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COUES WHITE-TAILED DEER AND DESERT COTTONTAIL IN THE SOUTHWESTERN OAK SAVANNAS: THEIR PRESENCE BEFORE AND AFTER BURNING EVENTS

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ABSTRACT

Coues white-tallied deer (*Odocoileus virginianus couesi*) and desert cottontail (*Sylvilagus auduboni*), also known as Audubon cottontail, are inhabits of oak savannas in the Southwestern Borderlands region. Food, cover, and scattered water for these two species are found in this comparatively open ecosystem. The results of a study on the presence (occurrence) of Coues white-tailed deer and desert cottontail in unburned the oak savannas of the Southwestern Borderlands Region are presented in this paper. Effects of cool-season and warm-season prescribed burning and a wildfire on the presence of these two species are also reported.

INTRODUCTION

Fire caused by lightning activity in late spring and early summer before the onset of monsoonal rains was a historical part of ecosystem functioning in the Southwestern Borderlands Region before Euro-American settlement. However, frequencies, characteristics, and impacts of fire on ecosystem resources have been altered since the late 1800s largely because past livestock grazing intensities had removed "large amounts" of the fire-carrying herbaceous vegetation and the aggressive fire suppression policies of management agencies. As a consequence of these practices and policies, overstory trees increased to "unnaturally high" densities on many sites with these trees becoming susceptible to insect infestations, disease infections, or stand-replacing wildfires. Also, mesquite (*Prosopis velutina*) and other woody plants have invaded many otherwise productive grasslands resulting in a reduction in the production of herbaceous (forage) plants.

Management agencies with support from their collaborators including universities, private organizations and local ranchers are interested in establishing a "more natural fire regime" in ecosystems where these undesirable conditions are encountered (Gottfried and Edminster 2005, Gottfried et al. 2007). One ecosystem of interest is the oak savannas situated in between the more densely stocked oak woodlands at higher elevations and the lower-elevation grassland and shrub communities. Managers are considering igniting prescribed burns in either the cool season or warm season to obtain a "more natural fire regime." However, more information on the impacts of fire on the natural resources in this ecosystem is needed before such a program is initiated. A first step in obtaining this information is evaluating the effects of prescribed burning treatments on natural resources of the ecosystem. One resource of importance is the indigenous wildlife species including Coues white-tailed deer and desert cottontail.

The presence (occurrence) of these species on the Cascabel Watersheds in the Peloncillo Mountains of southwestern New Mexico before and after cool-season and warm-season prescribed burning and a wildfire is presented in this paper. This information should be helpful to managers and local stakeholders in developing strategies for establishing a "more natural fire regime" in the oak savannas.

CASCABEL WATERSHEDS

The 12 Cascabel Watersheds, ranging from about 20 to 60 acres in area, are situated in the Peloncillo Mountains of southwestern New Mexico between 5,380 and 5,590 feet in elevation. Annual precipitation normally averages about 23.5 inches with nearly one-half occurring in monsoonal rainfall events in the summer. However, a prolonged drought was prevailing during the time of this study, with annual precipitation in this period averaging less than 15 inches. Vegetative, geologic, physiographic, and hydrologic characteristics of the watersheds are described in earlier publications (including Gottfried et al. 2000, 2007; Ffolliott et al. 2008) and, therefore, are not presented in this paper.

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BURNING EVENTS

The original objective of the research program on the Cascabel Watersheds was to evaluate the effects of cool-season (November through April) and warm-season (May through October) prescribed burning on ecosystem and hydrologic resources. It was planned that these evaluations would be compared to unburned (control) watersheds to determine impacts of the burning events on these resources. Four of the watersheds were burned successfully during the cool season in early March 2008. Three of the four watersheds to be burned in the warm season were burned on May 20, 2008 with burning of the fourth watershed scheduled for a later date. However, wind gusts up to 60 mph blew firebrands onto the unburned watershed in the morning of May 21 with a resulting wildfire crossing over the boundaries among the watersheds and spreading outward to burn about 4,000 acres. As a consequence of this wildfire, the original objective of research on the watersheds had to be modified to satisfy the objective of the program by evaluating the impacts of the prescribed burning and the wildfire on the ecosystem and hydrologic resources.

A system that relates fire severity to the soil-resource response to burning (Hungerford 1996, DeBano et al. 1998) was used to classify the severity of the burning events at the sample plots on the watersheds (see below). These classifications of fire severities were then extrapolated to a watershed basis to determine the percentages of the Cascabel Watersheds that were unburned or had burned at low, moderate, and high fire severities. The extrapolations indicated that all of the watersheds had burned at a low-fire severity (Stropki et al. 2009). These low-fire severities experienced were attributed largely to the mostly small and scattered accumulations of flammable fuels before the burning events (Ffolliott et al. 2006) and the relatively high wind speeds during the burns (M. Harrington 2010, pers. correspond.).

STUDY PROTOCOLS

Counts of fecal pellet-groups had been used to estimate numbers of deer in earlier studies in the forests of the region (Neff 1968, Smith 1968, Eberhardt and White 1979, Rowland et al. 1984). However, problems in obtaining reliable estimates of population numbers with this technique have been pointed out earlier by Neff (1968), Davis (1982), Rowland et al. (1984), and Braun (2005). One reason why counting deer pellet groups can lead to errors in estimating population numbers is that it is necessary to assume a constant defecation rate between sexes and within age classes of the population to be sampled. But, this assumption is not necessarily valid. Seasonal diets of deer can vary with less moisture and digestible matter in winter foods than foods in summer resulting in lower defecation rates in the winter. Furthermore, it is not always known whether a count of 10 pellet groups represents 10 deer that defecated once or 1 deer that defecated 10 times without validation information such as obtained from a sample of radio-marked animals. Therefore, the counts of Coues white-tailed deer pellet groups obtained on the Cascabel Watersheds were interpreted only as indices of presence (occurrence) of the ungulate on the watersheds because of these and other possible problems encountered with the use of this technique.

Counts of individual fecal pellets had also been used in earlier studies by Cochran and Stains (1961), Kundaeli and Reynolds (1972), and others to obtain estimates of cottontail population numbers. However, the problems encountered in obtaining reliable estimates of population numbers for deer from counts of fecal pellets also apply to counts of individual cottontail pellets. Therefore, similar to interpretations of the counts of white-tailed deer pellet groups, the counts of desert cottontail pellets were also interpreted as indices of presence of the mammal on the watersheds.

Sampling Basis

Between 35 and 45 permanent sample plots had been established along transects perpendicular to the main channel and ridge to ridge on each of the Cascabel Watersheds to provide the sampling basis for obtaining information on ecological and hydrologic resources (Gottfried et al. 2007). Intervals between the plots varied with the size and shape of the watershed sampled. A total of 421 sample plots were located on the 12 watersheds. This sampling scheme has been used to study the effects of the prescribed burning treatments and wildfire on the presence of Coues white-tailed deer and desert cottontail by counting fecal pellets on the watersheds.

Field Measurements

The presence of Coues white-tailed deer and desert cottontail was estimated by counting their fecal pellets on 0.01-acre plots centered over the permanent sample plots on the watersheds. Earlier depositions of pellets were cleared from the 0.01-acre plots when these plots were established in the spring of 2003 because the time (duration) of their accumulation was unknown. Deer pellet groups and individual cottontail pellets were then counted and cleared from the plots before the burning events in the fall of 2003 and continued in the spring and fall from 2004 through 2007. Effects of the burns on the presence of the two species were estimated from tallies of pellets made in the fall of 2008 and the spring and fall of 2009. Counts of fecal pellets were

not obtained in the spring of 2008 because of the warm-season prescribed burning and wildfire.

Analysis

The frequency distributions of the counts of Coues white-tailed deer fecal pellet groups indicated that these distribution were non-normal (Yazici and Yolacan 2007) throughout the study. Therefore, the nonparametric Wilcoxon two-sample test (Zar 1999) was used to determine the occurrences of statistically significant differences in fecal pellet deposited by the two species in the sampling periods before and after the prescribed burning treatments and wildfire. A 0.10 level of significance was selected for this purpose.

RESULTS AND DISCUSSION

The counts of Coues white-tailed deer and desert cottontail fecal pellets on the Cascabel Watersheds were statistically similar for the sampling periods before and after the prescribed burning treatments and wildfire. That there were no significant differences in the counts among the burning events was not surprising, however, as all of the watersheds experienced low-fire severities as a result of the burns (Stropki et al. 2009). Because of the statistical similarity, the data sets obtained in the study were pooled to evaluate the effects of the burns on the presence of the white-tailed deer and desert cottontail on the watersheds.

Coues White-Tailed Deer

The presence of Coues white-tailed deer before and after the burning events on the watersheds is indicated by the bar graph presented in Figure 1. Inferences relating to (apparent) differences in pellet-group counts shown by the graphs are not necessarily valid, however, because the distributions of the data sets forming the basis for constructing these graphs were non-normal. Therefore, the statistical differences in these counts were inferred through interpretations of the Wilcoxon two-sample test.

Coues white-tailed deer are found throughout the Southwestern Borderlands region. The species is wide ranging, however, and often move from one ecosystem in the region to another depending on the availability of food, cover, and water (Anthony and Smith 1977). It was not surprising, therefore, that there was a greater presence of Coues white-tailed deer on the Cascabel Watersheds in the spring than in the fall when pellet groups were counted in both the spring and fall of a year. It is possible that some of the deer moved to higher elevations of the Peloncillo Mountains in the summer to escape the high temperatures and a lack of water on the watersheds in that season. In this case, a lesser presence of the species on the watersheds in the summer months would be reflected by the fewer pellet group counted in the fall.

Relationships between the pellet groups deposited by Coues white-tailed deer and either the vegetative conditions (tree overstories and herbaceous and shrub understories) or physiographic characteristics (slope position, slope percent, and aspect) surrounding these plots were neither consistent nor meaningful. This finding was expected with respect to the vegetative characteristics because there had been little change in the structure of the tree overstories (Ffolliott et al. 2011) or the compositions and production of the herbaceous plants and shrubs (unpubl. data) as a result of the burning events.

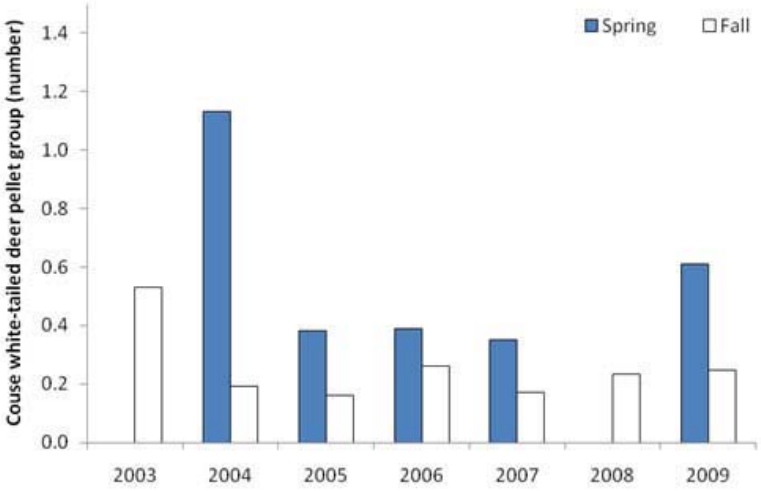

Figure 1. *Presence of Coues white-tailed deer (*Odocoileus virginianus couesi*) on the Cascabel Watersheds indicated by the total counts of pellet groups for sampling periods before (fall 2003-fall 2007) and after the burning events (fall 2008-fall 2009). Counts were not made in the spring of 2008 because of the warm-season prescribed burning treatment and wildfire.*

Desert Cottontail

Presence of desert cottontail on the Cascabel Watersheds before and after the prescribed burning treatments and wildfire as illustrated in a graph (Fig. 2). Once again, inferences relating to (apparent) differences in pellet shown by the graphs are not necessarily valid, however, because the frequency distributions of the data sets forming the basis for constructing the graphs were non-normal.

The presence of desert cottontail on the Cascabel Watersheds was also greater in the spring than fall in most of the years when both spring and fall counts of pellet were obtained. The smaller home range of desert cottontail in relation to that of the Coues white-tailed deer suggests that most of the cottontail might have remained on the watersheds in the summer months. Therefore, the often larger counts of pellets in the spring has been attributed largely to a higher reproductive rates of desert cottontail in the months preceding the spring counts. While desert cottontail breed year round, their breeding activity peaks from December to late spring with births occurring 25 to 30 days later (Stout 1970, Chapman 1978). Pellets deposited by the cottontail born at this time would be included in the spring counts. Predation by coyotes and birds of prey in the following months reduces the cottontail number before the fall pellet counts.

Similar to the findings for Coues white-tailed deer, relationships between the counts of cottontail pellets and the vegetative or physiographic characteristics surrounding the plots were not meaningful. This finding was expected as there had been little change in the tree overstories or and herbaceous plants and shrubs as a result of the burning events.

CONCLUSIONS

The presence of Coues white-tailed deer and desert cottontail on the Cascabel Watersheds was not altered by the prescribe burning treatments or wildfire. That the effects of these burning events on the presence of these species were insignificant was expected because there had been little change in the tree overstories or herbaceous plants and shrubs as a result of the burns. However, a greater presence of Coues white-tailed deer in the spring than the fall both before and after the burning events was attributed to the movement of an unknown number of the white-tailed deer to higher elevations to escape from the hot temperatures of the summer months. There also was a greater presence of desert cottontail on the watersheds in most springs than in the fall because of the presumed greater births of cottontail in the late fall and winter months than at other times of the year. Predation reduced cottontail numbers before the pellet counts in the fall.

The results presented in this paper should be interpreted as a case study because the effects of prescribed burning treatments on Coues white-tailed deer and cottontail in other oak savannas of the region are unknown. The effects of hotter burns on the two species should also be determined.

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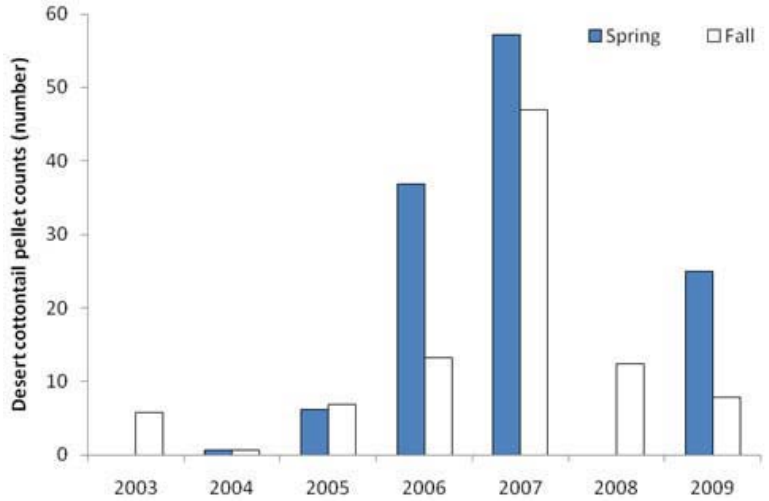

***Figure 2**. Presence of desert cottontail (*Sylvilagus auduboni*) on the Cascabel Watersheds indicated by the total counts of individual pellets for sampling periods before (fall 2003-fall 2007) and after the burning events (fall 2008-fall 2009). \Pellet counts were not made in the spring of 2008 because of the warm-season prescribed burning treatment and wildfire.*

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