Red Imported Fire Ant Population Response to Burning and Disking Treatments Intended to Increase Habitat Quality for Northern Bobwhite

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ABSTRACT: Red imported fire ants (*Solenopsis invicta*) have negatively impacted our wildlife resources in the southern United States since their accidental introduction approximately 50 years ago. Anecdotal evidence suggests that red imported fire ants (RIFA) are tied to habitats maintained with disturbance. If this relationship is factual, then habitat management intended to benefit wildlife populations may indirectly harm wildlife. However, no experimental evidence has supported this viewpoint. We examined the effects of disturbance on RIFA population densities in the Coastal Prairie of Texas. Fifteen, 150 - x 150 - m plots were assigned one of the following treatments during the first week of March 1998 - prescribed burning, disking, or control (no treatment). Prescribed burning and disking are two techniques commonly used to improve habitat for early successional wildlife species, such as northern bobwhite (*Colinus virginianus*). RIFA mound censuses were conducted prior to treatment in February 1998 and after treatment in July 1998 and 1999 using distance sampling. Mound densities were estimated using the program DISTANCE. Preliminary tests using analysis of variance revealed that while time was a significant factor (P= .043), there was no difference between treatments (*P* = .847). However, further analysis will be conducted to try to differentiate environmental influences (precipitation, soil moisture, soil temperature) across divergent years.

INTRODUCTION

The red imported fire ant (*Solenopsis invicta*) has been the object of much concern in the U.S. since it's accidental introduction. Red imported fire ants (RIFA) are expected to eventually occupy nearly 1/4 of the entire U.S. (Vinson & Sorenson 1986). Their impact on agricultural and economic resources has been well documented. However, their impact on wildlife resources is still unclear. Predominantly terrestrial species, such as northern bobwhite (*Colinus virginianus*) may be particularly susceptible to impacts of RIFA. Bobwhite populations in 15 Texas counties were highly negatively correlated with years of infestation (Allen et al. 1995). However, the extent of RIFA impacts on northern bobwhite has been the source of debate. Some researchers suggest that impacts of fire ants on bobwhite are not significant (Brennan 1991), while others suggest that bobwhite populations are indeed adversely effected (Allen et al. 1995). RIFA populations can be significantly reduced using insecticides such as AMDRO[. However, this treatment is not economically feasible for many landowners, particularly those with larger tracts of land. Until an economically feasible method to eradicate RIFA over large areas is available, we must focus on slowing the invasion of RIFA in uninfested areas and preventing increases in population densities in areas which have already been infested. Therefore, it is important that we examine whether current management practices are benefiting RIFA populations, and thus possibly degrading habitat for northern bobwhite and other wildlife species.

Little is known about the habitat requirements of RIFA in their homeland or the United States. Allen et al. (1974) noted that in Mato Grosso, Brazil, active colonies of RIFA were found only in moist or well protected areas. Tschinkel (1988) studied the distribution of RIFA in relation to habitat disturbance in the pinelands of northern Florida. RIFA densities were found to be positively correlated with disturbed habitats such as roadsides and margins of seasonal ponds.

RIFA mound densities were also found to be very low in undisturbed sites. However, the relationship between RIFA and habitat disturbance is unclear.

In contrast, the relationship between habitat disturbance and northern bobwhite is well established. Several different types of habitat manipulations, including disking and prescribed burning, are used to enhance habitat for bobwhite. Disking is a mechanical manipulation that can be likened to a combination of chaining and rootplowing (Guthery 1986). A large disk is dragged behind a bulldozer, leaving an approximately 12-foot-wide strip. This breaks up and kills most dense grasses and, to a lesser extent, shrubs. Forb growth is stimulated, which provides food for bobwhites (Buckner & Lander 1979). Disking also creates travel lanes through thick cover and provides edge between grasses and bare ground, which is beneficial to nesting hens (Guthery 1986).

Prescribed burning is one of the least expensive habitat manipulation techniques used to manage habitat for bobwhite (Wright & Bailey 1982, Guthery 1986). Fire favors many species of legumes, which are a preferred bobwhite food (Masters et al. 1995). Burning also encourages the growth of grasses such as *Panicum* spp. and *Paspalum* spp. (Wright & Bailey 1982). These grasses provide excellent winter food, and to a lesser extent, cover, for bobwhite (Lehmann 1984). Formerly shunned as a management practice, prescribed burning is becoming more and more accepted as a valuable tool for enhancement of wildlife habitat.

While both of the preceding habitat manipulations improve habitat quality for northern bobwhite, they may also make habitat more suitable for RIFA. RIFA mound density is positively correlated with habitat disturbance (Tschinkel 1988). If impacts of fire ants are assumed to be related to density, then the increase of fire ants may lessen or even negate the desired benefits of habitat manipulations. The objective of this study is to determine whether RIFA populations

increase in response to habitat management meant to benefit northern bobwhite.

Materials and Methods

Study Area. We conducted this experiment in Refugio County, Texas. Climate was subtropical, with dry, mild winters (average daily temperature of approximately 14°C), and hot, humid summers (average daily temperature of approximately 28°C) (Guckian 1988). Average annual precipitation is approximately 97 cm. Soils are primarily deep, alkaline to slightly acid clays and sandy loams. Vegetation was typical Texas Coastal Prairie (Gould 1975).

Experimental Design

This study utilized a completely randomized design. The experimental unit was a 150m x 150m plot of grassland, selected based upon presence of sandy loam soils, and adequate fine fuel load to conduct prescribed burns. Plots had to be infested with RIFA. Each plot received one of the following randomly chosen treatments: prescribed burning, disking, or control (no treatment). Disked strips around the perimeter of plots were necessary as firebreaks for plots where prescribed burns were conducted. To minimize possible variation due to the presence of the firebreaks, all experimental units were bordered by disked strips regardless of treatment.

RIFA Population Responses

Each plot was divided into two portions. A distance of 25m was measured towards the center of the plot along each side, creating a 1 ha core area in the middle of the plot bordered by 1.25 ha of edge-influenced area. RIFA mound counts were conducted within the core areas using distance sampling and program DISTANCE (Buckland et al. 1993) before the treatments were implemented in Feb. 1998 after treatment in July 1998 and 1999. Each core plot contained nine, 100 m transects arranged in a bar pattern. The first transect started at a randomly chosen distance between 5-15 m, with the remaining transects 10 m apart. All RIFA mounds detected within a 5 m

perpendicular distance were recorded. The uniform cosine estimator of program DISTANCE was used to estimate ant mound density based on the perpendicular distance of ant mounds from the transect line (Laake et al. 1996).

Application of treatments

Once pre-treatment ant mound density estimates were completed, we applied our habitat treatments (burning, disking, and control). Each treatment was randomly assigned to five plots. Prescribed burns were conducted using the strip headfire ignition technique (Wright & Bailey 1982). Burns were conducted as to maximize burned area of the plots. Disking treatments were applied using an approximately 7 m wide disk pulled behind a tractor for one pass. Eight strips were disked on each plot in a parallel fashion, thus covering approximately 40% of the plot. Burning and disking were conducted within the same week, between mid Feb. and early Mar. 1998.

Data Analysis

Ant response (change in mound density) was analyzed using a two-factor analysis of covariance, with year and treatment (burn, disk, and control) as factors and pretreatment density of RIFA mounds as a covariate. Significance was assessed at α=0.05.

Results and Discussion

Preliminary tests using analysis of covariance revealed that while time was a significant factor (P= .043), there was no difference between treatments (P = .847). However, further analysis will be conducted to try to differentiate environmental influences (precipitation, soil moisture, soil temperature) on ant mound density across divergent years.

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