Bird Nesting Efforts at Baca National Wildlife Refuge in Dry Meadow and Upland Shrub Habitat Types

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Introduction

In the summer of 2011, U.S. Fish & Wildlife staff conducted research to determine nesting effort and success of passerines across varying habitat types at Baca National Wildlife Refuge (BNWR). Two main habitat types were assessed: dry meadows and upland shrub communities. The most dominant plant in the sampled dry meadows was Baltic rush (*Juncus balticus*). Dominant plants in the sampled sites of the upland shrub communities were rubber rabbitbrush (*Ericameria nauseosa*) and black greasewood (*Sarcobatus vermiculatus*) with an understory containing a variety of native bunchgrasses.

Based on research and observations, it appears that when the plant communities listed above are left idle for several years, they decline in plant production and potential wildlife value. Due to the arid environmental conditions and short hydroperiod on BNWR, decomposition of plant material progresses at an extremely slow rate. This can cause a buildup of decadent plant matter, which appears to inhibit regeneration of herbaceous vegetation. Depending on amounts of precipitation and surface water received, these plant communities need periodic disturbance and reduction of decadent plant matter to remain productive, reduce noxious weed establishment and spread, and maximize wildlife habitat value. Therefore, managers use various techniques to modify these plant communities as necessary. Cattle grazing is a commonly prescribed tool, utilized in both the uplands and meadows. Haying practices are also utilized in the meadows, particularly in those that receive high amounts of irrigated surface water. BNWR managers also have plans to utilize prescribed burning as a management tool in these habitat types, although very little prescribed burning has occurred on the refuge to date.

One of the purposes of BNWR is to manage for native species with an emphasis on migratory birds. Prior to this study, BNWR managers had little information on native passerine nesting efforts on the refuge. In order to guide and potentially improve management efforts on the refuge, basic information regarding the impacts of various management techniques on nesting birds was needed. This study addresses some of those basic needs.

Methods

Survey sites were selected in both the dry meadow and upland shrub habitat types. Three sampling sites were chosen in each habitat type based on differing past management techniques. Each sampling site also had a replicate site in the same habitat type, giving a total of six sampled sites per habitat type. In the dry meadows, sampling sites were located in the following areas: a meadow that was grazed in 2009 (South Sheds #3), a meadow that was hayed in 2010 (Lovcy Breeding Trap), and a meadow that had been left idle for at least six years (North Willow Creek). In the upland shrub communities, sampling sites were located in the following areas: a pasture that was grazed in 2010 (Sheds Camp Pasture), a pasture that had a wildfire in 2007 (Baca #28), and a pasture that had been left idle for at least six years (West Cottonwood Pasture). Within the meadow habitat type, plant species composition was similar; the main factor that varied among sampling sites was past recent management actions that modified the habitat structure and amounts of residual vegetation. There was more variation with the plant species composition among the upland shrub communities. Both the grazed

and wildfire site were dominated by rabbitbrush and bunchgrasses, while the idle site contained more greasewood than the other two sites.

Dry Meadows

Nest dragging surveys in the dry meadows occurred weekly from June 6th through August 3rd, 2011. During one day per week, researchers would visit three dry meadow sites with different management treatments: 2009 grazed, 2010 hayed, and idle. The replicate sites for each treatment were visited in alternate weeks. A total of eight days were spent sampling dry meadow sites in the summer.

Meadow sites were sampled with a ¾ or 1 ½ inch diameter rope with each end attached to the rear hitch of an ATV. The ¾ inch rope was approximately 170 feet long, and the 1 ½ inch rope was approximately 200 feet long. During the surveys, the two ATVs were driven slightly staggered to each other with the rope extended between them and dragging along the ground. Researchers proceeded to drive the ATVs at a speed of approximately 3-4 miles per hour while observing areas immediately around the rope and in front of the ATV. An additional observer was also usually present walking behind the rope while searching areas around the rope for flushing birds. Nests were usually discovered by the ATV or rope causing a disturbance to a nesting adult bird, which compelled the bird to fly off of the nest and indicate the nest's location to observers.

On follow-up visits to nest sites, the structure and cover of vegetation was measured using a Robel pole, marked in 5-cm increments (Robel et al. 1970). Measurements were taken at a distance of ≤ 1 foot of the actual nest, in vegetation conditions that were similar to those at the nest site. These measurements were recorded from a distance of approximately 4 meters, at a height of 1 meter, in the four cardinal directions from the Robel pole, and then averaged to a single value for the site.

Upland shrubs

Nest searching surveys in the uplands occurred weekly from June 7th through July 26th, 2011. During one day per week, researchers would visit three upland shrub sites with different management treatments: 2010 grazed, 2007 wildfire, and idle. The replicate sites for each treatment were visited in alternate weeks. Seven days were spent sampling upland meadow sites in the summer.

Upland shrub sites were sampled by researchers simultaneously walking along parallel transects while spaced approximately 7 feet apart from each other. I estimate that this caused enough disturbance to flush adult nesting birds within a 25-foot range along each transect. The number of researchers walking along each transect was usually three, but occasionally ranged up to five people. The distance between transects and length of transects varied among sites depending on the size of the site. Transects were placed far enough apart to avoid flushing nesting birds on adjacent transects while walking along each transect. As the researchers walked, they visually searched for adult birds flushing from nests due to site disturbance, which often indicated the nest's location. Large shrubs were also visually inspected for nests.

At the end of the growing season (late September/early October), additional vegetation measurements were recorded in the sampled sites across the three management treatments. Random points were generated in the sampled areas using the Hawth's Tools extension in ArcGIS version 9.2. Thirty random locations were visited in each of the three management treatment areas. At each location, a 1 meter X 2 meter quadrat was placed on the ground and the following data was recorded from within the quadrat: percent shrub canopy cover, percent herbaceous vegetation cover, percent bare ground, percent prickly pear cactus cover, average shrub height, average grass height (live and residual combined), and estimated live/dead ratios of herbaceous vegetation. A total of 90 locations were sampled.

All sites

When a nest was located, the stage of the nest was recorded (eggs, chicks, or both), species identification was attempted, eggs and/or chicks were counted, and chicks were aged if possible. Vegetation characteristics around the nest and in the area were also recorded (dominant plant species, average height of shrub/herbaceous vegetation, and estimated live/dead ratio of above ground plant biomass). To determine nest fate, follow-up visits to the nest were usually required (Robel pole measurements were also recorded on follow-up visits in the dry meadows). I attempted to time my follow-up visits to a nest based on the age of the chicks that was initially recorded, and revisit the nest when the chicks were 6-7 days old. With many of the surveyed bird species, when the chicks are at this age, the eyes are open, feather tips are emerging from the sheaths, and the chicks are becoming more likely to fledge. I attempted to visit a nest no later than when chicks were 7 days old to reduce the risk of my disturbance causing the chicks to leave the nests too early. Nest successes were recorded when the chicks reached approximately 6-7 days old, and failures were recorded when the nest did not reach this stage due to abandonment, predation, etc. I was unable to determine nest fate for some nests due to various reasons, e.g. unable to relocate the nest, unable to revisit nest on the appropriate day, etc.

Results

Dry meadows

In the dry meadows, the total area that was sampled repeatedly measured approximately 140 acres. Approximately 44 acres were dragged in the idle unit, 41 acres were dragged in the 2009 grazed unit, and approximately 55 acres were dragged in the hayed unit (Figure 1). Two additional hayed units were initially dragged early in the season, but these sampling sites were later abandoned due to inconsistent vegetative conditions. Dry meadow sites were sampled a total of eight times during the summer.

A total of 36 nests were discovered in the dry meadows. In the idle unit 13 nests were found, 14 nests were located in the 2009 grazed unit, and nine nests were discovered in the 2010 hayed unit. In the dry meadow habitat type, 20 out of 36 nests were successful, or 56% of nests. In the idle unit, seven out of 13 nests (54%) were considered successful, two nests failed (15%), and the fate was unknown for four nests (31%). In the 2009 grazed unit, eight out of 14 nests (57%) were considered successful, five

nests (36%) failed, and the fate of one nest (7%) was unknown. In the 2010 hayed units, five out of nine nests (56%) were considered successful and four nests (44%) failed. Nest in the hayed units were located in both the mowed areas, and the unmowed patches and edges of the unit. Six out of the nine nests (67%) in the hayed units were located in the unhayed portions of the unit and of these, three (50%) were successful and three (50%) failed. Three of the nine nests (33%) in the hayed units were located in the mowed portions of the unit, and of these, two were successful (67%) and one failed (33%).

The overall detected nest density for passerines in the dry meadows was 0.26 nests per acre. The detected nest density in the idle unit was 0.30 nests per acre. The 2009 grazed unit had a detected nest density of 0.34 nests per acre, and the 2010 hayed unit had a detected nest density of 0.16 nests per acre. In addition, the closest nearest neighbor distance between nests in the dry meadow habitat type was approximately 35 meters in the 2009 grazed unit.

Four passerine species were found nesting in the dry meadows, with the vast majority of nests (18 out of 36) belonging to savannah sparrows (*Passerculus sandwichensis*). Additional nesting species found were: western meadowlarks (*Sturnella neglecta*), vesper sparrows (*Pooecetes gramineus*), and horned larks (*Eremophila alpestris*). One nest was of a species that was not positively identified. See Table 1 for number of nests and success rate by species. Out of the species where multiple nests were discovered, savannah sparrows had the highest nest success rate with 12 out of 18 (67%) nests determined to be successful. Western meadowlarks had the lowest nest success rate with 2 out of 8 (25%) nests determined to be successful.

Species diversity was greatest in the idle and grazed units with multiple nests each of Savannah sparrows, vesper sparrows, and western meadowlarks present in these areas. Nesting species diversity was lowest in the hayed unit, with only one species (savannah sparrows) positively identified there.

Robel pole measurements were taken at 30 of the 36 nest sites in the dry meadows. Robel measurements were not acquired at six of the nest sites due to various reasons, such as being unable to relocate the nest, missing the appropriate timing of the measurement, etc. The average Robel reading at the nest sites in the idle unit was 10.8 centimeters (standard deviation = 0.50). In the 2009 grazed unit, the average Robel reading at the nest sites was 10.9 cm (standard deviation = 0.30), and the average reading at the sites in the hayed unit was 6.6 cm (standard deviation = 0.42). A Shapiro-Wilk test was performed on the Robel readings from the three different sampling units to determine if they were normally distributed. Results showed that there were significant differences from a normal distribution at an alpha significance level of 0.05. Therefore, a non-parametric Kruskal-Wallis test was performed to detect differences in the Robel readings at nesting sites among the three different management treatments ($H=5.11$, $df=2$, $P=0.078$).

Upland shrubs

In the upland shrub plant communities, the total area sampled measured approximately 64 acres. Approximately 26 acres were sampled in the idle unit, 24 acres were sampled in the 2010 grazed

unit, and approximately 14 acres were sampled in the 2007 wildfire unit (Figure 1). Upland shrub areas were sampled a total of seven times during the summer.

A total of eight active nests were detected in the upland shrub plant communities. In the idle unit three nests were found, three nests were located in the 2010 grazed unit, and two nests were discovered in the wildfire unit. Three out of the eight nests were successful, or 38% of nests. In the idle unit, one out of three nests (33%) was considered successful, and two nests failed (67%). In the 2010 grazed unit, one out of three nests (33%) was considered successful, and two nests failed (67%). In the 2007 wildfire units, one out of two nests (50%) was considered successful and one nest (50%) failed.

The overall detected active nest density for birds in the upland shrubs was 0.12 nests per acre. The detected nest density in the idle unit was 0.12 nests per acre. The 2010 grazed unit had a detected nest density of 0.13 nests per acre, and the 2007 wildfire unit had a detected nest density of 0.14 nests per acre. In addition, the closest nearest neighbor distance between nests in the upland shrub habitat type was approximately 97 meters in the 2009 grazed unit.

Three bird species were found nesting in the upland shrubs: Brewer's sparrows (*Spizella breweri*), vesper sparrows (*Pooecetes gramineus*), and mourning doves (*Zenaida macroura*). One nest was of a sparrow species that was not positively identified. See Table 2 for number of nests and success rate by species. In the grazed unit, nesting Brewer's sparrows and a vesper sparrow were present. In the wildfire unit, a nesting vesper sparrow and unknown shrub-nesting sparrow was detected. In the idle unit, mourning doves were the only species detected.

Results from the quadrat sampling effort varied across the different management treatments, and these are summarized in Table 3. Sampled areas in the grazed sites had the highest average shrub cover (18.5%), and the wildfire site had the lowest shrub cover (7.1%). Alternatively, the wildfire site had the highest percentage of herbaceous ground cover (85.4%) while the grazed area had the lowest (6.6%). The amount of bare ground was highest in the grazed unit (73.5%) and lowest in the wildfire unit (7.5%). Average shrub height was similar across all sites (1.8-2.0 feet), however a significant amount of the shrubs in the wildfire site were dead (approximately 52%). The average height of herbaceous vegetation was highest in the wildfire site (13.1 inches), and it was lowest in the idle unit (5.2 inches). The average estimated live/dead ratio of herbaceous vegetation was lowest in the idle unit (16/84) and highest in the wildfire unit (44/56).

A Shapiro-Wilk test was performed on the percentage of shrub cover values from the three different sampling units to determine if they were normally distributed. Results showed that there were significant differences from a normal distribution at an alpha significance level of 0.05. Therefore, a non-parametric Kruskal-Wallis test was performed to detect differences in shrub cover in sampled areas among the three different management treatments ($H=16.46$, $df=2$, $P=0.0003$). The above tests were also completed for percent of: herbaceous cover, bare ground, live herbaceous plants, and dead herbaceous plants. Significant differences from normal distributions occurred for all categories. Kruskal-Wallis test results were also significant for all categories, and are as follows: 1) herbaceous cover

(H=56.73, df=2, P<0.0001), 2) bare ground (H=54.7, df=2, P<0.0001), 3) live herbaceous plants (H=29.05, df=2, P<0.0001), and 4) dead herbaceous plants (H=28.95, df=2, P<0.0001). To determine where significant differences occurred among the three sampled areas (grazed, idle, and wildfire), post-hoc Conover comparisons were performed (Stricker 2008). Percent shrub cover did not differ between the idle and grazed units (P>0.05), however the wildfire unit had significantly less shrub cover than both the idle (P<0.01) and grazed units (P<0.001). Percent herbaceous cover significantly differed in all sampled areas (P<0.01). Percent bare ground did not differ between the idle and grazed units (P>0.05), however the wildfire unit had significantly less bare ground than both the idle (P<0.001) and grazed units (P<0.001). The ratio of live/dead vegetation did not differ between the grazed and wildfire units (P>0.05), however the idle unit had significantly less live and more dead herbaceous vegetation than both the grazed (P<0.001) and wildfire units (P<0.001).

Conclusion

Dry meadows

Approximately the same amount of time was spent nest dragging in each management unit. However, acreage of sampled areas varied across management units, with the most acres sampled in the hayed unit. We were able to sample more acres in the hayed unit probably because fewer nests were detected in this area, resulting in less time searching for nests, and a quicker overall discovery time for actual nests, which then resulted in more time available for nest dragging at this site.

Detected nest densities were notably higher in the idle and 2009 grazed units than in the hayed unit. These results suggest that the idle and grazed units provided more suitable nesting habitat than the hayed unit. One obvious difference in the vegetation conditions among these units is that the idle and grazed units had considerably more residual vegetation present than in the hayed unit. Moderate to high amounts of residual vegetation can offer important structure and cover to nesting birds, which can also provide the nests with added protection from predators. The idle and grazed units had abundant amounts of residual vegetation throughout most of their acreage, whereas the hayed unit only contained this feature in small patches or on the edges of the unit. It appeared that in the hayed unit, birds selected for nest sites with abundant amounts of residual vegetation: six of the nine detected nests in this unit were located in the unmowed edges and patches of the unit. In addition, one of the three nests in the mowed area was located in a small pile (<2 feet diameter) of residual vegetation left behind by the mower.

It is difficult to know whether the detected nest densities were representative of the actual nest densities. I speculate that the detected nest densities were lower than the actual densities in the grazed and idle units, while they were likely fairly accurate estimates in the hayed unit. This conclusion relates to the amounts of residual vegetation present in the sampled areas. Higher amounts of residual vegetation in the idle and grazed units made nest searching more difficult after a bird flushed off of the nest. Therefore, it is probable that we did not detect 100% of the nests in those units. However, after birds flushed off the nests in the hayed unit, the relative lack of residual vegetation made nest discovery

relatively easy. It is likely that we detected approximately 100% of the actual active nests in the hayed unit versus the other two units.

One noticeable feature in the grazed unit that was mostly absent in both the idle and hayed units was the patchy presence of wild iris (*Iris missouriensis*) throughout the sampled area. In this management unit it appeared that birds were selecting for nest sites located in iris patches. Ten out of the 14 nests discovered in this unit were located directly in iris patches. I speculate that at sites where iris plants were dominant, a specific type of plant structure was provided that the birds may have favored over other types of native herbaceous vegetation that were present.

The detected nest success rate was similar among all management units. However, because the fates of some nests were recorded as unknown, there were notable differences in detected nest failure rates across the management units. The detected nest failure rate was highest in the hayed units (44%). This suggests that factors such as nest abandonment or predation may occur more frequently in hayed units than in grazed or idle units. I speculate that in the hayed unit, this could have a positive association with a relative lack of residual vegetation and more edge effects, which may result in a higher predation risk for nests in these areas. Results also showed that the hayed unit provided the lowest amount of nesting species diversity, with savannah sparrows being the only identified species nesting at that site.

Western meadowlarks had the lowest nest success rate among nesting passerine species (25%). I believe that this was at least partly due to researcher disturbance during nest dragging. Compared to the other passerines, the meadowlarks appeared to be physically more sensitive to the disturbance caused by the rope passing over the nest. In other words, often times, when the rope passed over this species, the rope would knock the bird over before the individual had a chance to escape. This could have contributed to higher nest abandonment rates. Overall, this species seemed to be most sensitive to nest dragging, perhaps due to its larger body size.

Robel pole readings differed at nests across the three management units. Although the results of the Kruskal-Wallis test were not significant at an alpha level of 0.05, the results did approach statistical significance (P=0.078) and they likely do have biological significance. The average Robel pole readings at nests in the idle and grazed units were very similar (10.8 and 10.9, respectively). The Robel pole readings at nests in the hayed units were considerably less, with an average reading of 6.6 cm. Because the majority of the nests were found in the idle and grazed units (27 of the 36), these results support earlier conclusions that the higher values of vegetation structure and cover (both live and residual) in these units may provide more suitable nesting habitat for passerines than in the hayed units. It appears that the ground nesting passerines generally selected for those sites with higher amounts of residual vegetation.

Future research efforts should attempt to replicate the data collection efforts from this study. The sampling efforts should continue to be applied across different types of management treatments, and also extended into the wet meadow habitat type. Improvements in data collection would be made

if the use of one rope was consistently implemented during nest dragging (instead of two). Ideal rope thickness would likely be 1 – 1 ¼", and appropriate rope length should not exceed approximately 170 feet. If nest dragging with ATVs is applied in the wet meadow habitat type, one should expect that the tracks from the vehicles could compact the vegetation and soil in certain areas. These areas may take several growing seasons to recover from this repeated disturbance. Future research efforts should also attempt to collect additional vegetation measurements such as species composition and frequency.

Upland shrubs

Results from the upland shrub habitat type are more difficult to interpret due to the low sample size of detected nests. Management implications from this research are limited, but the results raise concerns and issues for future research.

The amounts of time spent nest searching in each management unit varied. Correspondingly, acreage of sampled areas and total length of transects also varied across management units, with the least acres sampled in the wildfire unit. Among the three management units, the wildfire site was the smallest, and the amount of sampled acreage (and total length of the transects) in this site directly corresponded to the small overall size of the site. Due to the small size of the wildfire site, transects were shorter and spaced closer together than the other two sites. Total distance of transects in the wildfire site was approximately 2.1 miles, compared with 4 miles at the grazed site and 4.4 miles at the idle site. It is a reasonable notion to expect that if the size of the wildfire site was larger, and the sampling effort was correspondingly broader, that more nests would likely have also been discovered. Detected nest densities were fairly similar across all upland shrub sites.

Due to the low sample size of nests, the varying nest success rates across the different sites have limited management implications. A higher nest sample size is needed in future studies to be able interpret results of nest success rates. Three species were detected with active nests in the upland shrub habitat type. Although nest sample size was low per species, I can conclude that it is likely that we detected the most common nesting species in this habitat type. In other words, it is unlikely that we detected those species whose presences are rare in this habitat type. It is realistic to expect that Brewer's sparrows, vesper sparrows, and mourning doves are relatively common nesting species in the upland shrub areas on Baca NWR.

It is difficult to know whether the detected nest densities were representative of the actual nest densities. I speculate that the detected nest densities were lower than the actual densities in all of the sampled areas in the upland shrub habitat type. It is likely that some birds flushed after the researchers passed the nests, which resulted in those nests going undetected. It is also likely that some birds flushed from a further distance than expected, potentially resulting in additional undetected nests.

It is difficult to make associations between the quadrat vegetation sampling results and bird nesting efforts across the various sampling sites. However, one interesting occurrence was the discovery of a vesper sparrow nest in the grazed unit. Vesper sparrows typically nest in grasslands, and the measured percentage of grass cover in the unit where the nest was located averaged only 6.6%.

Grass coverage was very sparse and patchy in the grazed unit, so even though this habitat can apparently be suitable for this species, it is likely marginal at best.

One species was detected in the idle unit (mourning dove), and this species was discovered in neither of the other units. The idle unit had the lowest detected nesting species diversity. When comparing species diversity among sites, a larger sample size would have been useful, however I speculate that the wildfire site holds the most potential for providing for species diversity. The wildfire site had a few scattered live shrubs throughout the site that would be appropriate sites for shrub-nesters (like Brewer's sparrows). The grass cover of the wildfire site also was much more abundant and well-distributed than the other sites, which would provide a suitable habitat for grassland-nesters (like vesper sparrows). In addition, small patches of bare soil were also present, which could provide appropriate nesting sites for other species such as mourning doves and horned larks. When comparing the results from all three sites, upland shrub habitat that has moderate amounts of shrubs, herbaceous vegetation, and bare soil would likely be the most valuable for promoting nesting species diversity.

Significant differences occurred in all vegetation categories among the sampled units. Notable differences among the units include: 1) the wildfire unit had the least amount of shrub cover, 2) herbaceous vegetation cover was highest in the wildfire unit and lowest in the grazed unit, 3) the wildfire unit had the least amount of bare ground, and 4) the ratio of live/dead vegetation was the lowest in the idle unit. These results illustrate that the upland sites had distinct differences from each other, and we could thus expect differences in bird nesting efforts. Therefore, some upland sites may be more suited to certain nesting species while other sites that may appear to be similar, actually have distinct differences that could be more suited to different species. Vegetation measurements provide valuable information on the habitat structure and productivity of these areas.

The vegetation measurements provide important information for the future management of these units. It appears that using prescribed fire for management in the upland shrub habitat would be effective at both reducing shrub cover and potentially increasing herbaceous vegetation cover. Since the grazed unit had the lowest amount of herbaceous vegetation cover, a few consecutive, idle growing seasons would likely be beneficial for this area. The ratio of live/dead herbaceous vegetation in the idle unit could likely be increased through disturbances caused by grazing and/or prescribed fire, and would likely be beneficial to the vegetation in the idle unit. These disturbances would reduce the residual, decadent vegetation that can act to suppress regeneration of grasses. As a result, it would be expected that the grasses would respond to disturbances with higher amounts of new growth, and potentially, their abundance and distribution could also increase. In addition, in these areas, this would result in reduced soil erosion, and potentially also increase the moisture-holding capacity of the soil.

Future research efforts should attempt to utilize more personnel to sample more acreage. In addition, it is possible that the nesting birds in the upland shrub habitat type flushed from their nests at a greater distance than expected. Therefore future researchers may consider expanding their field of vision further out to potentially detect nests from further away. The field of vision for researchers in this sampling season was approximately 30-35 feet forward and to the sides. It may be useful to extend

that field out another 25-30 feet. In addition, if nests went undetected because birds flushed from nests behind the researchers (after the researchers passed by), future methods should consider using a staggered pattern as the researchers walk, instead of staying parallel to each other.

All sites

One important factor that likely influenced the results of this study is that 2011 was a drought year with very little precipitation, minimal surface water spread, and minimal soil moisture retention levels. This lack of water likely inhibited plant productivity, which potentially could have negatively affected food sources for nesting birds, which may have had influences on the birds' reproductive capabilities. When comparing these results with results from future studies, these factors should be considered.

Table 1 – Dry Meadows

Species	Number of Nests Detected	Nest Success Rate
Horned Lark	1	100%
Savannah Sparrow	18	67%*
Vesper Sparrow	4	50%*
Western Meadowlark	8	25%*
Unidentified Sparrow	5	40%*
Total: Four Identified Species	Total: 36	Average success rate: 56%

* Success rates marked with an asterisk indicate that the fate was unknown for at least one of the detected nests. When the fate was unknown, it was not recorded as making a positive contribution to the success rate, so those success rates represent the minimum rate that was detected.

Table 2 – Upland Shrubs

Species	Number of Nests Detected	Nest Success Rate
Brewer's Sparrow	2	0%
Vesper Sparrow	2	50%*
Mourning Dove	3	33%
Unidentified Sparrow	1	100%
Total: Three Identified Species	Total: 8	Average success rate: 38%

* Success rates marked with an asterisk indicate that the fate was unknown for at least one of the detected nests. When the fate was unknown, it was not recorded as making a positive contribution to the success rate, so those success rates represent the minimum rate that was detected.

Table 3 – Averages from quadrat vegetation sampling in the upland shrub plant communities (standard deviations reported in parentheses)

	% shrub	% herb	% bare	% cactus	Approx. shrub ht. (ft)	% shrubs dead	Approx. herb ht. (in)	% live herb	% dead herb
Idle	14.4 (15.1)	13.4 (16.6)	70.0 (19.3)	2.5 (2.9)	1.8 (0.7)	10	5.2 (1.9)	15.9 (17.5)	84.1 (17.5)
Grazed	18.5 (13.6)	6.6 (5.2)	73.5 (16.0)	1.5 (3.8)	2.0 (0.5)	0	6.1 (3.0)	37.7 (17.3)	62.7 (17.4)
Wildfire	7.1 (10.6)	85.4 (19.4)	7.5 (11.4)	0.0 (0.0)	2.0 (0.6)	52	13.1 (3.3)	44.3 (14.4)	55.7 (14.4)

Figure 1 – Nest Sampling Areas (repeatedly sampled throughout the summer)

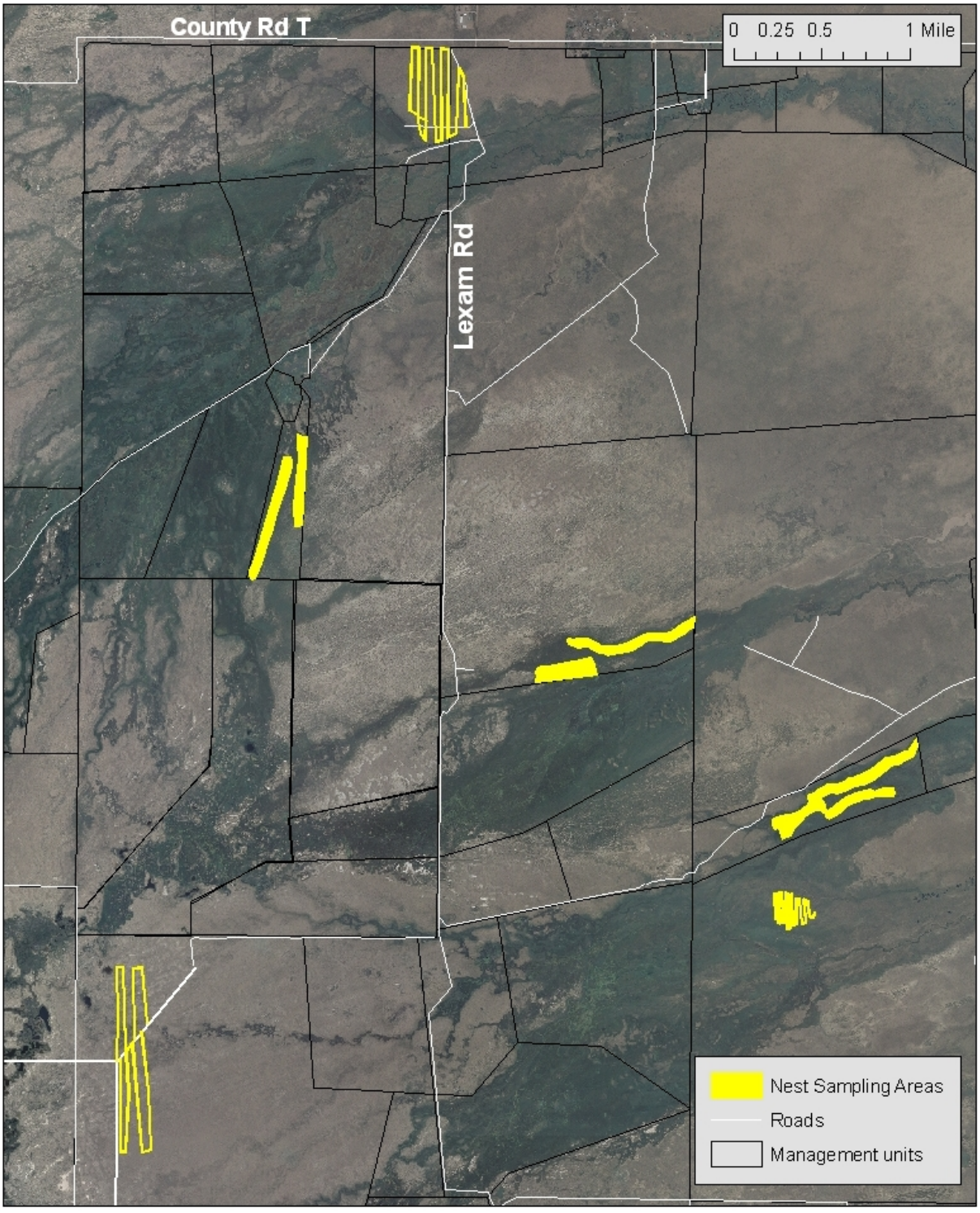
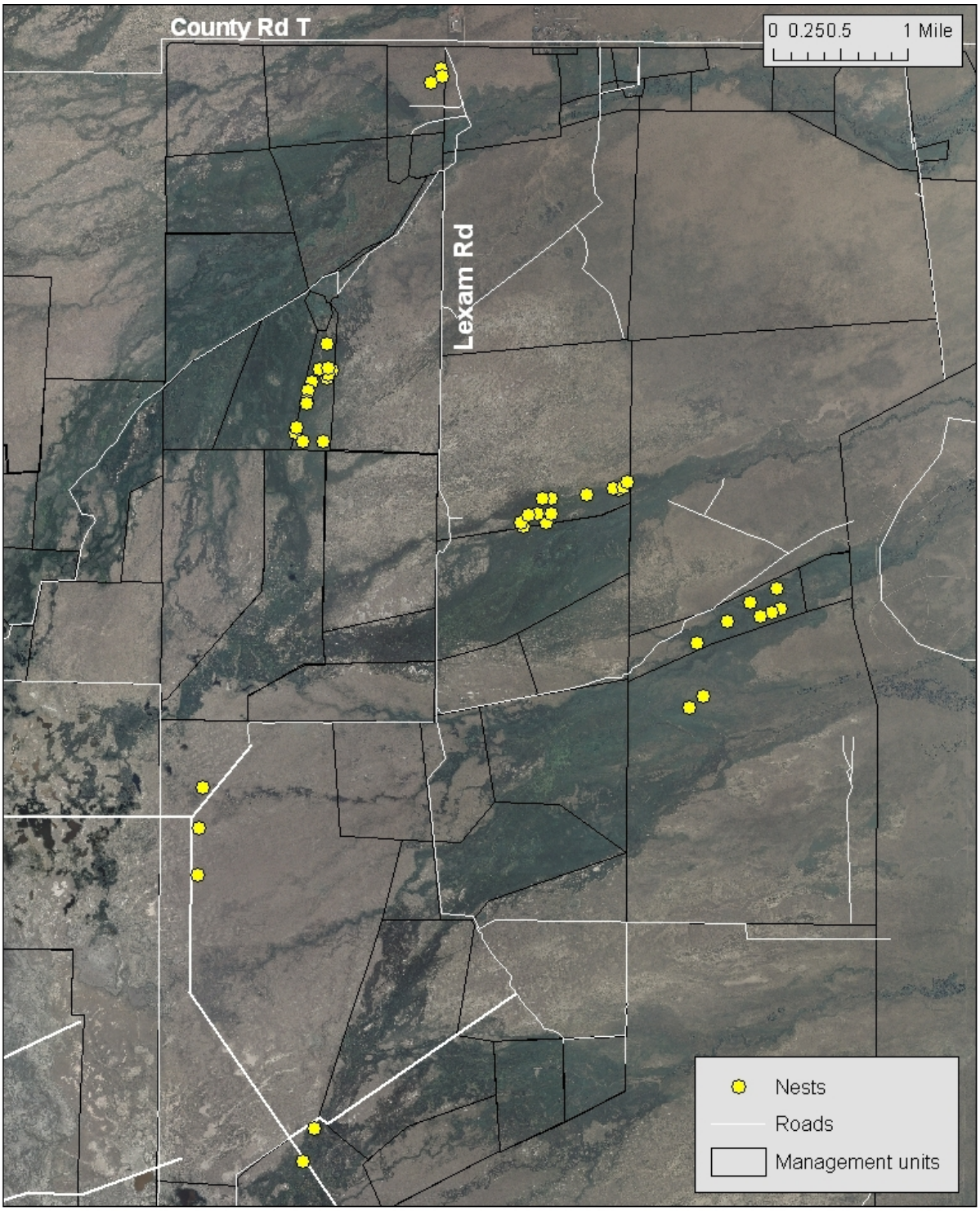


Figure 2 – Nest Locations



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