NORTH DAKOTA GAME AND FISH DEPARTMENT

Final Report

Implementing Adaptive Grassland Management for Declining Grassland and Wetland Birds at the Davis Ranch

Project T-23-HM

April 1, 2008 – December 31, 2010

Terry Steinwand
Director

Submitted by
Paul Schadewald
Chief, Conservation and Communications Division

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Introduction

Davis Ranch is one of the largest private properties dedicated to conservation management on the Missouri Coteau in North Dakota. It is also located in one of the most extensive continuous blocks of intact native mixed-grass prairie in the region (Figure 1).

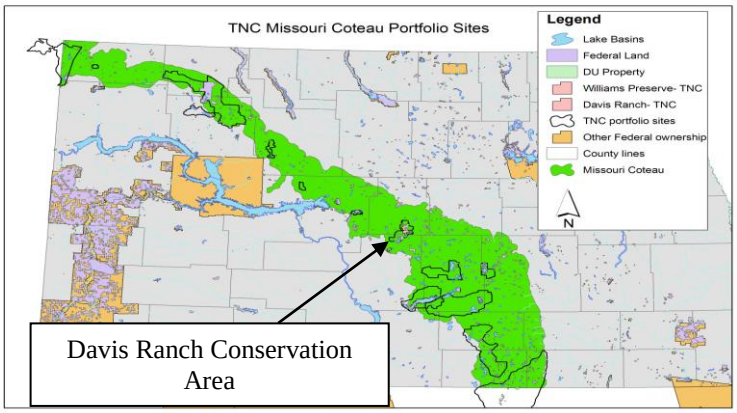


Figure 1. Location of Davis Ranch.

In 2005, The Nature Conservancy completed an analysis of the ecological health and threats to conservation targets at Davis Ranch and the surrounding landscape (Rosenquist 2005). Our analysis found that the conservation area is large enough to support viable grassland and wetland communities and the full diversity of species anticipated to occur in the area; however; the condition (an integrated measure of the composition, structure, and biotic interactions) and landscape context (a measure of the dominant environmental regimes, processes and connectivity) is likely outside its natural range of variation and will require management intervention to retain significant habitat for several species of concern.

Creating heterogeneous habitat structure through rotational grazing and fire have been suggested as Best Management Practices for grassland birds on the Missouri Coteau (Johnson 1996, Madden et al. 1999) and across the Great Plains (Fuhlendorf and Engle 2001). However, Winter et al. (2006) recommended that grassland bird management will be most effective if decision rules are refined to the specific needs of the grassland patch being managed using an adaptive management approach. We believe this may be especially important in areas where invasive grasses pose a substantial threat to grassland health. While various research has been conducted to evaluate plot-level response of Kentucky bluegrass and smooth brome to various management treatments (Willson and Stubbendieck 1996, Blankespoor and Bich 1991, Willson and Stubbendieck 2000), recommendations for management to control these invasive species at the scale of ranch operating units or while maintaining habitat for grassland birds are not available.

Currently, Davis Ranch is managed using three independent deferred rotation grazing systems. While we have modified pasture configuration since acquiring the property, we have not had the resources to establish effective management on about 3,500 acres of the preserve. As a result, we have not been able to control distribution and grazing intensity, compromising efforts to create heterogeneous structure for grassland birds and negatively impact invasive grasses.

The Adaptive Management at Davis Ranch project was conducted April 1st, 2008 to December 31, 2010 with the financial assistance of North Dakota Game and Fish departments State Wildlife Grants program, with the objectives to:

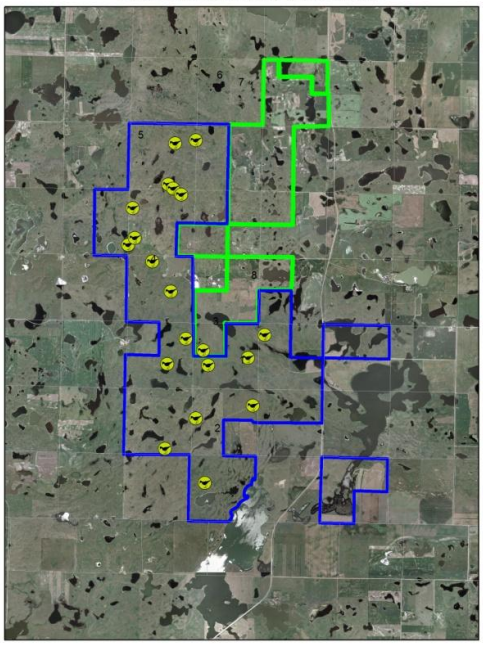
1. Implement a beginning stage of long-term grassland bird and invasive plant species monitoring program at the Davis Ranch.
    a. Document the frequency and density of breeding grassland passerine birds.
    b. Document the abundance of male sharp-tailed grouse.
    c. Document the spread of invasive pasture grasses over time.
2. Increase native herbaceous species cover, while reducing invasive pasture grass cover.
3. Utilize monitoring data to adjust grazing and fire management in an adaptive management context.
    a. Utilize management tools to create varied habitat conditions over time that will favor declining grassland birds.

Grassland Bird Monitoring

Upland passerine point counts

Grassland passerines were monitored in early June 2008-2010. Twenty plots, each with three survey points (total of 60 points) were surveyed twice (Figure 1). Frequency and density data were collected for all grassland affiliated birds within a 50 m radius circle. A total of 34 species were recorded within the 50 meter radius circle with Clay-colored sparrows being the most common, closely followed by Grasshopper Sparrows.

Grassland bird survey points, 2008



We used the Shannon-Wiener indices to determine species diversity and species evenness (Table 1). The S-W index is a measure of the likelihood that the next

individual will be the same species as the previous sample. The species diversity index is closely correlated with species richness, the index value will increase as the species richness increases. A value near 0 would indicate that every species in the sample is the same. Conversely, a value near 4.6 would indicate that the number of individuals are evenly distributed between the species. Species evenness (J') is a value between 0 and 1 and is a measure of how evenly the total bird numbers are distributed among the species present. A sample of equal numbers of individuals of the same species has a value of 1, for example.

Table 1. Grassland passerine species diversity and evenness (2008-2010).

	H' (diversity)	J' (evenness)
2008	2.15	.76
2009	2.52	.77
2010	2.28	.79

These values will not be overly predictive on their own but as additional surveys are conducted they will serve as a baseline to determine if diversity is increasing. Since certain species are known to prefer particular vegetation structure, managers will attempt to use the presence of various species to make assumptions regarding vegetation structure.

Preliminary observations of the data show species such as Grasshopper sparrows, Clay-colored sparrows, and Savannah sparrows to be the most common. These are species that are typically found in grasslands containing higher structure or sometimes brushy vegetation. Species including the Chestnut Colored Longspur, Willet, Baird's sparrow, Marbled Godwit and Upland sandpiper were found in much smaller numbers. These are species that tend to key in on shorter stature vegetation. These data may suggest the need for increased disturbance to create more favorable habitat for these species of special concern.

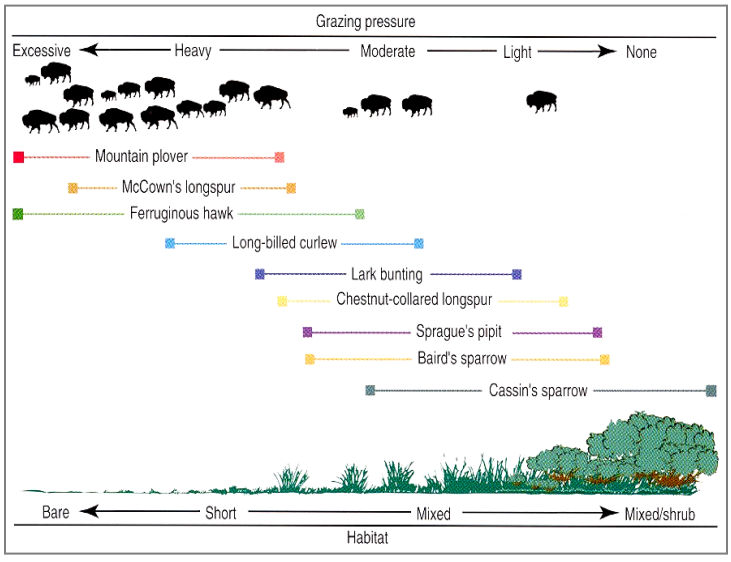
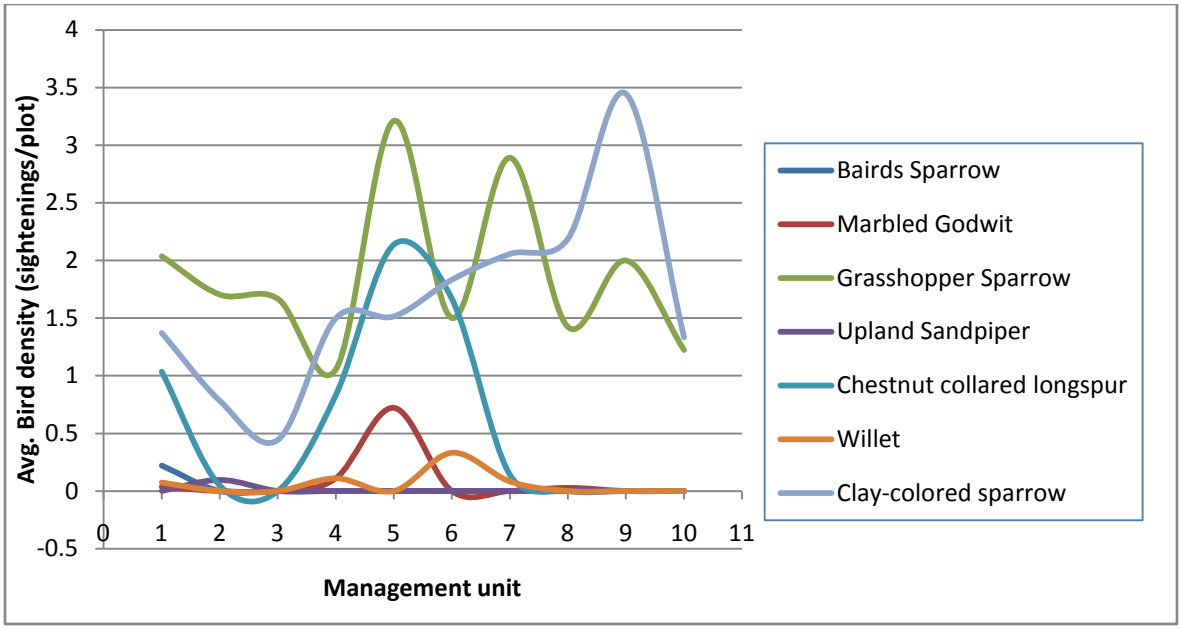


Figure 2. Conceptual diagram of birds species related to disturbance. (Knopf)

When bird density (avg. sightings/plot) are plotted as

related to management unit, units 5 and 6 appear to show highest number of species and generally higher densities then other management units. This may suggest diversity in vegetation structure.

Table 2. Average bird density across management units. (2008-2010).



A project conducted by the Wildlife Conservation Society the summer of 2010 yielded similar results. They also found high densities of Clay-colored Sparrows, Grasshopper Sparrows, Savannah Sparrows, and Western Meadowlarks, however,

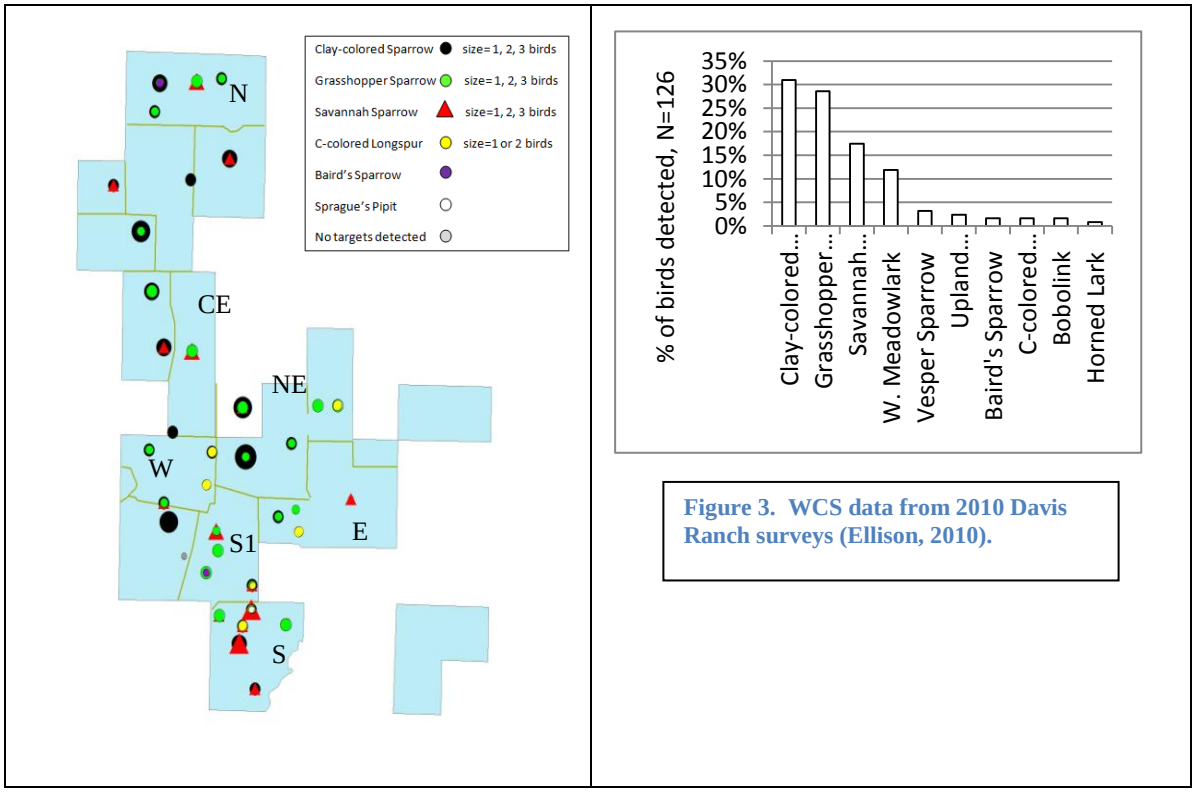
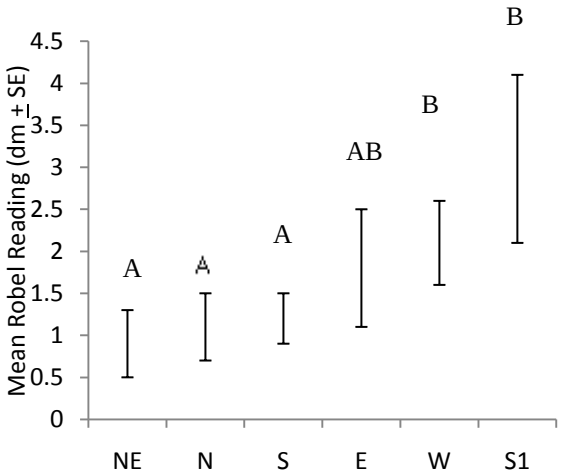


Figure 3. WCS data from 2010 Davis Ranch surveys (Ellison, 2010).

Upland sandpipers and Chestnut collared Longspurs were regularly detected in certain areas (Ellison, 2010). Baird's sparrows and Sprague's Pipits were also detected in their survey. Their surveys suggest high densities of bushy patches throughout the property, particularly snowberry and silverberry.

Figure 4. Variation in the vertical structure of vegetation at Davis Ranch. Letters (A, AB, or B) denote statistical overlap between management units. Barids Sparrows were in N and S1 and Sprague's Pipits were in S, adjacent to taller vegetation.



Sharp-tail grouse monitoring

Sharp-tailed grouse are a native grouse to the northern Great Plains and healthy populations are often considered an indicator to grasslands of significant size, quality and diversity. Unlike the passerines also monitored in this project the sharp-tailed grouse is a year-round resistant of the area thus subject to extreme winter conditions.

A 3.5 x 7.0 mile block was surveyed for sharp-tailed grouse leks 2008-2010 (Table 3). Results were sent of NDGF biologists for inclusion in annual population estimates. Eight leks were surveyed, 5 on TNC land, 1 on Ducks Unlimited's Coteau Ranch, and 2 on other private lands. Analysis of data from 2008-2010 show 6 of 8 leks decreasing and a 22% decrease across all leks surveyed. This seems to follow statewide declining trends over the same period. Paul Bultsma of Ducks Unlimited Inc. also contributed to data collection.

Table 3. Summary of Sharptailed Grouse Results, 2008-2010.

Lek #	Avg. males 2008	Avg. males 2009	Avg. males 2010	2008-2010 Average (males/lek)	% +/-, 2008-2010	*Long term Average (males/lek)	Ownership
1	12.5	20	23	18.5	+45.6	18.6	TNC
2	19	21	21.5	20.5	+11.6	23.1	TNC
3	20.3	6	14.5	13.6	-28.5	13.5	TNC
4	19.5	10	8	12.5	-58.9	12.5	TNC
5	20	7	17	14.6	-15.0	14.7	TNC
6	15.5	7.5	0	7.6	-100	7.6	Private
7	17.5	13.5	15.7	15.5	-10.2	15.6	Private
8	21	11	13.7	15.2	-34.7	15.2	DU
All leks	**18.1**	**12**	**14.1**	**14.7**	**-22**		

Vegetation monitoring

Belt transects

A total of 202 belt transects were established yielding 8148 useable sample points. From these transects the frequency of invasive grasses, native woody species, and favorable native grasses were determined. These data show that across the entire property, 32% of the points were in grassland considered to be pristine, 21% showed some sign of invasion, and the remaining 47% were mostly invaded. Kentucky bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*) were the most common invasive identified in the transects. Of all occurrences of invasive grasses, Kentucky bluegrass accounted for 77% of the total, Smooth Brome for 21%. Crested wheatgrass (*Agropyron cristatum*) was found in very small amounts.

The presence of woody vegetation was also measured. Brush species such as Western snowberry (*Symphoricarpos occidentalis*) and silverberry (*Shepherdia argentea*) comprised 39% of the total sample points with Western snowberry being, by far, the most common (86% of all brush occurrences) (Table 4).

Table 4. Vetetation Condition of Management units. Davis Ranch, ND.

Vegetation Condition by Management unit								
		Overall condition			Invasive Grasses		Brush	
Unit	Total sample points	Pristine (%)	Some Invasion (%)	Mostly Invaded (%)	KBG (%)	SB (%)	WSB (%)	Silverberry (%)
1	693	24	36	39	74	0.8	47	5
2	768	15	24	60	54	23	57	7
3	1830	13	29	57	70	14	24	6
4	100	0	0	100	100	0	50	76
5	384	17	36	47	57	21	15	4
6	404	50	8	42	8	40	34	0
7	922	55	6	39	21	23	44	1
8	1770	56	18	26	37	5	19	3
9	215	34	19	46	24	0	7	40
10	100	22	17	61	18	15	0	0
Entire Ranch	8148	31	21	47	50	14	34	5

KBG=Kentucky Bluegrass

SB=Smooth Brome

WSB= Western snowberry

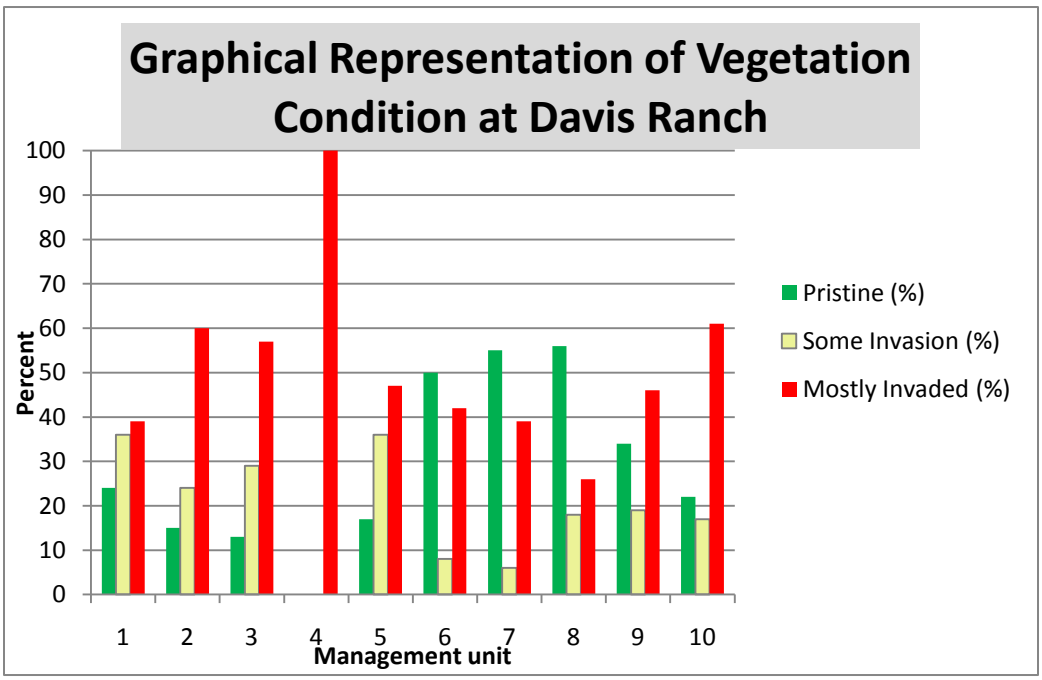


Figure 5. Graphical representation of vegetation condition at Davis Ranch.

These permanent transects will be repeated at 3-5 year intervals. A successful management program will increase the percentage of transects in the pristine category and prevent the percentage of transects in the mostly invaded category from increasing.

Realistically areas that are mostly invaded will likely stay in that state without intensive restoration efforts. Thank you to Todd Grant (USFWS) for his assistance.

Brome Patches

In 2008, 20 brome patches were measured following protocol described in (Lesica and Martin 2005). The average size of the patches was 107 sq. meters and ranges from 19- 341 sq. meters. These patches have not been re-sampled at the date of this report but will be immediately following the snow melt the spring of 2012.

Management activities

Grazing Management.

The summer of 2009 a fencing contractor was hired to construct approximately 12,000 feet of two strand, high tensile fence in management unit 8. This will change unit 8 from one, 1500 acre unit, to three 365-640 acre units. This will allow managers more flexibility to control the timing and intensity of grazing (Figure 6-7).

Prescribed Fire

From 2008-2010 TNC fire crews completed prescribed burns on 12 units throughout the ranch (Table 5). Burn units were located throughout the property in an attempt to provide a diverse mosaic of vegetation structure over a large area (Figure 8.) The objectives of the burns were to attempt to suppress cool season exotic grasses such as smooth brome and Kentucky bluegrass as well as snowberry. In addition, burning is being used to manipulate the distribution of cattle grazing. Cattle will tend to congregate on the re-growth following a burn. Rotating burn units from year to year will also serve to rotate cattle within management units creating a mosaic of different structure grasses. This diverse structure should be favorable to a large suite of grassland birds.

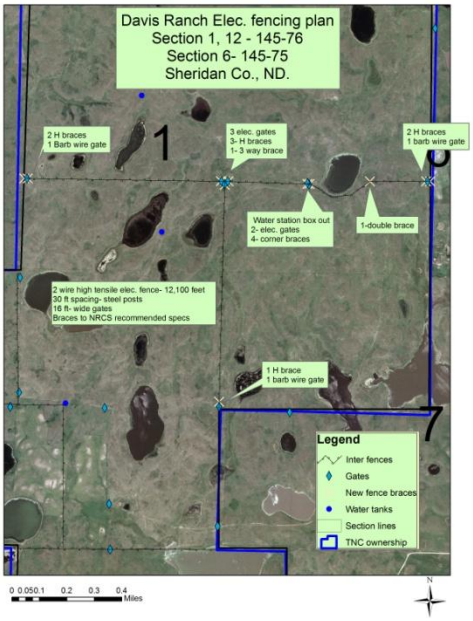


Figure 6. Location of new fence.

Figure 7. Photo of new fence.

Figure 8. Locations of burns at Davis Ranch, 2008-2010.

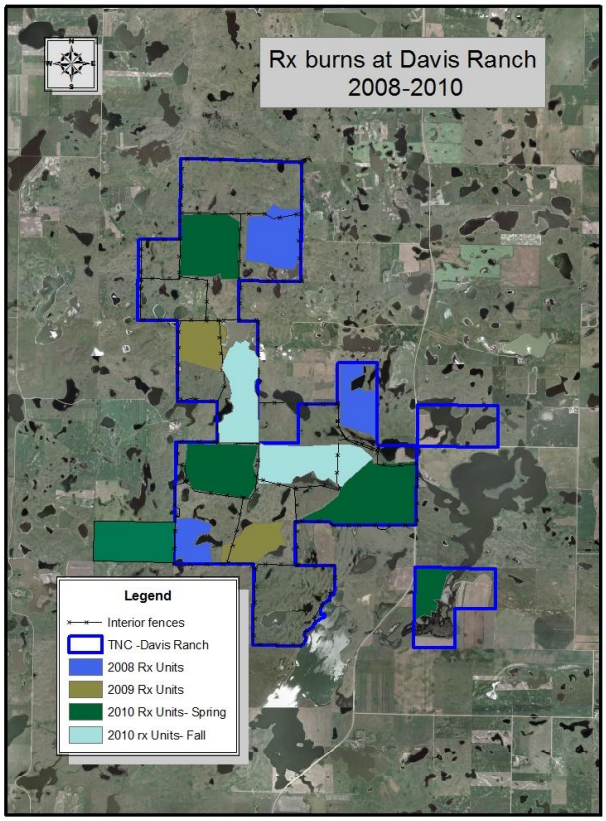


Table 5. Chart of burns at Davis Ranch.

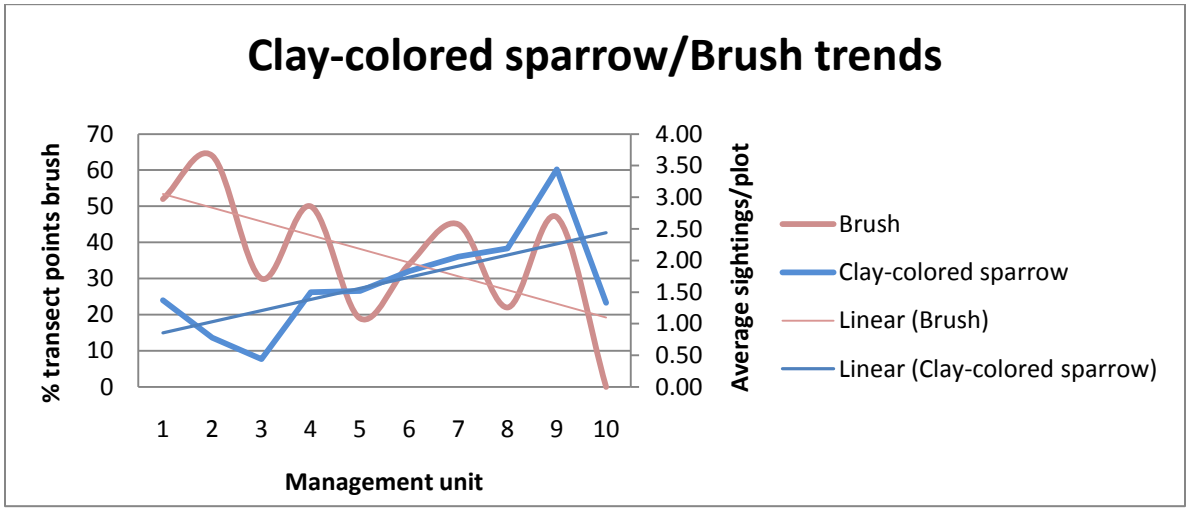
Year	Number of units	Number of acres burned
2008	4	623
2009	2	370
2010	6	1874

What did we learn?

The intent of this project was to develop a robust and comprehensive monitoring system which, in concert, will provide data which could be used to evaluate management. Management staff would then have a solid basis in which to make decisions and continue to evaluate response of targets.

What does our data tell us about bird density and abundance? On first glance data from point counts show a healthy number of species however these were dominated by species which often used a wide range of grass structures, as well as species that tend to favor more brushy areas. Species of special concern, such as Baird's sparrow, were seldom detected. Baird's sparrows are often associated with clumps of vegetation which provide moderate structure. In addition, high numbers of species associated with brush, such as Clay-colored sparrow, suggests perhaps two conditions. The grassland areas of the ranch may show a higher then desired level of homogeneity as well as higher then desired densities of brush, specifically snowberry, however a quick look at the relationship of brush densities and Clay-colored sparrow doesn't show an obvious link (Figure 9). Units that showed birds of special concern at levels greater than the ranch average also tended to have lower densities of brush.

Figure 9. Relationship of Brush and Clay-colored sparrows at Davis Ranch.



At the management unit level, is there a difference in the grassland bird communities by management treatment?

There was a statistically significant difference between the number of birds detected on units that were only grazed and units that were burned and grazed for 3 of the bird category groups: total detections ($p < 0.01$), obligate grass ($p < 0.01$) and brush dependent ($p = 0.03$). In all cases, the grazing only treatment had more detections of birds than the burning and grazing treatment with no effect of year. However, the bird

category of short grass birds had a statistically significant difference between years ($p < 0.01$) and no effect of management (Figures 10, 11, 12, 13) .

It is logical to expect this trend when considering the timing of burning and bird surveys. Since burning was conducted in mid-May and surveys were conducted in early June, burned areas would have very little vegetative structure at that time.

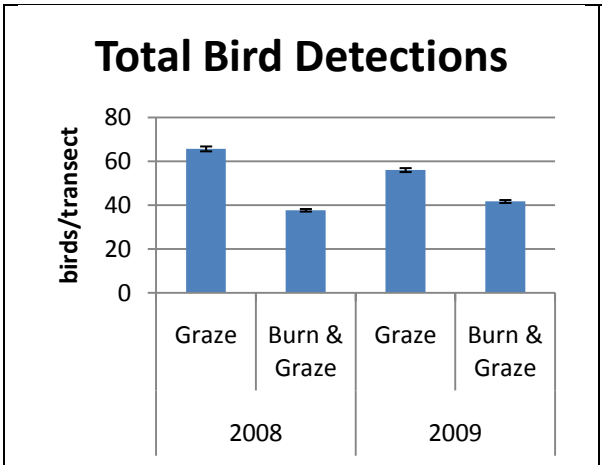


Figure 10. Total number of bird detections by year and management treatment (2007-2009).

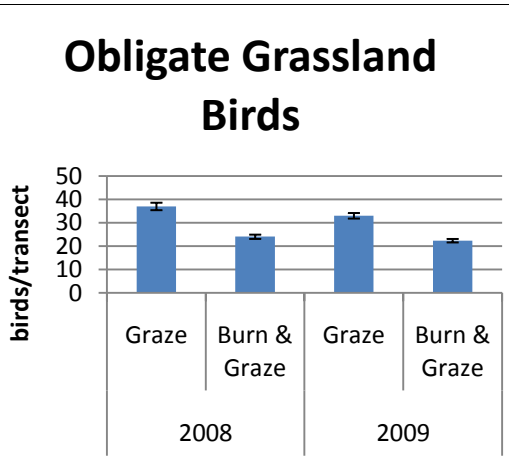


Figure 11. Detections of obligate grassland bird species by and management treatment (2007-2009).

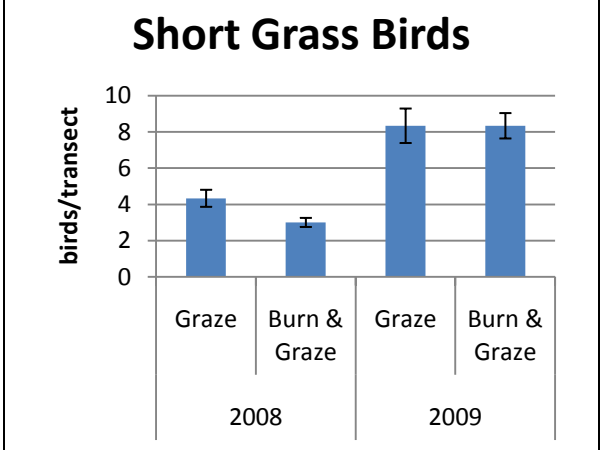


Figure 12. Detections of short grass bird species by year and management treatment (2007-2009).

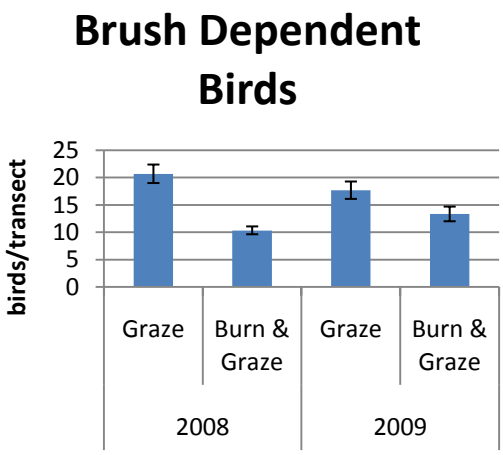


Figure 13. Detections of brush dependent birds by year and management treatment (2007-2009).

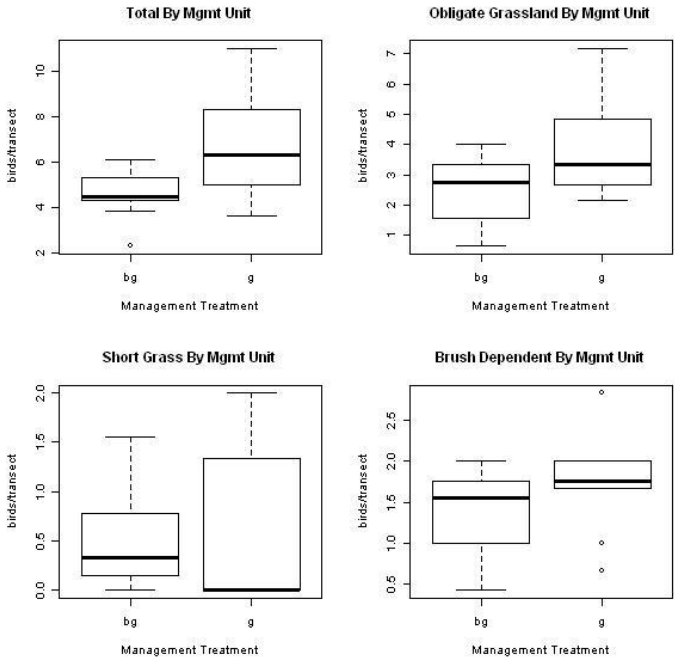


Figure 14. Boxplot of detections of bird groups summed for 2008- 2009 by management treatment; the dark horizontal line is the median, the bottom and top of the box are the 25th and 75th percentiles, whiskers are two standard deviations and the points are outliers.

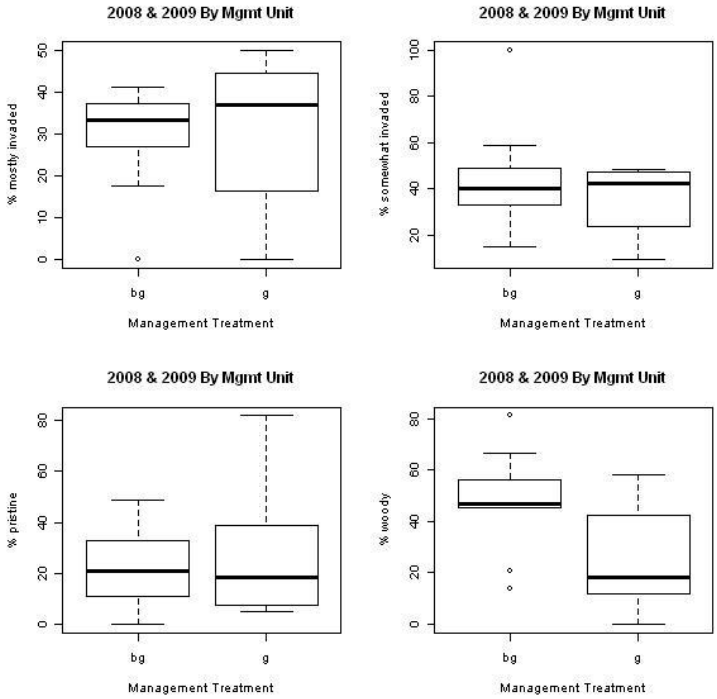


Figure 15. Boxplot of vegetation data summed for 2008-2009 by management treatment.

Is there an effect of management treatment on vegetation measurements?

There was no effect of management treatment or year on the frequency of Mostly Invaded, Somewhat Invaded or Pristine vegetation groups ($p > 0.31$ for all 3). However, grazing had a significant negative effect on the frequency of woody vegetation (snowberry and silverberry together; $p = 0.04$).

Is there an effect of vegetation on bird detections?

There was no effect of any of the four vegetation characteristics for Total Bird Detections, Obligate Grass species or Short Grass species ($p > 0.13$ for all models). For the Brush Dependent species, there was no effect of Mostly Invaded, Somewhat Invaded or Pristine, but there was a significant effect of Woody vegetation for this group. However, contrary to the fact that these birds use woody vegetation to nest, the relationship between the number of brush dependent birds and the amount of woody vegetation was significantly negative (-0.165 ± 0.056, $p = 0.01$).

Data Analysis Details

Models

Models run using glm and a Poisson distribution because non-normality of count data. Bird data analyzed in two different ways: at the management unit level to compare with vegetation data and at the transect level to compare management treatments. Year included in all models to account for annual variation.

Bird Data

From the two surveys done in each year, I used the maximum number of birds detected at a point. The number of detections per species were then summed for each "Unit" or point "Transect" and divided by the number of points surveyed. All bar graphs report the mean ± 1 standard error. The "Total Bird Detections" category includes 21 species (AMGO, BAIS, BOBO, BHCO, CCLO, CCSP, COGR, EAKI, GRSP, HOLA, KILL, LASP, MAGO, SAVS, SOSP, UPSA, VESP, WEKI, WEME, WILL, YEWA) that were considered upland species and had at least 2 detections across both years. The "Obligate Grassland Bird" category included species that nest in open grassland on the ground (BAIS, BOBO, CCLO, GRSP, HOLA, KILL, MAGO, SAVS, UPSA, VESP, WEME, WILL). The "Short Grass Birds" category included species that nest in very short grass habitats (CCLO, HOLA, MAGO, WILL, UPSA, KILL). The "Brush Dependent Birds" category included species that nest in woody vegetation (AMGO, CCSP, COGR, EAKI, LASP, SOSP, WEKI, YEWA).

Management Categories

We analyzed the bird data and the vegetation data using management categories. For sites that had only been grazed from 2007-2009, we put them in a grazing only category. For sites that had been burned once during 2007 and 2009 we put them in a burn and graze category. We split the burn-graze category into 3 categories that represent: burned 07 and grazed, burned 08 and grazed, and burned 09 and grazed at the management unit level.

Vegetation observations

While the number of transects completed is not statistically adequate it does give us a good picture of the condition of grasslands. The two issues that seem to be the most pervasive and detrimental to the overall condition of the property are the ubiquitous presence of Kentucky bluegrass and higher then desired densities of snowberry.

Vegetation at Davis Ranch was determined to 31% pristine prairie with no signs of introduced species. Grant et al. (2007) had similar findings (15%-30%) on USFWS prairies in northern and central North Dakota. It also appears that Kentucky Bluegrass is a larger part of the Davis Ranch grasslands (50%) then at USFWS properties which ranged from about 10%-35% of the prairie. However the extent of Smooth brome at Davis Ranch (14%) appears to be consistent with USFWS prairies in northern North Dakota and dramatically less then USFWS prairies in central ND and central SD (<40%).

Grant et. al (2007) suggest that historically brush would have made up about 5% of the prairie community. At Davis Ranch 39% of the prairie showed the presence of brush species, most significantly Western snowberry being 34% of the prairie. Grant et. al (2007) determined that USFWS properties in northern and central North Dakota to range from about 15%-25% low shrubs.

These data suggest strongly that invasive grasses are a significant issue at Davis Ranch and left unchecked will degrade the biodiversity of the area. Aggressive management and monitoring of these species will be essential for many years forward.

In response to this data we have a begun a fall burning program which we hope will be more effective at controlling Kentucky bluegrass and Western snowberry. It is thought that fall burning will leave the soil exposed over the winter month encouraging drying soil conditions which will be less favorable to cool season invasives (K. Smith). In addition to burning, strategically timed grazing will seek to further suppress these grasses.

Outreach

TNC staff have conducted outreach describing this project and the information gained to neighbors and agency resource managers. This report will be sent to resource managers near the Davis Ranch area with USFWS, Ducks Unlimited, NDGF, and the Wildlife Conservation Society. TNC also presented preliminary information at the SWG meeting, hosted by NDGF, the winter of 2009-2010. February of 2011, TNC held a meeting with our local grazing tenants to discuss this data and describe how our findings will influence management of the property.

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