Adaptive Grazing Management Experiment at the Central Plains Experimental Range: First Workshop Report

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Adaptive Grazing Management Workshop Summary

The USDA-ARS Rangeland Resources Research Unit (with lead scientists Justin Derner and David Augustine) and partners (Table 1) are initiating the Adaptive Grazing Management experiment at the Central Plains Experimental Range (CPER). This experiment addresses important gaps in our current understanding of grazing management including:

1) management-science partnerships to more fully understand the effect of management decisions, particularly adaptive management, on grazing management outcomes
2) management practices that optimize both livestock production and conservation benefits, as society expects rangelands to produce multiple outcomes
3) ranch-scale experiments to evaluate the effects of grazing management on both production and conservation goals.

The intent of this new experiment is to utilize a novel, collaborative approach with a Stakeholder Group to identify rangeland management and conservation practices that can be implemented to achieve multiple goals, including livestock production and conservation benefits. As the experiment incorporates different ecological sites and highly variable environmental conditions, results will mimic real-world approaches to managing semiarid rangelands. Adaptive management, or applying the principles of experimental design to natural resource management, is a key ingredient of this experiment because it allows managers to learn from their management actions and to make necessary adjustments in response to changing conditions. Having control pastures against which to compare the effects of adaptive management strategies is critical as these pastures provide a baseline against which to assess management effects in the face of fluctuating weather conditions. Inviting a diverse Stakeholder Group to collaborate in the experiment encourages innovation and identification of strategies that achieve a variety of goals.

The first workshop of the Adaptive Grazing Management Stakeholder Group occurred on September 18-19, 2012 at the Shortgrass Steppe Research and Interpretation Center near Nunn, CO. This Stakeholder Group represented a cross-section of interests in western Great Plains rangelands, including ranchers, land managers, conservation organizations, and non-governmental organizations (Table 2). Each of the 11 members of the Stakeholder Group had a fundamental understanding of rangeland and grazing issues with emphasis on shortgrass steppe rangeland ecosystems.

The overall goal of the Stakeholder Group was to create an Adaptive Grazing Management Plan for ten 320-acre pastures (total of 3,200 acres) at CPER. Each pasture was paired with a similar pasture (in terms of size, soils, topography, prior management history) that will be managed in a traditional manner: grazed season-long from mid-May to early October with 20 yearling steers in each 320 acre pasture which represents the recommended moderate stocking rate (from the Bement 1969 Journal of Range Management paper using data from this site). Stakeholder Group members were charged with:

1) Choosing goals for livestock production and conservation
2) Determining objectives to achieve each of the chosen goals
3) Identifying management strategies that would be implemented to achieve the objectives
4) Selecting appropriate background information and monitoring data (indicators) that would be needed by the Stakeholder Group to inform adaptive management
5) Selecting triggers for movement of livestock among pastures

The Stakeholder Group completed items 1, 2 and 3 over the two-day workshop, with much agreement on the appropriateness of goals, objectives, and strategies based on post-workshop

evaluations. The group agreed to meet again in January 2013 to complete items 4 and 5 and increase specificity of other plan components as needed.

The overarching theme that the Adaptive Grazing Management Stakeholder Group identified was to manage land in order to pass it on to future generations (see Figure 2). Three goals were chosen: 1) vegetation, 2) profitable ranching operations, and 3) wildlife. Objectives for each goal were determined. Management strategies were identified for each objective, and the Stakeholder Group assembled these strategies into four draft management plans for the ten pastures. This process revealed that there were synergies (win-win scenarios) between different goals and objectives: for example, resting a pasture for an entire grazing season may achieve objectives of all three goals (increase variation in vegetation structure among pastures, increase populations of some target bird species, and reduce economic impact of drought). The draft management plans were similar in a number of ways:

1) rest of some pastures (no grazing) for at least one full growing season, and this rest is to be rotated among pastures across years
2) rotation of 1-2 herds of cattle (from 50 to 200 head for herd size) among the 10 pastures
3) changing timing of grazing in a pasture across years (accomplished through the rotation of livestock through the 10 pastures, and also rest)
4) using rested pastures as emergency feed in drought management plans and to achieve conservation goals in normal and wet years (i.e., grassbanks)
5) incorporating fundamental understanding of the ecological sites (Loamy, Shaly, Sandy, Saline Flats) for grazing management decisions

Differences among the four options included 1) size of herd and number of pastures used in a rotation, and 2) strategies for creating mountain plover habitat. These differences point to a need for additional discussion of the mechanisms by which different management strategies are believed to influence vegetation, ranch profits, and wildlife. To the extent that some alternative management strategies may involve a high degree of uncertainty in their outcomes, specific sub-experiments could potentially be designed to compare alternatives and reduce uncertainty.

The Stakeholder Group agreed that the research team should synthesize recommendations of the four draft management plans into a draft Adaptive Grazing Management Plan (including indicators and triggers that were brought up during the meeting discussion) by late October. The Stakeholder Group will have additional opportunities at the January 2013 (likely the second week) meeting to provide additional input and determine which management strategies will be implemented for the Adaptive Grazing Management Plan. The research team also promised to deliver several additional products to the stakeholder group:

1) a summary of the workshop by early October (this document),
2) additional information and a report detailing workshop results by mid-October, and
3) two field opportunities for Stakeholder Group members to tour the ten pastures in November.

Once the Adaptive Grazing Management Plan is completed, the next steps in the adaptive management process are to *implement* the plan beginning in May 2013, *monitor* key indicators throughout the 2013 grazing season, *evaluate* whether objectives are being achieved, and make management *adjustments* as needed. The Stakeholder Group will meet again in Spring 2013 (likely April, before the grazing season) and again in Fall 2013 (likely October, following the grazing season) with the October meeting focused on *assessing* what has been learned during the first year-long loop of the adaptive management cycle, and determining which management changes will be implemented in the next growing season.

Adaptive Grazing Management Workshop Report

Background

Personnel of the USDA-ARS and several partners (Table 1) initiated the Adaptive Grazing Management experiment at the Central Plains Experimental Range (CPER) in order to identify grazing management decisions and conservation practices that achieve multiple goals, within the variable management environment associated with these rangelands. Adaptive management, or applying the principles of experimental design to natural resource management, is a key ingredient of this experiment because it allows managers to learn from their management actions and make necessary management adjustments in a changing management environment. Collaboration to achieve shared goals complements adaptive management by encouraging innovation and identification of strategies that achieve a variety of goals.

This report summarizes the process and outcomes of the first workshop of the Adaptive Grazing Management experiment, held September 18-19, 2012 at the Shortgrass Steppe Research and Interpretation Center near Nunn, CO. This Stakeholder Group represented a cross-section of interests in western Great Plains rangelands, including ranchers, land managers, conservation organizations, and non-governmental organizations (Table 2). Each of the 11 stakeholders had a fundamental understanding of rangeland and grazing issues with emphasis on shortgrass steppe rangeland ecosystems. Report structure mirrors the workshop agenda, with the following sections:

- Introduction and Purpose
- Adaptive Management
- Field Trip
- System Modeling
- Goals
- Objectives
- Strategies
- Proposed Plans
- Information Needs
- Post-Workshop Evaluations
- Next Steps

We highlighted items that may need further discussion by the Stakeholder Group by placing an image of a pointing hand (☞) in the right margin of the report. The workshop agenda, all materials produced in the workshop, and transcripts of parts of the workshop are attached as Appendices (A-C).

Introduction and Purpose

Justin Derner, Research Leader with the USDA-ARS Rangeland Resources Research Unit that manages CPER, began the workshop with an introductory presentation that described the Adaptive Grazing Management experiment. He told the group that this study addresses several key gaps in rangeland research to date, including engaging managers in science, conducting research at real-world scales, and using adaptive management to optimize production and conservation goals. The Stakeholder Group invited to contribute to the project is a cross-

sectional representation of organizations with an understanding of rangeland issues in the western Great Plains and a commitment to communication and learning. The charge to the Stakeholder Group is to come up with an adaptive management plan for ten pastures (Figure 1; Table 3), including the following steps (Table 4): choose and prioritize outcomes, identify grazing management practices, determine triggers for movement of cattle among pastures, and select appropriate monitoring data requirements for feedback to inform adaptive management.

Presentation of the "sideboards" of the experiment generated a great deal of discussion among the group and the research team. Ten pairs of 320-acre pastures with similar soils, ecological sites, and management histories have been established at CPER (Figure 1; Table 1). Beginning in 2013, one pasture in each pair will be managed using "traditional" practices (season-long moderate grazing, 16 acres/steer), while the other will be managed adaptively by the Stakeholder Group. Justin stated, "the challenge is how you manage these 10 pastures for multiple outcomes." The group will be responsible for managing 200 steers which they must graze at the same moderate stocking rate across the ten pastures during the same season (mid-May to early October) using existing infrastructure. Within those limitations, the group may use whatever grazing management practices they choose, with other practices possible but relegated to the "research parking lot" (a large white paper on an easel) for now. ARS will carry out grazing management as directed by the group, although they invite Stakeholder Group members to participate. ARS will also share any data that the group needs to inform decisions. In addition to clarifying these sideboards, the group discussed: drought planning; implications for Crow Valley Livestock Cooperative if livestock were pulled off due to drought; and how similar this experiment should be to real private and public rangelands.

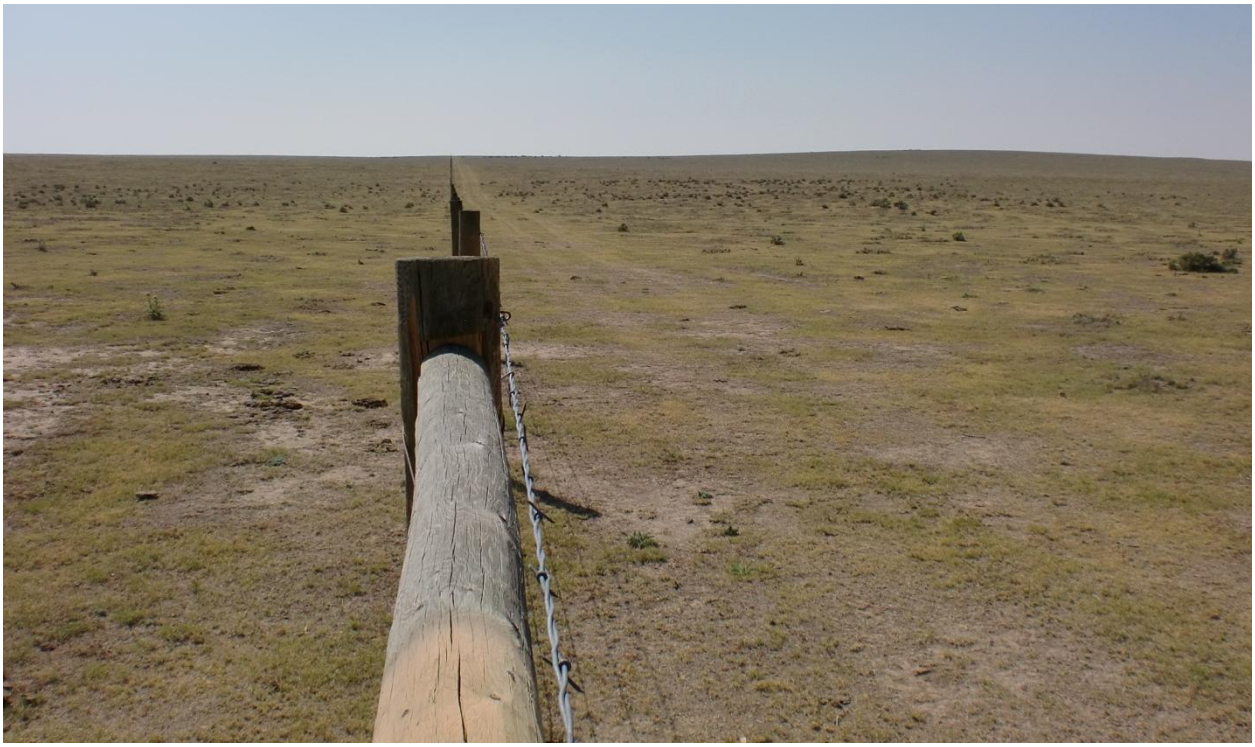


Photo 1. One pair of pastures in the Adaptive Grazing Management Experiment at the Central Plains Experimental Range. 25NW (right) will be adaptively managed by the Stakeholder group; 25SE (left) will be traditionally managed using season-long moderate grazing.

Adaptive Management

Maria Fernandez-Gimenez, Professor in the Forest and Rangeland Stewardship Department at Colorado State University, introduced the group to adaptive management in the next presentation. Adaptive management is all about learning from experience, and it embraces the uncertainty that is inherent in managing rangelands. Adaptive management is "the application of experimentation to the design and implementation of resource management." Importantly, "management is designed *both* to increase learning *and* to achieve management objectives." While she said that adaptive management is similar in many ways to what natural resource managers already do, Maria emphasized that she is talking about a more structured, formalized process that is designed to create reliable and broadly applicable knowledge (e.g. by monitoring desired outcomes and applying the principles of experimentation). The key steps of the adaptive management cycle are as follows (also listed in Table 4):

1. Assess
2. Design
3. Implement
4. Monitor
5. Evaluate
6. Adjust

This workshop focuses on the "Assess" and "Design" phases of the adaptive management cycle. We are aiming to address five key questions:

1. What do we know?
2. What do we want to achieve? (objectives/outcomes)
3. What are our options? (management strategies)
4. How will we measure success? (indicators)
5. How will we use this information? (triggers)

In discussion with the Stakeholder Group after Maria's presentation, the research team said that going through this planning process will give ARS an adaptive management plan or "road map" to implement during the 2013 grazing season and that provides associated contingencies. For example, if a predetermined trigger or set level of an indicator is reached, ARS will change the grazing management in the way that the Stakeholder Group has indicated. However, the plan is flexible, not rigid. The Stakeholder Group and the research team will maintain communication throughout the grazing season in order to ensure the intent of the plan is carried out and to update the plan due to unexpected events (e.g., wildfire).

Field Trip

The Stakeholder Group visited three of the 10 pasture pairs (Figure 1, white stars) in the afternoon of 9/18, spending about twenty minutes at each site. Differences among ecological sites and requests for additional background information about each pasture (e.g. plant and wildlife species composition, production) were common topics of conversation.

System Modeling

The system modeling activity was designed to answer the question, "What do we know?" and occurred after the field trip. The Stakeholder Group generally agreed that the system modeling activity was poorly explained and did not meet the group's desire to be efficient with their time.

As a result of this and other discussions, the research team met in the evening and re-vamped the agenda for 9/19.

Goals

Goals were identified by pre-workshop evaluations and several large group discussions on 9/18 and 9/19. The overarching commonality that the Stakeholder Group identified was "To manage land in order to pass it on to future generations," in terms of economics and ecology (Figure 2). At the Stakeholder Group's request, the research team identified three primary goals based on the Stakeholder Group's pre-workshop evaluations and a one-hour discussion of goals (Figure 2). The health of the vegetation was a goal expressed by nearly all stakeholders, although many different adjectives were used to describe desired conditions (e.g. "resilient", "diverse", "sustainable", "heterogeneous", "productive"). Many stakeholders expressed the close links between healthy vegetation and the other two goals, profitable ranching operations and wildlife. Profitable ranching operations depend on productive rangelands, and they maintain ranching livelihoods for people in northeast Colorado. Managing for this goal has the added benefit of ensuring that the practices identified will be broadly applicable to private landowners in the region. Wildlife depend on the habitat that grazed plant communities provide, and also represent a small but increasing source of income for ranchers.

Participants generally agreed to manage the pastures for these multiple goals. One participant expressed the possibility that these goals may all be compatible with each other, while others mentioned that there may be trade-offs among these goals, suggesting a need for "primary" and "secondary" goals. The research team agreed that it is their responsibility to gather information about trade-offs and feed them back to the group, in order to help them re-evaluate goals in the future.

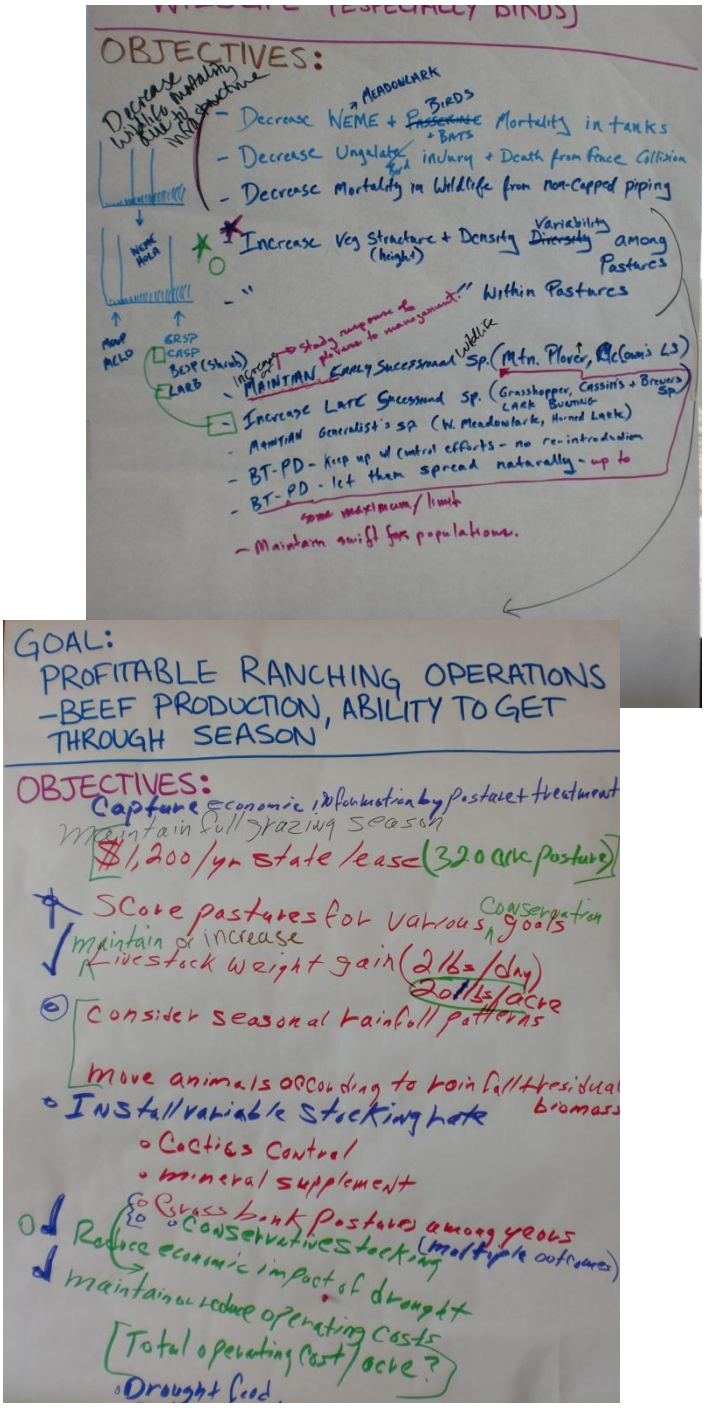


Photo 2. Draft lists of Objectives for the wildlife and ranching goals produced during break-out sessions.

Objectives

Objectives for each goal were initially identified in break-out sessions on 9/19, designed to answer the question, “What do we want?” Many of the resulting objectives were similar, even under different goals; for example, both vegetation and wildlife goals contained objectives regarding increasing vegetation heterogeneity within- and among-pasture. Based on the initial

lists of objectives, the three most important objectives for each goal were identified in a full group discussion (Figure 2). Upon review of the workshop notes, the research team decided to split Wildlife Objective A into two separate objectives (Figure 2), because the habitat needs of Mountain Plover were often differentiated from the habitat needs of the three other bird species identified.

Strategies

In break-out sessions and some full group discussions designed to answer the question "What are our options?" on 9/19, stakeholders identified a number of strategies that may be used to achieve particular objectives. Synthesis of this effort (Table 5; Figure 3) shows that many strategies were thought to achieve multiple objectives, even across different goals. For example, rotational grazing and associated grazing management practices, including season-long rest, seasonal deferment of grazing, and varying timing of grazing from year to year, were thought to be useful for all vegetation objectives, ranching objectives A and B, and wildlife objective C (Table 3). Other objectives required particular management practices that did not necessarily address other objectives. For example, wildlife objective A required patch burning and/or high intensity grazing of small areas to provide habitat for Mountain Plover. These situations represent areas that will require particular attention from the Stakeholder Group in writing their final plan.

The discussion transitioned to writing proposed grazing plans (next section), which continued to integrate strategies with goals and objectives.

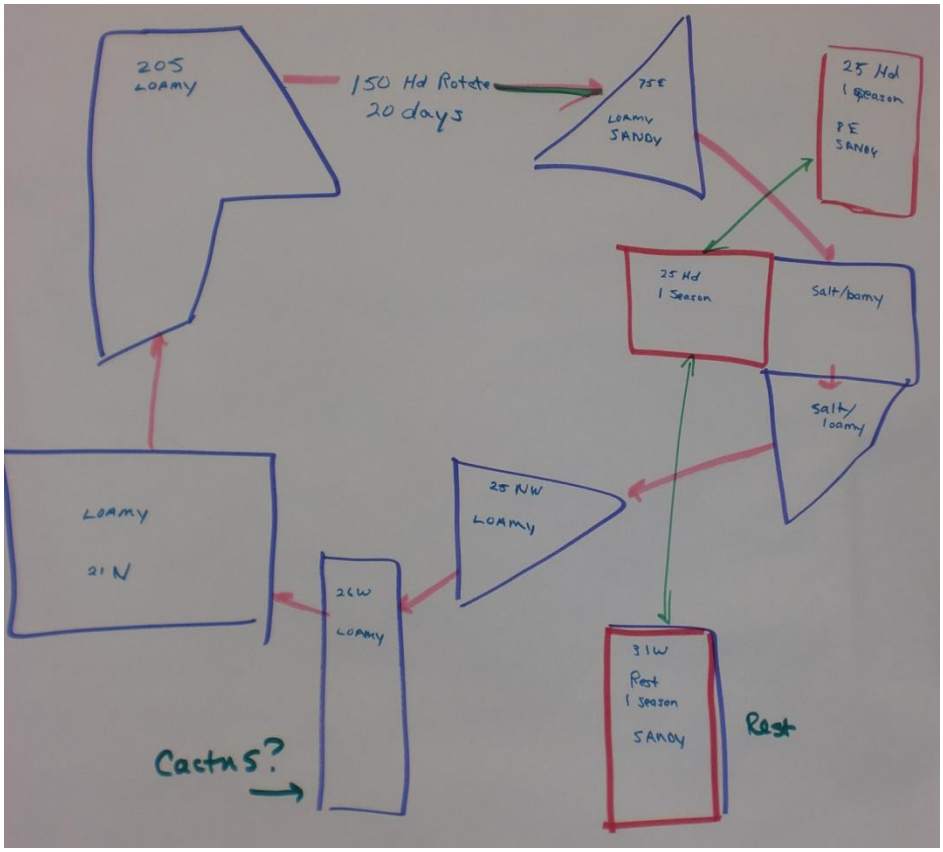


Photo 3. A draft Adaptive Grazing Management Plan with the rest of the group.

Proposed Management Plans

Building on commonalities identified in previous breakout sessions on 9/19 (e.g. Table 5, Figure 3), the proposed grazing plans developed by small (four sub) groups (Table 6) had a number of similarities. All four plans recommended a rotational grazing strategy with 1-2 herds of steers. Some pastures (1-2) would be deferred from grazing each year, and they would be rotated such that no pasture was grazed at the same time every year. All plans incorporated year-long rest in at least one pasture per year. During drought years, three plans suggested that the rested pasture would be grazed in order to provide emergency forage. All groups noted that inherent variability in ecological sites would alter their recommendations for individual pastures (e.g. timing and duration of grazing). These commonalities will form the basis of the "straw man" adaptive management plan that the research team will write for the Stakeholder Group to evaluate.

Differences among plans point towards decisions that will have to be made by the Stakeholder Group. They include the following:

- One herd of 200 (two groups) vs. two herds of 100 (one group) vs. one herd of 150 and one herd of 50 (one group)
- Two pastures rested (three groups) vs. one pasture rested (one group) each year

- For mountain plover habitat, patch burning small (15-80 acre) areas in the non-grazing season (one group) or intensely grazing small (40-acre) areas for a short period of time using electric fence.

The final plan will also have to specify additional details, including how ecological site considerations influence management of each. The ARS "straw man" plan will incorporate this level of detail, based on the individual plans, and also communicate areas of agreement and disagreement.

Information Needs

The group identified several information needs throughout the course of the workshop, including tables with plant species composition and production by ecological site and pasture, soil moisture maps, and more information about grazing deferment. The research team is compiling this information and agreed to share it with the group in mid-October.

Post-Workshop Evaluations

Post-workshop evaluations indicated that most of the Stakeholder Group agreed that the list of desired outcomes and strategies were appropriate (8 of 8 for both; 1 no answer, 2 evaluations not turned in). However, several participants echoed the need for additional clarification and detail, on the items they had accomplished and on those they had left to do.

Post-workshop evaluations also indicated that the Stakeholder Group generally agreed the workshop was well-organized (9 of 9; 2 evaluations not turned in). Successful aspects of the workshop, in the Stakeholder Group's opinions, were 1) willingness of the research team to change the agenda when things were not working; 2) sharing ideas and learning from others; and 3) making headway towards creating a plan. The workshop could have been improved by 1) providing more background information and 2) providing more structure and clarity for specific tasks. The research team is incorporating this feedback into our next steps, including designing future workshops.

Next Steps

The Stakeholder Group agreed that the research team should synthesize recommendations of the four draft management plans into a draft Adaptive Grazing Management Plan (including those indicators and triggers that were brought up during the meeting discussion, but this is not intended to be a complete list) by late October. The Stakeholder Group will use this as a basis for finalizing an Adaptive Grazing Management Plan at their next meeting in early January of 2013 (likely the second week). The research team also promised to deliver several additional products to the Stakeholder Group:

1) a summary of the workshop by early October
2) additional information and a report detailing workshop results by mid-October (this document), and
3) two field opportunities for Stakeholder Group members to tour the ten pastures in late October and November.

Once the Adaptive Grazing Management Plan is completed, the next steps in the adaptive management process are to *implement* the plan beginning in May 2013, *monitor* key indicators

throughout the 2013 grazing season, *evaluate* whether objectives are being achieved, and make management *adjustments* as needed (Table 4). The Stakeholder Group will meet again in Spring 2013 (likely April, before the grazing season) and again in Fall 2013 (likely October, following the grazing season) with the October meeting focused on *assessing* what they have learned during the first year-long loop of the adaptive management cycle and to consider modification to the next year's management plan.

Photo 4. Justin Derner summarizes the Adaptive Grazing Management workshops at the end of the second day.

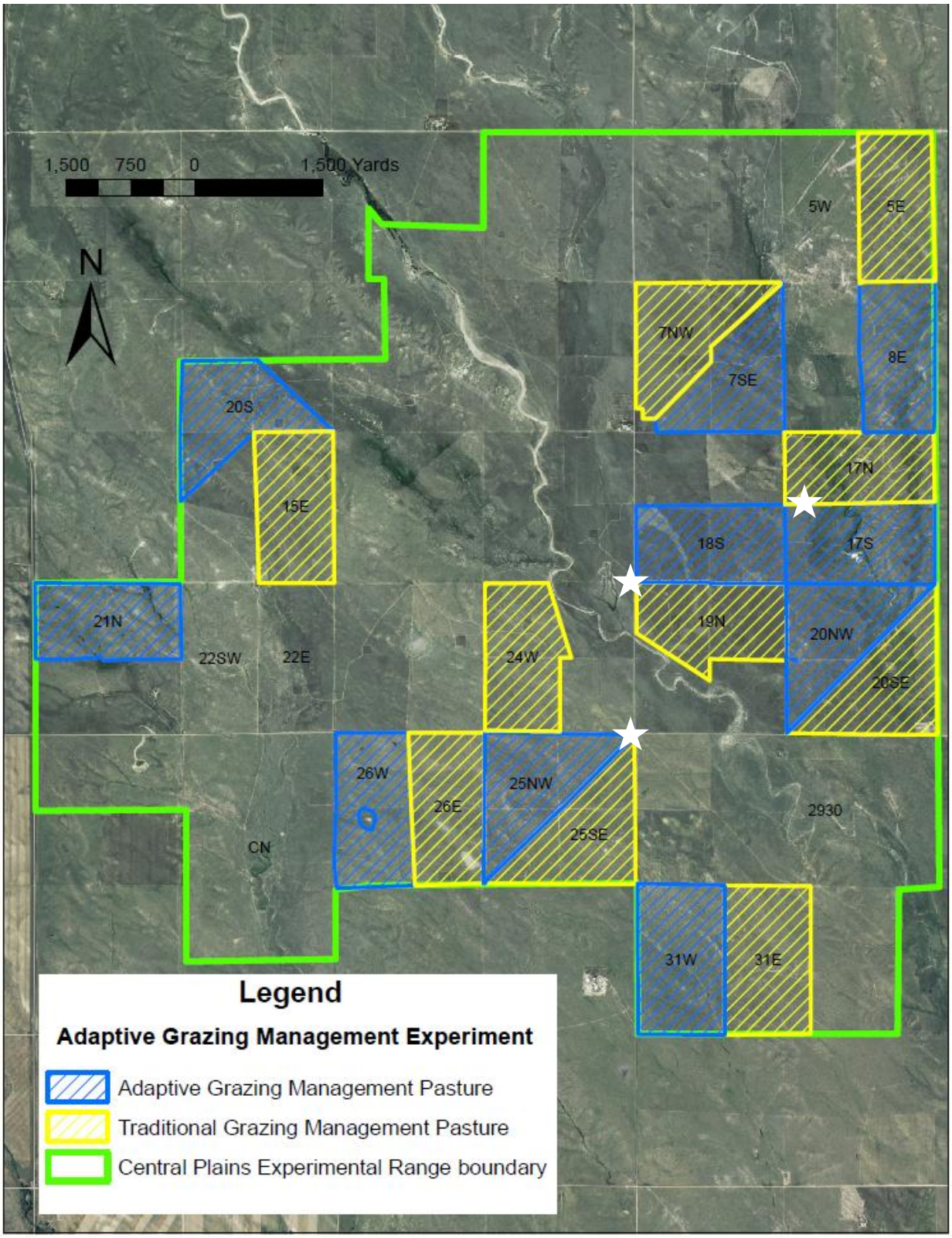


Figure 1. Pastures of the Adaptive Grazing Management experiment at the Central Plains Experimental Range, near Nunn, CO. White stars were stops on the field trip on 9/18/2012.

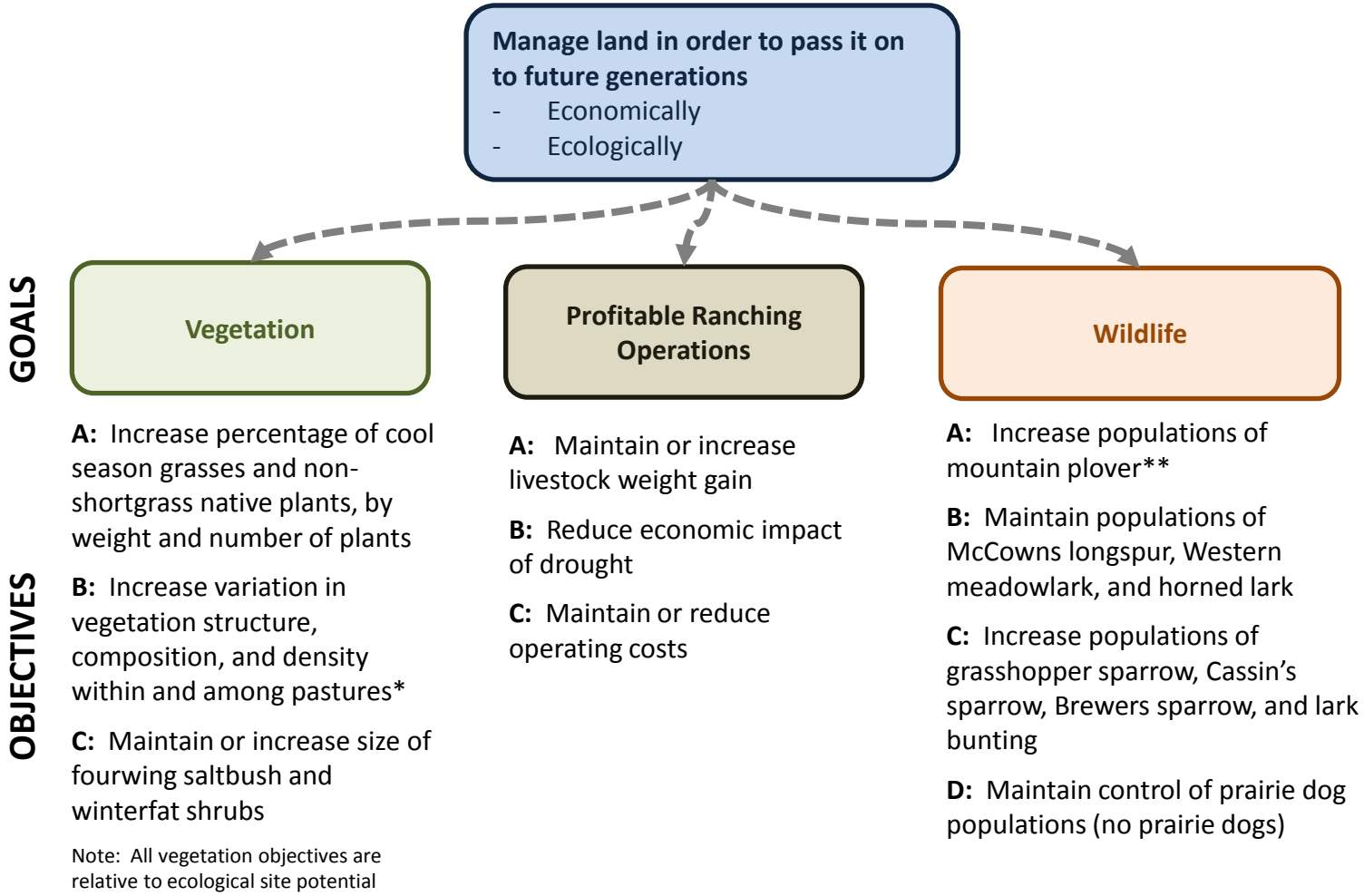
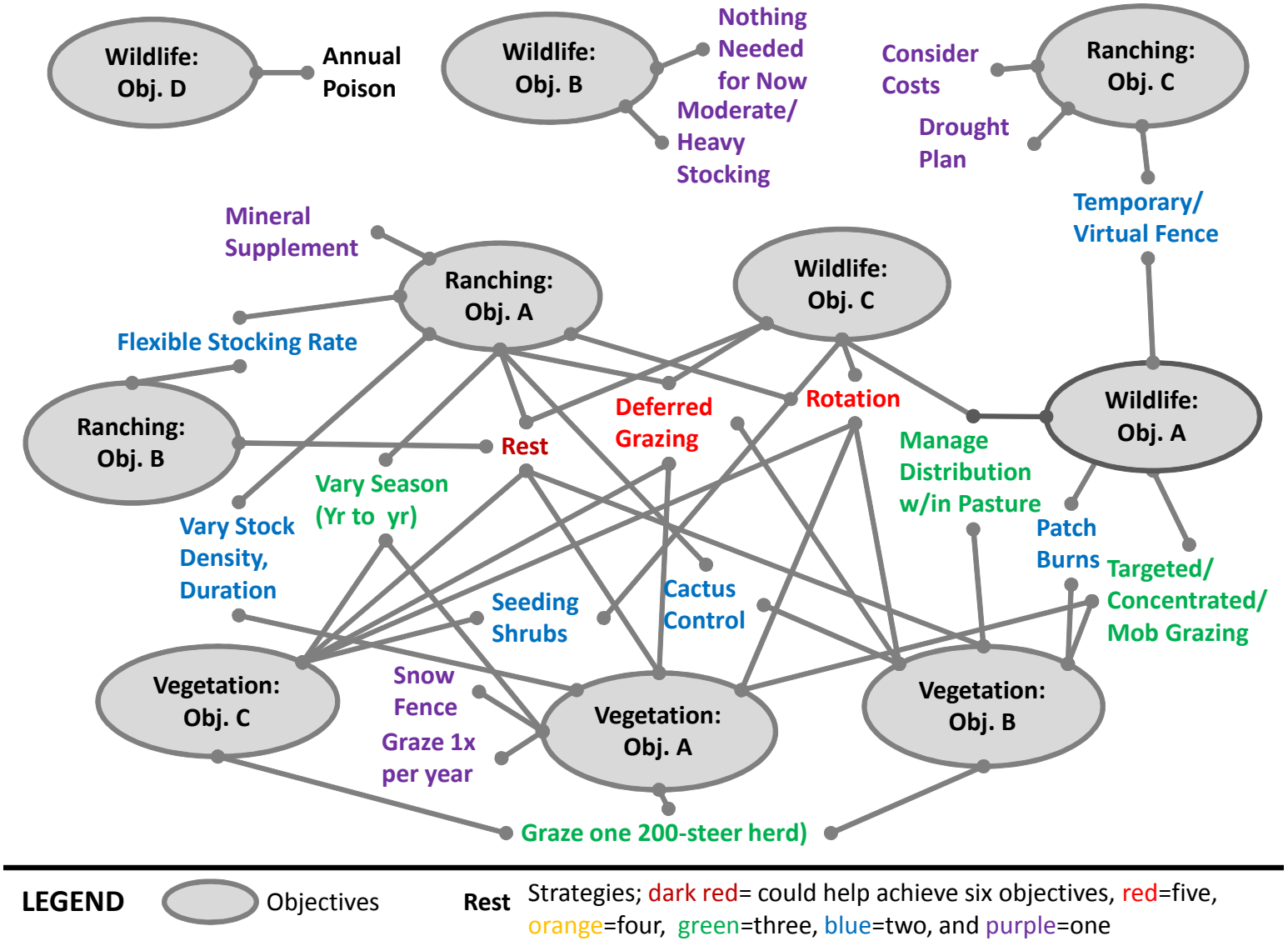


Figure 2. Goals and objectives identified by the Stakeholder Group in the Adaptive Grazing Management Workshops.

* "Composition" was added to this objective here because it was included in the discussion of this objective at the workshops.
** Wildlife objective A was combined with objective B in the workshops, but is split out here because strategies identified for mountain plover habitat were different from those identified for the other three species. Also, while a previous version of this objective read "maintain or increase", it reads "increase" here because many individuals and several of the proposed plans showed commitment to increasing mountain plover habitat in the experimental pastures.



LEGEND Objectives **Rest** Strategies; dark red= could help achieve six objectives, red=five, orange=four, green=three, blue=two, and purple=one

Figure 3. Strategies suggested for each objective by the Stakeholder Group in the Adaptive Grazing Management Workshops. Strategies are color coded according to the number of different objectives they were suggested for.

Table 1. Research team members and contact information.

Name	***Organization***	***Email***	***Phone***
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Table 2. Stakeholder Group members and contact information.

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Kim Obele	Forest Service	kobele@fs.fed.us	970-295-6755
Pat Reece	Rangeland consultant	patreece@prairieme.com	308-641-0167
Ted Toombs	Environmental Defense Fund	ttoombs@edf.org	970-290-2031

Table 3. Pastures of the Adaptive Grazing Management experiment at the Central Plains Experimental Range

Adaptively Managed Pasture	**Traditionally Managed Pasture**	**Dominant Ecological Site(s)**	**Average steer gains (lbs) for the grazing season**				**Grass cover (absolute, %, June 2010)**	
			2009	2010	2011	2012	BOGR/ BUDA	Cool Season
20S	15E	Loamy and Shaly Plains	-	-	-	-	-	-
21N	24W	Loamy and Shaly Plains	-	-	-	-	32.0*	2.8*
26W	26E	Loamy and Sandy Plains	-	-	-	-	32.1	1.7
25NW	25SE	Sandy Plains, some Shaly and Loamy Plains	-	-	-	-	-	-
31W	31E	Sandy Plains	323.9	312.3	318.1	207.1	-	-
20NW	20SE	Sandy Plains, some Salt Flat	-	-	-	-	39.4	0.4
18S	19N	Sandy Plains	-	-	-	-	14.4*	10.1*
17S	17N	Mix of Loamy, Sandy, and Salt Flat	373.9	288.1	350.0	236.6	-	-
7SE	7NW	Loamy and Sandy Plains, some Salt Flat	-	-	-	-	-	-
5E	8E	Sandy Plains	326.8	319.7	338.5	245.7	-	-

*Data were not available for the Adaptive Grazing Management pasture, so data from the Traditional Grazing Management pasture were used.

Table 4. One year (Fall 2012-Fall 2013) of adaptive grazing management at the Central Plains Experimental Range, including adaptive management steps, tasks assigned to the Stakeholder Group and the Research Team, and related events that will facilitate the process.

Adaptive Management Steps	***1. Assess***	***2. Design***	***3. Implement***	***4. Monitor***	***5. Evaluate***	***6. Adjust***
Tasks	- Choose goals for livestock production and conservation - Determine objectives for each of the chosen goals - Identify management strategies that would be implemented to achieve the objectives	- Select appropriate monitoring data (indicators) that would be needed by this Stakeholder Group for feedback to inform adaptive management - Select triggers for changes in management (e.g. movement of livestock among pastures)	- Carry out Adaptive Management plan		- Determine whether desired outcomes were achieved - Update understanding of shortgrass steppe	- Make changes to management if outcomes are not achieved or if goals or objectives are updated based on new knowledge
Process	Introductory Workshops	Field Trips; Workshops	USDA-ARS, in communication with Stakeholder Group		Workshop	
Date	September 2012	November 2012; January, April 2013	May-October 2013		Fall 2013	

Table 5. Strategies suggested for each objective by the Stakeholder Group in the Adaptive Grazing Management workshops. Strategies are listed in descending order of the number of different objectives they were suggested for.

	Vegetation			Profitable Ranching Operations			Wildlife			
Strategy	**Obj. A**	**Obj. B**	**Obj. C**	**Obj. A**	**Obj. B**	**Obj. C**	**Obj. A**	**Obj. B**	**Obj. C**	**Obj. D**
Rest/Grassbank	X	X	X	X	X				X	
Rotation	X	X	X	X					X	
Deferred Grazing	X	X	X	X					X	
Vary Season (year to year)	X		X	X						
Mass grazing (one 200 cow herd)	X	X	X							
Manage w/in Pasture Distribution		X					X		X	
Targeted/ Concentrated/ Mob Grazing	X	X					X			
Temporary/ Virtual Fence						X	X			
Seeding Shrubs			X						X	
Cactus Control		X		X						
Flexible Stocking Rate				X	X					
Vary Stock Density, Duration	X			X						
Patch Burns		X					X			
Graze 1x per Grazing Season	X									
Snow Fence	X									
Nothing (for now)								X		
Annual Poison										X
Mineral Supplement				X						
Consider Costs in Implementing Practices						X				
Moderate/ Heavy Stocking								X*		
Drought plan						X				

* Suggested for McCown's longspur only.

Table 6. Adaptive management plans suggested by the Stakeholder Group at the Adaptive Grazing Management workshops.

Group	Participants	Plan
A	Ted, Seth, Casey	In an average precipitation year, one herd of 200 steers rotates through the eight pastures over 135 days (~17 days/pasture; 12.8 acres/yearling/season). Some pastures are deferred (in order of rotation) to promote fourwing saltbush each year—pastures wouldn't be grazed at the same time each year, which would have the benefit of increasing among-pasture diversity. Rest two pastures for two consecutive years (starting with sandy pastures, 18S, 20NW years 1 and 2; 31W, 25N5 years 3 and 4). They also liked the suggestion of making their rests rotate (so that one pasture is always coming into rest). In a wet year, rest three sandy pastures (17S, 8E). In a dry year, use it all for built-in flexibility. In addition to grazing, they suggested prescribed burn in the non-grazing season to increase within-pasture diversity (60-160 acres/year total; 2-4 burns a year at 15-80 acres each; based on 20-50 year fire interval). Would have the benefits of increasing within pasture diversity, plover habitat increases and cactus removal.
B	Dana, Leonard, William	In an average precipitation year, two herds of 100 steers each rotate through four pastures, spending about 34 days in each pasture (12.8 acres/head), while resting two pastures. Start in different pasture each year. Consider production potential for each pasture when setting actual rotation times. For this year, those pastures could be: May 15, 7SE (salt flat) and 17S (salt flat); June 19, 8E and 18S (both saltbrush); July 27, 20S and 31W (both saltbush); September 30, 21N and 20NW; Rest 26W and 25NW (both sandy plains). Rational rotation so you start and end in a good place. Also, electric fence two 40 acre plots of loamy uplands (21N and 20NW) to graze hard for a short period of time for mountain plover. Adjust 20 days into each cycle—evaluate conditions to decide what to do next. Grassbank rested pastures and residual in grazed pastures (e.g. salt flats). In dry years, graze rested pastures. Also salt flats may produce more grass later in the year to use. Alternative system (twice over): Same rotation, but quicker first pass to hit the cool seasons while they are productive (10 days) and slower second pass (24 days).
C	Rachel, Jason, Pat	One herd of 200 steers rotates through 8 pastures, based on season/critical growth period—if grazed during critical growth period one year, rested in that time the next year. Two pastures are rested each year. They felt this would achieve habitat and grassbanking in dry years goals. Overall, the group stated their plan was very similar to Group A. They also noted that they want to base estimates on ecological sites rather than generic assumptions we have today.
D	Kim, Steve	A larger herd of 150 steers rotates through the 7 non-sandy (mostly loamy) pastures, at about 20 days per pasture. Graze each pasture at different times every year (deferring). May rest 1 loamy pasture per season. In the sandy pastures, one is rested while the other two have 50 head of steers total for the whole season. They noted that they tried to look at their grazing plans spatially, and keep operating costs low.