12-2010

EFFECTS OF VARYING FIELD CONDITIONS ON POTENTIAL PAINTED BUNTING HABITAT IN COASTAL SOUTH CAROLINA

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EFFECTS OF VARYING FIELD CONDITIONS ON POTENTIAL PAINTED BUNTING HABITAT IN COASTAL SOUTH CAROLINA

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Masters of Science
Wildlife and Fisheries Biology

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by
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December 2010

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ABSTRACT

Daily point counts were conducted during the summer seasons of 2006, 2007 and 2008 in randomly selected agricultural plots at two field sites in coastal South Carolina to examine habitat use by painted buntings, indigo buntings, blue grosbeaks and brown-headed cowbirds. Plots were selected based on their original condition, such as planted, fallow or old field, in 2006. The two sites, James A. Webb Wildlife Management Area and Nemours Plantation, are areas managed in methods similar to those described in several Conservation Reserve Programs (CRPs), and CP33 - Habitat Buffers for Upland Birds - in particular. I propose the management regimes outlined in CP33, and similarly the practices implemented at both study sites, are too intense to be able to provide the early successional habitat needed by the focal species. Although there was no statistical significance found when correlating focal species occurrence and plot variables, I observed the greater the intensity of management regime, as determined by the frequency of manipulations, the fewer occurrences of the focal species. The study landscapes offer a variety of habitat, but lack adequate three-year old growth in the form of hedgerows and buffers to sustain populations of the focal species.

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ACKNOWLEDGMENTS

There are so many people without whom this project would not have been possible. First and foremost, I would like to thank my professor and friend Dr. J. Drew Lanham for his guidance, advice and support. I would also like to thank my other committee members Dr. David Guynn, Dr. Greg Yarrow and Dr. Ernie Wiggers and all my other professors at Clemson who aided in my professional, educational and personal growth.

The staff at both the Webb Center and Nemours Plantation were also invaluable. Many thanks to Jay Cantrell and his staff, Ernie Wiggers, Eddie Mills, Adrian Campbell, Daniel Barrineau, Joseph Hollis, Ray Bass, Robert Kitler and Justin Rickenbaker.

Lastly, I would like to thank the peers and friends at Clemson for their continuing support and encouragement.

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CHAPTER ONE

Effects of Varying Field Conditions on Potential Painted Bunting Habitat in Coastal South Carolina

INTRODUCTION

Habitat degradation and loss are some of the primary reasons responsible for declining populations and reduced fecundity of painted buntings, a small Neotropical migrant songbird (Garcia 2004, Kissling and Garton 2008, Lowther et al. 1999, and Springborn and Myers 2005). Populations of painted buntings (*Passerina ciris)* indigo buntings (*Passerina cyanea)*, and blue grosbeaks (*Passerina caerulea)* in coastal South Carolina are known to prefer a maritime shrub/scrub habitat. However, these lands are also prime locations for coastal real estate development, as well as being pockets of intensely managed agricultural lands (Springborn and Meyers 2005). Therefore, it is important for coastal land managers and owners to determine how painted buntings and their associated species use this habitat. Additionally, as land managers' goals become more diverse and often include revenue *and* concern for other species, it is important to implement a management plan that considers suites of wildlife species and provides for multiple management goals across a landscape.

Much of the painted bunting's habitat overlaps landscapes dominated by agriculture and intensive forestry practices. Intensive agriculture practices create a variety of openings, edges and other forms of habitat fragmentation in formerly forested landscapes. Edges are defined as an abrupt boundary between two structurally distinct habitats (Hawrot and Neimi 1996). Avian communities are historically richer in abundance and diversity near edges (Hawrot and Neimi 1996). However, shrubland species, like buntings and grosbeaks, may not thrive near edges and they tend to avoid edges when possible (Rodewald and Vitz 2005). However, due to spreading agriculture, intensive forest management and development, edge avoidance is not always possible (Hanski 1996). Additional evidence cites that land use shifting from native vegetation to intense agriculture results in a change in species richness (Shrag et al. 2009). Shrag et al. (2009) also found areas of increased annual, non-native crop monoculture resulted in decreased avian species richness.

Several researchers showed that habitat with an increased edge ratio was less fit for shrubland species than habitats with fewer edges (Hanski 1996, Rodewald and Vitz 2005, and Weldon 2005). Weldon and Haddad (2005) also reported anthropogenic edges and patches with more complex shapes, and thus more edge area, functioned as ecological traps for the indigo bunting (*Passerina cyanea)*.

A patch is defined as a small area of land identified by similar landscape features, flora and fauna that when combined, form a landscape matrix (Yarrow and Yarrow 2005). Patches are used by painted buntings and their associate species. There is some concern that some patches, too, may be ecological traps. Weldon and Haddad (2005) examined indigo bunting's richness within patches and found patches with more complex shapes functioned as ecological traps for this species, even though they showed strong preference for edges (Weldon and Haddad 2005).

Often undisturbed stretches of habitat, or corridors, are left between these open patches. Like patches, corridors result in increased edge area, which often increases the ratio of predators to prey. Weldon (2006) reported higher predation rates for indigo buntings in winged corridors (those with branched sections) as than for isolated corridors (those with a rectangular shape). The result is most likely due to a higher edge to interior ratio and consequently an increased predator to prey ratio. This was the first landscaped-based study that provided evidence supporting the theory that corridors increase predation rates and decrease fecundity rates of indigo buntings.

Another component of habitat fragmentation is buffer strips – vegetation used to provide shelter for wildlife, windbreaks or other purposes (Yarrow and Yarrow 2005). Buffer strips often break up open areas, fields and patches. These strips are at times intentionally left undisturbed while clearing an area of timber, or while planting to provide foraging and cover habitat for target wildlife species. Buffer strips may be vital parts of a landscape as they can provide suitable habitat for some species, like buntings and bobwhite quail (Garcia 2004, NRCS 2007). Kissling and Garton (2008) found bird community composition fluctuated with buffer width. The highest species richness and diversity was found in buffers with narrower widths. This is due to the increased edge to interior ratio. While this sounds positive, with increased species diversity comes increased predation, especially for most Neotropical migrants who are open-cup nesters. However, buffer strips may help negate the loss of habitat for forest birds.

All these factors contribute to a less than ideal landscape for painted buntings, indigo buntings and blue grosbeaks. These birds require home ranges varying from three to five hectares per individual. As development of natural habitat continues and anthropogenic actions fragment landscapes, it is important to determine (1) how these birds use the current, multiple-use habitats; and (2) how to enhance existing habitats to make them more suitable for these species.

The objective of this study was to determine the probability of occurrence of painted buntings, indigo buntings, blue grosbeaks and brown headed cowbirds at the two study sites. More specifically, this study was an attempt to quantify how the study species utilize the habitat at the two sites. Additionally, information from the study will be used to provide recommendations to private landowners who are interested in providing quality habitat for Neotropical migrant birds. I hypothesized that the occurrence of the focal species would be closely associated with either field plot size and/or plot condition.

STUDY SPECIES

Painted Bunting

The painted bunting (*Passerina ciris*) is a small, brightly colored Neotropical migrant bird. Along the eastern seaboard of the United States, the painted bunting (4 letter species code PABU) is most often found in areas of early-successional scrub shrub habitat in maritime forests and in agricultural settings along field edges (Garcia 2004, Lowther et al. 1999, Springborn and Meyers 2005). Painted buntings frequently forage and nest in fallow fields, grassy areas, marshlands and woodland openings (Springborn and Meyers 2005). Another important component in painted bunting habitat is the presence and complexity of edges (Lowther et al. 1999).

Painted buntings are currently listed as a "species of concern" by the U.S. Fish and Wildlife Service in both Hampton and Beaufort counties in South Carolina, where both field sites are located, as well as across the United States. A "species of concern" is one that is rare and has limited distribution but is not legally protected by the Endangered Species Act (USFWS 2008). PABUs are also on the Partners in Flight Continental Watch List, a list comprised of species needing particular attention as related to specific sets of criteria (Rich et al. 2005).

There are two breeding populations of painted buntings in the United States - one in the Southeast (*Passerina ciris ciris*) and the other in the Southwest (*Passerina ciris pallidior*) (Garcia 2004, Thompson 1991). The eastern population of PABU is the densest and therefore of most concern in terms of population sustainability. Across the entire North American breeding range, Breeding Bird Survey results show a 2.7% annual decline of painted buntings over the past thirty years (Sauer et al. 2007).

Several factors contribute to this decline. The most obvious and prevalent cause has been linked to habitat loss and degradation (Sykes 2005). Especially on the eastern seaboard, painted bunting habitat coincides with prime locations for development and agriculture. PABUs are also vulnerable to capture for the pet-trade business on their South American wintering grounds. An estimated 5880 male buntings were captured between 1984 and 2000 on wintering grounds (Sykes et al. 2007).

Indigo Bunting

The indigo bunting (*Passerina cyanea*) is a small, sexually dimorphic species that is often found in areas dominated by shrubs and other weedy habitats. Areas of cultivation left to grow fallow typify indigo bunting preferred habitat. Indigo buntings (4 letter species code INBU) also utilize perches for singing roosts.

There are resident breeding populations of indigo buntings found throughout the eastern seaboard of the United States. In 2006, there was an average of 21.01 recorded observations of indigo buntings across 40 Breeding Bird Survey routes in South Carolina (Sauer et al. 2008). Indigo buntings are also found throughout parts of the central United States, as well as in isolated patches along the western coast (Payne 2006). INBUs are not currently on any watch list, but there is still some concern regarding the species' endurance in the face of habitat modification and loss. There are also known cases of INBUs being traded and captured for the pet industry in wintering grounds (Birds of North America Online).

Blue Grosbeak

Blue grosbeak (*Passerina caerulea*) males are a deep purple/blue in coloration and are relatively large buntings. Blue grosbeaks (4 letter species code BLGR) are also frequently seen singing from high perches. Male and female blue grosbeaks are also found in old fields, forest openings and other habitats characterized by brushy edges and hedgerows. Although perches are used by singing males, little additional canopy cover is needed (Ingold 1993).

Year round populations of blue grosbeaks can be found throughout the majority of the United States. The breeding range of blue grosbeaks has been steadily extending northward. Due to a lack of current research and data, specific numbers of blue grosbeaks are unknown. It is suggested that since blue grosbeak habitat overlaps with other bunting species, their population numbers are repressed and they have shown a nonsignificant decrease in population numbers based on Breeding Bird Survey results (Ingold 1993, Sauer et al. 2008).

Brown-Headed Cowbird

Brown-headed cowbirds (*Molothrus ater*) are the most well-known nest parasite bird in North America. Brown-headed cowbird (4 letter species code BRCO) habitat is characterized by expanses of open grassland area interspersed by a scattering of trees and shrubs. Brown-headed cowbirds also utilize hedgerows, brushy edges, orchards and residential areas, and their preferred nesting habitat is typically along forest-field ecotones (Lowther 1993).

Year round populations of brown-headed cowbirds are found throughout the south-west to south-central to the eastern portion of the United States. Breeding populations are found more commonly in northern climates. Resident populations are found in South Carolina, and Breeding Bird Survey results show a nonsignificant increase in their population (Sauer et al. 2008). Once confined to the grazing lands of the Great Plains BRCOs are now found throughout most of the United States. Urban development and sprawl has contributed to the increasing range of brown-headed cowbird habitat (Lowther 1993). BRCO’s range is constantly expanding and they are appearing in new areas at an alarming rate (Lowther 1993).

STUDY AREAS

Two field sites, with historically known populations of painted buntings, were utilized for this study: the Webb Wildlife Management Area in Garnett, South Carolina and Nemours Plantation in Seabrook, South Carolina.

Webb Wildlife Center

The Webb Wildlife Center (Webb) is located in Garnett, Hampton County, South Carolina. It is a state Wildlife Management Area that is managed by the South Carolina Department of Natural Resources. The Webb Center is comprised of approximately 2,374 ha and is flanked on its east and west sides by approximately 8,094 additional hectares of state-managed land. Planted loblolly pine (*Pinus taeda*), longleaf pine (*P. palustris*), and slash pine (*P. elliottii*) dominate large sections of the Webb Center. There are also blackwater swamps, ponds and hardwood bottoms on the property. Since Webb is managed largely for public hunting, fishing and wildlife viewing, the habitat is also characterized by large and small food plot plantings of corn (*Zea* spp.), lespedeza (*Lespedeza* spp.), winter rye mixes, chufa and other plantings for wildlife.

Nemours Plantation

Nemours Plantation (Nemours), located in Seabrook, Beaufort County, South Carolina, is managed by the Nemours Wildlife Foundation. The plantation has approximately 3,966 ha encompassing tidal marshes, upland hardwoods and pine stands. The plantation is a private wildlife management area and also serves as an outdoor classroom and lab for the educational and scientific studies sponsored by the foundation. Nemours is located within the Ashepoo, Combahee and Edisto (ACE) Basin, an area known for its rich floral and faunal diversity. Planted pines, bottomland hardwoods and coastal scrub/shrub plant communities can be found on Nemours. There are a variety of food plots and large planted areas of corn throughout the plantation. Dominant vegetation includes, but is not limited to, loblolly pine (*Pinus taeda*), longleaf pine (*Pinus palustrus*), sweetgum (*Liquidambar styraciflua*), lespedeza (*Lespedeza* spp.), and several species of oaks (*Quercus* spp.).

METHODS

As the objective was to discover how PABUs and associated species utilized the landscapes of the two study sites. We used daily point counts to estimate population density and related habitat use. We also wanted information gained from this project to be available to private landowners when developing and implementing strategies of management habitat for wildlife on their lands. Therefore, we decided the best way to gather this information was by conducting daily point counts in the various food plots.

Plot Selection

All possible plots were first identified for each study site and assigned a waypoint via a handheld Garmin etrex VistaC GPS unit. Plots were characterized by size and condition. Plot sizes were <0.4 hectare, 0.41 < 1.21 hectares, and >1.21 hectares.

Plot conditions were defined as old field, fallow and planted. Plots that had no planting activity within three or more planting seasons were considered old fields. Plots that did not have planting activity for two previous planting seasons were labeled fallow and planted fields were those that were currently planted in a row crop. Three plots of each size and condition combination were randomly selected for each study site.

Point Counts

Point counts typically began within thirty minutes of sunrise and continued until 10:00 am at the latest, and were five minutes in duration at each plot. Occasional point count times deviated from those listed above due to the spatial layout and numbers of plots, but all point counts were included in analysis. All visual and auditory identifications were recorded for the target species (PABU, INBU, BLGR, BHCO). Once a species was visually identified the following behaviors were also recorded: perching, feeding, flying, chasing, hopping and calling/singing. Plots were visited a minimum of once per week. The order and day in which the plots were visited were randomized in an attempt to limit temporal bias. In addition, during each point count I remained in the same location in order to reduce the chance of missed or double counts.

DATA ANALYSIS

To assess the relationships between species presence and study sites, and study plots, I used a generalized linear mixed model. Each year was examined separately due to temporal changes that occurred between and across years, such as plot changes, bird life span and migratory patterns, and weather variables. Data were examined to see if there were any statistical significance between the relationships of species and habitat ($\alpha=0.05$). The three years of data were analyzed using PROC GLIMMIX that was run in a SAS statistical package (Version 9.2). PROC GLIMMIX is a "procedure [that] fits statistical models to data with correlations or nonconstant variability and where the response is not necessarily normally distributed" (SAS 9.2). Statistical inference was performed for two fixed effects of bird presence against site and week across a binomial distribution, and total bird presence against plot size, across a binomial distribution.

RESULTS

Species Present/Point Counts

Over the three field seasons a total of 577 observations of focal species were recorded during 936 point counts, 539 at Webb and 397 at Nemours. Data on specific species observed at both field sites for the three field seasons are available in Figures 2-4.

For 2006, there was a 6% (SEM=0.06183) chance of the focal species occurring at Webb (Figure 6). At Nemours, there was a 12% (SEM=0.1227) chance of any focal species occurring in any patch. There was no difference in the probability of occurrence between the three field sizes and there was nonsignificant probability that there would be any bird present. There was a slightly higher chance of seeing one of the species within the first three weeks at either site, but this was not statistically significant (Figure 3). 2006 was the only year that there was any apparent difference in occurrence across weeks. Analysis was not completed for original field status or edge presence due to the large number of habitat structure changes that occurred mid-season and between seasons in plots.

For 2007, there was a 5% (SEM=0.05695) chance of the four target species occurring at Webb (Figure 6). At Nemours, there was a 7% (SEM=0.07107) chance of any bird present. There was no difference in probability of occurrence between the three field sizes. Furthermore, there was very low probability that there would be any bird present. There was a little variation in bird presence over the course of the field season, but this was not statistically significant.

For 2008, the analysis of bird presence across sites and weeks did not converge, meaning there was no correlating data. The data did converge for the analysis across plot sizes (Figure 7). There was a 9% (SEM= 0.09887) chance of any bird being present in small plots. For medium plots, there was a 12% (SEM= 0.1270) chance and a 14% (SEM=0.1406) chance of any bird being present in large plots.

The probability of occurrence of seeing any of the focal species

Habitat Changes

Plot conditions at Webb were not static within the sampling period. Changes often occurred on a daily or weekly basis and included herbicide application, burning, mowing, disking and planting. The number and types of changes observed are found in Tables 1 and 2.

DISCUSSION

Based on the data and analysis, my original hypothesis that occurrence of the four focal species would be closely associated with either field plot size and/or field condition is not statistically supported; thus, the null hypothesis is accepted. Using my data, no strong correlations were determined for either variable and bird abundance. This could suggest the variables I examined truly do not influence field use by these four focal species or my study design was flawed.

It is difficult to make landscape-wide recommendations for the two study sites, as the landscapes were so dynamic. To gain a better understanding of the status of the resident population of painted buntings and similar species in coastal South Carolina, I recommend that an approach similar to Garcia (2004) be taken. Following Garcia's procedure will allow one to first identify buntings and second to follow them to the habitat they are using. Thus, one would be better able to examine known concentrations of bunting populations and how habitat and landscape changes affect them.

In retrospect, there are several research plan modifications that I would recommend. First, it is important to work with the land managers. It is unrealistic to expect that all management activities will cease in selected plots; however, perhaps an agreement may be reached to limit the number and frequency of management applications that occur in study plots. Plowing, disking, planting, burning and herbicide applications were anticipated to occur prior to and in between study seasons, not on a daily basis which took place in some instances.

Sample plots at Webb were much more intensely managed than sample plots at Nemours in terms of the number and frequency of management changes that occurred within study plots. The constant rotation of crops and habitat structure at Webb made it difficult for buntings to find adequate vegetative structure in and around the study plots. Buntings, painted buntings in particular, need an average of three years of early successional forest growth for adequate cover, forage, and brood habitat (Lanham 2010).

With an average rate of change of 9.9% over the three years of sampling, the Webb center did not maintain adequate three year-old growth early successional habitat for painted buntings to thrive. This statement is supported by a 5.5% chance of a focal species being present at Webb. The number and types of changes recorded at Webb are available in Table 1.

The study area at Nemours had an average rate of change of 5.6% across the three years and there was roughly a 19% chance of observing a focal species within a sample plot. Although there were fewer numbers of total birds identified at Nemours as compared with Webb, there were also fewer point counts conducted. This is why there is a slightly higher chance of a focal species being present at Nemours. This gives strength to my argument that a mild to moderate management regime, or one that is less intense in the number, frequency and varieties of management changes, may be best for maintaining habitat that is suitable for buntings as well as other species. Specifically, a moderate regime will provide and maintain three year-old growth in and adjacent to managed agricultural and forested landscapes. Therefore only burning, disking, or mowing every third year on a rotational basis is recommended to provide adequate habitat. In a patchwork landscape, a moderate management regime is best to ensure there is adequate early successional habitat for buntings. The number and types of changes recorded at Nemours are available in Table 2.

Furthermore, the study design used for this project would be better implemented using two observers resulting in equal sampling time at each field site. Due to the logistics of random plot sampling, each plot could not be surveyed equally between the two sites. With two observers, the survey work would be divided more evenly.

As there were few statistically significant findings from this project, much of the following discussion is based on current research findings that may be applied to landscapes such as Webb and Nemours. Additionally, there are several viable government programs which offer assistance to private landowners who manage their lands for a variety of flora and fauna.

Agricultural land use is often dictated by technology, market pressure, policy, and values and priorities, rather than by land manager's goals (Burger 2006). As a result of ever-changing agricultural commodities, advancing technologies and subsequent endangerment of wildlife, it is vital that land managers begin to take into account wildlife species that are dependent upon their lands for survival. This project aimed to determine how the focal species used the landscape at the two study sites. Since the two study sites undergo multiple-use management results of this study and management recommendations from these two areas are also applicable to private landowners since they often have similar management goals. However, due to such a small sample size accrued over the three field seasons, most of the analysis completed was not significant, or for some processes in 2008, the data had zero correlation. While the statistical results were not significant, valid insights gained from the research will hopefully be applicable to landowners.

The United States government has created various programs that offer incentives to private land owners for providing wildlife habitat on agricultural and forested lands.

One of these programs is the Conservation Reserve Program (CRP), which began in the 1950s as the Soil Bank Program. The program grew in the 1980s into what it is recognized as today. Recently, in 2004, Conservation Practice 33 (CP33), Habitat Buffers for Upland Birds, was initiated by President George W. Bush (Burger et al. 2006a). CP33 is a specific USDA Farm Bill CRP and the first designed to meet specific wildlife habitat and population goals (Burger et al. 2006).

Essentially, over 100,000 ha were allotted across 35 states that fell within the bobwhite quail's (*Colinus virginianus)* range. CP33 provided incentives to land managers who would agree to implement particular management practices on their land. These practices include forming habitat buffers of 9-36.5m in width that are composed of native warm-season grasses, legumes and shrub (Figure 4). The idea of the buffer requirement was to provide adequate nesting and brood rearing habitat for quail. An additional component of CP33 is required, periodic, planned disturbances of the desired habitat over the life of the contract, provided that the plantings have become established, or three years have passed, whichever is less (Burger et al. 2006, Greenfield 2003, NRCS 2007). Indeed, there have been studies that show bare ground is needed for foraging habitat for quail, and that increased disturbance lends to prime bobwhite habitat (Greenfield 2003). Moreover the CRP and CP33 have been shown to have great success with grassland species. Haroldson (2006) found higher numbers of ring-necked pheasants and meadowlarks in lands enrolled in CRP programs.

Conversely, Neotropical migrant birds that are the species of focus for this study are known to utilize habitat with a higher degree of structure and complexity than those found in buffer strips or routinely found in and around disturbed agricultural areas (Birds of North America Online). Springborn (2005) recommends more than 50% ground cover is needed to provide optimal painted bunting habitat. So in theory, the CP33 treatment sounds like an ideal management regime for land owners, but the end results are not optimal for Neotropical migrants.

However, another program to consider alongside of CP33 is the Natural Resource Conservation Service (NRCS) Conservation Buffer Initiative. This initiative encourages the establishment of conservation buffers to achieve a multitude of objects, such as soil erosion reduction, water-quality improvements and wildlife-habitat improvement (Burger et al. 2006). Buffer strips are loosely defined as an area or strip of land that is maintained in permanent vegetation in an attempt to control pollutants and other environmental problems (NRCS 2010). Although this may be an economic trade off for land owners in terms of crop loss, buffer strips slow water runoff and trap sediment while providing shelter and corridors for wildlife (Burger et al. 2006, Conover 2007, NRCS). Part of the management requirements in this portion of CP33 require buffers to be 9-36.5m feet wide and planted with native, warm-season grasses, legumes and shrubs (Burger et al. 2006). However, landowners may implement the NRCS Buffer Initiative even if their entire field is not enrolled in or does not qualify for CP33 (NRCS 2010). Buffers are a good way to incorporate a feathered edge, or border zone between forest and field.

These buffer requirements, in combination of the previously mentioned disturbance regimes, may be an option for land managers who wish to provide quality habitat for game species, such as bobwhites, and songbirds, such as painted buntings

(Conover 2007). Kissling (2008) cites that buffer strips do work in some instances with certain forest species. In order to make buffers more attractive to the bunting species in this study, strips that are at least 20 meters wide should be implemented to provide adequate edge to interior ratio. Additionally, the buffers would need to develop undisturbed for several years to reach the prime early-successional stage that buntings favor (3 to 5 years).

An unknown component of the buffer scenario is how many buffers and what distance from each other are needed to provide optimal habitat. If a land manager created a landscape with 36 m wide buffers, it is much more probable to have quality bunting habitat, as it would provide more habitat and space for this species. Of course, this is an arbitrary assumption as there are many other variables that affect whether or not this would be ‘good’ bunting habitat, and it would require moderate modification roughly every three years to maintain the preferred bunting habitat of early successional shrub/scrub vegetation.

The management regime at Webb and portions of Nemours seemed to comply with some of the standards required for private lands enrolled in cropland conservation programs (CPs). While neither site was enrolled in any such program, the programs provide a way for private land owners to receive cost-sharing assistance for management and to gain personal benefits from good land stewardship, as well as to generate habitat for Neotropical migrants. In terms of identifying positive or negative impacts of CPs on Neotropical migrants, it is my recommendation that future studies occur on lands previously enrolled in CPs and examine what species currently populate them before any claims are made relating to CP's effect on these birds.

Another important aspect of CPs for landowners to consider is the cost of maintaining lands to meet all CP requirements. CP33 requires periodic planned disturbances – but at what cost to the landowner? For example, it is recommended to use a 30-50 horsepower (hp) tractor when managing small food plots ranging in size from 0.4 ha to 2.02 ha (Kammermeyer et al. 2006). An example of a typical tractor of this size is the John Deere 5203 which consumes 3.12 gallons of diesel per hour at maximum power (Nebraska Tractor Test Laboratory 2006). With the average cost of diesel in 2009 at $2.46 and a standard labor rate of $10 per hour, it is estimated to cost $141 a day to manage an agricultural landscape (U.S. Energy Administration 2008). Planting season costs will vary with the type of vegetation planted, soil condition and nutrient load and the amount of site preparation needed. Selecting even a third of the known plots to be managed (disturbed) on a third-year rotation cycle may result in substantial savings for the landowners, while simultaneously providing early-successional shrub/scrub habitat that is needed by these birds. Coupled with the correct spatial and temporal schedules, this modified management plan may also result in better compliance with the CP33 requirements as some plots could, over time, develop into buffers. If a land manager adjusts his manipulation schedule to space out habitat modifications, the results may be beneficial to both the land owner in terms of cost savings, and Neotropical migrants in terms of providing additional habitat.

Furthermore, when implementing a third year rotational management regime, land owners may also provide forage and shelter cover for a suite of species. These buffers, or edges, provide forage and cover in a small area, reducing the need for wildlife to move long distances (Kammermeyer and Thackston 2007). The plots that remain undisturbed for three years should provide adequate growth of low to mid-story forbs, native warm-season grasses and legumes that function as forage and shelter cover for white-tailed deer, quail, turkey and other game and non-game species. Most frequently in the Southeast, cover is a limiting factor for white-tailed deer (Yarrow and Yarrow 2005). When allowed to grow undisturbed, buffers and food plots consisting of native, warm season grasses are encouraged for white-tailed deer management as they grow tall enough to provide necessary cover (Guynn 2010). This is just one example of how a multi-use, third year rotational management regime could benefit a suite of species – both game and non-game

The study area's lack of focal species indicates their current management regimes, and possibly the similar management plants required by CP programs, are flawed if the management objective is to supply habitat for the focal species. They do not provide adequate habitat for the Neotropical migrants studied. While the CPs may be good in theory, it is my suggestion that lands enrolled in these programs present a habitat that is too diversified and lack enough contiguous early-successional habitat (three year-old growth) for the focal species. Edges, buffers and hedgerows are present, but not in a large enough ratio for the buntings to thrive. It is possible that buntings and associated species are moving away from habitats that are dominated by agriculture and into areas of mid to late succession forest interspersed with fewer openings. This claim is based only on personal observations of buntings in forested areas while traversing between study plots and currently has no statistical backing.

Table 1 – Number and type of recorded changes at Webb in 2006, 2007 and 2008.

Year	Plot type	Mow	Till	Burn	Herbicide	Plant
2006	Planted		5			
	Fallow		10			1
	Old		6			
	mixed					
2007	Planted					
	Fallow	2	3			
	Old					
	Mixed	3		1		
2008	Planted					
	Fallow	4	1		2	1
	Old	2	3	1	2	
	Mixed			1		

Table 2 – The number and type of recorded changes at Nemours in 2006, 2007 and 2008.

Year	Plot type	Mow	Till	Burn	Herbicide	Plant
2006	Planted	1				
	Fallow	2				
	Old					
	mixed					
2007	Planted	2	1			
	Fallow	5				
	Old		1			
	Mixed					
2008	Planted					
	Fallow	1				
	Old					
	Mixed					

Figure 1 – The number of recorded identifications of the focal species out of 186 and 29 point counts at Webb and Nemours, respectively, in 2006.

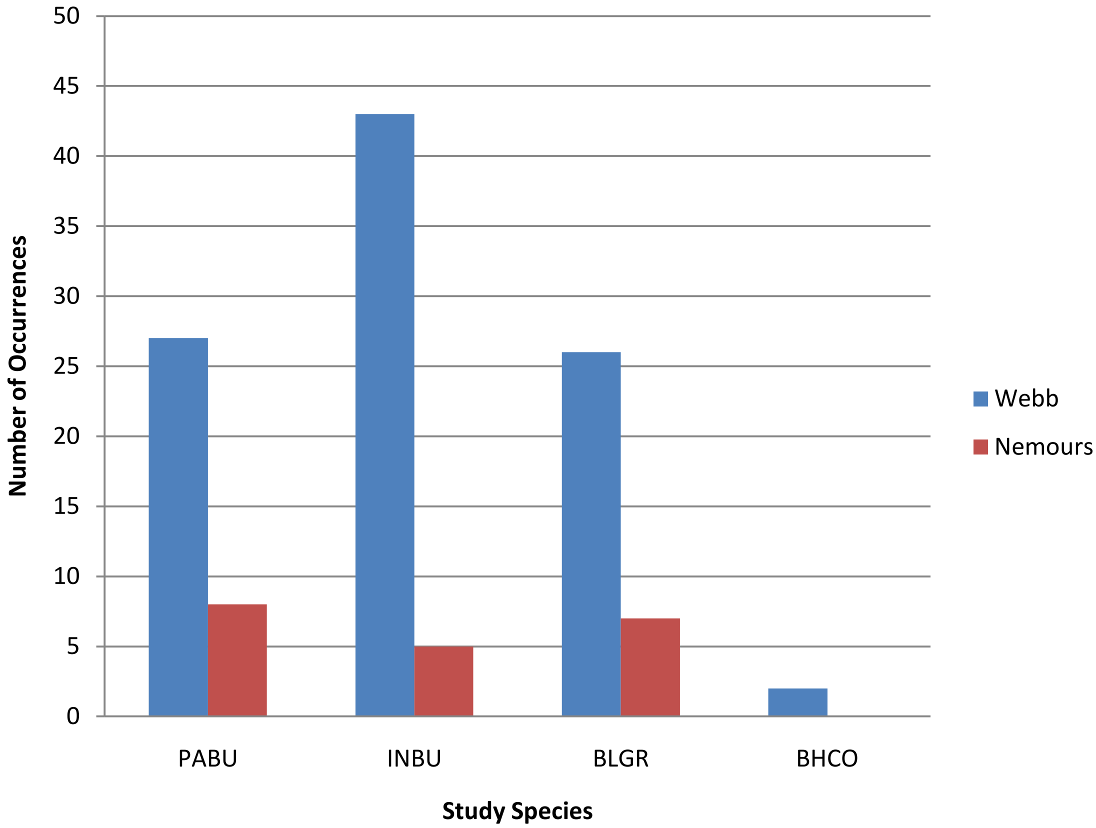


Figure 2 - Distribution of occurrences of focal species by week in 2006.

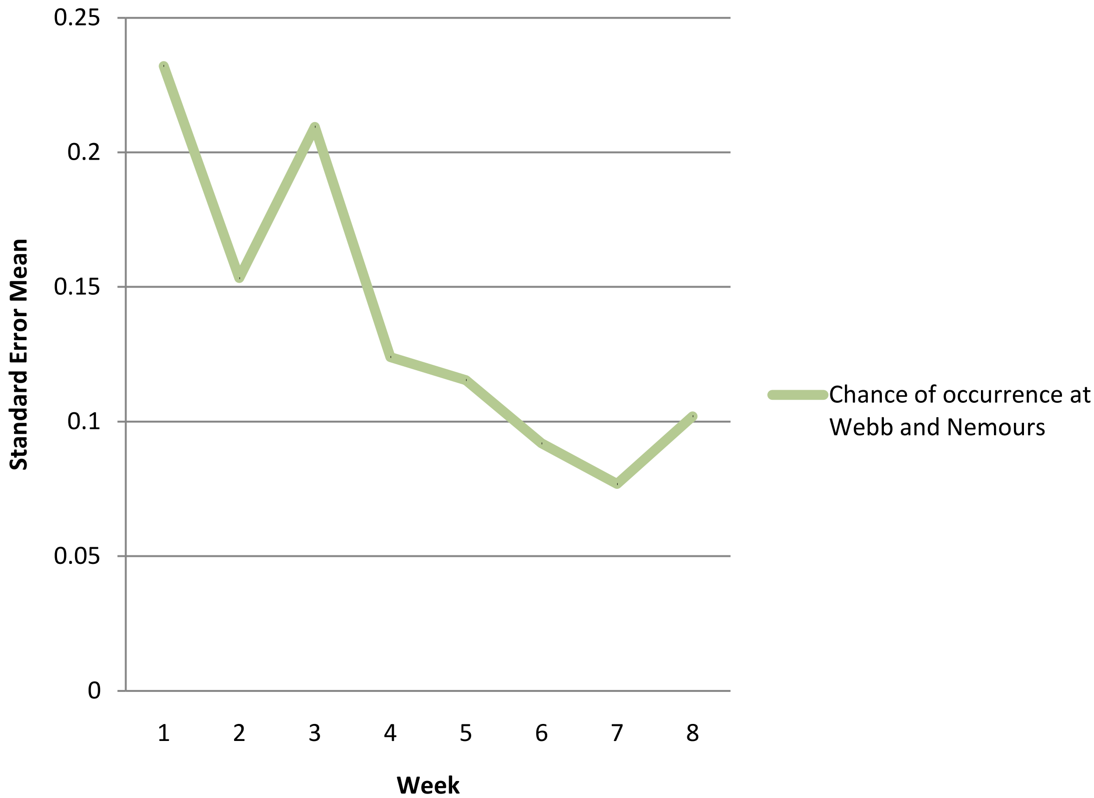


Figure 3 - The number of recorded identifications of the focal species out of 234 and 156 point counts at Webb and Nemours, respectively, in 2007.

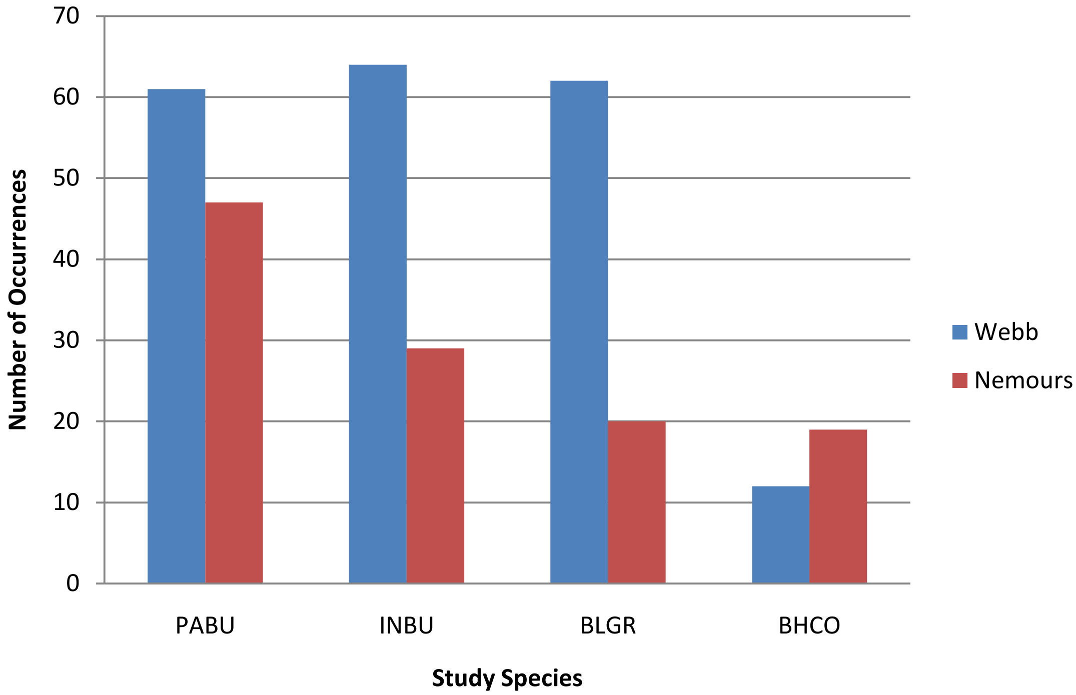


Figure 4 – Diagram of buffer initiative landscape.

USDA NRCS
"Contour buffer strips, field borders, grassed waterways, filter strips and riparian forest buffers are all part of the buffer initiative. Conservationists urge their use as part of a complete conservation system."

Figure 5 – The number of recorded identifications of the focal species out of 119 and 212 point counts at Webb and Nemours, respectively, in 2008.

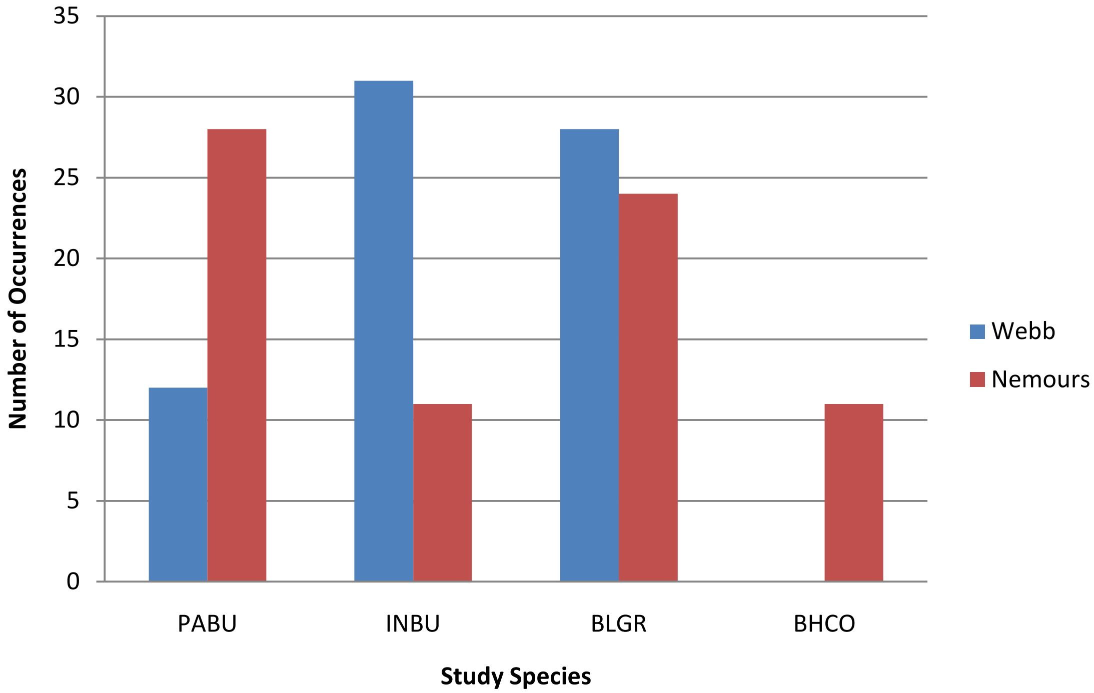
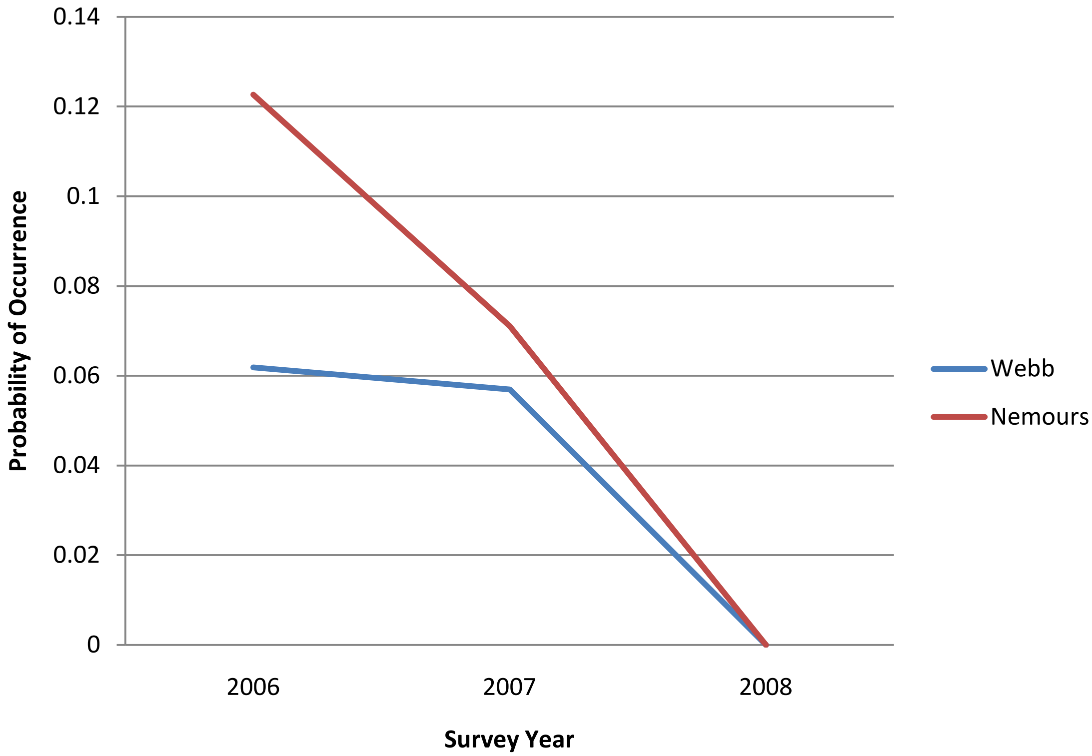
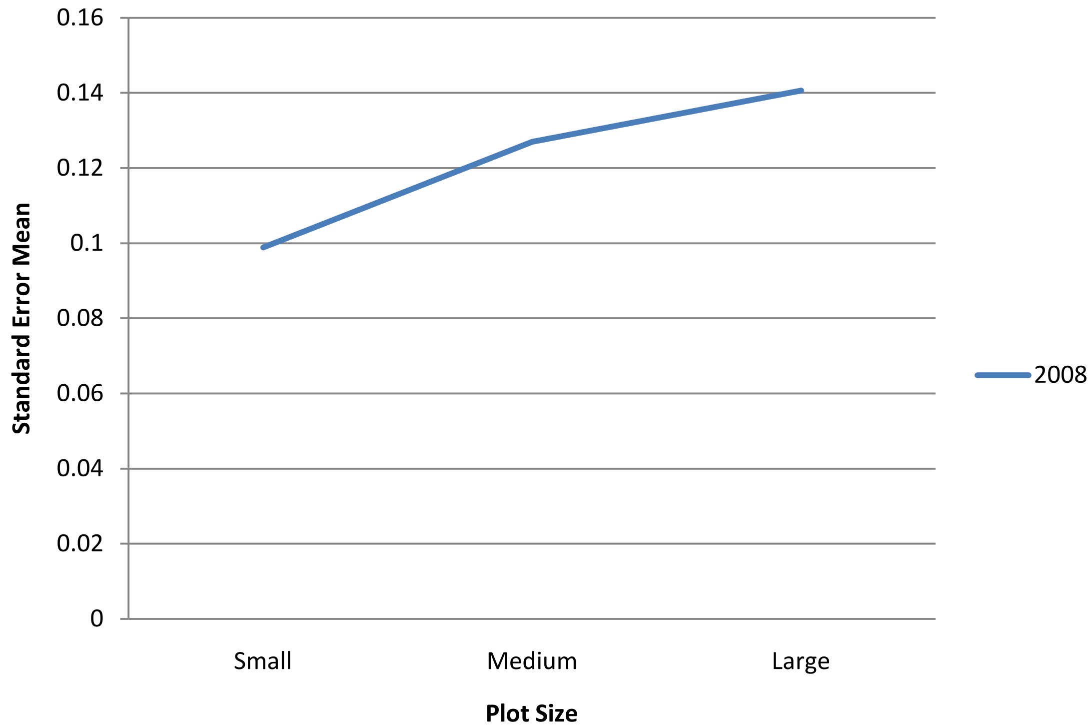


Figure 6 – Probability of species occurrence at Webb and Nemours by year.



The standard error mean of the probability of occurrence of any bird (PABU, INBU, BLGR or BHCO) being present at Webb or Nemours.

Figure 7 – Probability of species occurrence at both Webb and Nemours.



The probability of species occurrence was the only data set that converged for the 2008 sample season.

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