CONSERVATION INNOVATION GRANTS
Final Progress Report

Grantee Name: The Nature Conservancy	
Project Title: Integrated Management of Sericea Lespedeza in Tallgrass Prairie	
Agreement Number: NRCS 69-3A75-9-169	
Project Director: Robert G. Hamilton, Tallgrass Prairie Preserve Director	
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Period Covered by Report: 9/22/09 – 9/22/13	
Project End Date: 9/22/13	

Project Background

Project Purpose

The purpose of this project was to demonstrate the effectiveness of integrating patch burn grazing and spot-application of herbicides to manage sericea lespedeza in tallgrass prairie.

Project Abstract

Sericea lespedeza (*Lespedeza cuneata)* threatens both the economic and ecologic integrity of the tallgrass prairie. While sericea is an important cut forage crop in several southeastern states, it has become an extremely aggressive exotic weed in the Osage/Flint Hills of Oklahoma and Kansas, and throughout the southern tallgrass prairie region of the Great Plains. The 5M-acre Osage/Flint Hills comprise the largest native tallgrass prairie landscape in North America.

Unless it is fed as cured hay, sericea's high tannin content renders the plant's protein indigestible for most ruminants. Sericea is a highly competitive plant: it can reduce grass production up to 80% and displace up to 66% of the native forb species. Aerial application of broadleaf herbicides is the typical sericea control measure in the Osage/Flint Hills, but this is expensive and must be repeated every few years due to plant's abundant and long-lived seed bank in the soil. Broadcast spraying is also very destructive to the diversity of the native prairie plant community. Traditional efforts to control sericea are not working -- we need some new ideas.

This project will demonstrate and evaluate the integration of three powerful natural resource management tools – grazing, fire, and herbicides -- to manage sericea lespedeza. Grazing and fire will be linked with an innovative array of patch burn grazing (PBG) demonstrations: two different burn seasons (spring-only, and spring-plus-summer) in combination with fire-return intervals ranging from 1-4 years. A total of 10,750 acres in seven pastures will be involved, with 2,160 steers grazing from April 15 to September 30. The project will be conducted on 11,510 acres of The Nature Conservancy's Tallgrass

Prairie Preserve, Osage County, Oklahoma. The large scale of the project is intended to be representative of the private ranches in the Osage/Flint Hills, where operations of 10,000 acres or more are common.

Herbicide application will be integrated with the PBG system by targeting burn patches that are in their first growing season post-burn. An ATV-based herbicide crew will search these burn patches and spot-spray the sericea. Cattle will intensively graze the new burn patches and the decreased vegetation presents several advantages: improved detection of sericea, less interception of herbicides (less waste and better uptake/kill on sericea); and improved safety for the ATV riders (hazards are more visible). This innovative "follow the burns" approach may have good transferability with ranchers – the scale of spot-spraying on any size property is less overwhelming when only a portion of the ranch is targeted each year.

Routes traveled by the spray crew will be mapped by GPS technology. Evaluation of the spray crew efficiency and response of sericea and the plant community will be conducted by an Oklahoma State University graduate student and a field technician.

Project Administration

This project was funded by a FY2009 NRCS Conservation Innovation Grant applied for and received by The Nature Conservancy (TNC), and fully executed a Grant Agreement on 9-22-09. TNC applied for and received a one-year no-cost extension from NRCS that extended the project end date to 9-22-13. TNC negotiated a contract for spot-spraying services during the summers of 2010-2012 with a local contractor, and fully executed that contract on 1-5-10. TNC also negotiated a contract with Oklahoma State University (OSU) to provide the above mentioned field sampling services, and fully executed that contract on 4-13-10. TNC submitted eight Semi-Annual Progress Reports over the course of the project.

A) Summarize the work performed during the project period covered by this report:

Generate and maintain patch burn grazing (PBG) treatments.

Over the course of the project, a total of 17,396 acres were spring-burned and 1,130 acres were summer-burned to maintain the patch burn grazing treatments. The only short-coming was the inability to conduct summer burns in 2011 and 2012 due to county and state burn bans (extended drought period). Cattle for the project were provided by a local rancher under a grazing lease with TNC. Stocking rates for all pastures was 5 acres per steer for the 5.5 month summer grazing period during 2010 and 2011. Due to persistent drought, stocking rates were reduced to 7.5 acres per steer during summer 2012, and 10 acres per steer in summer 2013. All cattle were weighed when introduced and when removed using the preserve state-certified scales.

Apply herbicides to sericea in a spot-spray program that follows the PBG burn sequence.

Herbicides were applied to sericea lespedeza in a spot-spray program that followed the PBG sequence, by targeting burn patches for spraying during their first growing season post-burn. Herbicides were applied by an ATV-based contractor spray crew. GPS units on the ATVs recorded spray routes. Date, man-hours, herbicide type, and gallons of herbicide spray mix were recorded for each burn unit (patch) that was sprayed. A total of 11,112 acres were covered by the spray crew, requiring 4,967 man-hours of labor, and 51,615 gallons of herbicide spray mix.

Conduct sericea and plant community monitoring.

An Oklahoma State University PhD student and her field assistants conducted sericea and plant community monitoring during the project.

To evaluate the biological effectiveness of the patch burn grazing and spot-spray treatments, OSU established 49 sericea stand transects, comprised of 16 quadrats each transect. Within each quadrat, they recorded sericea stem density, cover (%), and percent stems grazed, along with random measurements of grazed and ungrazed stem heights. Quadrats along each transect were grouped into blocks of 4 and were then randomly assigned to one of the following treatments: early-season spray, mid-season spray, late-season spray, or control (unsprayed).

OSU spot-sprayed early-season spray treatment blocks with Remedy® in mid-June; mid-season spray treatment blocks with Remedy® in early August; and late-season spray treatment blocks with Cimarron Plus® in mid September. They collected sericea mortality data within all quadrats established and treated in 2010 and 2011, and recorded sericea stem density and cover at 1 and 2 growing seasons after treatment (GSAT) to calculate the percent change in stem density and cover.

Prior to conducting the mid-season spray treatment, OSU collected pre-treatment species composition data from within all mid-season and no-treatment quadrats. Similarly, they previously collected pre-treatment species composition data from mid-season treatment quadrats established in 2010 and 2011. In late July, they collected 1 and 2 GSAT species composition data for 2011 and 2010 quadrats, respectively.

From July through September, OSU continued to monitor GPS-recorded spray-crew routes. They analyzed 10 randomly selected 100m belt-transects along spray-crew routes within each treated patch. For each transect, they estimated the total area of sericea infestation along each transect, as well as the total area of sericea detected and sprayed, sericea undetected and unsprayed, misidentified and sprayed species, and collateral damage due to boom-spraying. From these area estimates, they calculated spray-crew efficiency estimates for each treated patch. Additionally, they incorporated herbicide costs, gallons (herbicide)/acre, and acres/man-hour spray-crew data for each treated patch to estimate total treatment costs per acre for 2010 – 2012.

Conduct educational/outreach events with project partners.

A total of nine presentations by project partners were provided to natural resource managers and landowners, with an overall audience of approximately 700 persons:

- October 20, 2010 Patch Burn Working Group annual meeting, Bartlesville, OK
- August 31, 2011 Patch Burn Working Group annual meeting, Beatrice, NE
- August 8, 2012 Ecological Society of America conference, Portland, OR
- August 28, 2012 Patch Burn Working Group annual meeting, Elmdale, KS
- October 4, 2012 Joint Annual Meetings of the Oklahoma Chapters of the Society for Range Management and The Wildlife Society, Tallgrass Prairie Preserve, OK
- February 5, 2013 Society for Range Management annual meeting, OK City, OK
- March 12, 2013 Western Society for Weed Science annual meeting, San Diego, CA
- April 2013 OSU-NREM graduate seminar, Stillwater, OK
- September 25, 2013 Patch Burn Working Group annual meeting, Gary, SD

B) Describe significant results, accomplishments, and lessons learned. Compare actual accomplishments to the project goals in your proposal:

Demonstrate innovative patch burn grazing system.

This objective has been fully realized. The seven patch burn pasture treatments have been functioning smoothly and are not difficult to maintain. The only significant challenge has been the inability in drought years to conduct summer burns due to county and/or state burn bans. However, those areas were burned the following spring.

Patch burn grazing as a range management tool continues to grow and gain more practitioners, as evidenced by the growth in attendance at the Patch Burn Working Group annual meetings. The first meeting in 2005 had one dozen attendees, while the 2013 meeting had approximately 100.

Demonstrate innovative sericea spot-spray approach that is integrated with patch burn grazing.

This project has effectively demonstrated the successful integration of these two range management techniques. This innovative “follow the burns” approach is easy to understand and apply in the field. Basically, fire enhances sericea seed germination and thereby depletes the seed bank, removes old growth, and provides young, palatable growth to increase utilization of sericea by cattle. The combination of fire and grazing leads to improved detection of sericea by spray crews, decreases herbicide interception, and reduces collateral damage to the native forb species.

The primary challenge to implementing this strategy is the significant labor needed to apply spot-spraying at a large scale. As stated above, this project required 4,967 man-hours of contractor ATV crew-time to spot-spray sericea on 11,112 acres of tallgrass prairie. Many ranches will not be able to invest this level of staff time, so this could be an opportunity for private enterprise to develop spot-spray businesses.

Evaluate the biological effectiveness of patch burn grazing with spot-spraying to control sericea.

Patch burn grazing appears to improve the grazing utilization of sericea lespedeza. Although all pastures were stocked with the same density of yearling steers, the variable burn patch sizes resulted in a range of effective stocking rates.

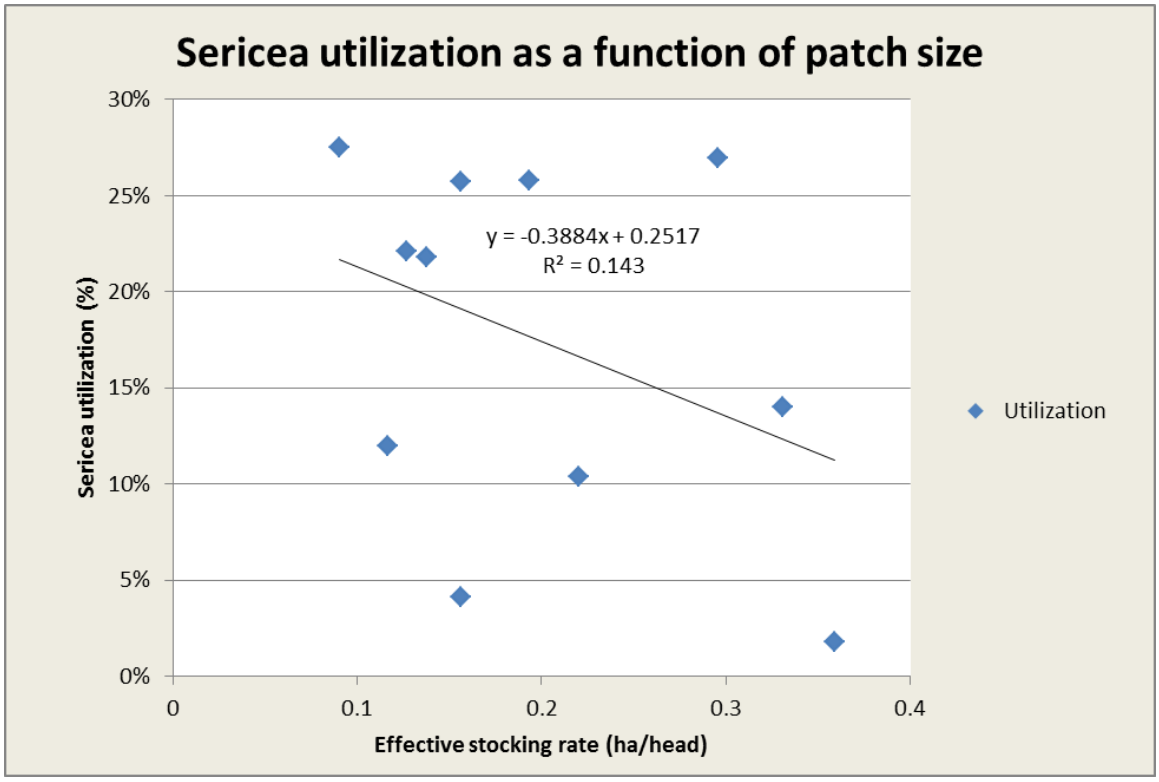

Figure 1. Sericea utilization as a function of patch size.

See Figure 1 above – sericea utilization increases as effective stocking rates increase (less pasture area per head). This more concentrated or "focal grazing" pressure is likely maintaining the sericea in a re-growth phase, thus improving palatability to cattle. As sericea grows and matures it concentrates tannins, thereby decreasing its digestibility and selection by cattle. Patch burn grazing appears to be an effective range management practice that can overcome this forage quality challenge.

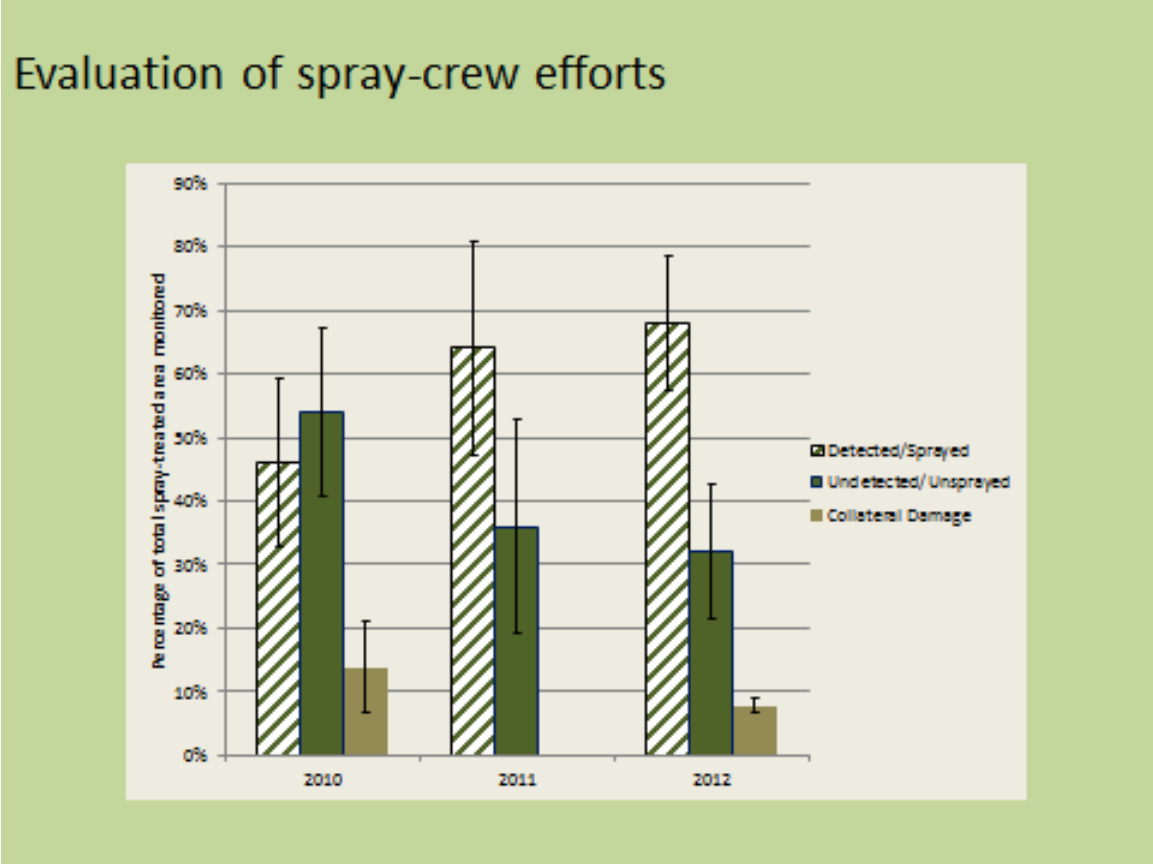

Figure 2. Spot-spray crew effectiveness.

Figure 2 presents a summary of the effectiveness of the contractor spot-spray crew. The crew improved its effectiveness as the project progressed: their abiltiy to detect and spray sericea improved with time, while they decreased the frequency at which they mistakenly did not detect nor spray sericea. They had a consistently low rate of "collateral damage" where they mistakenly sprayed non-target desirable forbs. This effective control of sericea in combination with a low rate of non-target damage is a strong reason to utilize spot-spraying rather than aerial application of herbicides.

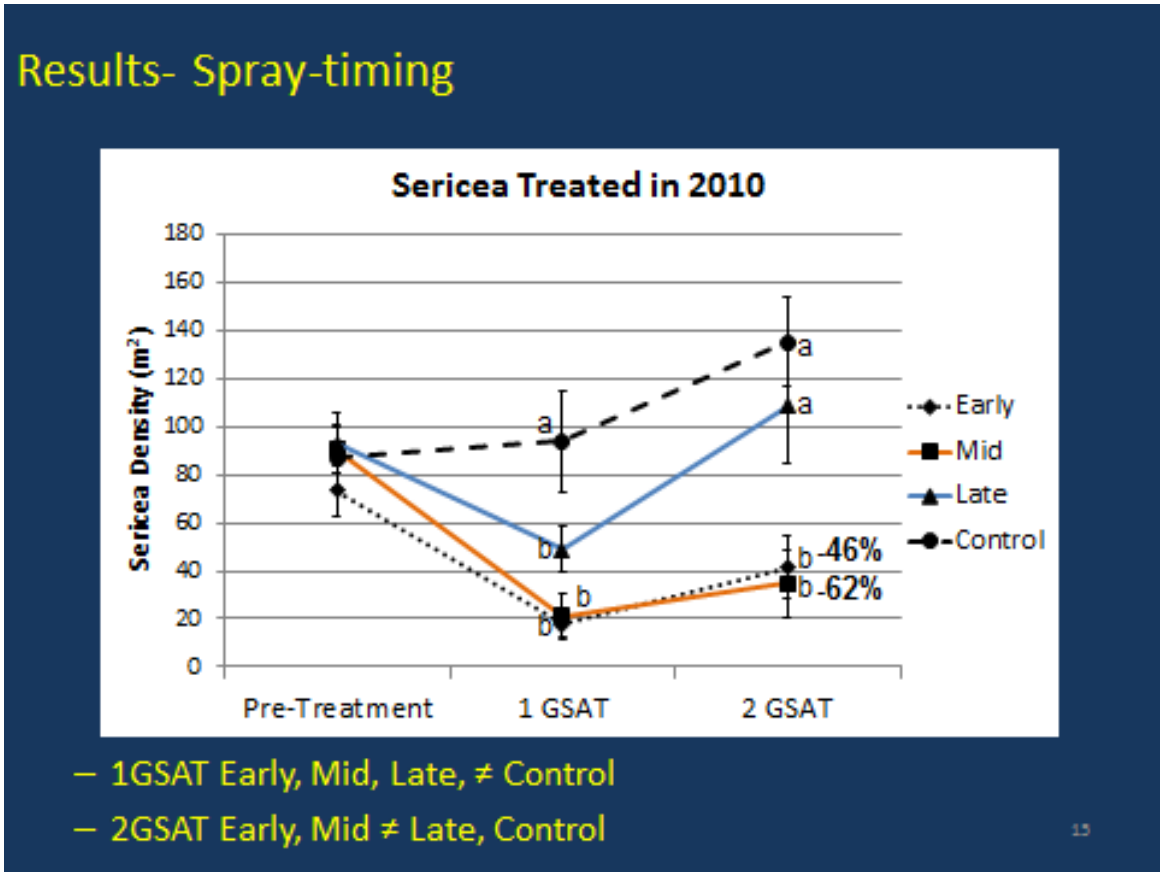

Figure 3. Herbicide application timing and sericea control. GSAT is Growing Season After Treatment.

The timing of the herbicide applications resulted in some interesting differences in sericea control (see Figure 3). The early-season (June) and mid-season (late July) applications of triclopyr (Remedy) had the most effective sericea control, and had no statistical difference. In contrast, the late-season (September) application of metsulfuron-methyl (Cimarron Plus) had the poorest sericea control of all the herbicide treatments and was not statistically different than the control (no herbicide treatment).

In summary, the rankings of the best sericea control practices were:

- Herbicide Timing: mid-season > early-season > late-season > no treatment
- Patch Burn Fire Return Interval: 3 years > 2 > 4 > 1
- Fire Seasonality: spring + summer > spring-only

<u>Conduct an economic analysis of patch burn grazing with spot-spraying to control sericea</u>.

Analysis of the cattle weight gain data from this project indicates that there is no significant difference between the pasture treatments (Figure 4). Therefore, producers can have some comfort that adopting this management regime should have little or no economic impact as compared to conventional management.

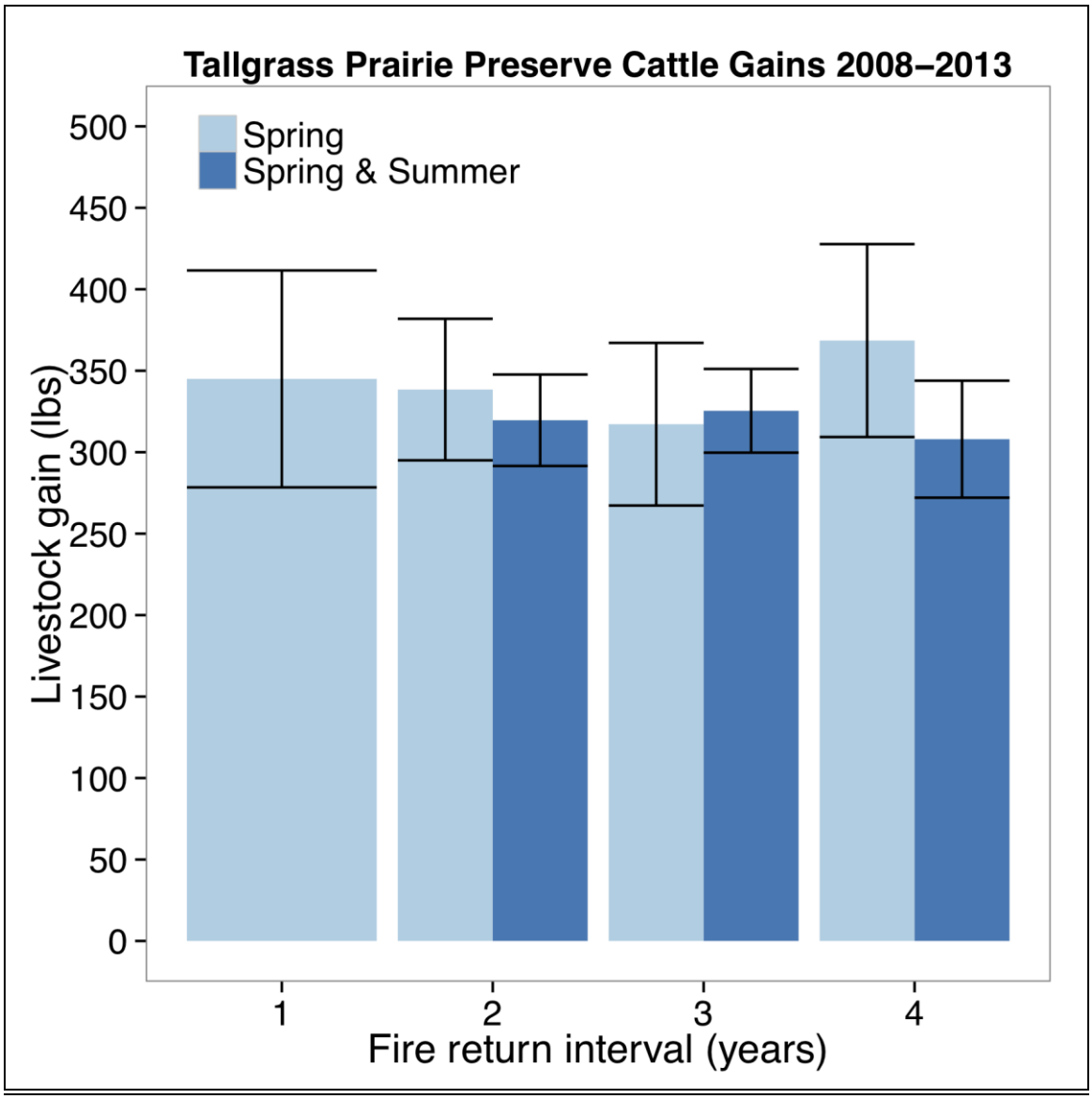

Figure 4. 2008-2013 season-long cattle gains by fire-return treatment. Each bar represents one of seven pasture treatments. The left bar (1-year fire-return interval) represents the conventional regional grazing treatment of annual spring burning.

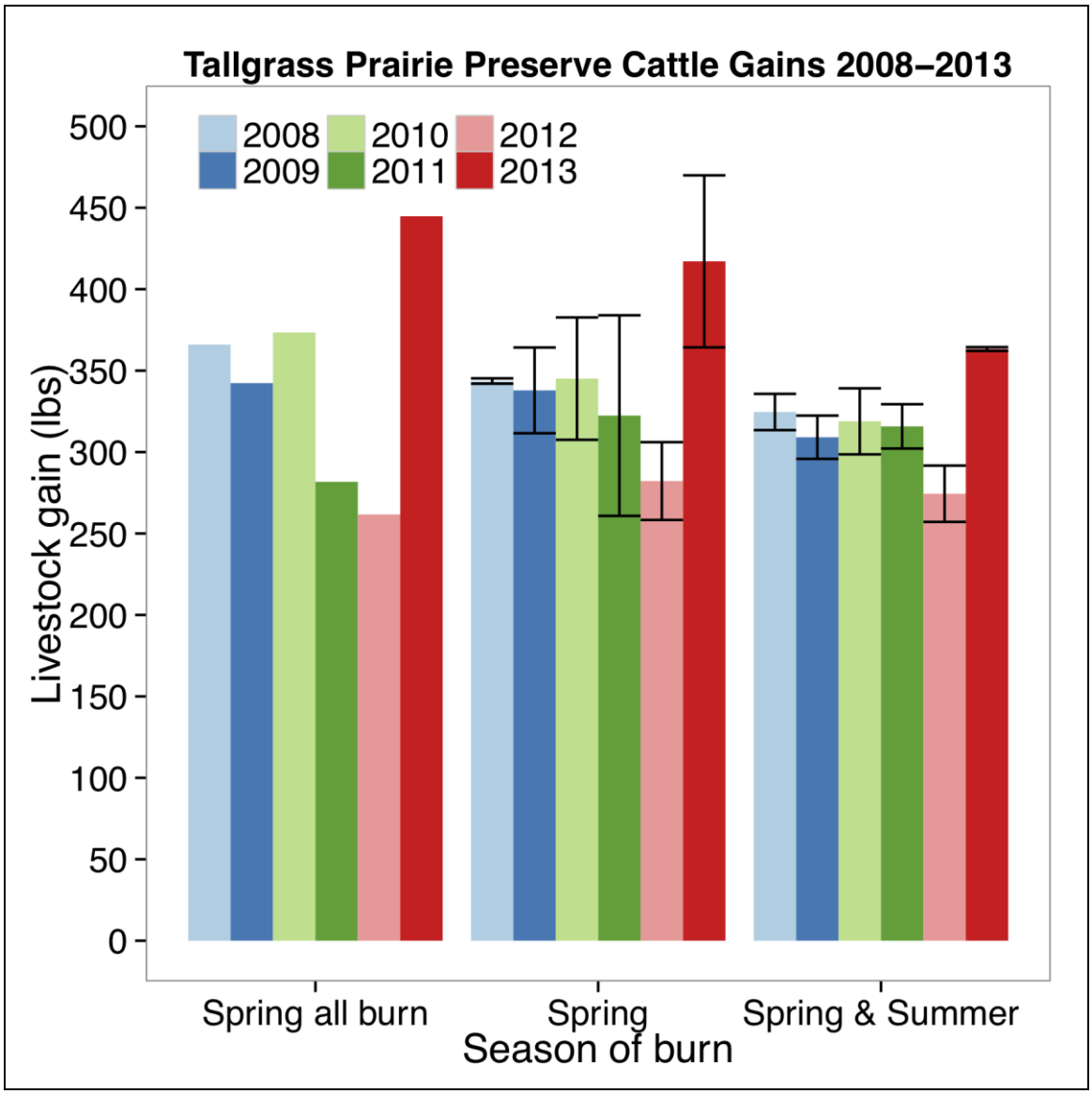

Figure 5. 2008-2013 season-long cattle gains by season of fire treatment.

As expected, the wide variation in climatic conditions over the project period resulted in significant differences in cattle gains (Figure 5). The drought of 2012 produced the lowest cattle gains. In contrast 2013 produced the highest gains, most likely due to the abundant rainfall in July and August (13 inches).

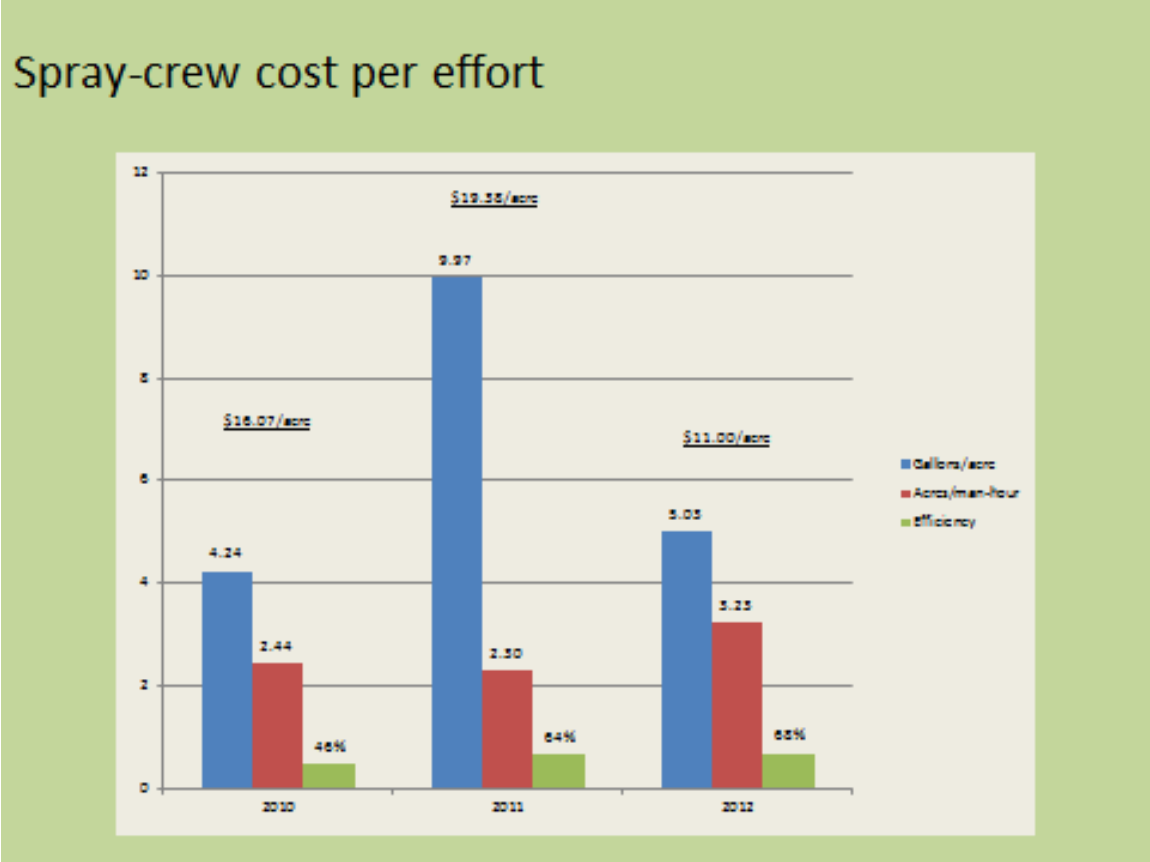

Figure 6. Spot-spray contract crew efficiency.

See the above Figure 6 for a summary of the spot-spray contract crew's efficiency during the project period. The variability in the gallons applied per acre was likely due to varying sericea densities in the patches sprayed each year. The three-year average total spray cost was $15.48 per acre, which is slightly less than the typical aerial application cost of $16 per acre. Therefore, patch burn grazing in combination with spot-spraying is an economical approach to controlling sericea lespedeza.

<u>Evaluate the tallgrass prairie plant community response to patch burn grazing integrated with spot-spraying to control sericea.</u>

Aerial application of broadleaf herbicides can greatly "simplify" the tallgrass prairie plant community by eliminating many of the forbs, which constitute the majority of the plant diversity of the ecosystem. By successfully demonstrating that patch burn grazing integrated with spot-spraying can be more "surgical" in removing sericea, this project offers a new strategy for maintaining the rich diversity of our native grasslands. This strategy also appears to be an economic win-win regarding livestock performance and herbicide application costs. Patch burn grazing has already been shown to be an effective tool to manage grasslands for structural heterogeneity (habitat diversity), so this strategy will also enhance wildlife diversity.

C) Provide the following in accordance with the Environmental Quality Incentives Program (EQIP) and CIG grant agreement provisions:

1. A listing of EQIP-eligible producers involved in the project, identified by name and social security number or taxpayer identification number. **No EQIP-eligible producers involved in the project.**

2. The dollar amount of any direct or indirect payment made to each individual producer or entity for any structural, vegetative, or management practices. Both biannual and cumulative payment amounts must be submitted.

3. A self-certification statement indicating that each individual or entity receiving a direct or indirect payment for any structural, vegetative, or management practice through this grant is in compliance with the adjusted gross income (AGI) and highly-erodible lands and wetlands conservation (HEL/WC) compliance provisions of the Farm Bill.

Figure 7. Patch boundary, patch burn grazing pasture, Tallgrass Prairie Preserve, OK. Unburned patch upper left; spring-burned patch to the lower right. April 24, 2010.

Figure 8. Yearling steers grazing on patch burn unit. Tallgrass Prairie Preserve, Osage County, OK, July 23, 2010.