THE EFFECTS OF TEBUTHURION ON SHRUB STEPPE ECOLOGY AND GREATER SAGE GROUSE USE IN LOWER HAMLIN VALLEY, UTAH

Annual Report 2007

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Introduction

Greater-sage grouse are large gallinaceous birds that inhabit large expanses of sagebrush rangeland in western North America (Schroeder et al. 2004). Populations of Greater-sage grouse have been declining throughout much of its historical range for the last half century (Connelly and Braun 1997). Numerous studies have been published on the status of the Greater-sage grouse and the reasons for its decline. Declines have been attributed to loss or alteration of quality sagebrush habitats (Artemesia spp.) to which it is dependent upon (Braun et al. 1977, Connelly and Braun 1997, Braun 1998). Sagebrush is important for nesting sage grouse as a source of food and cover (Connelly et al. 2000). Furthermore, an herbaceous understory within sagebrush habitat and a diverse invertebrate component is important for breeding and brood rearing habitat (Klebenow 1968, Connelly et al. 2000). In Utah, breeding sage grouse populations saw a 37% decline from 1985-1994 (Connelly and Braun 1997), and the Utah Division of Wildlife Resources estimates over a 50% decline since historical times (UDWR 1997). Braun (1998) estimated that 10.6% of all sage grouse occur in Utah and the UDWR estimates that over 50% percent of the population occurs on private or state land (UDWR 2002). In Utah, much of the remaining sagebrush range is late-successional stage and lacks a significant herbaceous understory due to settlements, fire suppression, over grazing and invasion of annual grasses (Beck and Mitchell 2003).

Due to its decline the Greater-sage grouse has been considered for federal listing under the Endangered Species Act. In response, numerous management regimes to improve sage grouse habitat have been employed throughout its range. One typical strategy is using chemical treatments to thin or kill late successional sagebrush rangeland. A common herbicide used to control sagebrush is tebuthiuron or Spike 20P (Halstvedt 1994.Dow Elanco Co., Indianapolis, IN). When used at low application rates tebuthiuron has been shown to create a more suitable habitat for sage grouse by opening up the shrub canopy and allowing more grass and forb communities to grow (Olsen and Whitson 2002). By controlling the amount of chemical applied, managers can selectively kill off a desired percentage of the shrub component to better meet guidelines for sage grouse habitat requirements. With much of the remaining sage grouse habitat in Utah being located on private land, landowners have been encouraged to transform sagebrush habitats that are otherwise degraded to more suitable sage-grouse habitat. In many cases landowners not only provide adequate sage grouse habitat but increase forage for livestock as a result of sagebrush manipulation (Olsen et al. 1994).

Study Objectives

The objectives of this study are:

1) Assess ecological conditions such as vegetation composition and avian populations.
2) To see if chemical treatments increase Greater sage-grouse use in lower Hamlin Valley.

Study Area

This study was conducted on private property (S&W Hall Co. Inc.) in lower Hamlin Valley, a sagebrush (A. *tridentada*) dominated plateau approximately 17km north of Modena in Iron County, Utah. The plateau is approximately 2000-2200m elevation and is fed by drainages originating from the Snake Range in Eastern Nevada. The study area in lower Hamlin Valley is typically big sagebrush dominated rangeland surrounded by a Pinion-Juniper forest. Cattle ranching, water developments, and road ways are sources of disturbance in Hamlin Valley. Specifically, the treatment plot is located in Section 2 of township 33 south and range 19 west.

The climate in and around the study area region is semiarid cold desert. The average annual precipitation ranges from 8 to 12 inches. The mean annual air temperature is 47 - 54 F., mean summer temperature is 66 -73 F., and the freeze-free period ranges from 115 to 145 days.

The treatment area was chemically treated in Nov. 2006 by aerial application of herbicide pellets. A total 492 acres of the 640 acre section were treated with tebuthiuron at a rate of 2 pounds of 20% tebuthiuron (Spike 20P) per acre resulting in an active chemical yield of 0.4 lbs. per acre. Of the area treated a 75-80% kill rate was desired based on the specific rate of application fore mentioned. The study area is situated in known sage grouse brood rearing habitat (UDWR 2002).

Methods

Vegetation Surveys

To determine the affect of tebuthiuron on the sagebrush steppe vegetative community we conducted comparative surveys of vegetation composition. As a control area we selected a similar size of habitat no less than 6 km from the treatment area. This area was selected due to similarities in elevation, moisture, soil, and vegetative community. Within both the control and treatment areas, we randomly assigned 10 permanent points. Each point acts as the origin of a 30 meter transect resulting in 300 meters of transect line per study area. Transect points were randomized using a stratified design to create a spacing of at least 250 meters between each transect point.

Vegetation sampling efforts were conducted in April/May of 2007, and shall be repeated each year. We used the line intercept method (Canfield 1941) to measure canopy cover and average shrub height along each transect. We used the Daubenmire technique (Daubenmire 1959) to measure overall herbaceous cover as well as overall vegetative composition and frequency. In addition to the aforementioned methods to sample vegetation, photos were taken at the origin of each transect at “eye level” at a zero degree bearing (facing north). Photos will be taken annually during vegetation surveys to visually document the changes in vegetation before and after treatments.

Vegetation Composition

To measure changes in the vegetation community we conducted quadrat sampling using the Daubenmire technique. For this sampling we used a 1m Daubenmire-type frame. This frame was placed at 5m intervals along each 30 meter transect, resulting in 5 1x1m Daubenmire

samples per transect and 50 1x1m samples per study plot. For each sample we identified the percentage of cover for each vegetation type (i.e. Shrub, Forb Grass) within the quadrat as well as the percentage of bare ground, rock and litter.

Shrub Canopy Cover

To measure changes in shrub canopy cover and average shrub height we conducted vegetation sampling using the line-intercept technique. For this sampling technique we stretched a measuring tape along the length of each transect and recorded the amount of shrub that intersects the transect line. The total amounts of shrub intersecting the line was tallied and divided by the total length of each transect to yield a percentage of total canopy cover. Spaces between foliage that exceed 5cm were excluded to maintain an accurate estimate of total live shrub coverage. To measure average shrub height the tallest part of each live shrub occurring along the transect line was recorded using a meter stick and averaged for each transect.

Sage Grouse Use Surveys

We estimated sage-grouse use using pellets count surveys (regular or cecal) and bird-dog surveys. Pellet counts were conducted in the late spring/early summer. To conduct pellet counts we randomly selected a starting transect to survey. For each transect we delineated a 30 x 30 meter square aligned with the cardinal directions. The southwest corner of the square was the original random point. Within the boundaries of this transect square we searched for fecal sign of sage-grouse for 15-20 minutes. When fecal sign was discovered, we recorded type, distance from the nearest habitat edge (i.e. living sagebrush or obvious vegetative cover). The distance from the nearest habitat edge might be outside the transect plot. We then removed this fecal sign from the transect plot to avoid double-counting. This process was repeated for each of the remaining transects in the treatment and control areas.

Bird-dog surveys may be implemented in late spring of each study year, beginning 2008, to estimate grouse populations in the treated and control areas. For each study area (treated and control) bird-dogs and their handlers will walk through the habitat for 1 hour each. The area will "walked" in such a way that the entire area will be represented in the search. There will be a ½ hour rest period between searching the treated and control areas. When a sage-grouse is flushed we will recorded the number of birds counted, the sex and age of birds counted, their GPS location at the point of flushing, distance from transect plot, habitat/cover type.

Avian Point Count Surveys

To sample the differences in local avian populations between the treatment and control plots, we conducted "partners-in-flight" point count surveys at each random point. Sampling was conducted in late spring/early summer, to be repeated each year of the study, to coincide with the breeding season of summer resident birds. Before sampling, we became familiarized with the exact location of the 10 points in each plot using GPS units. At each point we stood and scanned a 360 degree area recording all visual and auditory detections within a 9 minute observation period. Non-avian species detected during the survey were noted as well as temperature, wind speed, and cloud cover for each plot. Individual species were recorded and detections were

classified as visual (V), auditory (A), or both (B). Surveys were conducted between sunrise and conclude before 10:30 am to coincide with optimal activity and breeding song hours. The 9 minute observation time were divided into 3 separate time periods. Detections were recorded in their respective time of observation (e.g. 0-3 min, 3-6 min, and 6-9 min). Before starting each observation period, we incorporated a 2 minute wait period at each point to become acclimated to the surroundings. Control and treatment areas were surveyed within a week's time to insure adequate time to complete each plot while maintaining similar climate conditions for both counts. Before sampling began, we chose an intuitive route of travel to each remaining point in order to complete the survey in an efficient manner.

Preliminary Results

Objective 1. Ecological Monitoring (Vegetation)

Vegetation Surveys

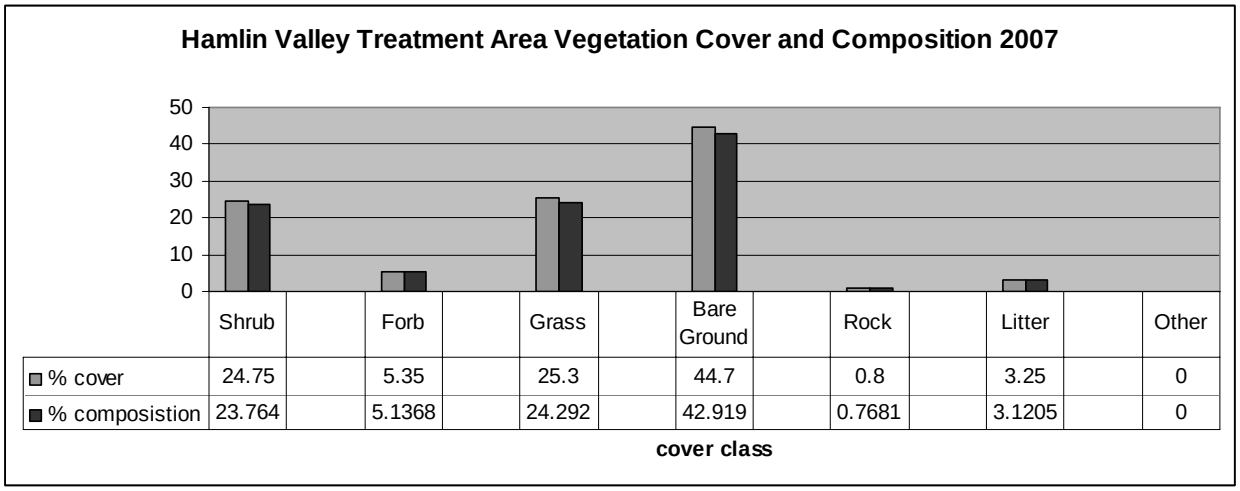
Shrub Canopy Cover

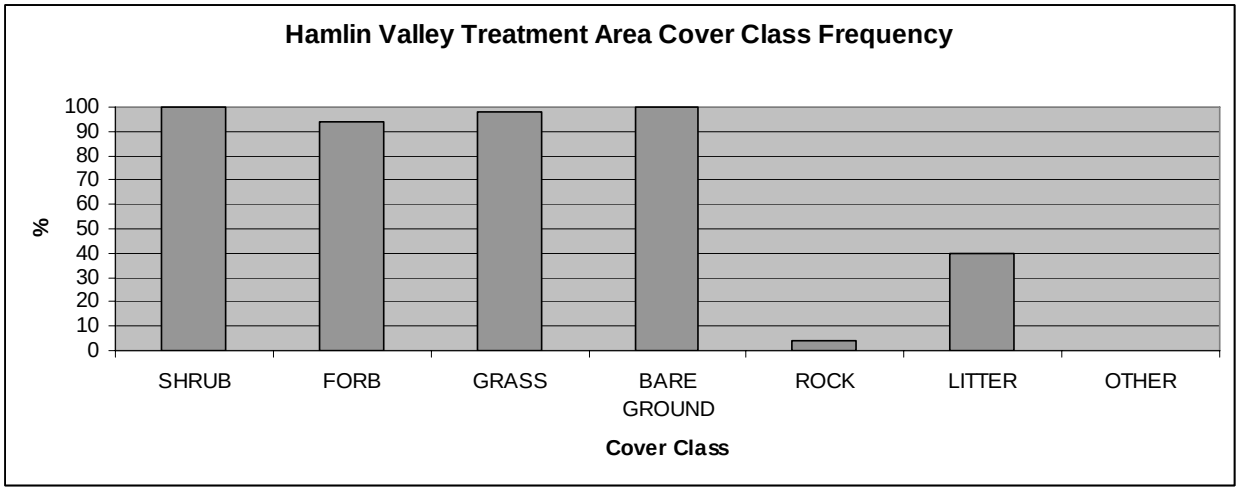
Line intercept measurements were recorded in May and June of 2007. The herbicide was applied to the treatment area in November 2006, so technically the data recorded is not pre-treatment. However, the herbicide does not take affect immediately after application. There is a lag time before shrubs start dying that is largely dependent on weather and precipitation in the area. Vegetation measurements were recorded on the Hamlin treatment plot in mid-May 2007 and the effects of the herbicide were not yet evident except in a few limited areas where sagebrush was just starting to die. In the Hamlin Valley treatment area overall shrub canopy cover was 16.68% and was comprised of two shrub species, Wyoming sagebrush (*Atremesia tridentata wyo.)* and Douglas rabbitbrush (*Chrysothamnus viscidiflorus*). Wyoming sagebrush was the dominant shrub with over 90% composition and rabbitbrush with 9.9% composition. Average shrub height in the Hamlin Valley treatment area was 40.62 cm. In the Hamlin Valley control area shrub canopy cover was 12.95% and was also comprised of Wyoming sagebrush and Douglas rabbitbrush. Wyoming sagebrush was dominant with a 95.58% composition and rabbitbrush had a composition of 4.43%. The average shrub height in the Hamlin Valley control plot was 42 cm.

Vegetation Composition

Data from Daubenmire frame plots were recorded in conjunction with line intercept surveys. For Daubenmire surveys we analyzed percent canopy cover, percent composition, and cover frequency for the following categories and/or cover classes: Shrub, Forb, Grass, Bare Ground, Rock, Litter, and Other. It is of importance to note that the "rock" category was methodologically different than the traditional Daubenmire technique in that we only recorded rocks that were large boulders (>20cm) or bedrock. Small pebbles and medium stones were categorized as bare ground. Percent canopy cover was calculated by estimating the total cover for each cover class within the frames. Percent cover can total over 100% because it was a measurement of foliar cover as it projects to the ground on a vertical plane. Therefore, the different levels of the canopy are separately assessed, this accounts for overlap in cover types.

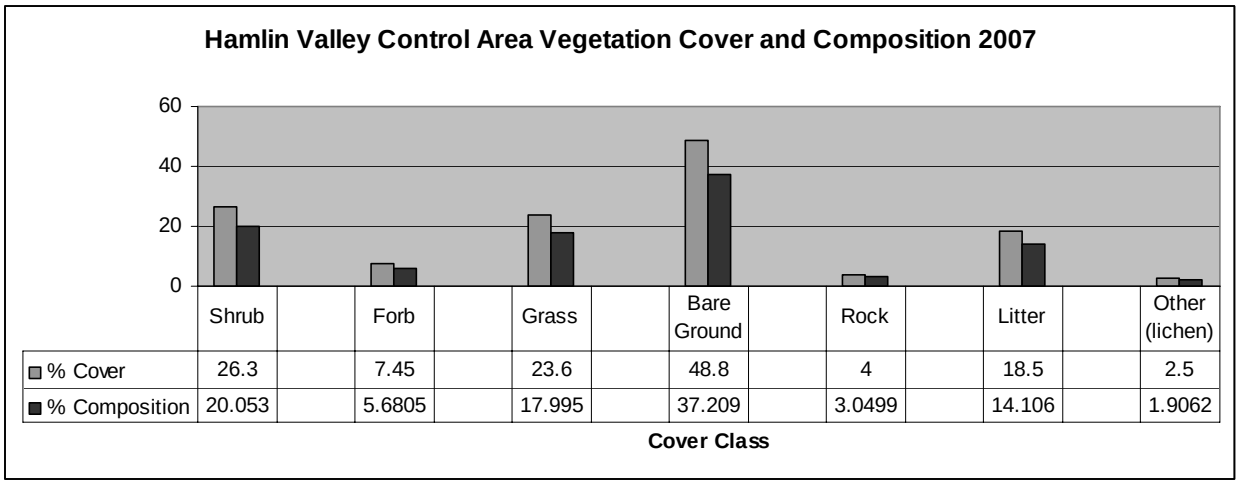
Percent composition was simply the percent of each cover class divided by the overall cover for all cover classes. The following is a summary of the Hamlin Valley treatment area vegetation cover, composition, and frequency:

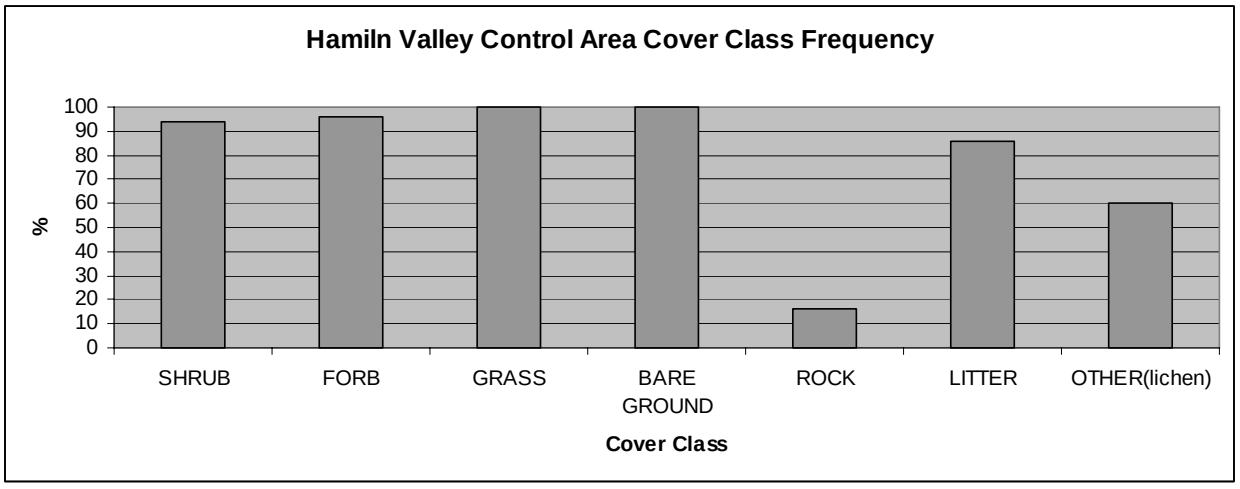




Of the vegetation cover classes (e.g. Shrub, Forb, Grass) in the Hamlin Treatment area, Grass exhibited the highest cover and composition. The grass species most abundant were Needle-and-Thread (*Stipa comata*) and Blue Grama (*Bouteloua gracilis*). Cheatgrass (*Bromus tectorum*) was present throughout the treatment area but not in large quantities. Grass was present in 49 of the 50 Daubenmire quads for a frequency of 98%. Shrubs exhibited a similar percent cover and composition to the grass but with a 100% frequency rate. Forbs were wide spread in the treatment area (94% frequency) but in limited numbers with a little over 5% cover and composition. Common forbs in the treatment area include: Buckwheats (*Eriogonum spp.),* Rose Heath (*Chaetopappa ericoides*), Locoweed (*Astragalus spp*.), Phlox (*Phlox and Microsteris spp.*) and, Globemallow (*Sphaeralcea spp.*) In the treatment area bare ground was present with a high cover and composition percent but this was typical for a dry shrub steppe community. Large rocks were mostly absent throughout the treatment area, however the soil was quite gravelly. Litter in the treatment area was surprisingly low with a 40% frequency rate and around a 3% cover and composition percentage. In the Hamlin Valley control area vegetation results were quite similar to the treatment area with the exception of a lower grass percentage and a higher litter percentage. Also, a type of ground lichen (*xanthoparmelia spp.*) was present on the control

site which was not recorded in the treatment area, this lichen was recorded as "Other" for cover class. Cheatgrass was virtual absent from the control site, the major grasses were Blue Grama, Needle-and-Thread, and Squirreltail (*Sitanion histrix*). The following is a summary of the Hamlin Valley control area vegetation cover, composition, and frequency:





Objective 2. Habitat Use

Sage Grouse Use Surveys

In the Hamlin Valley treatment area we only found one cluster of cecal and fecal pellets during sage-grouse pellet searches. It was very old and less than a meter from the nearest cover (sagebrush). In the control site a total of eight clusters were found in one location. Of the eight clusters, three were cecal and five were both fecal and cecal. Coordinates for all clusters found were recorded in UTM NAD83 and removed from the transect square to avoid future double counting. Bird dog surveys are scheduled for the second year of the study and will take place in spring 2008 pending availability of dogs and handlers.

Objective 1. Ecological Monitoring (Avian)

Avian Point Counts

Avian point counts were completed at 10 points in the Hamlin Valley treatment and control sites in 2007. At this time data analysis is restricted to only one year's data and more robust statistical analysis are planned once future counts are completed. At this time we can only present count data in a descriptive fashion. Interestingly, the difference in numbers of birds detected and the diversity of bird species varied greatly between the treatment and control site. The treatment area had 57 detections and 13 species recorded to the control area's 14 detections and 7 species. These differences are likely due to geographic features of each area and time of year. The treatment site is close to water and is surrounded on the southern end by Juniper and Pinion Pine. Whereas the control site is more isolated and lacks water or trees. Also, the timing of the counts was quite late in the year and many birds may have ceased singing mating songs. The following is a summary of point count detections for each site:

Hamlin Valley Treatment Area Point Count Results 6/20/07

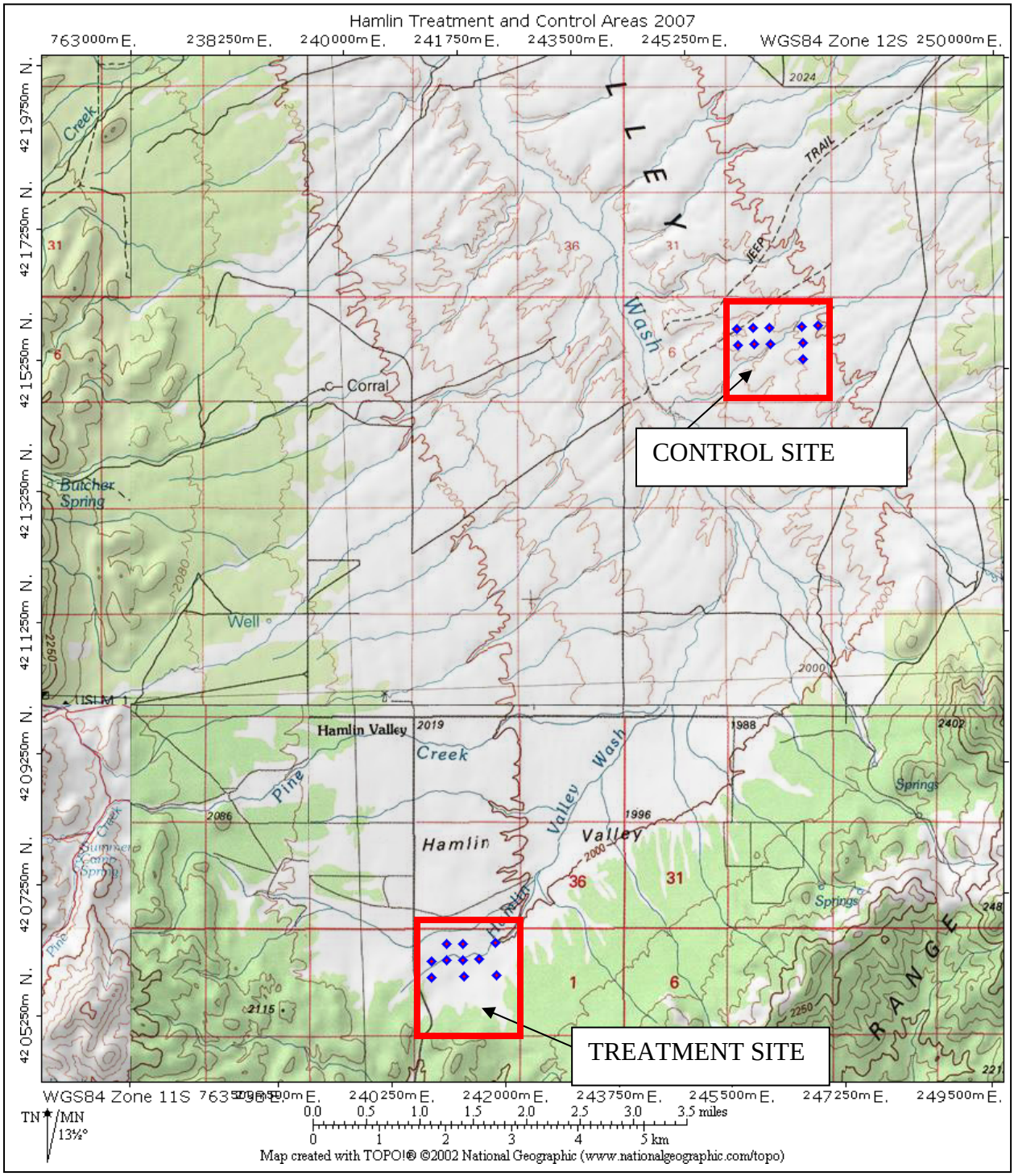
	DETECTION TYPE				
Species	**audio**	**visual**	**both**	**total**	**%**
Vesper Sparrow	8	4	5	**17**	29.82456
Horned Lark			11	**11**	19.29825
Western Meadowlark	6	4	1	**11**	19.29825
Pinyon Jay	3		1	**4**	7.017544
Brewer's Sparrow	1	2		**3**	5.263158
Common Raven	1		1	**2**	3.508772
Mourning Dove	2			**2**	3.508772
Black-Throated Sparrow			2	**2**	3.508772
Northern Harrier		1		**1**	1.754386
Northern Flicker	1			**1**	1.754386
Mountain Bluebird			1	**1**	1.754386
Ash-Throated Flycatcher			1	**1**	1.754386
American Kestrel			1	**1**	1.754386
total	**22**	**11**	**24**	**57**	100
%	38.5964912	19.29825	42.10526	100	

Hamlin Valley Control Area Point Count Results 6/28/07

	DETECTION TYPE				
Species	**audio**	**visual**	**both**	**total**	%
Horned Lark	1	2		**3**	21.42857
Vesper Sparrow	1	2		**3**	21.42857
Sage Sparrow	1	2		**3**	21.42857
Common Raven	2			**2**	14.28571
Common Nighthawk		1		**1**	7.142857
Sage Thrasher			1	**1**	7.142857
American Kestrel		1		**1**	7.142857
total	**5**	**8**	**1**	**14**	100
%	35.7142857	57.14286	7.142857	100	

2008 Plan of Work

Next year field work will resume and we will attempt to replicate what was accomplished in 2007. The only change will be the addition of bird dog surveys to further assess sage-grouse use in Hamlin Valley. Vegetation work will be of great importance as the Tebuthiuron has now taken affect and the plant community will exhibit measurable differences from this year's measurements.



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