Using Trained Weed-Eating Cows to Reduce Weeds and Improve Landscapes

Final Report

This project was funded by a grant from the Western Sustainable Agriculture Research and Education Program
http://wsare.usu.edu • (435)797-2257

Project by: Kathy Voth, Livestock for Landscapes, Home Office - (970)663-6569
http://www.livestockforlandscapes.com • kvoth@livestockforlandscapes.com

A Quick Summary

This three year project was a demonstration to show how or if we can manage cattle to reduce weeds and improve ecosystem function on Western rangelands. Our theory was that by using cattle trained to eat weeds and focusing them on weedy sites we could reduce weeds, improve soils, and increase the potential for native and grass species to return.

Were we successful?

> ***Plans get you into things, but you've got to work your way out.***
>
> - Will Rogers

This quote from Will Rogers is the best description of the course of this project. When I prepared the proposal, I thought that 3 years was enough time to gather the information I thought I needed. I didn't factor in extreme fluctuations in precipitation from cool temperatures and record rainfall in one year to a stock pond emptying drought in the next. I also could not have anticipated that my project pasture would become the site of herbicide trials, or that a new biking and hiking trail would be built through the pasture, with a trailhead parking lot constructed on a portion of my first trial pastures. Having spent almost 15 years building electric fence for both goats and cattle, I never imagined that this project would test my skills and knowledge beyond their limits. I especially did not plan for the hikers and bikers and herbicide researchers who would turn off the electric fence and let the cattle out. When endangered leopard frogs were discovered in the primary water source for the cattle grazing in the pasture during the second season of the project, it was just one more challenge in a series.

> ***Everyone has a plan until they get punched in the face.***
>
> - Mike Tyson

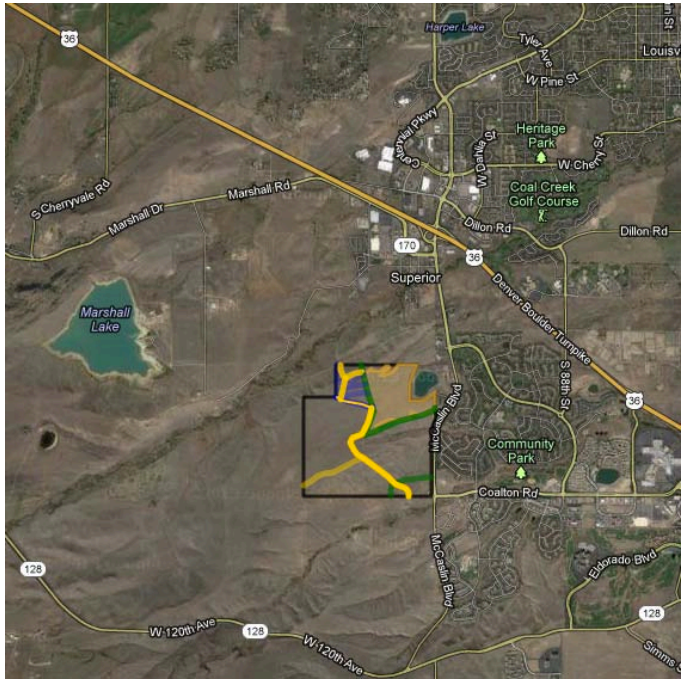
As these unforeseen circumstances came up, my assistant and I worked with the ranchers and our Boulder County partners to adjust grazing timing and location, cattle numbers, and fence lines. The kinds of changes we made were always designed to help us meet our goal of demonstrating how or if cattle could be intensively managed in a a landscape to reduce weeds and improve ecosystem function.

Lessons Learned

Though we weren't always grateful for the learning opportunities presented to us, we did learn a lot. I list the key points here and discuss them in greater detail later.

1. **Electric fencing in arid climates is a special challenge that is not easy to overcome.**
2. **Mob Grazing presents significant challenges beyond simply managing the animals.** Some were logistical, some were political, some were a result of how grazing has been managed in this area both historically and currently, and some were a combination of all three.
3. **Cattle will focus on weeds on their own, and changes in weed populations can and do occur.**
4. **Change is hard.**

To Boulder, Colorado



To Denver, Colorado

Mayhoffer pasture (with fence lines and herbicide treatment areas) and surrounding area. Superior, Colorado is to the north and east and the open space belongs to the City of Boulder and Boulder County Parks and Open Space.

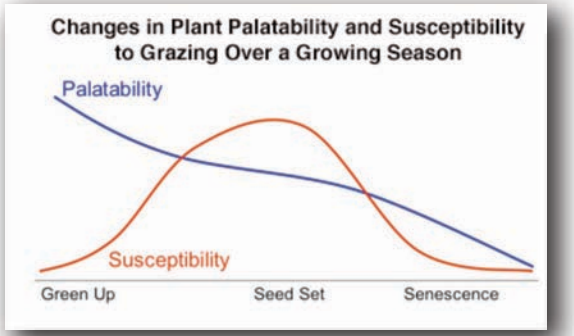
Project Background

In spite of continued efforts to control invasive species, and the best efforts of herbicide companies to develop products for their management, weeds continue to spread nationwide at an average rate of 14% per year. In 2000, farmers and ranchers were already spending $5 billion to control pasture weeds, and an additional $1 billion was lost due to reduced grazing potential, reduced wildlife-related recreation, higher levels of soil erosion and reduced water quality (Pimental et al 2000). Researchers Rejmanek and Pitcairn noted in 2004 that when a weed is wide-spread "biological controls may be the only long-term effective way to suppress its abundance over the invaded area."

Managing weeds on rangelands in the arid west is difficult because weedy species are spread over many acres, increasing the cost and difficulty of using herbicides, fire and mechanical controls. In addition, herbicides may be doing more damage than good to our forage base. The title of the sixteen year study by Rinella et al summarizes his findings succinctly: "Control effort exacerbates invasive-species." The paper concludes that, "Aside from a transient increase in grass forage production, herbicide provided little benefit to the livestock producer or the ecosystem we studied. One of the primary objectives of spraying was to increase cattle forage by decreasing Euphorbia esula (leafy spurge) production, but paradoxically, two sources of evidence suggest that herbicide ultimately increased E. esula production." They note that their previous research showed that grasses and forbs compete with E. esula, and as herbicide leads to long-term suppression of several native forbs, it followed that reduced native-forb abundances would lead to increased production of the target weed. Thus, spraying was actually increasing their problem. Research by Fuhlendorf et al (2009) supported Rinella's conclusions that herbicide did little for the producer's forage base or bottom line. While forbs were reduced by herbicide, grass cover varied more due to annual precipitation than herbicide treatments and "...livestock production was not altered either on an individual basis (gain/head) or on an area basis (gain/ha)."

Cattle in the 2004 Grant-Kohrs Ranch Pilot project learned to eat leafy spurge. They chose it in pasture due to it's high protein content (greater that 21%) and experienced none of the negative side effects that are believed to be associated with grazing this plant.

Both research and experience have demonstrated that grazing can be used to reduce weed populations when timing and intensity of grazing is managed to put stress on target plants. As the graph to the right indicates, a plant's palatability and susceptibility to grazing changes over the growing season with both decreasing after seed set (Launchbaugh 2006). Since palatability is based on the nutritional value, it is obvious that we will have best luck with grazing when the plant's nutritional value is higher. Since seeds may also be spread in the manure of grazing animals, it also makes sense that we avoid grazing after seed set. Thus by paying attention to the growth stage of the target weed, we can pick a time before seed set to graze for maximum impact.



Can Cows Eat Weeds?

In 2004, I began working on a process to turn weeds into forage for cattle. The inspiration came from work done by Dr. Fred Provenza and his colleagues at Utah State University that described how animals choose what to eat. They found that animals learn first from their mothers what to eat, and then from internal feedback from nutrients and toxins in foods (Provenza 2003). My theory was that animals did not eat weeds because their mothers had not eaten them, but that if they were nutritious, and if I could get them to take a bite of a weed, they would experience good feedback and would learn to eat the weed in pasture.

I tested this theory in a pilot project at Grant-Kohrs Ranch National Historic Site in Deer Lodge, Montana. I have since refined the process so that anyone can teach a cow to eat a weed in just 8 hours over 7 days. Because

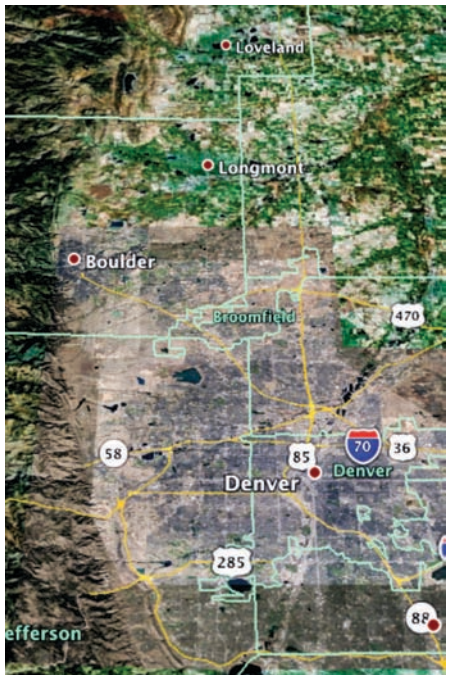
weeds are generally as good or better than alfalfa in nutritional value (Voth, Livestock for Landscapes website), cattle will eat weeds in pasture, and remember them year after year. By teaching cows to eat weeds producers have more forage available and they reduce costs for weed management. Cows teach their herd mates and calves to include weeds in their diets and they continue eating weeds year after year, even adding new weeds on their own. For more on the training process visit http://www.livestockforlandscapes.com.

In 2007 and 2008 I used this process to train Babe and Leo Hogan's cows to eat late-season diffuse knapweed and Dalmatian toadflax. In 2009 we moved these trained cows and their calves to the Mayhoffer pasture with 30 cow calf pairs belonging to Bill Hogan. We wanted to watch as the trained cows taught the untrained cows to eat weeds.

An example of grazed Dalmatian toadflax. Though this plant is lower in protein (8% at bloom) educated cattle have continued to eat it well every year in pasture.

The weeds the cows ate exceeded our expectations. They ate very little grass and preferred to graze in the weedy area created by prairie dogs on the south end of Mayhoffer (Voth 2009). Based on what we saw, we theorized that by managing them more intensively we could reduce weeds and increase grasses and native forages. Thus we developed and submitted a proposal for a demonstration project to Western Sustainable Agriculture Research and Education (Western SARE) to further explore this possibility.

We selected the Mayhoffer pasture for this demonstration because it had a significant invasive species problem and it was also easy for participating ranchers to move cattle into and out of. Before Boulder County acquired this property as part of its open space program, it was continuously grazed. Ranchers remember it as having some of the best forage in the area. However county managers were concerned that the big bluestem populations were decreasing as a result of grazing and under their management 38 of Bill Hogan's cow calf pairs graze it for 2 to 3 weeks annually. Weed invasions in the pasture are quite large and include a growing population of diffuse knapweed, Dalmatian toadflax, tumble mustard, curlycup gumweed, broom snakeweed, horehound, wormwood sagewort, a variety of thistles, and more. Weed invasions and soil erosion is being enhanced by a 200 acre prairie dog colony on the southern slope of the 500 acre pasture, and on the upland portion where prairie dogs were once reintroduced.



☆ Mayhoffer Pasture is 500 acres managed by Boulder County Parks and Open Space. It is on the outskirts of Superior, Colorado on the front range between Denver and Boulder. Some open space is managed for agricultural uses including crops and grazing. It is also important to recreational users.

Because educated cattle were readily eating weeds in this pasture, we wondered if focusing them on portions of the pasture using Mob Grazing techniques might lead to improvements. As enthusiast and mob grazing expert Greg Judy explains, pastures are stocked at the equivalent of 1600 head per acre (the mob), and animals are moved when they have "eaten half and trampled half." The purpose of this level of impact is to increase soil organic matter and nutrient cycling and improve the water cycle by incorporating plant material into the soil surface and improving it with manure and urine. Practitioners, including University of Nebraska Extension Specialist Terry Gompert, say that mob-grazed pastures show an increase in soil-organic matter of 450% in just a few years, as well as increases of up to 200% in native and forage species production.

We expected numerous challenges in exploring mob grazing in this area. Given that arid regions in the west do not typically have the same amount of

biomass available for grazing or trampling, it seemed unlikely that gains could be achieved at the scale described by Gompert. We wanted to see what kind of changes we could expect. Another issue was that as currently managed, mob grazing systems require intensive management of animals, with some operators moving cattle twice a day or more. This was the opposite of traditional management in the area where producers run a series of smaller herds of cattle on scattered pastures, grazing them season-long. It was the hope of our Boulder County partner that this project might demonstrate how herds could be combined on larger pastures to increase stocking density without increasing labor. With that in mind, we hoped to develop examples of the kinds of stock densities that would work best in more arid regions and how they affect forage and livestock productivity.

The basics of the three year proposal funded by Western SARE included:

- Working with weed-eating trained cattle belonging to Babe and Leo Hogan and Bill Hogan on the Mayhoffer pasture managed by Boulder County Parks and Open Space.
- Sharing information and gathering input from ranchers and the City of Boulder open space managers so that whatever grazing management we developed would work for them and others as well.
- Doing rangeland health assessments, repeat photo monitoring and other data gathering to determine if our management is having the results we hope for.

Citations

Fuhlendorf, S.D., D.M. Engle, C.M. O'Meilia, J.R. Weir, D.C. Cummings. 2009. Does herbicide weed control increase livestock production on non-equilibrium rangeland? Agriculture, Ecosystems and Environment. Volume 132: Issues 1-2, July 2009.

Launchbaugh, K.L. 2006. Targeted Grazing: A Natural approach to Vegetation Management and Landscape Enhancement. An American Sheep Institute Publication. Available online at: http://www.cnr.uidaho.edu/rx-grazing/Handbook.htm

Pimentel David, Lori Lach, Rodolfo Zuniga, and Doug Morrison. 2000. "Environmental and Economic Costs of Non- indigenous Species in the U.S." Bioscience 50, no. 1. p. 53-65.

Provenza, F.D., 2003. Foraging Behavior: Managing to Survive in a World of Change. Department of Forest Range and Wildlife Resources. Utah State University.

Rejmánek, M., and M. J. Pitcairn, in Vietch, C.R. and Clout, M.N. (eds). Turning the tide: the eradication of invasive species, 2004. IUCN SSC Invasive Species Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Rinella, M.J., B.D. Maxwell, P.K. Fay, T. Weaver and R.L. Sheley. 2009. Control effort exacerbates invasive-species problem. Ecological Applications. 19(1), 2009, pp. 155-162.

Voth, K. 2009, GLCI 2009 Final Report: http://www.livestockforlandscapes.com/pdfs/GLCI%20Final%20Report.pdf

Voth, K. Livestock for Landscapes web site: http://www.livestockforlandscapes.com

Project Participants

Our primary partners in this project were Boulder County Parks and Open Space, Rob Alexander and Meaghan Huffman and the ranchers who supplied the cattle, Albert (Babe) and Leo Hogan and Bill Hogan. Brothers Babe and Leo owned the first cattle to be trained in Boulder County and their cousin Bill was the Mayhoffer pasture lessee. We met with our primary partners to plan for the upcoming season, make adjustments along the way, and then to talk about what went right at the end of the season, and what we would like to do differently.

The City of Boulder also owns extensive open space, some of which is managed for grazing and is adjacent to grazing lands managed by Boulder County Parks and Open Space. Because of this close relationship, I asked

Andy Pelster of Boulder Open Space and Mountain Parks to act in an advisory capacity to the project. We share information and invited him to meet with us on site, and his thoughts about the politics, science and art of grazing management informed some of the lessons learned.

Initially we also had four ranchers participating in an advisory capacity: Al Green, Dick Miller, John Hall, and Jim Roberts. None of them participated in the Rangeland Health Assessment training, nor in the end of the first year review, and since they didn't return phone calls we understood that they were no longer interested in participating.

Brothers Albert (Babe) and Leo Hogan. Their family has been ranching this property since the are was settled in the 1800s.

At the end of the first year we invited all our ranching participants to a picnic at the Mayhoffer pasture. We served up fried chicken, potato salad, coleslaw, cold drinks and cupcakes. We talked about pasture management, and weed protein values and what they would like to see in the future. We also discussed their overall grazing management programs and whether or not it might be possible to combine herds with other ranchers to achieve mob grazing style impacts.

Objectives

1. Train City and County staff and participating ranchers in the use of rangeland health assessments to create a team of monitors. - Spring 2010

2. Set up demonstration site pastures and manage cattle within them.

3. Conduct six rangeland health assessments for each of the demonstration areas over the course of three years. As it turned out, the pasture was in one soil type, so that doing rangeland health assessments over the entire area would not have given different results.

4. Develop draft criteria for managing high density grazing including number/ pounds of animals per acre, how long animals should be in one pasture based on changes in forage. This criteria will be developed using input from participating ranchers, successful practitioners, available literature, and adaptive management during the project. Criteria will begin development in the fall of 2010 and will be completed by the end of the project in 2012.

5. Create outreach and education materials to share with producers, City and County staff, media, County commissioners, Open space advisory boards, NRCS and extension staff and others. These will include results in report form, flyer invitations and handouts for field days, and a video on DVD documenting the project . Results will

also be available on the Boulder County Parks and Open Space and the Livestock for Landscapes. web site. Outreach and education materials will begin development in spring of 2012 and will be completed by the end of the project in 2012. Results will also be shared at annual meetings of producers with County and City staff.

Methods (What We Did)

2010

Before we could begin the grazing project, Boulder County determined it was necessary to spray 100 acres of the 500 acre Mayhoffer pasture to reduce diffuse knapweed. Every year they get complaints from the neighbors to the east of Mayhoffer because of knapweed skeletons that pile up on their fences, and this was an attempt to reduce their problems. To prevent this from impacting the project, our County partner, Rob Alexander, had us fence that area off so that cattle would not graze there. The fenced area is shown on the 2010 map.

For year one, we began fairly modestly, using only 80 cow calf pairs plus bulls. This was an opportunity to test "mob grazing" and to see what kind of impact we would have on the weeds. Because we hoped to compare standard grazing with more concentrated grazing, we first brought the cattle into the 500-acre Mayhoffer pasture on June 10, allowing them to lightly graze the entire pasture as they would under normal management. Beginning on June 22, we confined the herd to small test pastures, focusing on areas heavy in "weed" species including diffuse knapweed, dalmatian toadflax, horehound, gumweed, musk and canada thistle, broom snakeweed, field bindweed and more. You can see the pastures and grazing course on the 2010 map.

The herd expanded to 100 animals on July 2. When someone opened a gate on the north boundary of the pasture, our herd joined with a smaller group grazing to the north. Since they all belonged to the same rancher, and it would have been very difficult to separate them, we simply included them in the project.

Our goal was to graze to the degree that each weed had been bitten at least once. By July 9, the cattle had worked on 4 separate pastures. During that time they had escaped from the electric fence twice, once when someone let them out, and again when a thunderstorm took the fence down temporarily. They escaped again on July 9 when someone turned off the charger to the fence. Since the project was slated to end three days later, instead of herding them back to their pastures we released them from mob grazing and were pulled from the pasture on July 12, 2010.

2010 Results

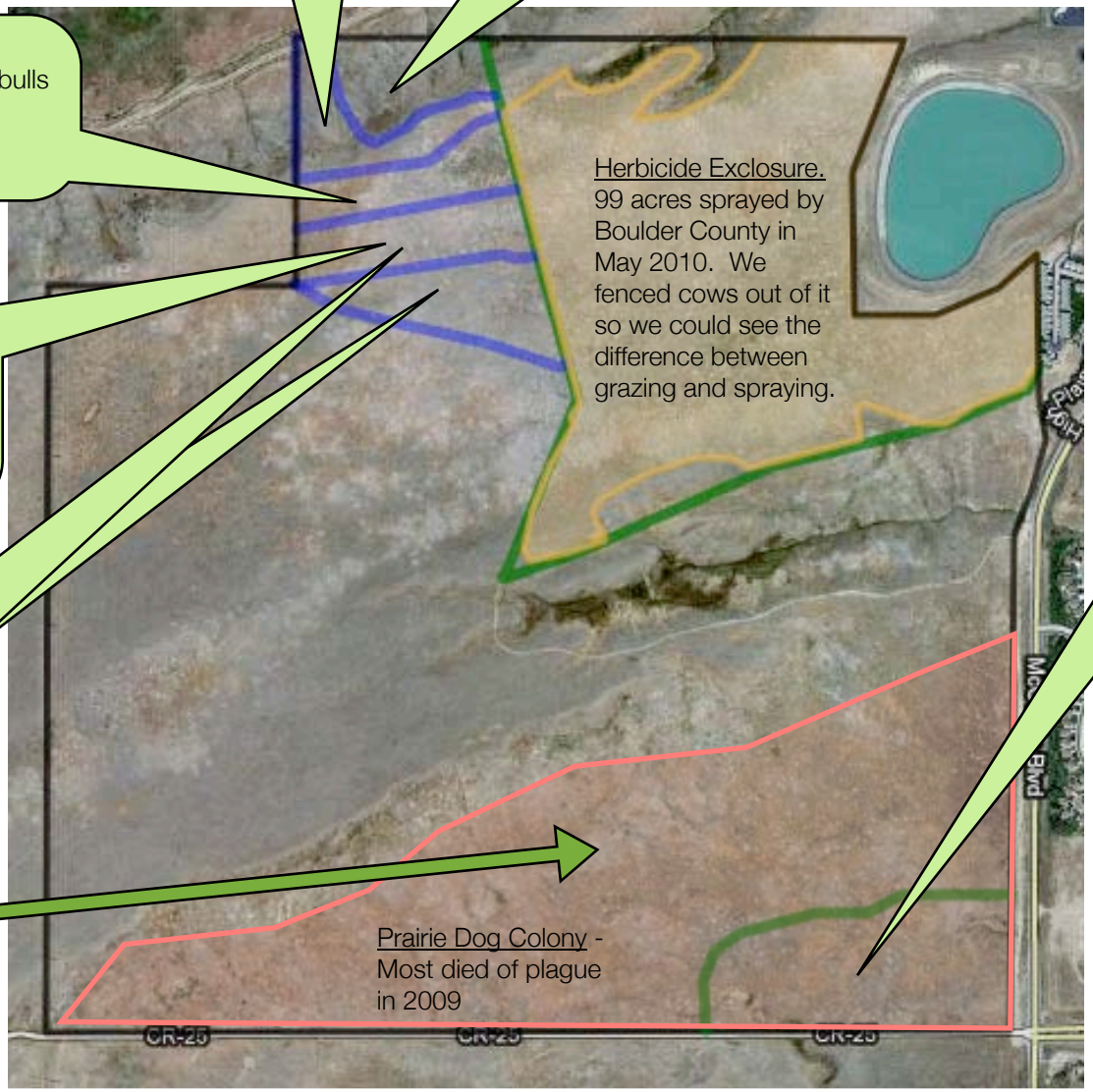
We toured the pasture several times with Rob Alexander and Meaghan Huffman, our Boulder County partners. Rob was very pleased with the level of impact on the pastures, noting where hoof action and manure had improved them for native forbs and grasses. Before and after pictures of some of the pastures are included after the 2010 map.

Rob points to new forb growth in cattle hoof prints noting that they were able to take advantage of water trapped there to get started. (9/29/10)

We also learned that given the amount of forage we had, 100 cow calf pairs with bulls require about 2 acres per day. During our meetings with ranchers and with our Boulder County partners, we agreed that increasing the herd size to between 200 and 300 animals would allow us to cover more of the area that Boulder County hoped to have treated by cattle.

The cattle continued to expand the kinds of plants they grazed in pasture. This year they added curly cup gumweed, yucca (right), and common mullein.

2010 Mayhoffer Weed Grazing Project



Pasture 2
80 pairs, 2 bulls
8.35 acres
June 28 to July 2

We fenced this area out of the project. It was primarily grass and we wanted to focus the herd on treating weeds.

Pasture 3
100 pairs, 3 bulls
7.22 acres
July 2 - 5

Herbicide Exclosure.
99 acres sprayed by Boulder County in May 2010. We fenced cows out of it so we could see the difference between grazing and spraying.

Pasture 4
100 pairs, 3 bulls
Herd moved here on July 5 but broke the fence during a thunderstorm and were out on July 7.

Pasture 1
22.88 acres
80 pairs, 2 bulls
June 22 to 28.
This pasture was primarily "weeds" with very little grass.

Pastures 4 and 5 combined
100 pairs, 3 bulls
Herd moved here on July 7 and had Someone turned off the fence sometime after 2:00 pm on July 8. When we returned on July 9 the herd was out and grazing here.

Prairie Dog Colony - Most died of plague in 2009

Our Project Starts Here and Moves Counter Clockwise

We began with 80 pairs and 2 bulls on June 10. The herd had access to the entire pasture, less the 100 acres fenced out as an herbicide exclosure. This represented typical pasture management to provide a comparison to "mob grazing" management.

Pasture 1 Before and After

Central part of pasture in knapweed area

Looking south at pond. Shows the level of trampling we want to return vegetation to the soil

Pasture 2 Before and After

At bottom of hill near community ditch

On top of hill in heavy knapweed area

2011

This was a difficult year for the project. An extremely dry winter was followed by a cold, wet spring. This entire area sees about 10 to 12 inches of precipitation annually, but this year 5 inches of that fell as rain during the month of May. The combination of a lack of winter moisture followed by rain and temperatures in the 40s and 50s for several weeks in the spring slowed vegetation growth so that we were 2 to 4 weeks behind normal.

Water was another serious problem. The southern ponds that we typically rely on to water livestock were empty at the end of April, and only partially filled after the May rains. Cattle can also usually water at the irrigation ditch at the northern boundary of the pasture. But this year, because of all the rain in May, irrigators were not calling for their water, so the community ditch was not turned on until the end of the second week in June.

The stock ponds we normally use in the middle of the pasture were not in working order. Piping had been broken or removed and left unrepaired, so the lower, larger tank could not collect water, and the smaller tank received only a trickle from the spring feeding it. The small pond above these tanks was only partially filled due to the dry winter.

Boulder County staff were reluctant to allow cattle access to the spring and stock tanks for reasons beyond lack of maintenance. First, Boulder County wildlife staff discovered leopard frogs in the pond at the end of the 2010 grazing season. Leopard frogs are rare and being considered for listing under the Endangered Species Act. The Boulder CountyAgriculture staff was concerned about potential overlap between the grazing season and the frog breeding season. We later learned that our grazing season did not overlap with breeding season. A second reason staff was concerned about using the central stock ponds was that a new, regional, hiking and biking trail had just been built through the pasture. The edges of the trail had been seeded and were lined with straw anti-erosion barriers. Staff was concerned that cattle would cause damage to the seedings and barriers and that there would be conflicts with trail users.

To prevent problems with the frog and the trail users we built new electric fencing to keep the cows in the western half of the pasture. Our plan was to

2010 water levels

2011 water levels at the same time of year

University of Colorado researchers checking on the status of the leopard frog in the stock pond on August 2, 2011. They told me there were lots of frogs.

graze the cattle first in the southern portion of the pasture and then, when we no longer had water in the ponds there, we would move the herd to the north end of the pasture where they would be able to water from the community ditch when it was ready.

In 2010 we had all agreed that we should begin grazing earlier in the season so that we could hit the Dalmatian toadflax when it was higher in protein. So our Boulder County partners asked us to begin our grazing season on May 27, 2011 with 150 cow calf pairs. The problem was that "early" was measured by date, instead of plant growth stage, and since plant growth was 2 to 3 weeks behind the normal, there was much less forage for the animals. In addition, the early growth stage of the big bluestem made it much more palatable to the cattle and they grazed it in 2011 though they had not done so in previous years. This raised concern for our Boulder County partners and resulted in cattle being removed from pasture by the end of June.

Here is an example of the difference in plant growth stage using the leopard frog stock tanks as a comparison.

We again had issues with the electric fence. The new fence was taken down several times by blowing tumbleweeds that accumulated overnight. When water got low, no fence would hold the cattle, and they broke out and headed for the the leopard frog ponds.

2011 Results

While the human participants struggled with all of these things, our cow colleagues just continued to do the job they'd been hired for. They did an excellent job targeting the most weed infested areas of the pasture, whether or not the electric fence was in place. When I returned in August and again in September, I could not find a single Dalmatian toadflax plant that had not been grazed. They also did a good job on late season diffuse knapweed, though their success would have been better if the human partners had been able to agree on the timing of bringing them back to pasture.

One of the indications of the willingness of animals to focus on weeds was that they waited at the electric fence keeping them from the knapweed in the northern pasture. I mistook their attention for needing water from the ditch on the northern boundary of Mayhoffer. I let them in, but instead of heading for water they ran to the knapweed patch and grazed it down.

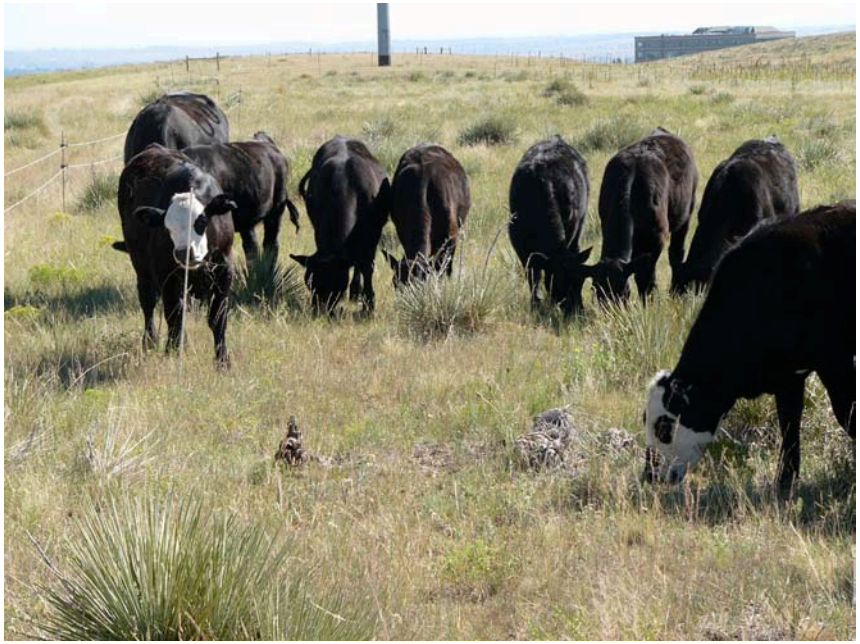
Grazed Dalmatian toadflax. This is typical of what I found throughout the pasture.

Grazed Rabbitbrush

Because research shows that grazing knapweed more than once in a season can reduce populations even more, ranchers and the county had agreed to putting a small group of cattle back in the northern pasture at the end of the summer. Unfortunately, I was not able to get permission from the county when the plants were ready for regrazing. By the time I was allowed to put the cattle in, the plant had gone to seed and was no longer palatable.

Though this didn't achieve the hoped for result, it did add an important bit of information. Graziers have often wondered if animals will cause weeds to spread by eating their seeds. Research indicates that animals would not eat plants gone to seed because of their very low nutritional value. That is exactly what we saw in this case. Animals avoided the weed in seed and ate everything else in pasture instead.

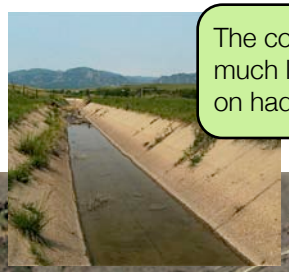
One of the best results to come out of this summer was evidence that grass is returning to replace weed species in the southern portion of the pasture. Participating ranchers are excited by the increase of sideoats grama in the pasture and it is clear that there is more grass overall throughout the pasture. This year cattle also added broom snakeweed, rabbit brush and wild rose to their diets.



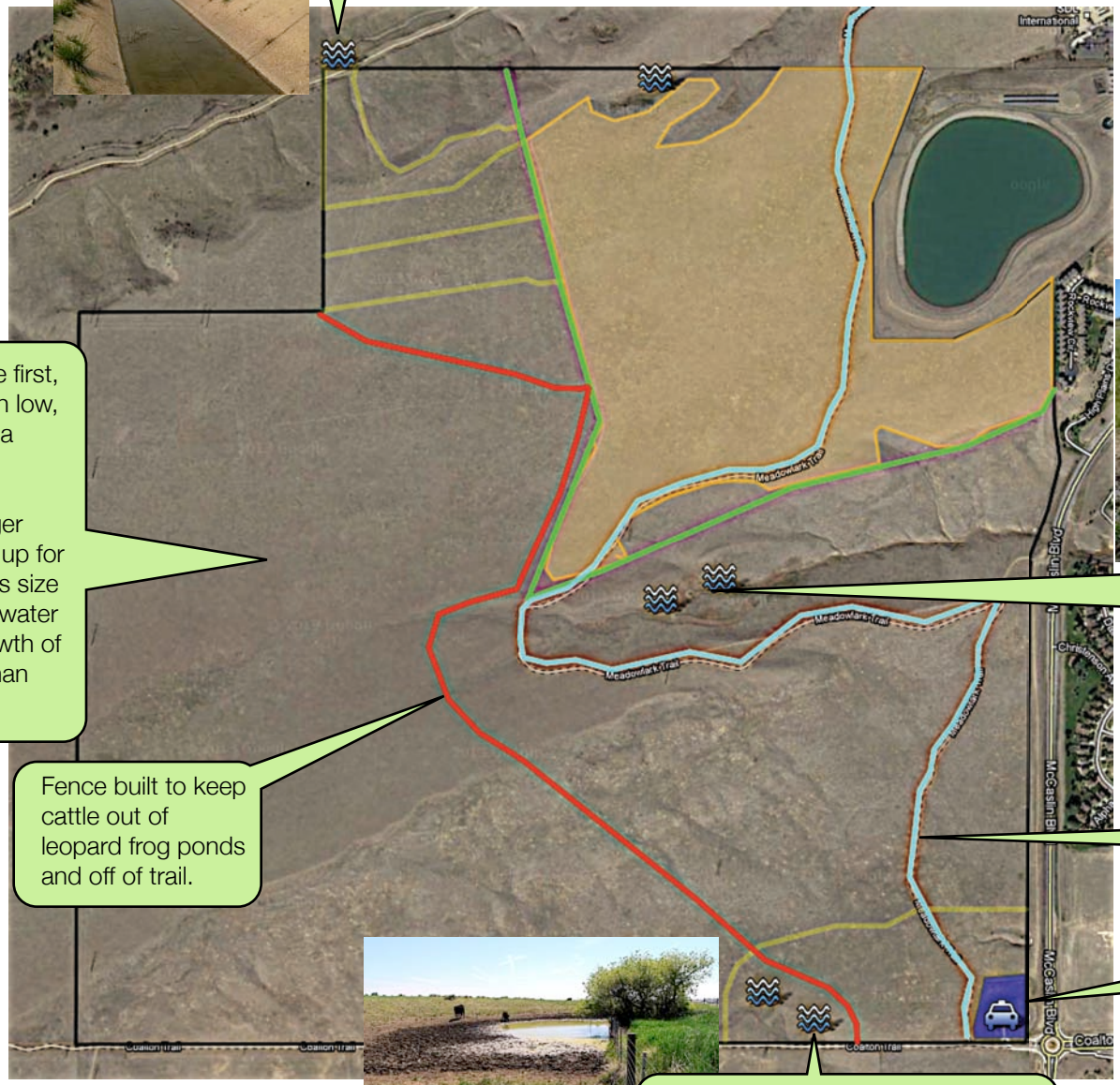
As our Boulder County partner, Rob Alexander, pointed out, this area had a lot more grass and a lot less diffuse knapweed than in previous years.

Before the rains began, our plan was that the herd would graze the northern part of the pasture first. Here you can see the fence line contrast in the northern part of the pasture where cattle had grazed the previous year on May 9, and on May 24 after 5 inches of rain.

2011 Mayhoffer Weed Grazing Project



The community ditch was not turned on until much later in the grazing season, and early on had only a few inches of water in it.



Cattle grazed in this pasture first, but then, because water ran low, they were moved to the area north of the red line.

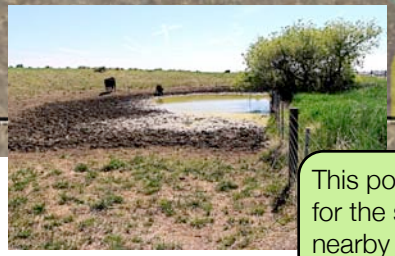
This pasture was much larger than we would typically set up for Mob Grazing. However, this size was necessary because of water issues and the delayed growth of forage thanks to a cooler than normal spring.

Leopard frog pond and stock tanks

Fence built to keep cattle out of leopard frog ponds and off of trail.

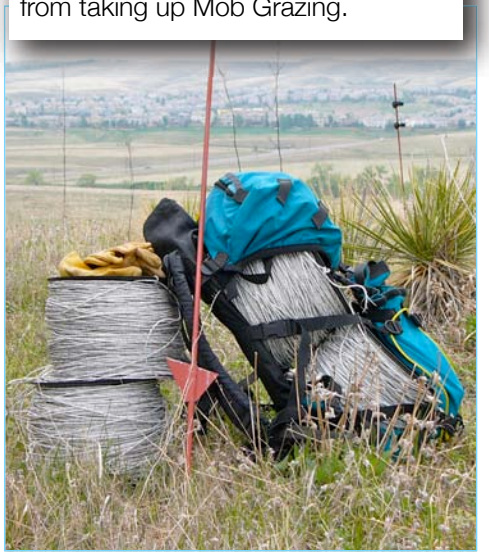
Meadowlark Trail

Trailhead



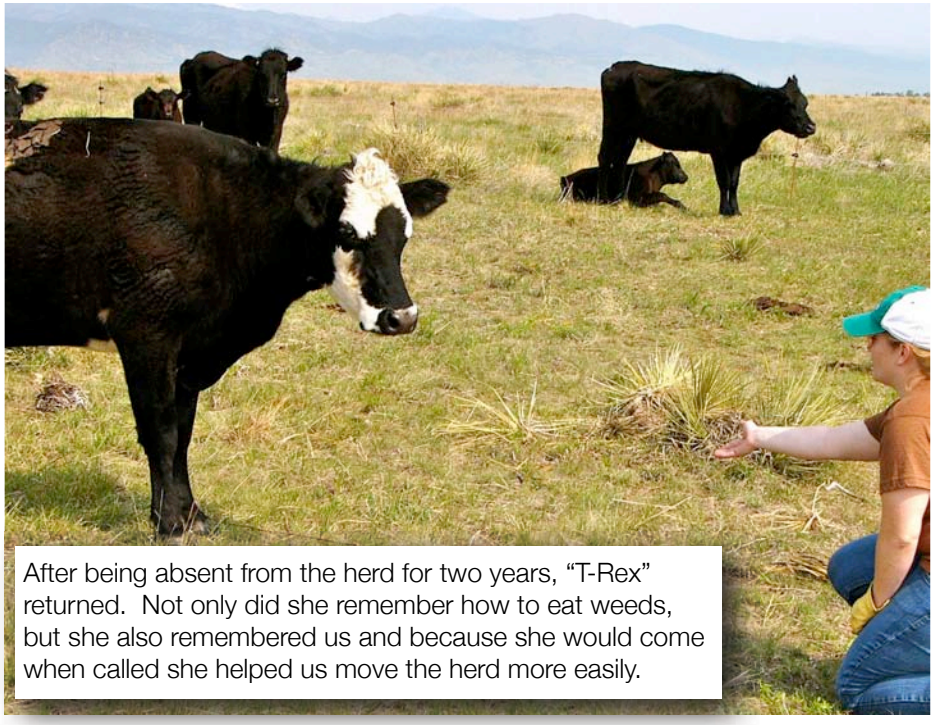
This pond was the only water source for the southern pasture. The other nearby pond was completely dry.

To protect soils and vegetation, I was not allowed to use a vehicle when installing fence. So I hauled equipment with a backpack. This would definitely discourage ranchers from taking up Mob Grazing.



Intensive management is also frustrating when winds fill fence lines with tumbleweeds on a daily basis.

Fencing was not required for the herd to focus on toad-flax. They grazed it throughout the pasture.



After being absent from the herd for two years, “T-Rex” returned. Not only did she remember how to eat weeds, but she also remembered us and because she would come when called she helped us move the herd more easily.

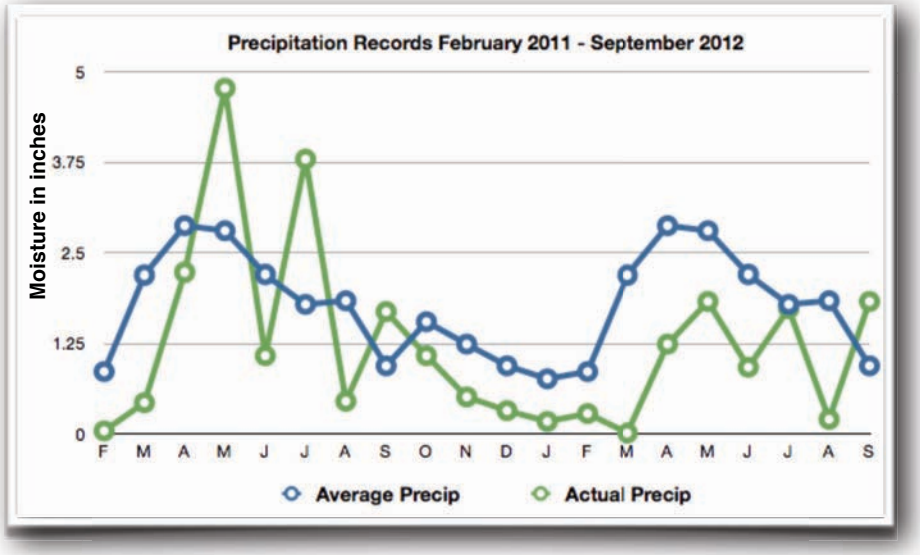
Horehound was uniformly grazed to small 8 inch high clumps.

2012

> ***It was a bad drought. It was the worst in the living memory of many farmers.***
>
> Robert Geigengack,
> University of PA, Earth and
> Environmental Science Department

When I went to check the Mayhoffer pasture in the spring of 2012, I didn't come home with good news. Crunchy was the best way to describe the pasture. In fact 2012 was drier than any of the dustbowl years, and the only year drier in Colorado history was 1895. In the Mayhoffer pasture, the only water for that year would be on the north end, provided by the Community Ditch.

Based on the conditions we reduced our herd size to 38 of Bill Hogan's cow calf pairs and prepared for a very short grazing season on the north end of the pasture where the herd could drink from the irrigation ditch. The red lines on the map show our fence placement.

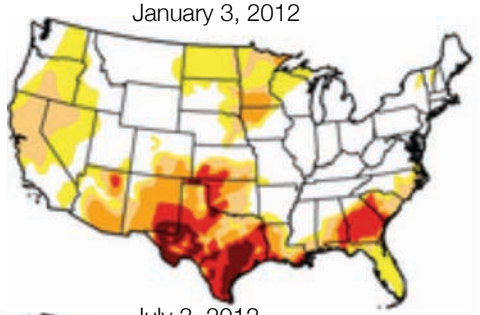


The chart above is from a weather station located just to the south of the Mayhoffer pasture. It shows how the drought actually began during the fall of 2011, which affected root reserves and plant health. The lack of moisture in spring, further reduced forage growth.

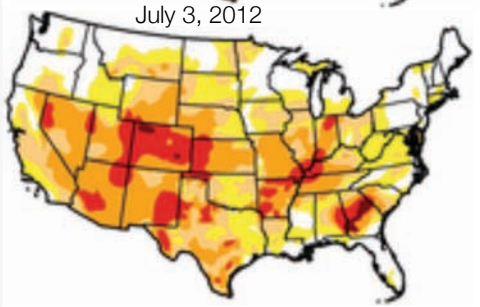
Tracking this kind of information has been recommended by NRCS staffs in Kansas, another drought stricken state, to develop "trigger dates" when producers should make destocking decisions. Based on our interactions with Boulder County staff and ranchers, trigger dates could improve their ability to work together.

US Drought Monitor

January 3, 2012



July 3, 2012



Note expansion to most of the country over the course of the spring and summer.

Bill moved the cattle to the pasture on June 7. When we arrived the morning of June 8, the cattle were out and grazing in the Leopard Frog/stock tank area. Bill came to put them in again for us. We made sure the fence was working correctly and also herded the cattle down to the irrigation ditch to make sure they knew where water was. We also placed a supplement tub on the upland portion of the pasture to further encourage them to stay put.

The cattle were out again on June 10, and then again on June 11, and each time we had to call Bill to help us put them back. In theory these were animals that we had worked with for 4 years, and in the past, even when they escaped we were able to herd them on foot back to their pastures. But these cattle seemed almost wild and had very little respect for the fence. We could not herd them back to the fenced pasture and had to call on Bill to come and herd them back with his 4-wheeler every time. In addition, though we saw some evidence that the target weeds were being grazed, it did not match what we were accustomed to seeing in previous years.

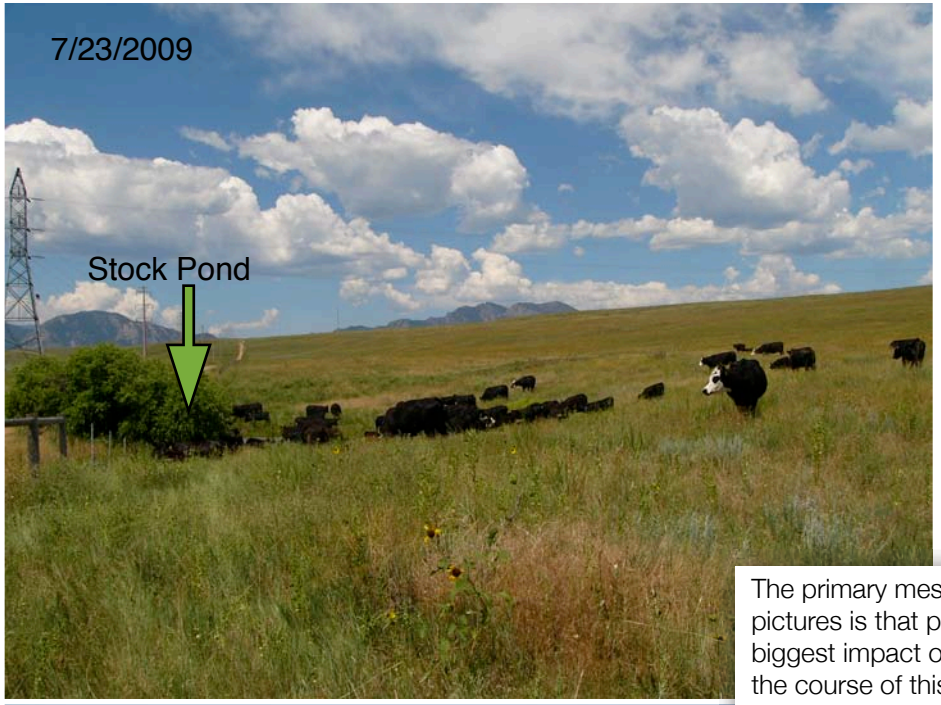
Day 1 Escape - Our herd headed to the stock tanks and leopard frog pond in spite of the fact they had water in the irrigation ditch at the north end of their electric-fenced pasture.

Another Escape - This time the herd headed to the ponds at the south end of the pasture. As shown here, there was no water, only a pond bottom of weeds.

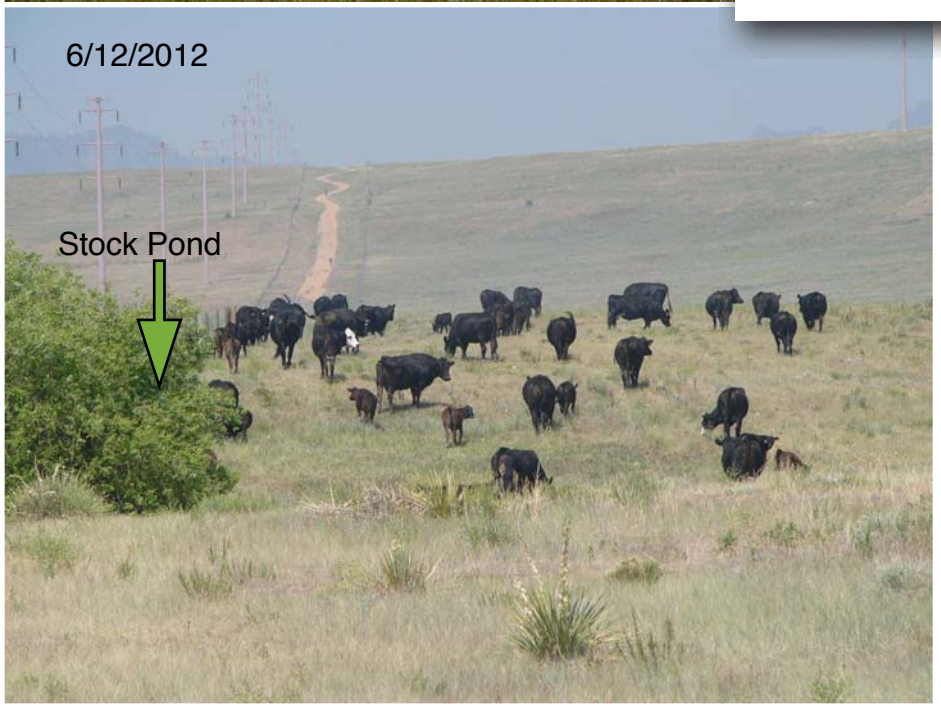
I called Bill Hogan to see if they were cattle that we had previously used, and he told me he had no idea what he had put in the pasture. His response matched our observations that most if not all of these animals were not trained to the fence, or to to eating our target weeds.

We were now faced with a decision about what to do for the remaining 10 days of grazing that Boulder County was allowing for grazing in Mayhoffer. We considered the importance of maintaining the health and safety of the animals, our inability to keep them fenced in the trial pasture, and that Bill Hogan had plenty of other work on his hands due to the drought. It seemed best for all concerned if we stopped trying to keep them in the trial pasture and give them the run of the entire area.

I went back later in the summer to check on pasture health. It seemed that the drought had set our progress back on diffuse knapweed and that though every Dalmatian toadflax plant in the pasture had been grazed, its population had expanded.



The primary message of these pictures is that precipitation had the biggest impact on vegetation during the course of this project.



Outcomes and Impacts

Some of the outcomes have been listed in the annual results section of this report. What we found overall is that precipitation had the largest impact on the outcomes of this project and influenced all the rest of the outcomes. Here we'll summarize our Lessons Learned.

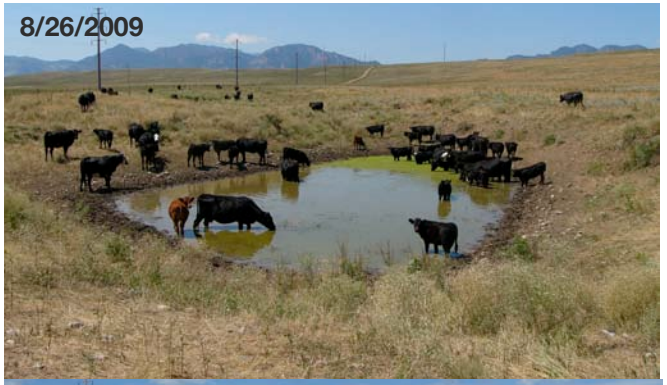
Water dictates where and when animals can be grazed.

The second two years of the project when we were experiencing drought, were naturally the most difficult. We looked at costs for hauling water, and considered ways to dam the Community Ditch so that water might last longer and provide a longer grazing season. In 2012, Boulder County agriculture staff began discussions with the Wildlife staff about changes to the leopard frog pond and stock tanks that would protect frog habitat and provide water to working livestock.

The places where mob grazing is currently most popular are less arid and the land base is typically much smaller than in the arid west so it is easier to place water sources and to move animals to them. The water situation in the arid west is different. Water sources that can serve large numbers of animals don't exist in the Mayhoffer pasture, or in most pastures in the county or city. Large water sources are also rare in most of the arid west and the distance between them is greater. In addition because of the large scale of the pastures, hauling water is cost prohibitive or impossible because of lack of road access.

As noted, research has indicated that grazing livestock can have an impact on weed populations, even in the arid west. Since concentrating animals is difficult due to watering issues, it may be that land managers need to adjust their expectations about the speed with which they can accomplish change to include their ability to provide water to working livestock.

One of the outcomes of this project that Boulder County staff hoped for was that we could demonstrate how grazing can assist in weed management, so that upper level managers release funds to allow them to develop additional water sources in pastures. We don't know yet if this will happen.



These pictures show the difference in water availability from a "normal" year to a drought year. The June 2011 pictures show stock ponds that are low in spite of the fact that the pasture had almost 5 inches of run in May. What this tells us is that we should track winter precipitation as an indicator of where and when we can graze in the spring.

Temporary electric fencing on arid rangelands is difficult and may be more work than is possible for producers and land managers.

There are three things that reduce the success of temporary electric fencing: animals that aren't trained to fencing before arriving on site, competing bulls in the herd, and poor grounding. Boulder County agriculture staff worked with ranchers to train animals before they arrived on site, and this helped a great deal. However, when bulls began competing, they tore down fences without even realizing that a fence existed. We found that, when ranchers moved the herd into a new pasture, and left them near the fence, we had problems with bulls. But if we continued to herd them past the fence line and place them near the center of the pasture, there was adequate space for them to compete and solve their differences without taking the fence down.

It was not so easy to solve the grounding issue. Manufacturers suggest multiple ground rods, and we installed 3 to 5 per fence. But we found that soil moisture had a large impact on whether or not the fence continued to carry a charge. Drought caused a combination of low charge and need for water in the animals, making our fences very difficult to maintain.

Over the course of the project I spoke with a wide variety of fencing manufacturers and contractors who installed fencing for a living. One suggested using a post hole digger to make a hole for the ground rods, and filling them with a bentonite soil mixture to better hold water. Given that it was often almost impossible to drive a small metal post into the ground, digging a hole wasn't going to work any better. Another consultant suggested ground rods spaced out along the fence rather than near the charger. Unfortunately, the project had already ended, so we did not have an opportunity to try this.

Another problem with temporary electric fencing is the work involved in building enough fence on the very large pastures ranchers have. When we asked our ranching partners if they would be willing to invest the $4,500 for this project on a 500 acre pasture, along with the labor of stringing 3 miles of fence a year, they just laughed at us. While this may not be a statistically valid indicator of interest, we feel it is a socially valid indicator that most ranchers will simply not be interested in doing this.

Plant Chosen by Boulder County Project Herd	Protein (%)
Bindweed (*Convolvulus arvensis)*	16.1
Prickly lettuce (*Lactuca serriola*)	17.3
Prostrate pigweed (*Amaranthus blitoides*)	20.1
Common Sunflower flowers (*Helianthus annuus*)	14.1
Cutleaf Nightshade (*Selenum triflorum*)	15.6
Broom-like ragwort (*Senecio spartioides*)	14.6
Netseed lambsquarters (*chenopodium berlandieri*)	15.2
Common ragweed (*Ambrosia Psiostachya*)	11.3
Musk Thistle flowers (*Carduus nutans*)	11.2
Chinese Lantern/Purple Groundcherry (*Quincula lobata*)	13.9
Wormwood Sagewort (*Oligosporus dracunculus*)	12.3
Wild Licorice (*Glycyrrhiza lepidota*)	15.2
Louisiana sage (*Artemisia ludoviciana*)	10.0
Plains milkweed (Asclepias Pumila)	12.3
Fetid Marigold (*Dyssodia papposa*)	18.4
Red Stem pigweed (*Chinopodium hostata*)	9.3
Unknown Sunflower	8.9
Velvet weed (*Gaura mollis/parviflora*)	11.8
Wild Rose (*rosa arkansana*)*	6.8
Moth Mullein (*versbacum blattaria*)	8.5
Curly Cup Gumweed (*Grindelia squarrosa*)	9.2
Common Mullein (*Verbascum thapsus*)	14.9
Broom snakeweed (*Gutierrezia sarothrae*)	6.0
Rabbitbrush (*Chrysothamnus*)	22.0
Scotch thistle (*Onopordum acanthium*)	13.4

Expanded Animal Diets

I originally trained animals in the project herd to eat only two weeds: late season diffuse knapweed and Dalmatian toadflax. As noted earlier, in 2009, I placed a group of trained animals with a group of untrained and not only did they all eat weeds but they began to eat a little of everything they found in pasture. They continued to add more and more plants to their diet every year.

Grasses in Boulder County Project Pasture	Protein (%)
Big Bluestem (*Andropogon gerardii Vitman*)	8.7
Blue grama (*Bouteloua gracilis*)	7.9
Smooth brome (*Bromus inermis*)	2.8

Since we did not always get the exact same cows back every year, some of our trained animals shared their education with other herds owned by the Hogans. Babe Hogan told us that now when he puts cows out in pasture for the first day of the grazing season, they all head straight for the weeds.

Stocking Rates

Our test pastures demonstrated that **100 cow calf pairs plus bulls managed in small pastures require 2 acres per day**, given the kind of vegetation we had in 2010. This helped us determine how many cattle we could potentially manage in out years. We were able to increase the number to 2011 and 2012. In our discussions with our partners we have arrived at a number of 200 - 300 for the next grazing season so that we can accomplish our goals for vegetation change. We never achieved this level of stocking for reasons we discuss under Public Policy and Perceptions.

Public Policy and Perceptions

Public policy and perceptions play an important role in how grazing can be managed on publicly owned pastures and rangelands. When I discussed mob grazing with our partners, a variety of hurdles came up. Some were logistical, some were political, some were a result of how grazing has been managed in this area both historically, and since the City and County began acquiring open space, and most of them were a mix of all three. Those challenges include:

- **Concerns from the public and from internal staff that cattle will be mismanaged and will over graze** make county and city staff responsible for overseeing grazing programs very cautious about change. Though they are positive about this project, and about the value of grazing, there is only so much they can do, given their heavy work loads, to demonstrate these benefits to skeptics.

For example, a riparian corridor adjacent to the Mayhoffer pasture is overcome with diffuse knapweed and a wide variety of weeds that trained cattle now eat. The land managers agree that having cattle deal with these problems is really the only affordable tool they have. Yet they face a great deal of opposition to allowing the cattle to work in this small corridor.

One staff member is very concerned about cattle being allowed to graze in the 200 acre prairie dog colony on the southern end of the Mayhoffer pasture because opponents of grazing may think that the cows have created the weed and erosion problem. In reality, cattle have rarely grazed on that portion of the pasture and the problem is caused by an over-abundance of prairie dogs. The problem is not a small one. When the chinook winds kick up, dust from the prairie dog town has caused a local school to keep students in for recess to prevent respiratory problems. They have shared their concerns with him and his supervisors.

His efforts to share information on prairie dog issues is countered by the very active Prairie Dog Coalition, and advocacy group for the protection of imperiled prairie dogs. They have successfully blocked removal of prairie dogs from lands in and around Boulder county, and assisted in reintroductions post-plague. The County does have a Prairie Dog management plan that governs the removal of colonies when they cause erosion or environmental damage, but implementing projects is not easy.

The picture on the next page hows a portion of the south end of Mayhoffer pasture. Each of the dots is prairie dog home. In 2009 a plague came through decimating the population. It is now beginning to rebound. There are also suggestions from County wildlife staff to reintroduce prairie dogs to this pasture.


South Mayhoffer pasture showing
portion of the Prairie Dog Colony
Meadowlark Trail

- **City and County grazing management has led to dispersed grazing spread over many pastures so that change is very hard for the producers.** My ranching partners and advisers said that historically many of these pastures were grazed much longer than they are currently grazed. The Mayhoffer pasture, for example was grazed from early spring through the fall by a much larger number of animals than the 38 pairs that are now grazed there for 2 weeks to a month every year. Ranchers also have a perception that they can't be sure of how long animals will be allowed to stay on a particular piece of open space from year to year, so they feel at risk. In fact, leases are written with the stipulation that the County can tell lessees to move cattle at any time. Rancher response to this has been to lease more, private pasture so that they can graze enough animals to make their living.

Problems with this system arise when the City or County decide that they would like to use the animals as a tool. In the past the City has tried to keep more animals in a particular pasture, but because the rancher has invested in other pasturage, he feels the need to use it and move his animals before they've accomplished the goals of the City land manager.

Fencing for more intense management is expensive and happens at a time when most ranchers are busy haying. In response, City and County staff have suggested that the ranchers run their animals in one large herd moved from large pasture to large pasture so that they can accomplish vegetation management goals. Ranchers are reluctant to do this because of their existing pasturing agreements, because moves may happen at critical points during haying season, and because they are worried that disease may be spread among herds more easily.

While it may be possible to manage the entire system so that haying is not required and cattle graze year round, for ranchers who have successfully operated they way they do for many, many years, such a change seems monumental in size.

Accomplishments

The primary accomplishments for this project are:

1. County staff and the participating ranchers developed a better understanding of each others' needs and problems through facilitated communication by project staff. This could lead to changes in how herds are managed to better meet vegetation management goals.
2. Trained Boulder County and City of Boulder staffs on how to do Rangeland Health Assessments. This turned out to be a very important step toward helping different disciplines understand each other and how grazing is managed on open space. Prior to this time, wildlife and recreation staffs did not have positive working relationships with agriculture staffs. The training was an opportunity for them to learn more about open space vegetation and what can and should be growing on pastures.
3. Demonstrated that cattle will continue to eat weeds, and continue to expand their diets and will influence herd mates to do the same.
4. Demonstrated that there are significant challenges to be overcome when attempting to use temporary electric fencing in the arid west.

Publications/Outreach

1. Annual meetings with our participating ranchers and county staff to discuss lessons learned and develop plans for subsequent years.
2. What's Edible publication on Livestock for Landscapes website that shares information on weeds cows can eat.
3. 2010 report outlining work and accomplishments for that year.
4. Final report. Reports are shared with all our partners and with Boulder County Commissioners and the Parks and Open Space Board. They will also be available on the Livestock for Landscapes Website.
5. Upcoming - Video on the project will be put up on Youtube at the Livestock for Landscapes channel: http://www.youtube.com/kathyvoth.
6. As co-editor of the online grazing magazine "On Pasture" I will be excerpting portions of the reports and publishing them as articles in the magazine. Information about the video and list of weeds cows can eat is also being shared from this publication which has had over 21,000 views in the one month it has been online. (http://onpasture.com)

Future Recommendations

Drought had a huge impact on this project and its outcomes. The change in precipitation over the course of the project led to unanticipated problems with fencing, with providing cattle with water, and with being able to accomplish grazing goals on the ground. In the end, we had to so drastically reduce numbers that what remained could never have been considered a “mob.”

That said, here are recommendations that might help those considering trying more intensive grazing management:

1. Train your cattle to eat weeds. Educated cows were able to use all vegetation in the pasture as forage, and in years with normal moisture, this reduced how much grass they ate. The combination of increasing stress on target weeds, and reducing stress on species preferred by managers initially showed increases in grass species after the first year. Unfortunately drought stressed the grasses, reducing the overall impact of the grazing cattle.

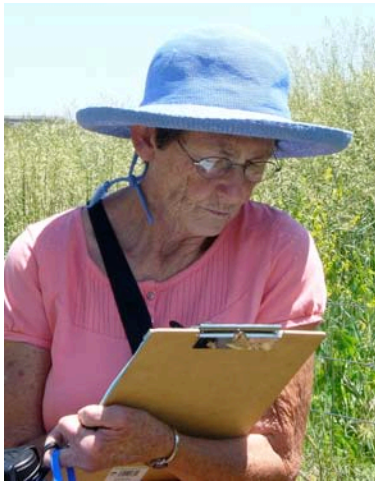
2. Do everything you can to make your fencing successful. Train your cattle to electric fencing before putting them in the fenced area. Use these trained cattle every year, and if you don’t be sure to train the ones you will use. When moving cattle into a new pasture, show them their water and don’t leave them at the gate where you turn them in. Thirsty animals are more prone to breaking through an electric fence, and so are bulls who are unfamiliar with each other. Last, consider putting ground rods along the length of the fence to enhance the fence’s overall charge.

3. Make a worst case scenario plan and go over it with partners or family members you will be working with. Make sure they are on board with the entire project, or make adjustments for concerns they have. Be clear about responsibilities and agreements about how you will handle difficulties such as drought before they happen. This will help you make a grazing plan that everyone can live with and is willing to work on through the hard times.

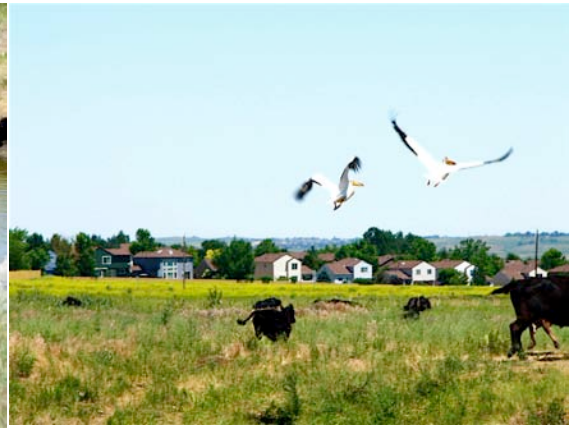
Thanks to the Livestock for Landscapes Project Staff

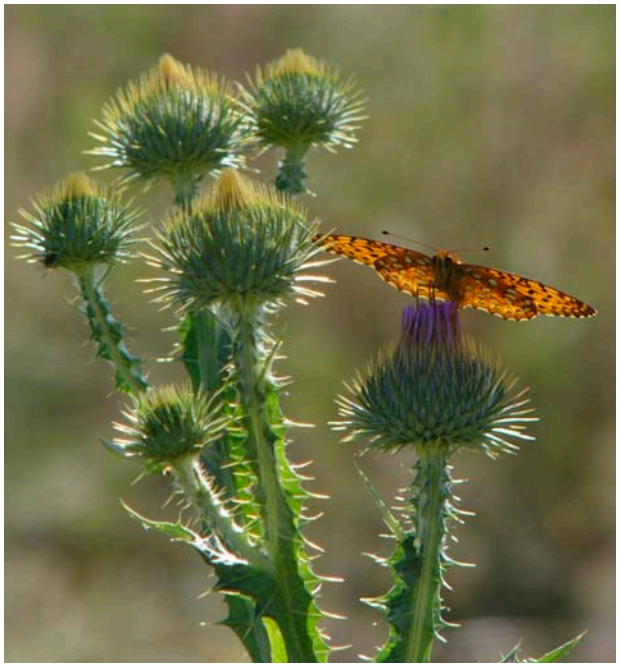
Project Lead - Kathy Voth

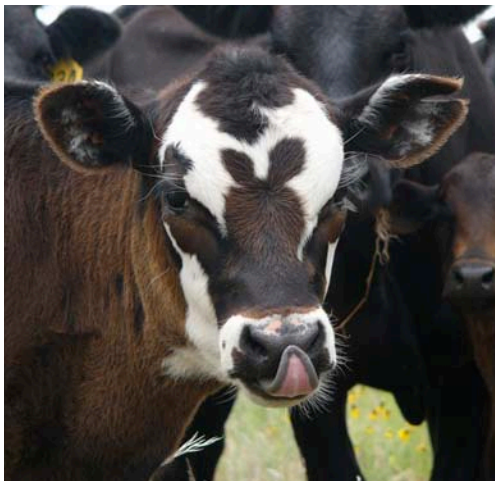
Assistant - Leah Ashley Esser



Volunteers (and Kathy’s parents) Donna and Orie Voth, who took pictures and notes, helped chase escapee cows from time to time and helped me find my cell phone in the middle of the pasture when I dropped it during a long day of fencing and herding. Thank you!!!







Some of the Plants Cows Ate