

Response of Bailey's Eastern Woodrat (*Neotoma floridana baileyi*) to a Controlled Fire Management Regime

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Abstract

The prairie ecosystem has evolved with fire as being an important factor in determining the structure of the prairie. Today, fire is utilized as a prairie management tool to control spread of invasive species. Bailey's Eastern Woodrat (*Neotoma floridana baileyi*) is an isolated and threatened species of woodrat found only along the middle portion of the Niobrara River in north central Nebraska. Controlled burns are used in the woodrat's habitat to control the spread of Red Cedar. This study attempted to determine whether controlled burns have a beneficial or detrimental effect on woodrat populations. Walking surveys were conducted in various areas of differing fire histories to determine if any significant differences are present in burned areas with respect to woodrat nest presence and density. Slight differences were observed indicating burned areas being of possible benefit to woodrat populations, but the differences were not statistically significant. Results do not show any dramatic detrimental effects to woodrats from prescribed burning.

Introduction

Fire has long been an important natural factor in prairie ecosystems and recently has become an important tool in managing the growth and diversity of prairies (Johnson, 1997). During most of the 20th Century there was a substantial pressure to prevent any type of prairie or forest fire (Johnson, 1997). This lack of disturbance changed the composition of prairies throughout the Great Plains, allowing invasive and non-native species to take hold and choke out native flora. Until recently many invasive species have gone unchecked and have been allowed to spread (McCullough, 2003). Fire is now utilized to halt invasive species and revert prairies back to a more original and healthy state.

There is considerable interest in the effect of fire on all aspects of prairie ecology, ranging from the change in habitat structure and composition to the effect on both large and small animal populations. One response seen repeatedly is the demographic change in small mammal communities following fire disturbance (Boggs, 1993). Due to the high density and diversity of rodents and other small mammals this group has been one of the most studied faunal groups found in the prairie. Previous research has shown a positive response of small mammals to prairie fire (Higgins, 1989). Much of the response by small mammals isn't due directly to fire but considered a response to fire-disturbed habitat (Higgins, 1989). Fire increases primary production and many small mammals seem to prefer recently burned areas with adjacent unburned areas due to the exposed seed bank and cleared ground (Higgins, 1989). Although many species benefit from fire, many herbivores will temporarily emigrate from the area due to lack of vegetative cover.

The response of Bailey's Eastern Woodrat (*Neotoma floridana baileyi*) to fire is of particular importance because Bailey's Woodrat is a threatened species endemic to the middle Niobrara River valley and adjacent areas in north-central Nebraska. This subspecies of the Eastern Woodrat (*Neotoma floridana*) is isolated from other populations by approximately 100 miles south of unlikely habitat (McCullough, 2003). Recently, areas along the Niobrara River have been burned to help curb the spread of invasive Western Red Cedar (McCullough, 2003). Many of the burned areas include *N. f. baileyi* habitat as the woodrats tend to construct nests under Red Cedar and other tree species. When these areas are burned many of the constructed nests and trees are damaged. Although Bailey's Woodrats are currently common along the river corridor, any negative effects from fire has the potential of impacting the population due to its isolation. The aim of this study was to determine whether controlled burns have a beneficial or detrimental affect on this threatened species of woodrat.



Bailey's Eastern Woodrat (*Neotoma floridana baileyi*).



Active Woodrat Nest.

Materials and Methods

Materials:

The following are the items were used in this study: lab notebook for record keeping, markers, pens, and Fire History maps obtained from Niobrara Valley Preserve Headquarters in Johnstown, Nebraska.

Methods:

Upon arriving at the Niobrara River Valley Preserve, five survey plots were established. The survey areas were chosen to give a variety of fire histories, from unburned to very recently burned. Sites One and Three have been not been recently burned and sites Two, Four, and Five have been recently burned. The order in which the surveys were conducted was random and the surveys were done within a two to three week period to eliminate any bias due to weather and season. A group of two to four surveyors began at the same location and followed predetermined routes in back and forth patterns roughly seven to ten yards apart to thoroughly survey the area. One member of the group was responsible for the lab notebook in collecting the verbal data reported from the other surveyors.

After all the areas were surveyed, the data was analyzed and compared to the area of the survey plots, whether the plots were burned or unburned, and the count of nests detected (both active and non-active). Using the collected data rough nest densities (nests/mile²) were calculated for statistical comparison. Simple t-tests were performed to determine significant differences among the burned versus unburned and north versus south plots. The possibilities of specific tree preference by woodrats were also determined.

Prescribed Fire History Near NVP HQ

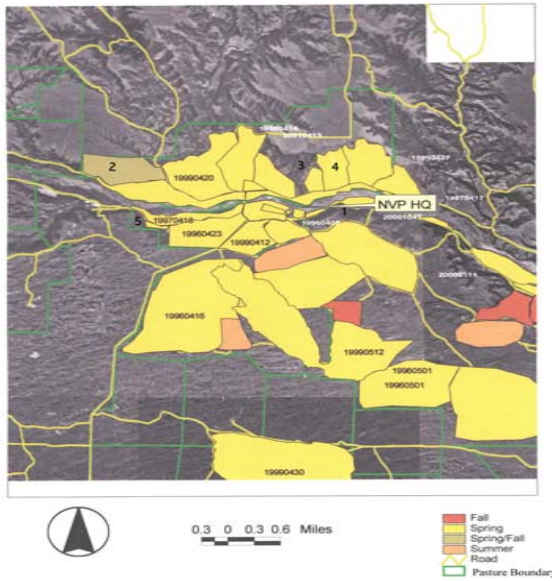


Figure 1: Map showing the fire histories near Niobrara Valley Preserve Headquarters. Study sites are labeled 1-5 and legend indicates what season prescribed burns were conducted.

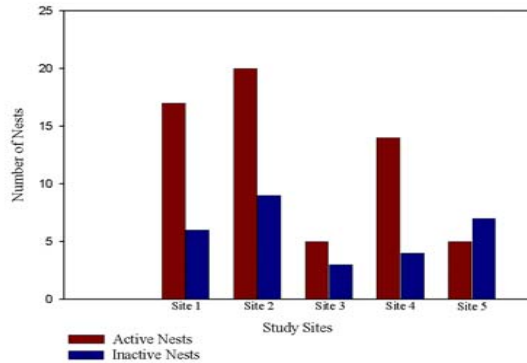


Figure 3: Abundance of Active Nests and Inactive Nests at each of the five study sites.

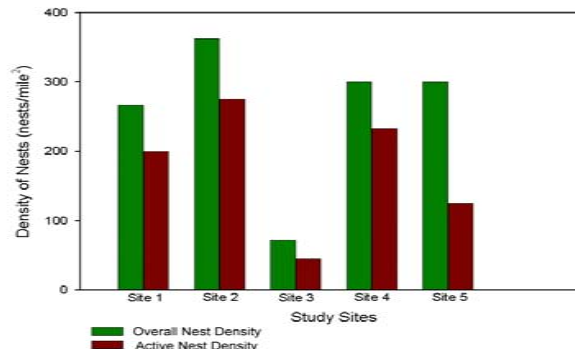


Figure 4: Comparison of Overall density vs. Active nest density at all five sites.

Results

Sites Two, Four and Five were plots burned within the previous six years, while One and Three remained unburned. Sites Two, Three and Four were located on the north side of the river and Sites One and Five were on the southern side (Figure 1). To be considered active, the nests must have physical evidence of woodrat activity, including rat droppings at the nest entrance and an overall physical appearance of nest upkeep. In Site One (Figure 2), 24 total nests were located, with 75% of the nests considered active. At this site, Cottonwood (*Populus deltoides*) was the preferred tree with 11/29 nests. Basswood (*Tilia Americana*) was the second most preferred with 7/29 nests and Red Cedar (*Juniperus virginiana*) constituted the remaining 6 nests (Figure 2). Site Three, which had the densest plant growth, had 5 of 8 nests active (Figure 2). Of these nests surveyed 5 were identified with Red Cedar and 3 with Ponderosa Pine (*Pinus ponderosa*) (Figure 2).

Site Two, had a total of 22/29 active nests, with Red Cedar the most preferred nest type (15/29). The remaining nests were found under Oak (7/29), Basswood (2/29), and Cottonwood (5/29) (Figure 2). In Site Four, 18 nests were identified with 14 being active. Site four was adjacent to Site Three, but the composition was more similar to Eastern Deciduous habitat than the Ponderosa Pine stand found in Site Three. Bur Oak (*Quercus macrocarpa*) was the most preferred nesting type in Site Four constituting 13/18 nests. Red Cedar and Box Elder (*Acer negundo*) constituted the rest with 3/18 and 2/18 respectively (Figure 2). Site Five, had 12 nests with 5 active. Bur Oak dominated with 9/12 sites the rest being Red Cedar (2/12) and Basswood (1/12) (Figure 2).

Nest density (nests/mile²) for all sites is shown in Figure 4. The first two statistical tests conducted compared active and inactive nests. T-tests indicated no significant difference in nest density between all sites (95% confidence level). See Figure 4 and Appendix 1.

Woodrat tree preference was also examined. Again simple t-tests were conducted on data obtained on the tree used by woodrats to build the nest around. The three tree types most utilized by woodrats in this study were Oak, Red Cedar, and Cottonwood, although not to a significant level (Figure 2).

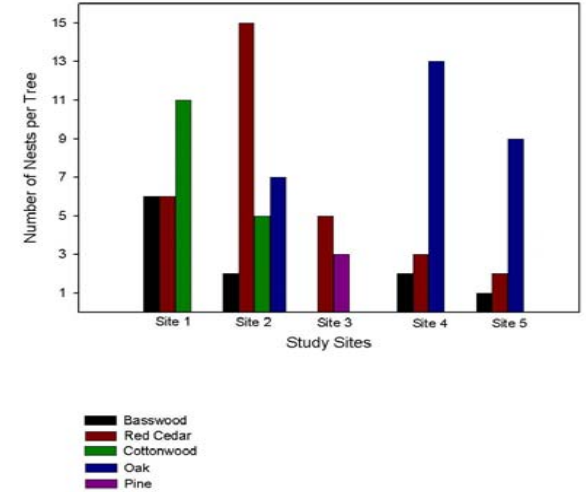


Figure 2: Surveyed woodrat nest counts per tree type selected by Bailey's woodrat.

Conclusion

Data collected from this study appear to show some difference between the populations of woodrats utilizing burned areas compared to unburned areas (Figure 2), but the differences weren't great enough to be considered a significant difference (t-test on SigmaStat, SPSS Inc.). Further studies may clarify this relationship.

Neotoma floridana baileyi showed no significant preference to a particular tree species for nest building. Woodrats appeared to prefer deciduous (Cottonwood, Oak, Box Elder, Basswood) to coniferous (Pine and Red Cedar) trees (Figure 2). However, tree diversity appeared positively correlated with woodrat population size (Figure 2).

No significant impact of controlled burns could be determined from this study. However there was no indication of a negative effect on nest numbers. The small amount of data collected does show a possible benefit of prescribed fire to woodrats (elimination of dense stands of Red Cedar). A more thorough study would be needed to support the findings of this study. A larger study area utilizing multiple sites along a larger stretch of the Niobrara valley would be beneficial in further determining whether or not the controlled burns have any significant effects, beneficial or detrimental, to the overall population of *N. f. baileyi*. The population appears stable within the valley and is in no immediate emergency as far as viable reproducing populations.

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