Impact of ponderosa pine thinning on Abert's squirrel (*Scuirus aberti*) populations on Heil Valley Ranch

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ABSTRACT:

This study continues monitoring of Abert's squirrel (*Sciurus aberti*) populations in thinned and unthinned stands of ponderosa pine on Heil Valley Ranch. In 2008, twenty-seven 4-hectare (200mx200m) monitoring plots (8 in thinned stands, 19 in unthinned stands) were sampled for incidence of Abert's squirrel over-wintering feeding activity and general vegetation characteristics important to their populations. In 2009, we repeated sampling in the 27 plots and added five additional plots, two in an area scheduled to be chipped and three as additional controls. Abert's squirrel density for each monitoring plot was estimated using a recognized feeding sign index regression model, similar to 2008. In 2008, feeding sign was found on all but 2 of our 27 monitoring plots with no difference in squirrel density between thinned and unthinned stands. In marked contrast, feeding sign was much lower in 2009, with 13 out of 32 plots showing no feeding sign. Regressions of canopy cover with squirrel density showed no relation. Regression of ponderosa pine dbh and squirrel density also showed no statistical relation. This most important finding from 2009 was an overall decrease in the abundance of squirrels throughout Heil Valley Ranch. The cause of the decrease was not investigated in this study, though future work should focus on maintaining squirrel populations and determining cause for decline.

INTRODUCTION:

During May and June of 2008, we surveyed Heil Valley Ranch for Abert's squirrel (*Sciurus aberti*) activity by looking for feeding sign. We surveyed 27 4-hectare (200 m x 200m) plots, and Abert's squirrel feeding sign was found in 25 of the plots. We found no activity in previously burned plots, though there is some evidence in the literature that burning is a good restoration technique for maintaining mixed age stands of ponderosa pine. There was no difference in squirrel density between thinned versus unthinned forest plots. The previously published literature suggests that squirrels prefer mixed age stands, but we did not find this result at Heil Valley. For the 2009 field season, we started earlier in the spring (April 25, 2009), and we surveyed five additional plots, for a total of 32 plots. Here we report the findings from the 2009 field season.

The literature surrounding Abert's squirrel has not substantially changed since last field season, so the literature review that follows is similar to last year's report. Abert's squirrel (*Sciurus aberti*) is considered a Management Indicator Species (MIS) by the US Forest Service with the potential to be used as an indicator of the effects of various management practices (Keith 2003). Generally assumed to be ecologically dependent on southwestern ponderosa pine forests for food, cover, and nest sites (Nash and Seaman

1977; Keith 2003; but see Edelman and Koprowski 2005), their presence, habitat use, and demographics can be indicative of forest health (Carey 2000; Koprowski 2005). The range of Abert's squirrel corresponds to that of dry, montane, interior ponderosa pine forests in the southwest (Keith 2003). In Colorado, ponderosa pine is often the dominant forest species in the foothills of the eastern slope particularly in the lower montane vegetation zone (Kaufman et al. 2006) and the distribution of Abert's squirrel reflects their reliance on these trees (see Davis and Bissell 1989). The habitat specificity of Abert's squirrel has led to its listing as a mammal of special concern by Boulder County (BCPOS 1996a) yet much of their ecology is not well understood (Keith 2003; Koprowski 2005).

Abert's squirrel habitat preferences have been described rather extensively and are summarized in Keith (2003). Ideal Abert's squirrel habitat is fairly open uneven-aged ponderosa pine forest (375-625 trees/ha) composed primarily of trees >30cm dbh with small clusters of even-aged groups including dense, young trees. High quality stands have a significant number of large trees (>50cm) and interlocking canopies between tree clusters to provide means of travel and protection. Nests are maintained and used throughout the year and generally located 9-15m above ground in trees ~40cm dbh occurring in tree clusters (Keith 2003). Nests have also been observed in witches' brooms caused by dwarf mistletoe (*Arceuthobium vaginatim*) infestation of ponderosa pines (Garnett et al. 2006) and, occasionally in cavities of Aspen trees (*Populus tremuloides*) (Edelman and Koprowski 2006). The food of Abert's squirrels varies with availability and includes pine seeds, hypogeous fungi, apical buds, inner bark, and male and female pine cones (Keith 2003).

The structure of Abert's squirrel habitat, southwestern ponderosa pine forests, has changed dramatically since European settlement; human impact on ponderosa pine forests has dramatically altered forest structure. Prior to European settlement, ponderosa pine forests were open and park-like (Covington and Moore 1994; Moore et al. 1999). With logging, grazing, and wildfire suppression, however, these forests have typically become thick, uniform stands of even-aged pines. Present day ponderosa pine forests are often homogenous in structure and dominated by young trees with frequently >3,000 stems/ha (Mast 2003).

Because of our dramatic impact on ponderosa pine forests and the associated threat of severe fires, insect infestations, and low ecosystem health, efforts to restore ponderosa pine forests to pre-settlement conditions are widespread throughout the southwest; these efforts most often include aggressive thinning and prescribed burns (Covington and Moore 1994; Covington et al. 1997; Moore et al. 1999; Allen et al. 2002). While forest management practices do not often consider tree squirrels (Dodd 2003; Keith 2003), studies on several species in different habitats have converged on the conclusion that promotion of a mosaic landscape is the most successful conservation approach (Carey 2000; Dodd et al. 2003; Koprowski 2005 and refs. therein). Nonetheless, the impact of various forestry management practices on Abert's squirrel has not been widely studied (Dodd 2003; Koprowski 2005). Intensive thinning treatments may be detrimental to Abert's squirrel because they remove interlocking canopy trees, dramatically decrease tree density often resulting in densities of <60 trees/ha, decrease both the number of large trees and forest structure diversity, and alter the availability of fungi (Mast et al. 1999; Allen et al. 2002; Keith 2003; Dodd et al. 2006). On the other hand, restoration initiatives that involve only "thinning-from-below" (removal of saplings) may improve Abert's squirrel habitat as characteristics of presettlement forests are achieved; recently, the recruitment and survival of Abert's squirrel showed a negative correlation with the number of small saplings (Dodd et al. 2006).

The current ponderosa pine community at Heil Valley Ranch is relatively disturbed compared to pre-settlement conditions primarily due to fire suppression and logging (BCPOS 1996a; Kaufmann et al. 2006). Without low intensity fires thinning out seedlings and saplings, the forest is relatively closed, continuous, and lacking in complexity, composed primarily of young (<100 years old) trees. Restoration efforts on Heil Valley Ranch include both prescribed burns and thinning of ponderosa pine forests (BCPOS 1996b). The thinning implemented focuses on removing understory trees, seedlings, and saplings that normally would have been killed by ground fires. Forest management plans indicate that the objectives are to reduce the density of forest stands, returning them to a more natural density thereby decreasing the likelihood of catastrophic fires and insect infestations. Additional objectives relevant to Abert's squirrel habitat include retaining large trees (>50cm dbh) and maintaining mosaics of stand density, size, and age (BCPOS 1996b). In addition to forest management, BCPOS (1996b) has described general management goals for wildlife in this area as including protection and management of effective wildlife habitat especially natural food, cover, and nest sites. The density of Abert's squirrel on the property is unclear but they are known to be fairly common (BCPOS 1996a; Mark Brennan pers. comm.).

As ponderosa pine forest restoration continues on BCPOS, the effect on Abert's squirrel needs to be examined. While forest restoration practices will not likely eliminate the species, understanding the impact of the management techniques on the density of Abert's squirrel is important. This study provides two years of data regarding Abert's squirrel population size in thinned and unthinned stands of ponderosa pine on Heil Valley

Ranch and tests methodologies that can later be employed in a much needed monitoring program of the species. With knowledge of the current status of Abert's squirrel on Heil Valley Ranch and their associated habitat preferences, BCPOS will be able to consider including forest structure that is beneficial to the squirrels in their treatments and management plans, a rare practice in Colorado (Keith 2003).

METHODS:

Feeding Sign

Squirrel density on Heil Valley Ranch was estimated using a monitoring technique developed by the Arizona Game and Fish department (Dodd undated, Dodd et al. 1998) that has subsequently been successfully implemented by others (e.g. Frey 2005, 2006). Based on signs of Abert's squirrel over-wintering feeding activity, this method is an indirect population index that is reliable, consistent, efficient, economical, and low-impact (Dodd 1998, Frey 2003, 2004, 2005, 2006). Feeding sign includes cone bracts and cores, terminal needle bundles, and short twigs with outer bark removed that are dropped to the ground while feeding (Rasmussen et al. 1975; Dodd undated; Dodd et al. 1998). An individual Abert's squirrel generally clips 10 to 1000 twigs from a single ponderosa pine tree though clippings in excess of 1200 have been documented (Keith 2003).

Crucial to this monitoring technique is accurate identification of Abert's squirrel over-wintering feeding sign, but there is reportedly a relatively steep learning curve when beginning to identify the source of sign, age of sign, etc. (Jennifer Frey, pers. comm.). Fortunately, Jennifer Frey and colleagues offered to share their expertise; prior to initiating fieldwork, Worden and Kleier traveled to northern New Mexico to receive training on how to identify Abert's squirrel feeding sign. Care was taken to become adept at distinguishing Abert's squirrel sign from that of red squirrels, porcupine, other animals, and other factors (Rasmussen et al. 1975).

Monitoring Plots and Data Collection

In consultation with BCPOS forestry personnel, thirty-two 4-hectare monitoring plots were established in 10 different areas of Heil Valley Ranch (Figure 1). The locations of the sampling areas and the plots within were selected primarily based on logistical considerations including distributing plots among different areas of the property, ensuring representative habitat, and ease of access. Within each of the 10 areas, 2 to 4 monitoring plots were established. No active thinning occurred on any of our monitoring plots from the start of sampling in 2008 through completion in 2009. Plots 31 and 32 added in 2009 did, however, directly border a current mastication project and were expected to be masticated after sampling. This mastication project was located northwest of the visitor's parking lot, directly south of plots 31 and 32. Past forest treatments resulting in thinned stands took place in 1995-2006, 2006, and 2007; please see appendix A for past treatment dates of specific stands.

Following the general recommended sampling design (Dodd undated, Dodd et al. 1998, Frey 2003, 2004, 2005, 2006), each monitoring plot is a 5x5 grid with points 50m apart (effectively, 5 parallel transects forming a 200x200m plot). Within each plot, $1m^2$ quadrats were used to quantify the abundance of Abert's squirrel over-wintering feeding sign. Quadrats were placed every 12.5m along each of the 5 transects, giving a total of 85 samples per monitoring plot. The presence of any Abert's squirrel feeding sign within or touching the quadrat was recorded. A handheld GPS unit was used to determine the location of the first plot corner and a compass bearing used to generate the transects (see appendix A for specific plot locations and bearings). While working, visual surveys were made and the presence of tree squirrels and any other evidence of current or past use of the stand by Abert's squirrels recorded.

General vegetation characteristics reported to influence Abert's squirrel populations were measured in 2008 following a similar methodology employed by Dodd (2003) and Dodd et al. (2003). Within each monitoring plot, the point-centered-quarter method was used at 5 randomly selected points located throughout the grid at least 50m from each other (1 point per transect). In each quarter (determined by cardinal directions), the identity, diameter at breast height, and distance from the sampling point of the nearest two trees was recorded. This method resulted in a total of 40 trees measured per plot and allowed calculation of basal area by tree species and density corresponding to size classes. Density was calculated according to Mueller-Dombois and Ellenberg (1974; also see Mitchell 2007). In addition, at each sampling point a spherical densiometer was used to assess canopy cover in the 4 cardinal directions. For 2009, vegetation characteristics were only measured on those plots that were not surveyed in 2008.

Due to the difficulty distinguishing active Abert's squirrel nests from inactive ones, no quantification of nesting structures was conducted in this study. As stated above, Abert's squirrels often use witches' brooms created by dwarf mistletoe infestations for nests. While we a few mistletoe infestations were observed during the study, we were not able to determine if they were being used as nests.

Data Analysis

Data analysis includes estimating Abert's squirrel density for each monitoring plot using a feeding sign index regression model developed by Dodd and used by Frey (2003, 2004, 2005, 2006; Figure 2). This model corresponds to the relationship between the percentage of $1m^2$ sampling quadrats containing feeding sign and the density of the population. The relationships between the habitat variables and squirrel density were assessed using regression analyses.

Schedule

While Dodd et al. (1998) found that mid-March to late May provides the most consistent relationship between feeding sign and squirrel density, monitoring often needs to be delayed to avoid snow on the ground (see Frey 2003, 2004, 2005, 2006). For 2008, our sampling began May 29th, 2008 and concluded June 17th, 2008. While accurate sampling was maintained throughout our study, it became more difficult to recognize older feeding sign as sampling progressed. Therefore, in 2009, our surveys began on April 28th, 2009 and concluded on May 19th, 2009, a full month ahead of the 2008 study. It should also be noted that we found evidence of active feeding on twigs and cones throughout the study suggesting that the squirrels rely on these food sources well into the spring.

RESULTS:

Abert's squirrel feeding sign was found in 13 (40.6%) of the 32 monitoring plots in 2009. Some plots that had feeding sign in 2008 were devoid of sign in 2009 (Figure 1). While there was generally more feeding sign found in unthinned stands in 2008, the difference was not significant for any of the different feeding sign types. Similarly, differences were not significant between thinned and unthinned plots in 2009 (Table 1). Both thinned and unthinned plots showed declines in squirrel density from 2008 to 2009.

When considering all types of feeding sign in all plots, Abert's squirrel density ranged from 0 to 0.376 individuals per hectare with a mean of 0.061 in 2008. For 2009, again considering all types of feeding sign (i.e. not excluding cones), density of Abert's squirrel ranged from 0 to 0.0536 individuals per hectare with a mean of 0.0084. The mean in 2009 was only 13.8% of what it was in 2008 showing a marked decline between years. In 2008, cones were excluded from the analysis, and Abert's squirrel density ranged from 0 to 0.215 per hectare with a mean of 0.032. This mean from 2008 without cones included is still much lower than the 2009 mean. Although cones were included in the census in 2009, because of the low number of any feed sign, the analysis was not performed without cones for the 2009 data.

The vegetation characteristics for thinned and unthinned ponderosa pine stands were summarized in Table 2 of the 2008 report. Because only five plots were added this year, and because three of those plots were controls which roughly matched the vegetation analysis from 2008, the vegetation characteristics of all the plots were not reanalyzed.

Abert's squirrel density showed no relation with either dbh of ponderosa pines or with canopy cover (Figures 4 and 5). In both cases, the R-squared value of the regression was extremely low as shown on the figures and the result was not significant. These results are consistent with those reported in the 2008 report (Table 3, 2008 report).

DISCUSSION:

The 2009 results support the 2008 findings of no significant differences in Abert's squirrel densities between thinned and unthinned ponderosa pine stands and reveal a marked decline in squirrel density. In addition, there are several important observations that should be noted for future Abert's squirrel monitoring: the sampling protocol, differences between thinned and unthinned forest plots, and implications to natural resource and visitor management.

There were two aspects of the study protocol that require further investigation – inclusion of cones and timing of the study. The analyses presented 2008 and 2009 were based on Abert's squirrel densities using all types of feeding sign, including chewed cones. These values may be slight overestimates as both red squirrels and Abert's squirrels remove cone scales and discard the cores. Though no observations of other mammals feeding on cones in this nature were observed, we were not specifically looking for this behavior. In 2009, feeding sign was so low in all the plots that removing cones would not have substantially changed the data. Because we included cones in both years of analysis, we recommend that recording cones as feed sign be retained in future studies, despite a potential overestimate of squirrels if in fact other mammals are eating the cones.

Timing of the study is another important consideration in future monitoring efforts. For 2008, we conducted the surveys in late May and early June and concluded that an earlier start time would allow for observation of over-wintering feed sign only and reduce the likelihood of overlooking sign that has aged; as terminal branches begin to brown after they fall from the tree, distinguishing between the recent winter's and the previous winter's feed sign can be difficult. For these reasons, we began sampling earlier in 2009, beginning in late April and finishing in mid-May. Starting one month earlier could have been one reason for the decreased estimates of overall squirrel populations densities, though we thought this unlikely because sign would have had less time to age. We recommend that monitoring should remain at a consistent time of the spring, although this may also be dependent on what other activities are occurring in the area, i.e. mastication or other forest treatments.

Our study at Heil Valley Ranch showed no differences in the density of large trees between the thinned and unthinned stands, which is important because many studies have indicated that Abert's squirrels prefer forests that include trees over 40cm DBH (Keith 2003). Therefore, although the tree density in the Heil Valley plots differed, the major determining factor for the squirrels, trees over 40 cm DBH, was not different, and so a difference in overall density may not have been expected. The forest data from 2008 also show that while there are more medium sized trees in the thinned plots, this difference did not affect squirrel densities. So, while some authors have argued that thinning is good for squirrel densities (Keith 1965) and others have argued that thinning is bad for squirrel densities (Koprowski 2005), our study indicates that thinning will not have an effect if the density of trees with DBH over 40cm remains the same.

Our largest concern in 2009 was the overall decline of feeding sign in both thinned and unthinned plots. As mentioned previously, this decline could be due to an earlier timing of the study, or it could be due to a number of abiotic factors that our study did not measure. However, one of the most significant changes between 2008 and 2009 was the additional mastication projects that occurred in the early spring of 2009. The mastication operation was loud, and the noise may have caused the squirrels to go elsewhere. Farentinos (1974) as cited in Keith (2003) reports that Abert's squirrels do communicate using auditory cues. Additionally, many tree squirrels have alarm calls (Shelley & Blumstein 2007), and one study indicated that ground dwelling squirrels changed their predator response behaviors due to nearby wind turbine noise (Rabin, Coss & Owings 2006). Given these findings, Abert's squirrels may have declined due to the noise of mastication. Only a long-term monitoring project can determine if the squirrel populations respond to mastication noise.

It should also be noted that because our estimates of squirrel density rely on an indirect measure (feeding sign) we cannot say with certainty that the actual squirrel population has declined. It may very well be that for one reason or another, the squirrels were not feeding on the types of sign identified and that the population is in fact stable. Factors that may contribute to the squirrels reducing their feeding on terminal branches, twigs, and cones of ponderosa pines are many and may include variation in precipitation, amount of persistent snow, date of snow melt, temperature changes, etc. A long term monitoring project should record these factors to estimate correlations with squirrel densities as estimated indirectly by feeding sign.

The literature on the impact of various forest treatments on Abert's squirrel populations and the presence or absence of any lag time between a particular forest treatment and squirrel recruitment or reestablishment in the treated stand is lacking. However, considering past forest treatments that took place on our sampled plots in 1995-2006, 2006, and 2007, it does not appear that there has been a long-term negative impact on the density of Abert's squirrels; all previously thinned stands contained Abert's squirrels in 2008 and/or 2009. Because sampling of these plots did not occur until 2008, however, we are not able to detect a more short-term negative impact of the treatments. Referring to Appendix B in our 2008 report one can easily assess the relative density of Abert's squirrels in each of the sampled areas. With the exception of area T3 (plots 26 and 27), there does not appear to be a relationship between treatment date and squirrel density. Because area T3 burned in 2007 and is, therefore, relatively unique, it is not necessarily surprising that it had the lowest squirrel density in 2008. With the recent mastication efforts in and around the established monitoring plots, a long term project may be better able to detect the impact of such treatments

In terms of overall management for BCPOS, we recommend investigating the Abert's squirrel population over a long-term time scale. A recent article using population viability analysis suggests populations of Abert's squirrels can successfully persist if they begin with an average of 25 individuals (Wood, Koprowski & Lurz 2007). Given that population estimates ranged from 0 to 0.05 with an average of 0.0084 squirrels per hectare, and that Heil Valley Ranch is approximately 1,992 hectares, we can estimate a total population of about 17 squirrels from the 2009 data. However, using the 2008 mean of 0.061 squirrels per hectare, the population could be as high as 121 squirrels. Clearly, that is a large range, with the high end being good and the low range indicating possible non-persistence.

CONCLUSION:

In conclusion, we recommend continuing monitoring of Abert's squirrel. We also recommend that future sampling continue to include cones as feed sign, begin at the same time every year, preferably in mid-May, and to especially monitor areas that have been chipped or thinned.

TABLES:

Table 1. Frequency of Abert's squirrel feeding sign on 1m^2 quadrats in monitoring plots located in thinned (N=8) and unthinned (N=24) ponderosa pine stands (85 quadrats/plot). Data are reported as percent of quadrats that had feed sign within plot treatments. There is no significant difference between thinned and unthinned stands for any feeding sign type.

Percent of Occurrence Per Monitoring Plot (mean ± standard error)		
Feeding Sign Type	Thinned	Unthinned
Peeled Twigs	1.47 ± 0.69	1.66 ± 0.41
Terminal Branch Clippings	1.47 ± 0.64	1.17 ± 0.37
Cone Cores	0.15 ± 0.49	0.59 ± 0.28
All Sign	1.61 ± 0.49	2.06 ± 0.52

FIGURES:

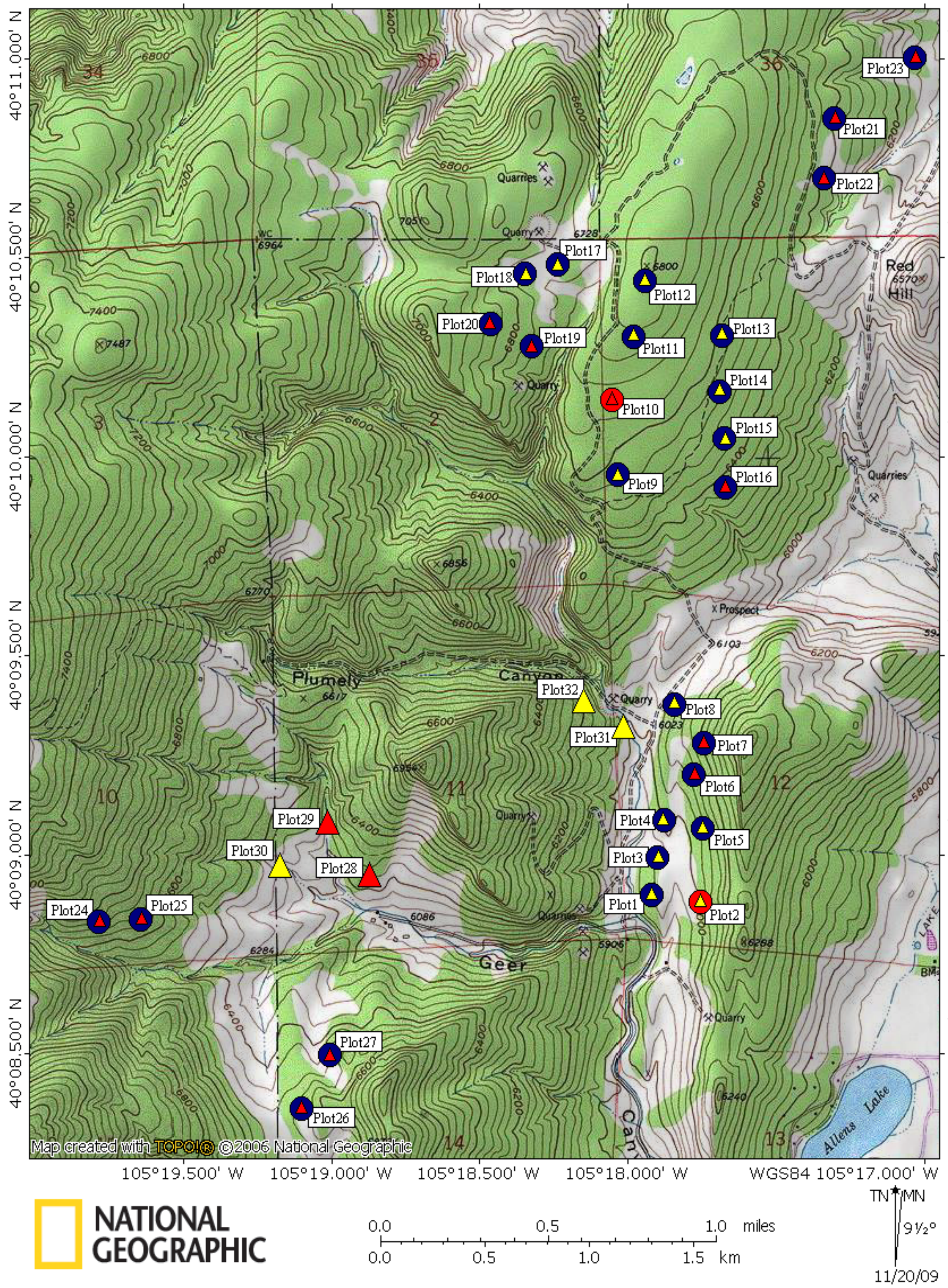

Figure 1. Location of monitoring plots on Heil Valley Ranch. Circles = plots sampled in 2008; Triangles = plots sampled in 2009. Red = no feeding sign for that year as designated by symbol shape. See Appendix A for additional plot information.

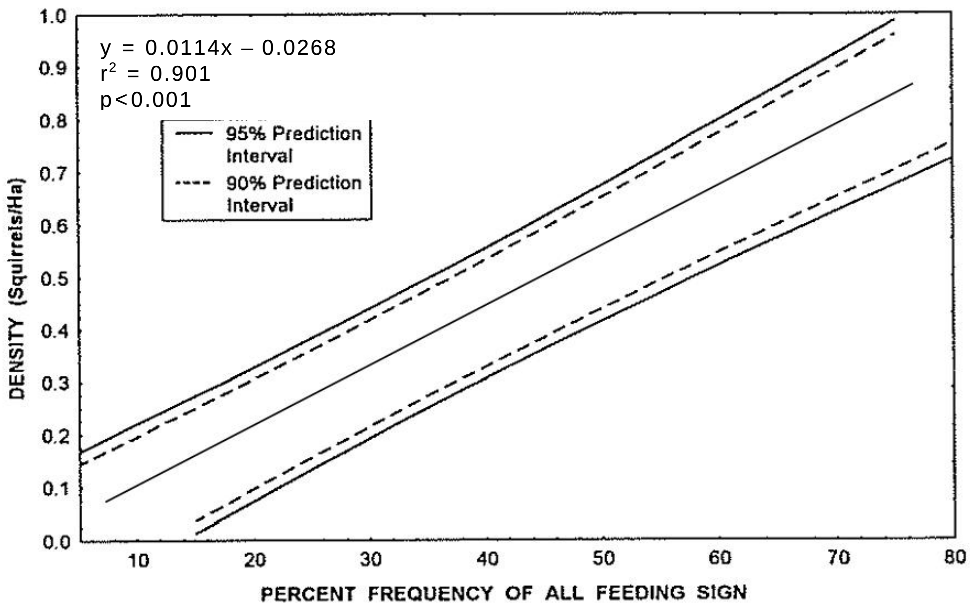

Figure 2. Adapted from Dodd 1998. Regression model between percent feeding sign and Abert's squirrel density developed from data collected in north-central Arizona.

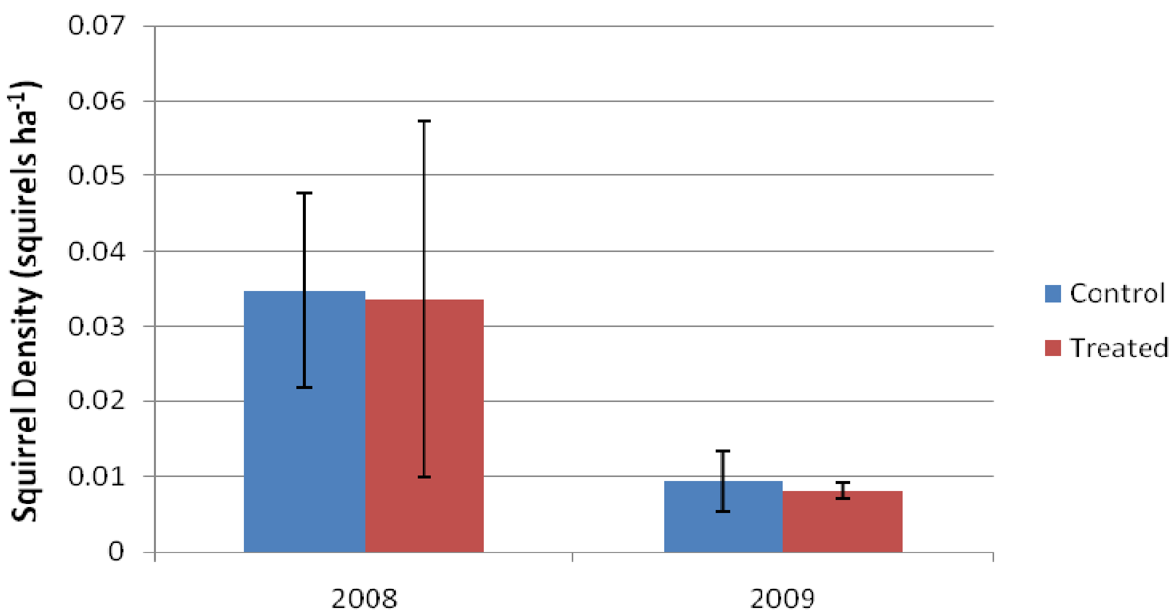

Figure 3. Abert's squirrel density (mean±SEM) in thinned and unthinned (control) ponderosa pine stands in 2008 and 2009 as estimated by all over-winter feeding sign (peeled twigs, terminal branch clippings, and chewed cones).

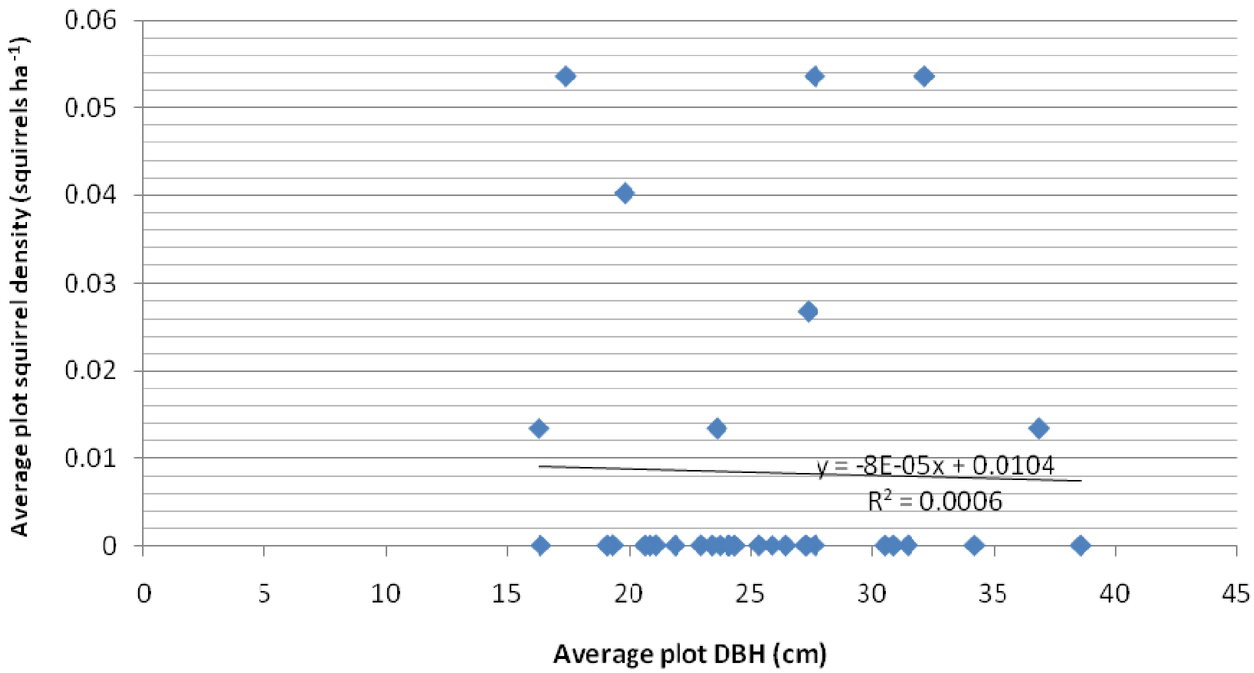

Figure 4. Regression relation between the average diameter at breast height (cm) for all trees within a plot and the average plot squirrel density (# squirrels per hectare).

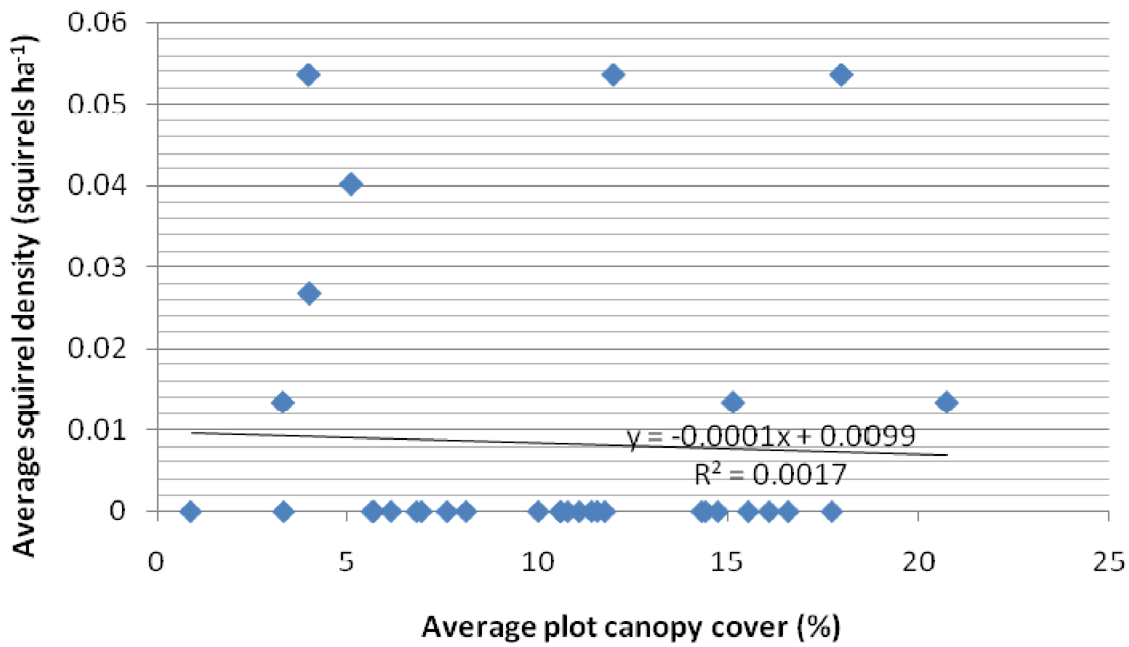

Figure 5. Regression relation between percent canopy cover and the average plot squirrel density (# squirrels per hectare).

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Appendix A. Abert's squirrel monitoring plots on Heil Valley Ranch. C = unthinned forest stands, T = thinned forest stands with treatment dates in parentheses.

Plot	Date	Treatment	Staring Corner	Transect Direction	First Corner Coordinates (N)	First Corner Coordinates (W)	Plot Elevation (m)	Notes
1	4/26/2009	C	SW	N/S	40 08.855	105 17.960	1817	
2	4/26/2009	C	SW	N/S	40 08.861	105 17.808	1840	
3	4/25/2009	C	SW	N/S	40 08.953	105 17.951	1819	
4	5/6/2009	C	NE	N/S	40 09.136	105 17.827	1831	
5	5/6/2009	C	SW	N/S	40 09.016	105 17.788	1854	
6	4/30/2009	C	SE	N/S	40 09.322	105 17.682	1857	
7	4/30/2009	C	NE	N/S	40 09.324	105 17.681	1902	
8	4/30/2009	C	NE	N/S	40 81.417	105 17.803	1854	
9	5/8/2009	T (1995-2006)	SW	N/S	40 09.873	105 18.078	2004	
10	5/19/2009	T (1995-2006)	SE	N/S	40 10.096	105 17.983	2031	
11	5/19/2009	T (1995-2006)	SW	N/S	40 10.265	105 18.094	2057	
12	5/19/2008	T (1995-2006)	SE	N/S	40 10.406	105 17.839	2073	
13	5/8/2009	C	NE	N/S	40 09.413	105 17.603	2004	
14	5/8/2009	C	NW	N/S	40 09.210	105 17.751	1988	
15	5/8/2009	C	NE	N/S	40 10.064	105 17.587	1966	
16	5/8/2009	C	NW	N/S	40 09.942	105 17.717	1938	
17	5/11/2009	T (2006)	NE	N/S	40 10.507	105 18.175	2053	
18	5/11/2009	T (2006)	SE	N/S	40 10.405	105 18.293	2058	
19	5/11/2009	C	NE	N/S	40 10.323	105 18.268	2053	
20	5/11/2009	C	SE	N/S	40 10.294	105 18.440	2092	
21	5/19/2009	C	NW	N/S	40 10.886	105 17.345	1950	
22	5/14/2009	C	NE	N/S	40 10.713	105 17.313	1920	
23	5/19/2009	C	SE	N/S	40 10.949	105 16.966	1867	
24	5/14/2009	C	SW	E/W	40 08.780	105 19.816	2049	
25	5/14/2009	C	NW	E/W	40 08.871	105 19.708	2029	
26	5/8/2009	T (2007)	SW	N/S	40 08.311	105 19.151	1994	Burned
27	5/8/2009	T (2007)	SW	N/S	40 08.421	105 19.071	1981	Burned
28	4/26/2009	C	SE	E/W	40 08.943	105 18.869	1899	
29	5/2/2009	C	SE	N/S	40 09.082	105 19.008	1903	
30	5/2/2009	C	SE	N/S	40 08.981	105 19.171	1916	
31	5/3/2009	C	NE	N/S	40 09.332	105 18.023	1833	To be thinned (2009)
32	5/3/2009	C	NE	N/S	40 09.368	105 18.145	1882	To be thinned (2009)