evident during recent drought years on the T Quarter Circle. The owners have been cautious, keeping their utilization rates between 30 to 50 percent. The rangeland offers a variety of native forage species, although the cattle are often observed selecting cheatgrass.

Wildfire

The relation between cheatgrass and wildfires is a vital concern. The fine herbage of early-maturing cheatgrass greatly increases the chance of fire ignition, and the density of cheatgrass allows a rapid rate of fire spread.

In 1985, the T Quarter Circle Ranch experienced two extensive fires burning approximately 65,000 acres of winter use rangeland. It was necessary for the ranch to re-adjust their grazing patterns and reduce their base herd to accommodate the loss of range forage.

Rangeland fire is a concern, and the T Quarter Circle owners are constantly aware of its consequences. In the past, salt desert ranges have apparently been free of wildfires, lacking sufficient herbaceous fuel to spread fire. Recent encroachment of cheatgrass into these arid habitats has brought the risk of wildfires, which permit cheatgrass and other annuals to invade open sites created by the loss of desert shrubs (Young and Tipton 1990). Palatable desert shrubs such as shadscale, winterfat, and fourwing saltbush, which are not adapted to periodic fires, provide a much needed protein source on these winter ranges.

Management of cheatgrass must include fuel load management. Resting cheatgrass-dominated ranges in a grazing system that is meant to favor perennial grass is an open invitation for disaster. Cattle grazing can reduce the accumulation of cheatgrass litter and in turn reduce accumulation of fuel to lessen fire hazard (Pellant 1990. Young and Tipton 1990). By incorporating the concept of winter grazing, there is a reduction in excess cheatgrass herbage and seed source, yet protection to the dormant perennial grasses.

Looking Back Fifty Years

As we reflect back on more than fifty years of ranching and land management experience dealing with cheatgrass, perhaps a quotation from Fleming et al. (1942) would be appropriate:

> On account of its (cheatgrass) wide and abundant distribution and its ability to maintain a high density of ground cover year after year it would seem that we should now recognize this grass as a highly important part of Nevada's grazing resources....Because of its grazing value at various stages of growth and maturity, it contributes at least as much feed for the grazing livestock as many other single forage plants found on Nevada ranges. Broncograss (cheatgrass) has become a permanent source of feed on many of our most important rangelands and it will necessarily have to be taken into consideration in the determination of seasonal use and in making grazing capacity estimates.

The insight of Fleming and his coauthors concerning cheatgrass and its impact on Nevada rangelands is still considered to be valid today. Cheatgrass range needs to be managed, possibly as an annual grass range rather than as a perennial grass range. The challenge is to manage grazing on these rangelands in a manner that protects the range productivity while making beneficial use of the forage resource. T Quarter Circle is an example of that kind of management.

References

DeFlon, James G. 1986. The Case for Cheatgrass. Rangelands. 8(1):14-17.

Emmerich, F.L., J.A. Young, and J.W. Burkhardt. 1992. A Nevada Ranch Family: Their Success Through Four Generations. Rangelands. 14(2):66 70.

Fleming, C.E., M.A. Shipley, M.R. Miller. 1942. Bronco Grass (*Bromus tectorum*) on Nevada Ranges. Bulletin No. 159. Agricultural Experiment Station. The University of Nevada. Reno, Nevada. 21 p.

Hull, A.C. Jr., and Joseph R. Pechanec. 1947. Cheatgrass-A Challenge to Range Research. J. of Forestry. 45:555 -564.

Melgoza, Graciela and Robert S. Nowak. 1991. Competition between Cheatgrass and Two Native Species after Fire: Implications from Observation and Measurements of Root Distribution. J. of Range Manage. 44(1):27 33.

Pellant, Mike. 1990. The Cheatgrass-Wildfire Cycle: Are There Any Solutions? In: *Proceedings-Symposium on Cheatgrass Invasion*, Shrub Die-off, and Other Aspects of Shrub Biology and Management. Forest Service. Intermountain Research Station General Technical Report INT-276. November 1990. pp. 11 18.

Many of agriculture's problems are hashed out around kitchen tables. In the fall of 2006 two UNR professor's, a rancher and a couple of Extension specialists, two cowboys, and a graduate student (me) met at the Gund Ranch kitchen table and discussed the following question: What can be done about the cheatgrass problem? Specifically, what can be done to reduce cheatgrass fuel loads since it is a major fuel contributor to the six most significant wildfire seasons since 1960, all of which have occurred since 2000.

The Problem

Cheatgrass has increased steadily in acreage and now is the major understory of 19.2 million acres of the Intermountain West. Cheatgrass is a winter annual that competes with other perennial plants by depleting soil moisture, producing prolific amounts of seed, (up to 28.2 million seeds per hectare) and germinating readily in the fall or spring, ensuring that annual recruitment is maintained.

Cheatgrass attributes make it an ideal fine fuel. Cheatgrass matures four to six weeks earlier in the growing season and remains flammable longer in the fall than native perennial species and provides greater fuel continuity enabling fire to carry through communities. Each time a sagebrush community reburns, cheatgrass increases its dominance, leading to a downward spiral of degradation. The Great Basin's normal mosaic burn patterns have been replaced by large, contiguous burn areas dominated by cheatgrass and the natural fire cycle for the sagebrush steppe which is estimated to have been 30-100 years has now decreased to as little as three to five years in some cheatgrass invaded areas.

Project Beginning

As we sat around the kitchen table we discussed what is known about cheatgrass grazing. We know that cheatgrass fuel loads can be reduced by grazing in the spring. However, three significant problems occur with spring grazing. First, year to year annual standing cheatgrass production varies up to tenfold leading to dramatic changes in available grazing forage, a situation untenable for most livestock operations because of the necessity to maintain stable livestock numbers and the inability to plan on a consistent forage base. Second, the spring grazing window is also a short duration moving target. We know that we have to graze cheatgrass before it begins to turn purple as it sets seed, loses palatability and increases the danger of mechanical injury to livestock from seed heads. Lastly, the heavy spring grazing necessary to reduce fuel load may put perennial grasses at risk and must be monitored closely to determine grazing effects. We also know that much of the grazing success has been using sheep to graze cheatgrass seedheads during the dough stage thereby reducing the amount of cheatgrass. However we also know many more cattle are available to graze cheatgrass in Nevada than there currently are sheep.

Back at the kitchen table the question became how do we overcome the problems connected with spring grazing? How about grazing in the fall with cattle? The negatives become positives with fall grazing.

- ✓ Production is known well before the beginning of fall grazing season
- ✓ Supplement can be used to congregate and utilize targeted cheatgrass areas better
- ✓ There is a relatively long window for grazing
- ✓ Perennials are dormant and are unlikely to be harmed

By reducing the amount of cheatgrass litter with cattle grazing in the fall, fire hazard and cheatgrass establishment can be reduced. Plant material build up under a cheatgrass dominated area equals two or more years of litter accumulation resulting in ideal conditions for fire. Cheatgrass establishment has also been positively correlated to litter cover.

Our Project

In order to improve our understanding of the effect of fall grazing as a fuel reduction tool and fall grazing effects on perennial plant communities, we conducted an experiment with these specific objectives: 1) determine the effects of large scale fall grazing of cheatgrass by cattle on fuel reduction; 2) determine the effects on cattle condition and performance; 3) determine potential plant community changes; 4) explore what land managers need to know to implement fall grazing on the land they manage. Ken Conley did a great job of providing background and describing the initial phase of this project in *The Progressive Rancher* December 2007 issue.

Concerns

Wait a minute you say, if we graze dry cheatgrass our cows will come in rail thin and all have lump jaw and pink eye! Our answer is not if we develop a job description for the cattle we graze. The cows should be mature Body Condition Score 5 or 6. Their calves should be weaned and they should be in their 2nd trimester. Additionally, cheatgrass forage should be sampled for nutritional content to determine necessary supplements.

Younger cows or yearling replacement heifers require a higher plane of nutrition than mature body condition 5 or better cows. Inadequate energy intake is the primary cause of reduced performance in cattle on forage diets. Protein and energy have a direct relationship and if forage contains less than 7% crude protein, feeding a protein supplement and ionophore will increase protein and energy status of cattle by increasing total forage intake and digestibility.

Finally, cheatgrass should be grazed in the fall only after seed drop since consuming cheatgrass herbage with sharp awned seeds intact can greatly increase the incidence of mechanical injury and infection of the mouth and eyes of cattle.

What we did

The project was located on the University of Nevada-Reno Gund ranch approximately 50 miles northeast of Austin, Nevada along the western base of the Simpson Park Mountain Range. The site was selected for cheatgrass continuity, and because it lies at the approach to an upland native perennial site that burned in 1999. The entire area has the potential for entering the degrading cheatgrass-fire cycle.

The total area consisted of 1500 acres of which 705

Fall Back to Cheatgrass Grazing

acres were grazed in the fall of 2006, 2007, and 2008. (Table 1)

Plant attributes were measured after the key perennial grass species reached peak production during the summers of 2007 and 2008 in order to determine the effects the previous years fall grazing had on the plant community.

What Happened?

We documented dramatic reductions of cheatgrass fuels from livestock grazing on a relatively large pasture scale. (Figure 1) According to the BEHAVE Plus fire model and the Rothermel equation, during each year (2006, 2007, and 2008) residual cheatgrass fuels (92, 39 and 15 lbs ac^{-1}, respectively) were below the level (200 lbs ac^{-1}) at which all firefighting methods can be employed.

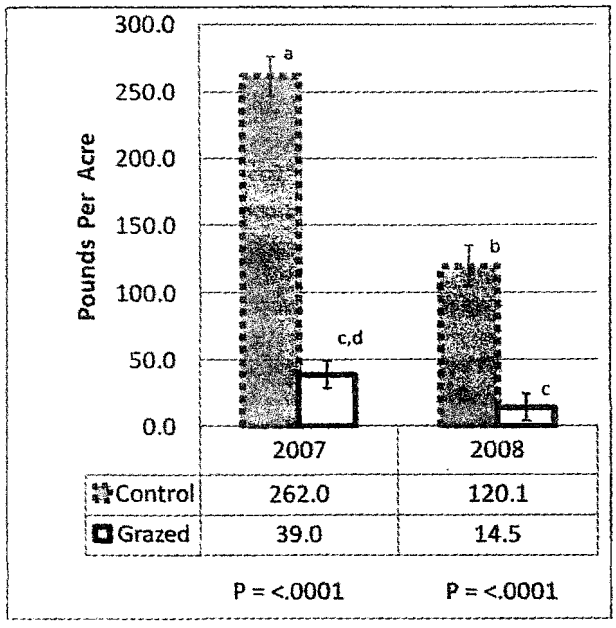


Figure 1. Comparison control and grazed treatment in lbs ac^{-1} of post-graze above ground biomass of cheatgrass for 2007 and 2008. [ab] Means with different superscripts differ ($P < .05$).

Cattle utilized 81.5% of cheatgrass during 2006 and even remained constant at 80.4% & 78.4% utilization respectively during the drought induced low production years of 2007 and 2008.

Additionally, a reduction in cheatgrass cover and seedbank density was documented after only one grazing treatment with additional reduction after two fall grazing treatments. Cheatgrass density did not decrease until after the second grazing treatment, leading us to conclude that at least two grazing treatments are necessary.

It is important to note that cheatgrass seedbank populations declined in our study without removing seedheads via a spring grazing treatment. We believe the cheatgrass seedbank reduction was accomplished through cattle consuming residual seeds contained in the duff and litter in the grazed portion. However this reduction may be of little value since the density of the grazed cheatgrass seedbank level of 185 plants ft^{-2} is far above the reported threshold concentration of 4 plants ft^{-2} that can easily out-compete crested wheatgrass seedlings and can displace native bunchgrass seedlings.

Perennial Grasses

During 2007, and 2008 cattle removed 100% and 92.8% of the biomass of needleandthread making it the most preferred grass Crested wheatgrass was the least preferred grass, with only 52.3% and 43.7% removal. Perennial grass cover, density and seedbank density were not different over time in either the grazed or control areas Treatments had no measurable effects on perennial grass density or cover. Perennial plants may have actually benefited by reducing competition through reduction of cheatgrass density and litter. Additionally, we saw the cover of crested wheatgrass and Sandberg bluegrass increase in grazed areas after the 2nd fall grazing treatment. We did not measure plant fitness, however visual appraisal indicated that crested wheatgrass, Sandberg bluegrass and needleandthread were more robust and produced more seed in the grazed area than in the control in 2008 even during a drought period. If we look at the combined use of all perennial grass species for 2007 and 2008 (61.8% and 59.2% yearly utilization respectively), cattle peferred cheatgrass utilizing (80.4% and 78.4%) each year respectively for the same time period.

Cattle Performance

Cattle gained significant amounts of weight and increased body condition each treatment year. (Table 2)

Cattle gained weight during this study in contrast to the findings of other investigators and leads us to believe that cheatgrass nutrition needs more evaluation. Cheatgrass nutritional quality varied considerably with time. Cheatgrass crude protein was considerably lower in 2006 (3.37% CP) than 2007 (7.0% CP) or 2008 (7.8% CP). Cheatgrass TDN followed the same pattern as crude protein: 2006 = (45.9% TDN), 2007 (60.77% TDN), and 2008 (56.8% TDN) No differences were detected between years for CP or TDN for the perennial grass species crested wheatgrass, needleandthread, and Sandberg bluegrass.

We speculate that the marked difference in nutritional content for both CP and TDN between 2006 and the drought years of 2007 and 2008, was due to fine cheatgrass stems and quick short growth during drought years. It is important to note cheatgrass on our sites did not green up during the

Table 1. Animal unit months, cow numbers and days grazed in 2006, 2007, and 2008 on grazed treatment area.

Year	Total AUM's	Average cow numbers	Days Grazed
2006	269	183.2	44
2007	297	240.5	37
2008	155	186.4	25

summer or fall of 2007 or 2008.

Management Implications

Plant nutritional analysis, coupled with the cattle gains in both 2007 and 2008 suggest, at least during drought years comparable to 2007 and 2008, cheatgrass would have met the nutritional needs of the cattle grazing it without protein supplementation. However, given the possible benefit of increased utilization, more even utilization, the ability to add an ionophore, and the necessity of protein for low quality forage digestion and utilization, we felt the 1 lb per head per day all natural protein liquid supplement used was still warranted.

Based on this study we would recommend 1) to affect the largest degree of fuels reduction, cattle be grazed at least two years on each site before moving to a new target area. 2) Cattle can graze without losing condition to a level of 14 lbs acre^{-1} residual cheatgrass. 3) Sample both quantity and quality of cheatgrass to ensure cattle maintain condition and performance. Quantity of above ground biomass should be sampled to determine the length of time cheatgrass forage will be available for grazing. Nutritional quality of cheatgrass must be sampled to determine supplementation level necessary. 4) When developing a fall grazing plan, be aware of the potential for the planned area to burn since fall grazing is only a spark away from no grazing. 5) Long term monitoring is necessary to determine changes in plant community attributes. In particular, monitoring should focus on: changes in weed cover and density; key perennial grasses and forbs cover and density; cheatgrass biomass pre and post grazing.

Justification

Others have provided justification for projects such as ours since we started in the fall of 2006. The Great Basin Wildfire Symposium spoke specifically to cheatgrass grazing for fuels reduction. The report indicated that current knowledge must be integrated into a large-scale vegetation management and site rehabilitation demonstration project utilizing cattle, sheep and/or goats in targeted areas to provide an economic and feasible way of reducing fire fuel loads, increasing the probability of safely suppressing an ignition before it becomes a mega-fire.

The Murphy Wildland Fire Grazing and Fuel Assessment Team reported that unless extreme weather conditions were present, cheatgrass grazing may have produced mosaic burn pattern fires by reducing the intensity and rate of fire spread. The team recommended a carefully designed fuels reduction demonstration project aimed at reducing fuel load of key areas thereby changing fire behavior.

Dan Gralian of the TS Ranch provides another rancher perspective. Dan has been using an essentially monoculture cheatgrass pasture in the Boulder Valley in the fall for several years. While waiting to wean and preg check, the cattle are held on cheatgrass for several weeks when they come off the summer country. He believes the cows maintain their body condition as long as a protein supplement containing an ionophore and plenty of water are available. Some of his BLM winter allotments also have monocultures of cheatgrass that are often under-utilized because the AUM's that cheatgrass can provide are not recognized. He would like to see an extension or prescription based on increased AUMS during high production years. "We have been told so many times that cheatgrass has no nutritional value after it matures that we have started to believe it." Maybe, we need to look at how much value cheatgrass actually has.

In conclusion, these results indicate fall grazing will reduce the abundance (density, cover, biomass and seedbank density) of cheatgrass fuels while maintaining the abundance (density, cover, and above ground biomass) of perennial species in grazed areas. At least during dry years, cattle prefer cheatgrass and will gain weight grazing cheatgrass. All indications from this study lead to the conclusion that fall grazing of cheatgrass is a viable fuels reduction tool.

If you want to know more, Contact: Lee Schmelzer, Stillwater County Extension Agent 400 3rd Avenue North Columbus, MT 59019. (406) 322-3038. lees@montana.edu

Thesis link: http://www.extn.montana.edu/counties/Stillwater/agriculture.html

Link to Ken Conley's 2007 article: "Make Peace Not War" http://www.ag.unr.edu/nsrm/progr__rancher.htm

Table 2. Cattle weight gains and Body Condition Scores (BCS) for 2007 & 2008

	Cattle Weight				Frame Score	
	Pre graze	Post Graze	Gain	Gain head day^{-1}	Pre graze	Post graze
2007	1178 lbs^{a}	1221 lbs^{b}	43 lbs	1.2 lbs	5.5^{A}	5.75^{B}
2008	1192 lbs^{b}	1235.8 lbs^{c}	43 lbs	1.74 lbs	5.6^{B}	6^{C}

$^{ab\ or\ AB}$ Means within a trait with different superscripts differ ($P < .05$)