Mississippi's Conservation Reserve Program

CP33 - Habitat Buffers for Upland Birds

Mississippi Bird Monitoring and Evaluation Plan

Final Report, 2006–2008

MISSISSIPPI STATE UNIVERSITY™

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Executive Summary

Populations of northern bobwhite and other upland grassland birds have experienced precipitous range-wide declines for several decades. In an attempt to reverse these declines and through the recommendation of the Southeast Quail Study Group (SEQSG), the USDA-Farm Service Agency (FSA) approved a new Conservation Reserve Program (CRP) continuous signup practice, CP33–Habitat Buffers for Upland Birds. Habitat buffers, planted with native warm-season grasses, forbs and legumes, are primarily designed to provide nesting and brood rearing habitat for bobwhite in agricultural landscapes. Buffers may also provide habitat for other grassland bird species of conservation concern. The FSA allocated 250,000 CP33 ac to 35 states to be actively managed for a contract period of 10 years. Mississippi was allocated a total of 9,404 ac. Since the program's initiation on October 4, 2004, 2,179 ac have been enrolled throughout 22 counties in Mississippi. Because CP33 was specifically designed to address population recovery goals of the Northern Bobwhite Conservation Initiative (NBCI), the FSA requested that the SEQSG develop a large-scale monitoring program to estimate bobwhite and priority songbird population response to implementation over a 3-yr sampling period. Mississippi State University, cooperating with the Mississippi Department of Wildlife, Fisheries and Parks, Mississippi FSA, and Mississippi USDA-Natural Resources Conservation Service (NRCS), is responsible for implementing Mississippi's CP33 monitoring program. Breeding season bird surveys were conducted during June 2006–2008, and fall covey call surveys were conducted during October–November 2006–2008 on a sample of 40 paired CP-33 and control fields. State-level breeding season and fall covey data analyses were conducted using conventional distance sampling to generate density estimates. CP33 vegetation communities were evaluated using 10 systematically place 1-m^2 vegetation sampling plots within each CP33 buffer. Overall avian species richness was greater in CP33 sites relative to control sites. Bobwhite exhibited an average 540% greater breeding season density and 120% greater fall covey density on CP33 fields, relative to control fields, over all 3 years. Dickcissels exhibited a 360% greater density in 2006 and 2007 and 1200% greater density in 2008 on CP33 buffered fields. Both field sparrow and eastern meadowlark densities were slightly greater in CP33 fields than control fields. Indigo buntings exhibited high densities in both CP33 and control fields, but densities were still greater in CP33 fields with an average effect size of 54 male birds/100 ac. Many non-priority early successional bird species, including the common yellowthroat and the yellow-breasted chat, were more abundant on CP33 fields than control fields. Species that generally thrive in agricultural fields such as the mourning dove and red-winged blackbird also responded positively to CP33 buffers. The vegetation community varied in CP33 buffers throughout the three years of sampling. Native warm-season grass species dominated the buffers all three years, and mean percent coverage was greatest in 2007 at 62.89%. Some exotic grass species persisted, covering an average of 13% over all 3 years. Forb, legume, and woody species percent coverage averaged 30%, 8%, and 3%, respectively. Native warm-season species including legumes and forbs peaked in 2007, whereas exotic and woody species decreased in 2007. CP33 buffer habitats have produced positive benefits to many avian species in agricultural landscapes, specifically northern bobwhite quail. This positive response is likely attributable to increased nesting, brood-rearing, and foraging cover and associated insect and seed food resources. Observed bobwhite densities illustrate that recovery goals of the NBCI are achievable with the application of upland habitat buffers affecting only 8% of the total landscape and 15% of row-crop acreage, if broadly deployed. As CP33 buffers are maintained and managed and vegetative structural cover continues to improve in subsequent years, it is expected that CP33 buffers will provide for more positive population effects.

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Introduction

Northern bobwhite quail (hereafter, bobwhite) populations have declined at an average of 3%/yr throughout their entire range and almost 4%/yr in Mississippi since 1966. These declines have presumably been a result of loss of quality habitat due to changing land use, including monoculture farming, intensive timber management, reforestation, urbanization, and the elimination of fire. As a result, bobwhite and other species dependent on the same habitats have exhibited precipitous population declines. The Northern Bobwhite Conservation Initiative (NBCI) is a range-wide, habitat-based restoration plan developed by the Southeast Quail Study Group (SEQSG). The NBCI is predicated on the assumption that creation of sufficient amounts of early succesional native plant communities in working forest and agricultural landscapes will stabilize declining populations and lead to population restoration. To help address the habitat goals identified in the NBCI, in 2004 the USDA-Farm Service Agency (FSA) approved a new Conservation Reserve Program (CRP) continuous signup practice, CP33–Habitat Buffers for Upland Birds. CP33 is designed to benefit bobwhite and other grassland songbirds by providing idle native herbaceous habitat in agricultural systems. Under this program 30–120' habitat buffers planted to approved native warm-season grass, forb, legume, and shrub species are established around cropfields to provide nesting, brood-rearing, winter, and foraging habitat for bobwhite and grassland birds.

Of the 250,000 total CP33 ac allocated by the FSA to 35 states, Mississippi was allotted 9,400 ac. Since the program's initiation on October 4, 2004, 2,179 ac have been enrolled throughout 22 counties in Mississippi (Figure 1). Monroe County in northeast Mississippi has the greatest amount enrolled at 708 ac. The remaining 1.471 ac are mainly clustered in Delta and northeastern Mississippi counties (Table 1). All contracts will expire 10 years following initial enrollment. Therefore, contracts will begin to expire during 2015.

Because CP33 was specifically designed to address population recovery goals of the NBCI, the FSA requested that the SEQSG design a large-scale monitoring program to estimate bobwhite and priority songbird population response to CP33 implementation (FSA Notice CRP-479). Subsequently, the "CP33–Habitat Buffers for Upland Birds Monitoring Protocol" was developed (Burger et al. 2006). The protocol called for monitoring bird populations on a sample of fields in the 20 states that were allocated 95% of the total CP33 acreage. Fourteen states, including Mississippi, participated in the coordinated monitoring program. Mississippi State University, cooperating with the Mississippi Department of Wildlife, Fisheries and Parks, Mississippi USDA-FSA, and Mississippi USDA-Natural Resources Conservation Service (NRCS), was responsible for implementing Mississippi's CP33 monitoring program on 40 enrolled fields. The objectives of this 3-yr monitoring program include: (1) satisfying the FSA's required wildlife monitoring component of CP33; and (2) evaluating the programmatic effects of CP33 on bobwhite and grassland bird populations in Mississippi.

Methods

Experimental Design

A random sample (n=50) of Mississippi's CP33 contracts was selected from the FSA CRP contract database. From these contracts, 40 CP33 fields were randomly selected in 9 counties within the state (Calhoun, Chickasaw, Clay, Coahoma, Itawamba, Monroe, Newton, Prentiss, and Union counties; Figure 2) for avian and vegetation sampling. A similarly cropped non-enrolled field (control), located >1 km and <3 km from each CP33 field (treatment), was also surveyed for comparison. All fields were sampled from 2006–2008 during both breeding season and fall to determine field-level effects of CP33 implementation on bird populations.

Breeding Season Counts

The SEQSG in cooperation with Partners in Flight developed a list of obligate or facultative grassland priority bird species of conservation concern. These species included bobwhite, dickcissel, eastern kingbird, eastern meadowlark, and indigo bunting. Mississippi monitoring included priority birds, but also documented presence and abundance of all species observed. We conducted breeding season surveys according to the "CP33–Habitat Buffers for Upland Birds Monitoring Protocol" (Burger et al. 2006) during June, 2006–2008. All calling male birds were recorded by species, distance band (0–25 m, 25–50 m, 50–100 m, 100–250 m, 250–500 m, and >500 m), and time interval (1–3 min, 4–5 min, and 6–10 min). Two replicate surveys were conducted at most fields each breeding season.

Fall Covey Counts

We monitored post-breeding bobwhite populations by conducting fall (October–November) covey-call count surveys in 2006–2008. Surveys began approximately 45 min before sunrise and concluded at sunrise. Covey locations, time of calling, and specific weather variables were recorded on datasheets containing aerial photos of the survey location. Distance was later measured from georeferenced imagery from the National Agriculture Imagery Program (NAIP) using ARCGIS software to generate an exact radial distance from the point to the estimated location of the calling covey. Each treatment field and associated control field were sampled simultaneously and one time per year.

Vegetation Structure and Community

We characterized vegetation structure within 10 systematically placed 1-m^2 vegetation sampling plots along within each CP33 buffer in which avian call counts were conducted. We sampled vegetation within these plots during all 3 years of avian community monitoring to document changes over time. Within each 1-m^2 plot, we recorded percent coverage of native and exotic grass species, forbs, legumes, woody species, litter, and bare ground to evaluate native warm-season grass/forb/legume establishment and quantify habitat composition and structure.

Bobwhite Quail

Dickcissel
Photo courtesy of Jim Rathert, Missouri Department of Conservation

Eastern Kingbird

Eastern Meadowlark

Indigo Bunting

Data Analysis

We analyzed call count data for all priority bird species, excluding eastern kingbird, using conventional distance sampling techniques to generate estimates of density for each species (breeding season males/100 ac for all species and fall coveys/100 ac for bobwhite) on CP33 and control fields in Mississippi in 2006, 2007, and 2008. The eastern kingbird exhibited an inadequate number of detections for analysis. Therefore, we were unable to obtain accurate density estimates for this species. However several other non-priority species were encountered in high enough numbers to calculate density and were included in the analysis. These species included the common yellowthroat, brown-headed cowbird, yellow-breasted chat, mourning dove, and red-winged blackbird.

Because vegetation structure of field borders could potentially influence detection probability, we compared pooled global detection functions with detection functions stratified by treatment (CP33 vs. control). We truncated species-level data at distances where detection probability was less than 0.1. We used model selection via Akaike's Information Criteria to evaluate the fit of 3 key-function models (uniform, half-normal, and hazard rate) between the global and stratified detection functions with and without the addition of covariates (Bird Conservation Region (BCR) and year) and adjustment terms (simple polynomial, hermite polynomial, and cosine). Breeding season data were analyzed using distance intervals and fall covey data using exact distances. Both breeding season and covey density estimates reported in this summary may differ from those reported in the 2006 and 2007 reports because the additional data from the 2008 breeding season and covey counts allowed for the application of more robust models and the acquisition of more precise estimates. For vegetation data analysis we estimated mean percent cover of native and exotic grass species, forb, legume, woody, litter, and bare ground for 2006, 2007, 2008, and pooled over all 3 years.

Common Yellowthroat

Brown-headed Cowbird
Photo courtesy of Marshall Ieff

Yellow-breasted Chat

Mourning Dove

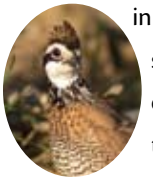
Red-winged Blackbird

Results

Avian Community

Species richness was greater at CP33 sites than control sites. Across the 2006–2008 breeding seasons, we observed 69 total species at control sites and 82 total species at CP33 sites. We observed 52 and 67 different species at control and CP33 sites, respectively, during the 2006 breeding season; 50 and 54 different species at control and CP33 sites, respectively, during the 2007 breeding season; and 50 and 55 different species at control and CP33 sites, respectively, during the 2008 breeding season. Table 2 summarizes the relative abundance of breeding bird species detected between control and CP33 sites throughout the 3 years of sampling.

All priority avian species responded positively to the establishment of CP33 habitat buffers (all densities are referenced in Table 3). Bobwhite exhibited a greater breeding season density in CP33 fields all 3 years with an effect size ranging from 4.51 birds/100 ac in 2007 to 7.53 birds/100 ac in 2006 (Figure 3). Bobwhites were on average 540% more abundant on CP33 sites relative to control sites. Bobwhite fall covey density was on average 120% greater on CP33 fields compared to control fields with an effect size ranging from 0.46 coveys/100 ac in 2007 to 0.74 coveys/100 ac in 2008 (Figure 4). Dickcissels also showed considerable response to CP33 buffers, exhibiting densities of 17.7, 11.2, and 5.4 male birds/100 ac in 2006, 2007, and 2008, respectively, at control sites and 81.9, 52.1, and 71.5 male birds/100 ac in 2006, 2007, and 2008, respectively, at CP33 sites (Figure 5). This represents a 360% greater density in 2006 and 2007 and a 1200% greater density in 2008 relative to control sites. Field sparrow density was slightly greater in CP33 fields with an effect size of 1 male bird/100 ac in 2006 and 2007 and almost 3 male birds/100 ac in 2008 (Figure 6). Indigo buntings exhibited high densities on both control and CP33 sites, but densities were still greater in CP33 fields with an average effect size of 60 male birds/100 ac (Figure 7). Eastern meadowlark density was only slightly greater at CP33 sites in 2006 and 2007 with effect sizes ranging from 0.36 male birds/100 ac in 2007 to 0.46 male birds/100 ac in 2006. Eastern meadowlarks exhibited lower densities in CP33 fields in 2008 (-0.7 % relative effect size) compared to control fields (Figure 8).



Most non-priority species responded positively to CP33 implementation relative to control sites. Common yellowthroat densities were greater at CP33 sites than control sites, but response varied among years with effect size ranging from 1.2 male birds/100 ac in 2007 to 17.7 male birds/100 ac in 2008 (Figure 9). Conversely, brown-headed cowbird densities were lower at CP33 sites than control sites all 3 years. Brown-headed cowbirds were almost 200% less abundant in 2006 and 5% in 2007 and 2008 in CP33 buffered fields relative to control fields (Figure 10). Densities of the yellow-breasted chat were similar at both control and CP33 sites in 2006; however, densities were 4.5 male birds/100 ac greater in CP33 fields in 2007 and 2008 (Figure 11). Mourning doves responded well to the implementation of CP33 buffers exhibiting effect sizes of 7.22, 12.61, and 3.77 male birds /100 ac in 2006, 2007, and 2008, respectively (Figure 12). The 2007 effect size represents a little more than 200% greater density relative to control sites. Red-winged blackbird densities were considerably greater in 2006 with an effect size of 48 male birds /100 ac, but tapered off in 2007 and 2008 exhibiting effect sizes of 4 and 17 male birds/100 ac respectively (Figure 13).

Vegetation Structure

The vegetation community varied throughout the 3 years of sampling (Table 4). Native warm-season grass species dominated the buffers in 2006–2008 and mean percent coverage was greatest in 2007 at 62.89%. Although CP33 buffers were established in native grass, forb, and legume species, exotic grass species comprised an average of 12.53%, 11.99%, and 15.77% cover in 2006, 2007, and 2008, respectively. Among the 3 other life forms evaluated, forbs exhibited the greatest percentage ranging from 16.62% in 2006 to 42.36% in 2007. Percent coverage by leguminous species ranged from 1.55% in 2008 to 14.68% in 2007. Percent coverage by woody species ranged from 0.14% in 2007 to 5.43% in 2006. Coverage of native warm-season species, legumes, and forbs peaked in 2007, whereas exotic and woody species decreased in 2007. Percent litter coverage was greatest in 2006 at 36.58% and decreased in 2007 and 2008. Percent bare ground varied among the 3 years exhibiting coverage of 30.36%, 49.86%, and 19.33% in 2006, 2007, and 2008, respectively. Figures 14, 15, and 16 illustrate the changes in vegetation across years in the Southeastern Coastal Plain portion of Mississippi. Figures 17 and 18 are examples of mixed grass buffers on fields located in the Mississippi Alluvial Valley (Delta).

Discussion

Bobwhite populations have declined at an average of almost 4%/yr in Mississippi since 1966. The NBCI is a habitat-based rangewide restoration plan designed to reverse these declines in landscapes where improvable lands still exist. The NBCI is predicated on the presumption that in most landscapes the lack of idle, native grass, forb, and shrub communities limits bobwhite populations. Because agricultural systems are abundant in the southeast, are generally open lands that support remnant low density bobwhite populations, and are amenable to modification, they have been targeted as key areas for bobwhite habitat restoration. The CP33–Habitat Buffers for Upland Birds practice provides a programmatic vehicle to provide essential habitat in these landscapes.

In Mississippi, CP33 buffers were established by planting native warm-season grasses and forbs. Consequently, buffers were dominated by native warm-season grasses and a diverse mixture of native forbs and legumes. These buffers provide additional bobwhite habitat necessary to support sustainable populations. Assuming an effective survey radius of 500 m (194 ac), our pooled 2006–2008 estimate of effect size for adjusted covey densities (0.631474 coveys/100 ac) translates to an average increase of 1.23 coveys in the vicinity of CP33-enrolled fields relative to control fields. Given an average fall covey size of 12 birds, this would translate to 14.7 additional birds in the 194 ac radius in CP33 fields compared to control fields. The

effective surveyed area around CP33 sample points contained on average 15.25 ac of habitat buffers. If higher fall densities of bobwhite around CP33 buffered fields actually reflect an increase in individuals (successful recruitment of new birds to the fall population) rather than simple redistribution of existing populations, our results suggest that every acre of CP33 enrolled contributes approximately 0.96 bobwhites to the fall population.

The Mississippi step-down plan of the NBCI (MS-NBCI) establishes short-term (5–10 yr) goals of increasing fall bobwhite populations to an average 0.015 coveys/ac or 0.18 bobwhites/ac on managed agricultural lands (based on assumption of 12 birds/covey; Smith 2004). Compared to these population goals, the 194-ac area around CP33 fields supported an average of 0.012 coveys/ac or 0.14 bobwhites/ac, nearly achieving the NBCI population goals with a single conservation practice. In these landscapes, CP33 represents 7.8% of the total area surrounding surveyed points and 15% of the total row-crop acreage. These observed densities illustrate that the bobwhite recovery goals of the MS-NBCI are likely achievable with the application of upland habitat buffers affecting only 8% of the total landscape and 15% of row-crop acreage. Implementation of additional conservation practices, such as edge feathering, timber thinning, and prescribed fire would further enhance population response, easily exceeding the population goals defined in the MS-NBCI. However, to affect landscape-level populations these practices must be broadly adopted.

The establishment of the native warm-season grass, forb, and legume buffers also had a noteworthy effect on breeding bird densities, specifically grassland-adapted species exhibiting population declines. Most of these species depend on early successional habitat for all or part of their life cycle. Changes in bobwhite breeding densities are consistent with increases in fall covey densities, indicating the positive benefits of added foraging and nesting cover. Grassland obligate species such as dickcissel and scrub-successional species such as indigo bunting and common yellowthroat (in year 2008) exhibited a considerable response to CP33 buffers. Species that tend to thrive in agricultural landscapes such as the mourning dove

and red-winged blackbird appeared to further benefit from the grassland buffers. Surprisingly, the yellow-breasted chat, which favors briar/shrub/sapling thickets, seemed to also benefit from CP33 buffers, exhibiting densities 4–5 birds/100 ac greater relative to control sites. However, the eastern meadowlark, a grassland obligate species, only increased an average of 0.26 birds/100 ac relative to control sites. Lack of response in eastern meadowlark is expected in that they prefer shorter cover and have been described as area-sensitive, requiring larger contiguous patches of grassland. Following buffer establishment, field sparrows, also considered scrub-successional, exhibited effect sizes of 1 bird/100 ac in 2006 and 2007 and 3 birds/100 ac in 2008. Field sparrows tend to be more numerous in open fields in the winter rather than the breeding season, and they prefer saplings, shrubs or tall herbaceous cover in the breeding season. Brown-headed cowbirds do not have a breeding season habitat preference, but as nest parasites, they roam from habitat to habitat. Therefore, with an increase in abundance of these grassland species, we may expect to see an increase in the abundance of brown-headed cowbirds. This, however, was not the case. Brown-headed cowbirds did not respond to CP33 buffered fields and actually exhibited lower densities compared to control fields. Eastern kingbirds have been characterized as mid-story or canopy nesting. Kingbirds may not have responded to CP33 buffered fields, because they are more dependent on the presence of woody species.

Presuming greater abundances on CP33 fields represent net population changes rather than redistribution of existing populations, CP33 upland habitat buffers have the capacity to affect population changes in many declining early successional species of Mississippi, specifically the bobwhite. The NBCI population recovery goals are achievable in agricultural landscapes by only altering and improving 8% of the total landscape and 15% of row crop area. However we need to apply these management strategies on a much larger scale. Currently, only 2,179 of the 9,400 total acres allotted to Mississippi have been enrolled. Given that there are 4.74 million cropland acres in Mississippi, attaining an 8% change in land use (comparable to the CP33 enrollment in the effectively surveyed area around our CP33 points) would require enrollment of approximately 379,200 ac of habitat buffers. However, an enrollment of this magnitude could contribute more than 350,000 birds to the fall population. Clearly, such an enrollment is well beyond the scope of the current CP33 acreage allocations; however, such a goal is not unattainable given that more than 884,000 ac are currently enrolled in all CRP practices across Mississippi. Minimally, given the demonstrable economic and environmental benefits of CP33, the remaining 7,221 ac of available CP33 in Mississippi present an opportunity for bobwhite and grassland songbird population restoration not yet realized.

Acknowledgements

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References

Barbour, P. J., S. W. Martin, and W. Burger. 2007. Estimating economic impact of conservation field borders on farm revenue. Online. Crop Management doi:10.1094/CM-2007-0614-01-RS.

Burger, L. W., M. D. Smith, R. Hamrick, B. Palmer, and S. Wellendorf. 2006. CP33–habitat buffers for upland birds monitoring protocol. Southeast Quail Study Group and Southeast Partners in Flight miscellaneous publication.

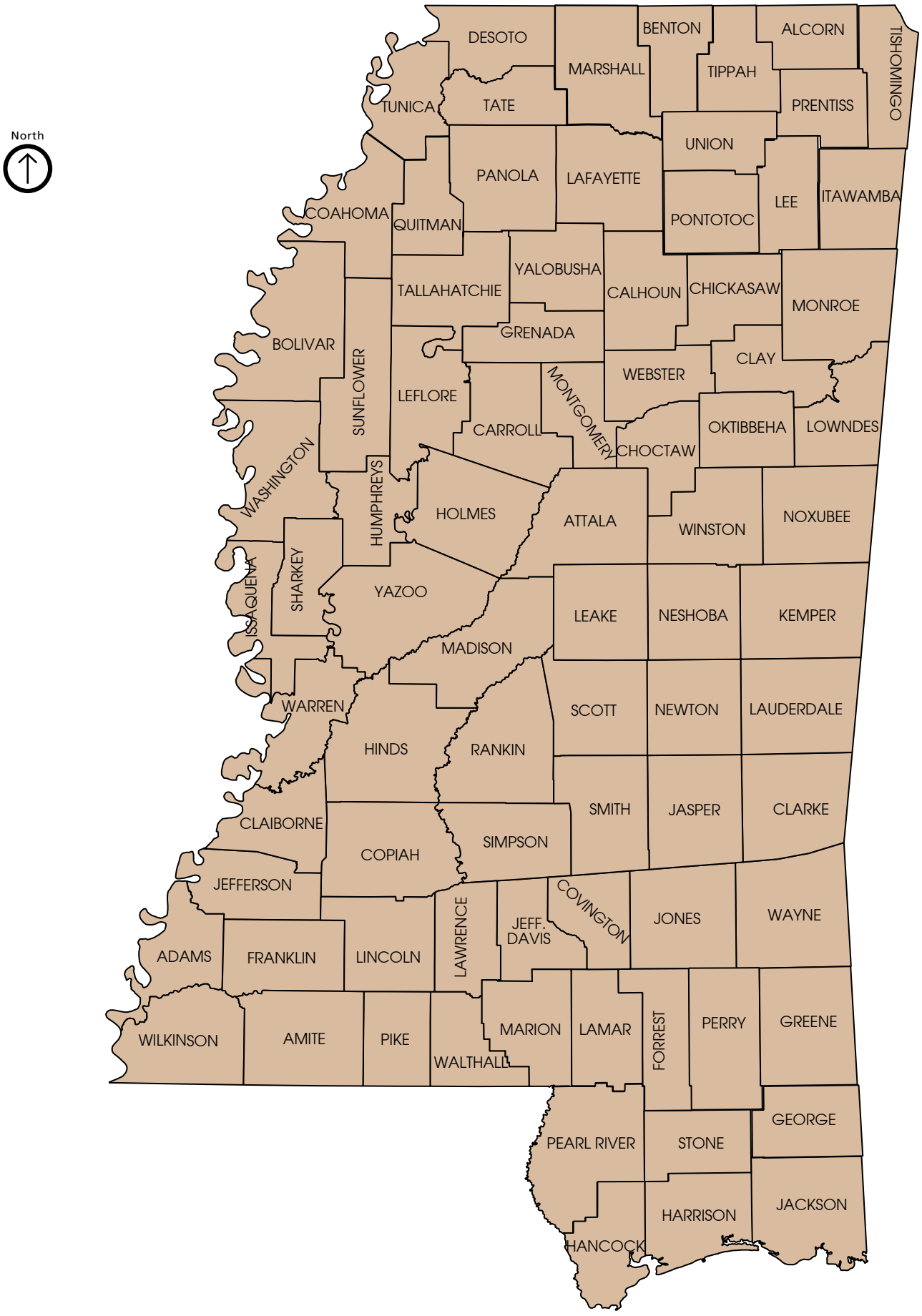
Smith, M. D. 2004. Wildlife habitats benefits of field border management practices in Mississippi. Ph. D. Dissertation, Mississippi State University, Mississippi State, MS.

Wellendorf, S. D., W. E. Palmer, and P. T. Bromley. 2004. Estimating calling rates of northern bobwhite coveys and measuring abundance. Journal of Wildlife Management 68:672-682.

Table 1. CP33 enrollment acreage by year and county.

County	2005	2006	2007	2008
Adams	0.0	0.0	0.0	0.0
Alcorn	0.0	0.0	0.0	0.0
Amite	0.0	0.0	0.0	0.0
Attala	0.0	0.0	0.0	0.0
Benton	0.0	0.0	0.0	0.0
Bolivar	0.0	30.4	30.4	30.4
Calhoun	0.0	9.8	9.8	9.8
Carroll	0.0	0.0	0.0	0.0
Chickasaw	0.0	64.5	79.3	79.3
Choctaw	0.0	0.0	0.0	0.0
Claiborne	0.0	0.0	0.0	0.0
Clarke	0.0	0.0	0.0	0.0
Clay	206.2	206.2	320.1	320.1
Coahoma	56.0	56.0	180.4	233.6
Copiah	0.0	0.0	0.0	0.0
Covington	0.0	0.0	0.0	0.0
De Soto	0.0	0.0	9.5	9.5
Forrest	0.0	0.0	0.0	0.0
Franklin	0.0	0.0	0.0	0.0
George	0.0	0.0	0.0	0.0
Greene	0.0	0.0	0.0	0.0
Grenada	0.0	0.0	0.0	0.0
Hancock	0.0	0.0	0.0	0.0
Harrison	0.0	0.0	0.0	0.0
Hinds	0.0	0.0	25.0	25.0
Holmes	0.0	0.0	0.0	0.0
Humphreys	0.0	0.0	0.0	0.0
Issaquena	0.0	0.0	0.0	0.0
Itawamba	0.0	37.6	37.6	37.6
Jackson	0.0	0.0	0.0	0.0
Jasper	0.0	0.0	0.0	0.0
Jefferson	0.0	0.0	0.0	0.0
Jefferson Davis	0.0	0.0	0.0	0.0
Jones	0.0	0.0	0.0	0.0
Kemper	0.0	0.0	0.0	0.0
Lafayette	0.0	0.0	0.0	0.0
Lamar	0.0	0.0	0.0	0.0
Lauderdale	0.0	0.0	0.0	0.0
Lawrence	0.0	0.0	0.0	0.0
Leake	0.0	0.0	0.0	0.0
Lee	0.0	0.0	0.0	0.0

County	2005	2006	2007	2008
Leflore	0.0	71.4	85.1	85.1
Lincoln	0.0	0.0	0.0	0.0
Lowndes	0.0	0.0	0.0	0.0
Madison	0.0	0.0	0.0	0.0
Marion	0.0	0.0	0.0	0.0
Marshall	0.0	0.0	1.0	1.0
Monroe	0.0	399.7	657.4	708.8
Montgomery	0.0	0.0	0.0	0.0
Neshoba	0.0	0.0	0.0	0.0
Newton	0.0	109.1	109.1	109.1
Noxubee	0.0	0.0	0.0	0.0
Oktibbeha	0.0	0.0	0.0	0.0
Panola	0.0	0.0	0.0	0.0
Pearl River	0.0	0.0	0.0	0.0
Perry	0.0	0.0	0.0	0.0
Pike	0.0	0.0	0.0	0.0
Pontotoc	0.0	0.0	0.0	0.0
Prentiss	19.3	128.2	146.4	156.1
Quitman	0.0	0.0	34.5	34.5
Rankin	0.0	0.0	0.0	0.0
Scott	0.0	0.0	0.0	0.0
Sharkey	15.8	15.8	15.8	15.8
Simpson	0.0	0.0	0.0	0.0
Smith	0.0	0.0	0.0	0.0
Stone	0.0	0.0	0.0	0.0
Sunflower	0.0	0.0	48.4	59.7
Tallahatchie	0.0	31.3	31.3	31.3
Tate	0.0	11.3	11.3	11.3
Tippah	0.0	0.0	0.0	0.0
Tishomingo	0.0	0.0	19.0	19.0
Tunica	0.0	0.0	0.0	0.0
Union	19.0	160.9	160.9	160.9
Walthall	0.0	0.0	0.0	0.0
Warren	0.0	0.0	0.0	0.0
Washington	0.0	2.5	2.5	2.5
Wayne	0.0	0.0	0.0	0.0
Webster	0.0	0.0	0.0	0.0
Wilkinson	0.0	0.0	0.0	0.0
Winston	0.0	0.0	0.0	0.0
Yalobusha	0.0	0.0	0.0	0.0
Yazoo	0.0	0.0	0.0	37.2


North
DESOTO
MARSHALL
BENTON
TIPPAH
ALCORN
TISHOMINGO
TUNICA
TATE
PRENTISS
UNION
PANOLA
LAFAYETTE
LEE
ITAWAMBA
COAHOMA
QUITMAN
PONTOTOC
TALLAHATCHIE
YALOBUSHA
CALHOUN
CHICKASAW
MONROE
BOLIVAR
GRENADA
CLAY
SUNFLOWER
LEFLORE
WEBSTER
MONTGOMERY
CARROLL
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WINSTON
NOXUBEE
ISSAQUENA
SHARKEY
YAZOO
LEAKE
NESHOBA
KEMPER
MADISON
WARREN
SCOTT
NEWTON
LAUDERDALE
HINDS
RANKIN
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Figure 1. Distribution of CP33 enrollment acreage throughout Mississippi in 2006, 2007, and 2008.

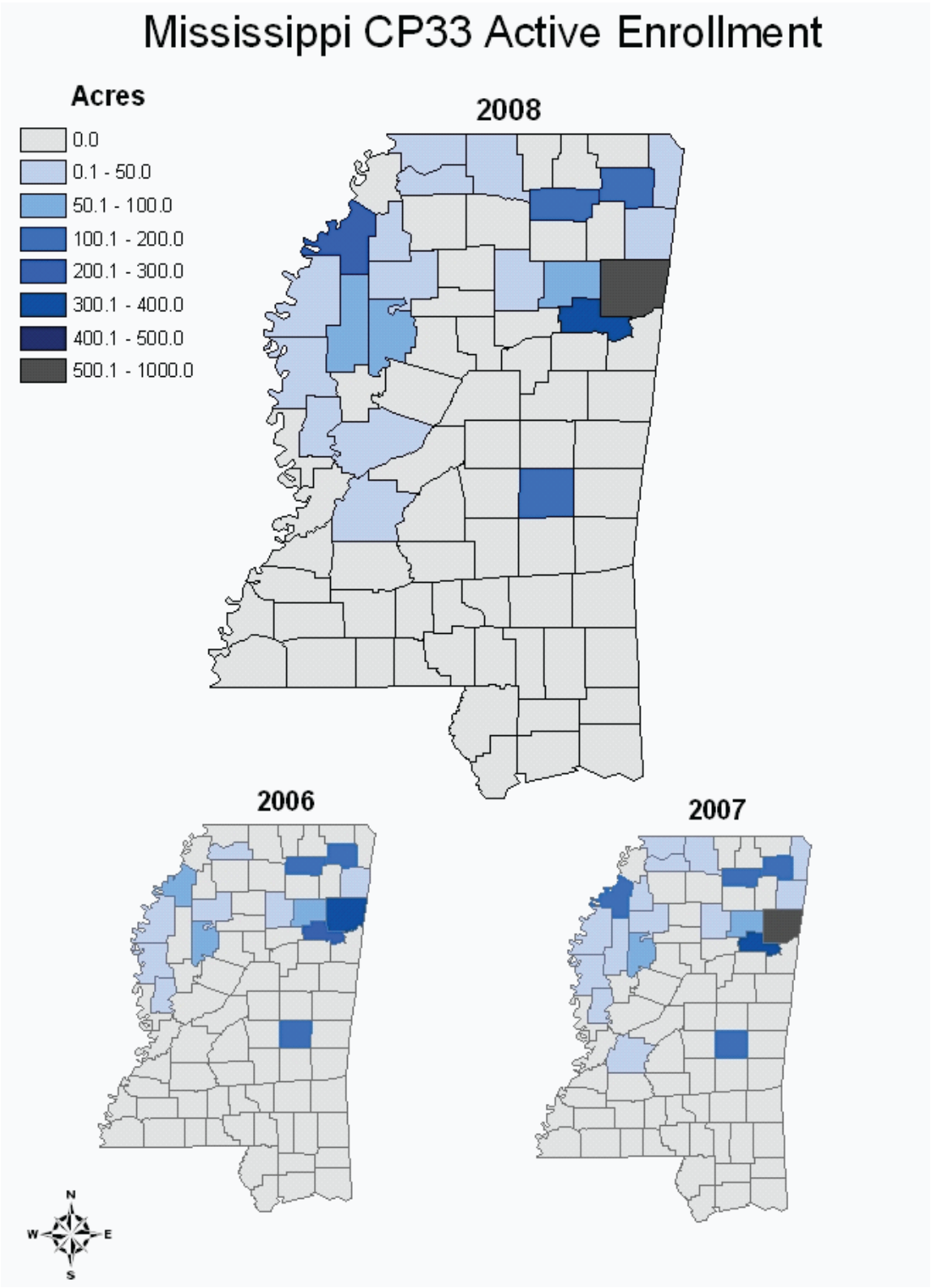


Figure 2. Distribution of CP33 bird monitoring points in Mississippi.

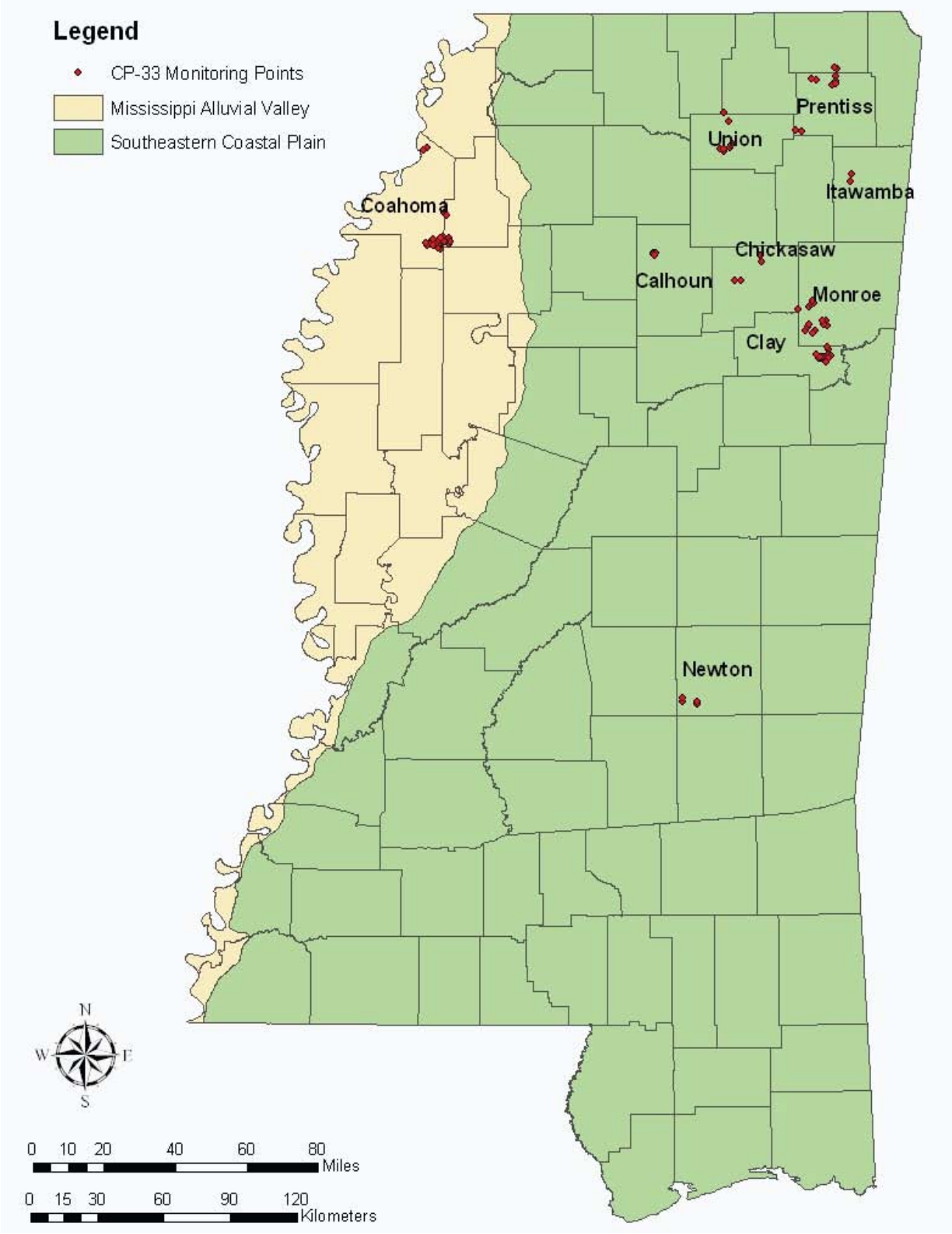


Table 2. Cumulative counts of birds (calling males) detected during 2006 breeding season counts at control and CP33 sites in 2006, 2007, 2008.

Common Name	2006 Control	2006 CP33	2007 Control	2007 CP33	2008 Control	2008 CP33
Acadian Flycatcher	0	0	0	1	1	0
American Crow	84	90	41	39	13	21
American Goldfinch	0	1	0	0	0	1
American Robin	0	1	2	2	0	0
Bank Swallow	0	4	0	0	0	0
Baltimore Oriole	2	4	0	0	0	1
Barn Swallow	17	20	1	0	0	0
Barred Owl	0	0	0	0	0	1
Belted Kingfisher	1	1	0	0	1	0
Blue-gray Gnatcatcher	7	7	9	10	2	8
Brown-headed Cowbird	19	18	17	22	13	17
Blue Grosbeak	3	1	14	20	9	28
Blue Jay	23	31	25	28	20	17
Black Vulture	1	0	0	0	0	0
Brown Trasher	0	3	0	4	0	1
Broad-winged Hawk	0	1	0	0	0	0
Carolina Chickadee	11	3	10	6	18	9
Cattle Egret	16	7	0	0	1	0
Carolina Wren	58	51	33	35	46	41
Chimney Swift	3	13	15	2	0	0
Cliff Swallow	0	0	3	0	0	0
Common Ground-Dove	1	3	0	0	0	0
Common Grackle	9	12	1	2	0	0
Cooper's Hawk	0	2	0	0	0	0
Common Yellowthroat	22	27	31	45	22	63
Dickcissel	59	133	47	104	27	111
Downy Woodpecker	8	7	9	4	3	1
Eastern Bluebird	14	8	7	11	9	5
Eastern Kingbird	10	3	7	5	8	4
Eastern Meadowlark	31	35	23	32	35	27
Eastern Pheobe	0	0	2	0	1	5
Eastern Towhee	24	33	34	43	33	37
Eastern Wood-Pewee	7	4	5	5	9	4
Eurasian Collared-Dove	0	2	0	3	0	0
Eastern Tufted Titmouse	18	18	23	23	32	38
European Starling	2	3	0	0	0	0
Fish Crow	0	1	0	0	0	0
Field Sparrow	40	48	22	37	16	39
Great Blue Heron	8	5	0	0	5	0
Great-crested Flycatcher	0	0	4	6	2	4
Great-horned Owl	0	0	0	1	1	0
Gray Catbird	0	2	0	1	2	1
Green Heron	0	1	0	0	0	3
Grasshopper Sparrow	5	2	3	0	3	1
Hairy Woodpecker	0	1	2	1	0	0
Horned Lark	19	23	14	17	31	9
Hooded Warbler	0	0	0	0	1	1

Table 2. (continued) Cumulative counts of birds (calling males) detected during 2006 breeding season counts at control and CP33 sites in 2006, 2007, 2008.

Common Name	2006 Control	2006 CP33	2007 Control	2007 CP33	2008 Control	2008 CP33
Indigo Bunting	206	249	154	163	141	159
Kentucky Warbler	0	0	0	0	0	1
Killdeer	43	30	24	23	24	12
Lark Sparrow	0	0	0	0	3	0
Little Blue Heron	0	1	0	0	0	0
Loggerhead Shrike	2	0	0	2	2	3
Mallard	0	0	1	1	0	0
Mourning Dove	66	85	39	70	28	54
Northern Bobwhite	61	126	47	87	37	96
Northern Cardinal	109	116	100	102	117	115
Northern Harrier	1	0	0	0	0	0
Northern Mockingbird	40	71	27	26	25	41
Northern Parula	0	0	0	0	1	2
Northern Rough-winged Swallow	0	2	0	0	0	0
Orchard Oriole	1	0	1	5	2	6
Painted Bunting	0	0	0	2	0	1
Pine Warbler	0	0	0	0	2	2
Pileated Woodpecker	3	8	4	3	2	2
Prairie Warbler	0	0	0	1	0	2
Purple Martin	8	10	3	1	0	0
Red-bellied Woodpecker	16	35	27	27	15	18
Red-eyed Vireo	4	3	4	5	7	12
Red-headed Woodpecker	3	1	4	2	0	1
Rock Dove	0	10	0	0	0	0
Red-shouldered Hawk	0	5	3	2	3	2
Red-tailed Hawk	8	5	3	2	0	1
Ruby-throated Hummingbird	1	5	1	2	0	0
Red-winged Blackbird	142	213	95	107	98	143
Song Sparrow	0	1	1	0	0	0
Summer Tanager	9	6	0	3	2	5
Turkey Vulture	0	2	0	0	0	0
Unknown	3	1	0	0	0	0
White-eyed Vireo	9	11	5	17	23	23
Wild Turkey	0	1	0	0	0	0
Wood Duck	0	1	0	0	0	1
Wood Thrush	0	2	3	8	1	5
Yellow-breasted Chat	43	58	41	57	55	78
Yellow-billed Cuckoo	42	44	38	36	21	39
Yellow-shafted Flicker	1	0	3	0	0	0
Yellow-tailed Vireo	0	0	0	1	1	2

Table 3. Density (birds/100 ac), 95% confidence intervals (CI), and effect sizes of breeding bird species and northern bobwhite fall coveys at control and CP33 sites in 2006, 2007, and 2008.

Species	2006				
	Control		CP33		
	Density	CI	Density	CI	Effect Size
Northern Bobwhite *	1.30	(0.64 , 2.66)	8.83	(5.65 , 13.81)	7.53
Dickcissel *	17.70	(10.82 , 28.95)	81.93	(53.79 , 124.80)	64.23
Field Sparrow *	4.14	(2.12 , 8.08)	5.15	(2.67 , 9.94)	1.00
Indigo Bunting *	54.67	(40.91 , 73.06)	144.63	(81.43 , 256.88)	89.95
Eastern Meadowlark *	3.56	(2.25 , 5.63)	4.02	(2.07 , 7.82)	0.46
Common Yellowthroat	5.35	(2.39 , 11.99)	8.75	(4.88 , 15.71)	3.40
Brown-headed Cowbird	23.53	(10.92 , 50.70)	18.98	(7.76 , 46.39)	-4.55
Yellow-breasted Chat	9.68	(5.21 , 17.95)	10.06	(5.84 , 17.32)	0.39
Mourning Dove	11.89	(6.54 , 21.61)	19.12	(12.25 , 29.83)	7.22
Red-winged Blackbird	56.94	(30.98 , 104.64)	105.11	(68.67 , 160.90)	48.18
Northern Bobwhite #	0.61	(0.42 , 0.86)	1.30	(1.08 , 1.57)	0.70
2007					
Northern Bobwhite *	1.02	(0.47 , 2.21)	5.52	(3.62 , 8.43)	4.51
Dickcissel *	11.20	(5.92 , 21.18)	52.09	(34.16 , 79.43)	40.89
Field Sparrow *	2.67	(1.42 , 5.02)	3.77	(2.33 , 6.08)	1.10
Indigo Bunting *	33.11	(25.28 , 43.36)	72.20	(41.15 , 126.70)	39.09
Eastern Meadowlark *	3.12	(1.86 , 5.21)	3.48	(2.19 , 5.53)	0.36
Common Yellowthroat	9.26	(5.07 , 16.91)	10.49	(6.42 , 17.14)	1.23
Brown-headed Cowbird	15.49	(7.84 , 30.59)	14.65	(7.85 , 27.34)	-0.84
Yellow-breasted Chat	5.63	(3.13 , 10.14)	9.80	(6.12 , 15.68)	4.16
Mourning Dove	5.71	(2.74 , 11.87)	18.32	(11.27 , 29.77)	12.61
Red-winged Blackbird	35.95	(19.61 , 65.91)	39.69	(23.75 , 66.32)	3.74
Northern Bobwhite #	0.50	(0.32 , 0.76)	0.95	(0.73 , 1.24)	0.46
2008					
Northern Bobwhite *	0.91	(0.42 , 1.94)	6.44	(4.30 , 9.64)	5.53
Dickcissel *	5.39	(2.93 , 9.91)	71.53	(50.31 , 101.68)	66.14
Field Sparrow *	0.75	(0.31 , 1.82)	3.69	(2.34 , 5.84)	2.94
Indigo Bunting *	41.23	(32.34 , 52.56)	94.24	(53.59 , 165.75)	53.01
Eastern Meadowlark *	3.40	(2.12 , 5.46)	3.38	(2.01 , 5.67)	-0.03
Common Yellowthroat	5.84	(3.02 , 11.26)	23.55	(15.46 , 35.88)	17.71
Brown-headed Cowbird	17.99	(8.80 , 36.77)	16.95	(9.04 , 31.82)	-1.04
Yellow-breasted Chat	10.45	(6.55 , 16.67)	15.43	(9.89 , 24.09)	4.98
Mourning Dove	5.10	(2.63 , 9.90)	8.87	(5.05 , 15.58)	3.77
Red-winged Blackbird	48.18	(29.22 , 79.44)	65.14	(43.09 , 98.47)	16.96
Northern Bobwhite #	0.48	(0.32 , 0.73)	1.22	(1.00 , 1.49)	0.74

* Priority Species

Northern Bobwhite fall covey density, 95% CI, and effect sizes

Table 4. Mean percent coverage of native and exotic grass species, forbs, legumes, and woody species, litter, and bareground for 2006, 2007, 2008, and pooled across all 3 years.

Type	2006	2007	2008	Pooled
Native Grass Species	30.49	62.89	29.51	44.81
Exotic Grass Species	12.53	11.99	15.77	12.70
Forb	16.62	42.36	36.41	30.61
Legume	6.62	14.68	1.55	9.57
Woody	5.43	0.14	1.18	2.53
Litter	36.58	22.20	19.36	27.98
Bare Ground	30.36	49.86	19.33	37.65

Figure 3. Northern bobwhite breeding season density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.

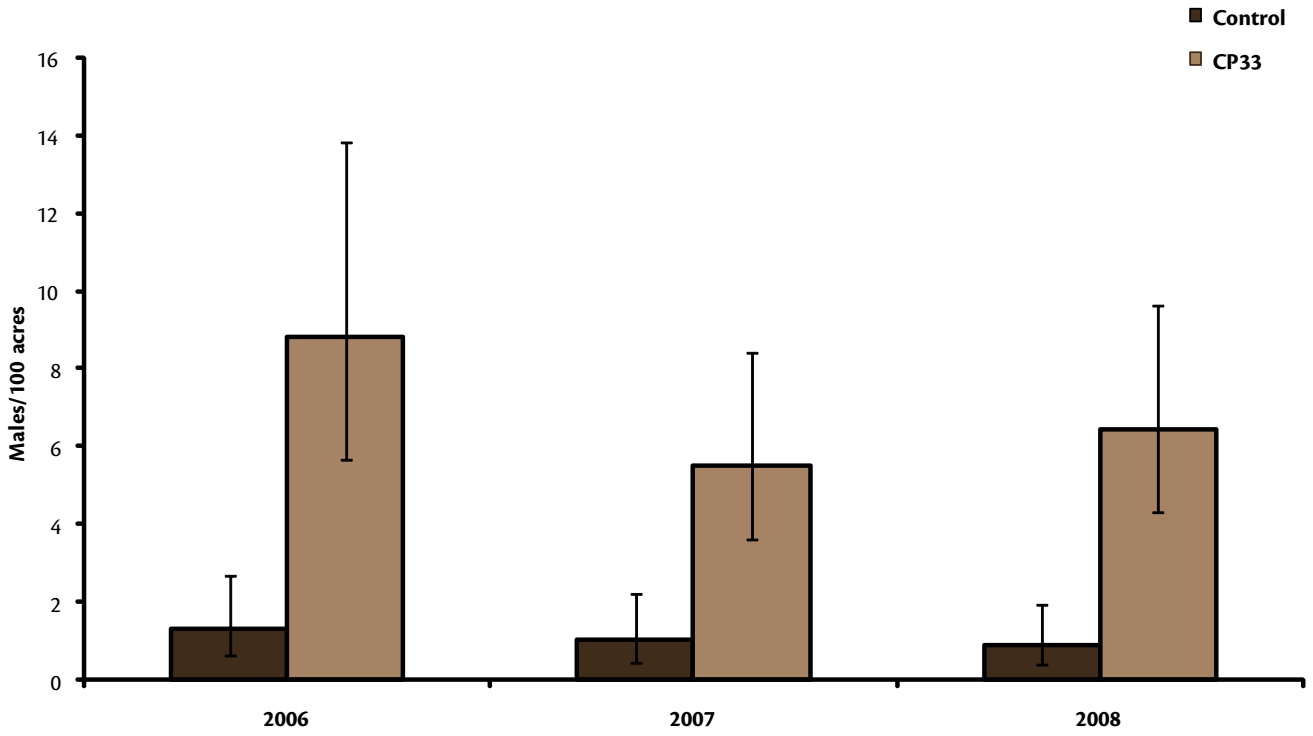


Figure 4. Northern bobwhite fall covey density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.

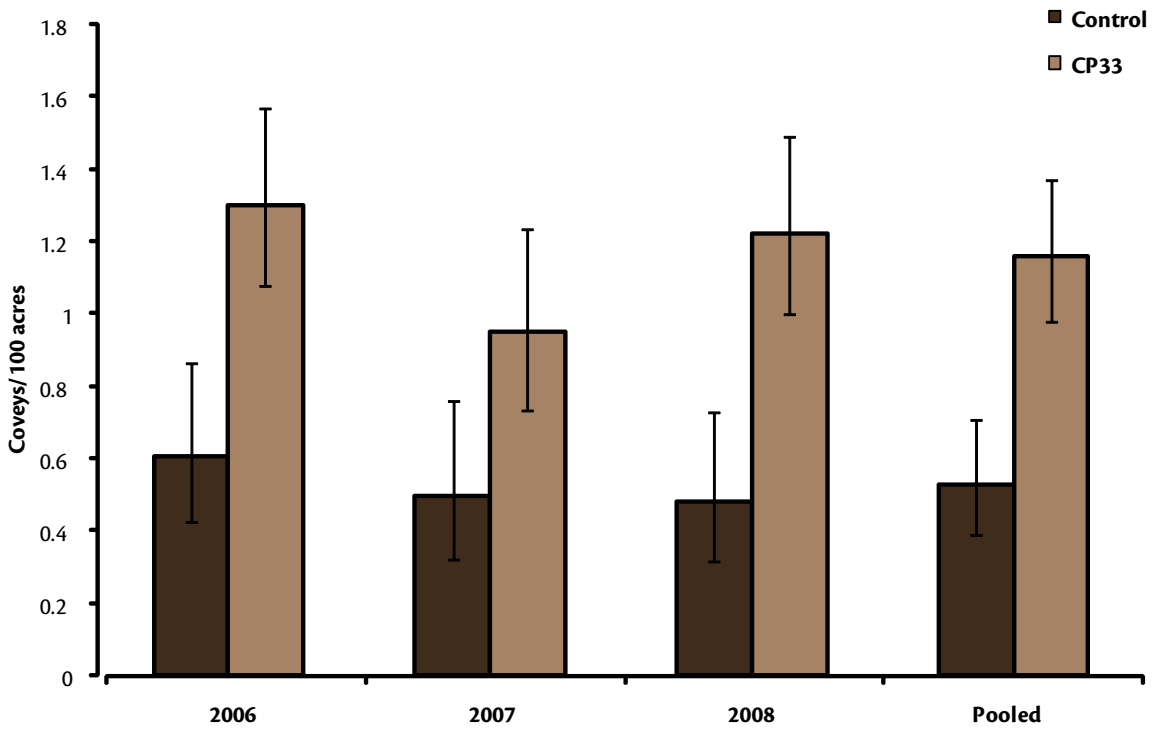


Figure 5. Dickcissel breeding season density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.

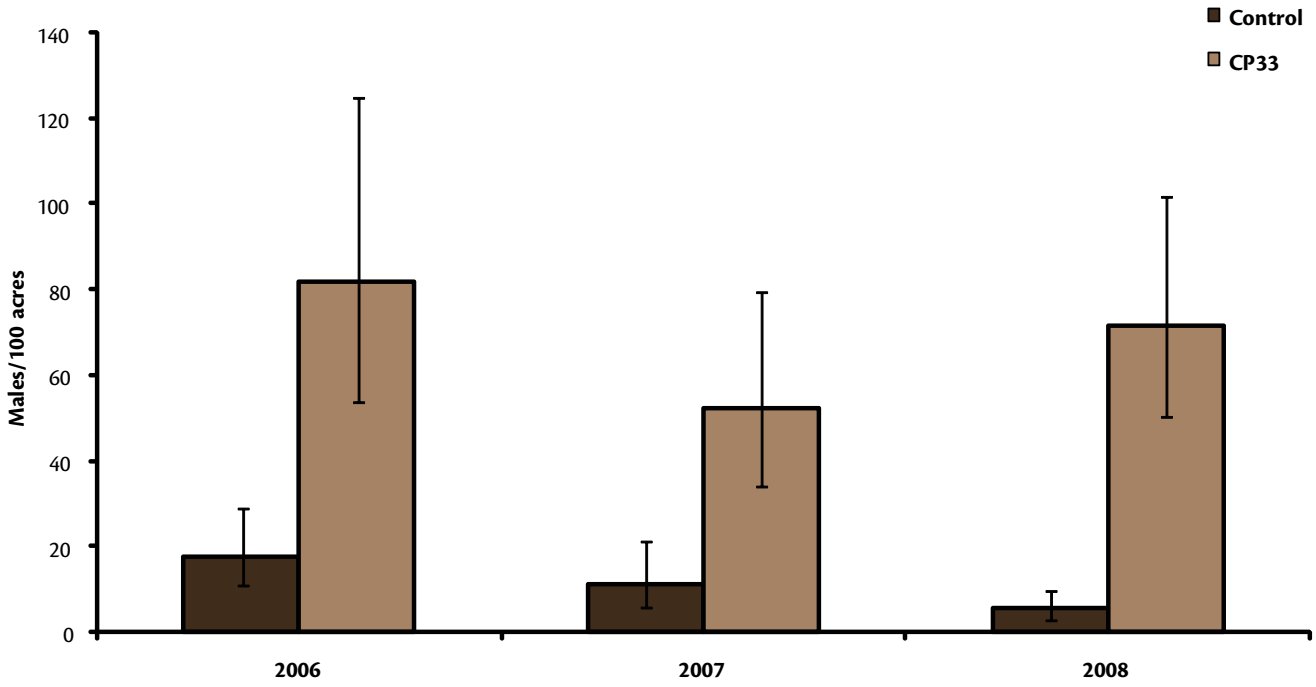


Figure 6. Field sparrow breeding season density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.

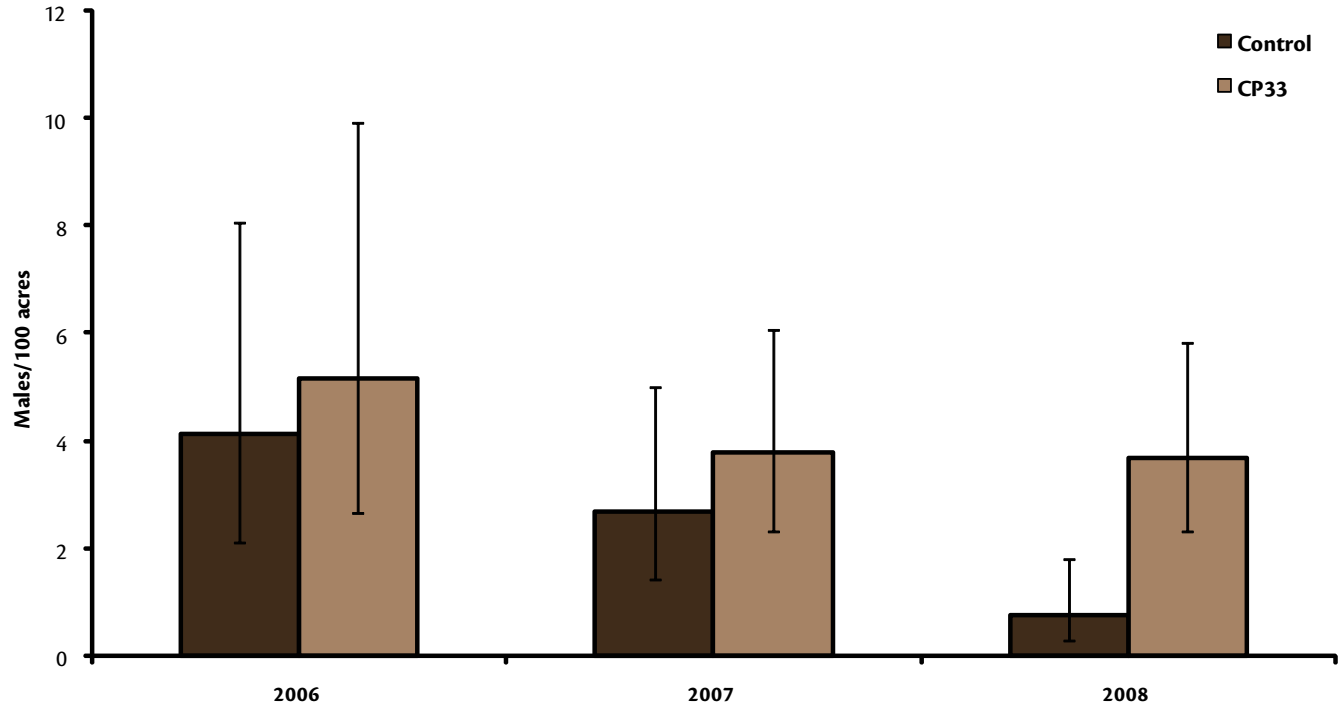


Figure 7. Indigo bunting breeding season density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.

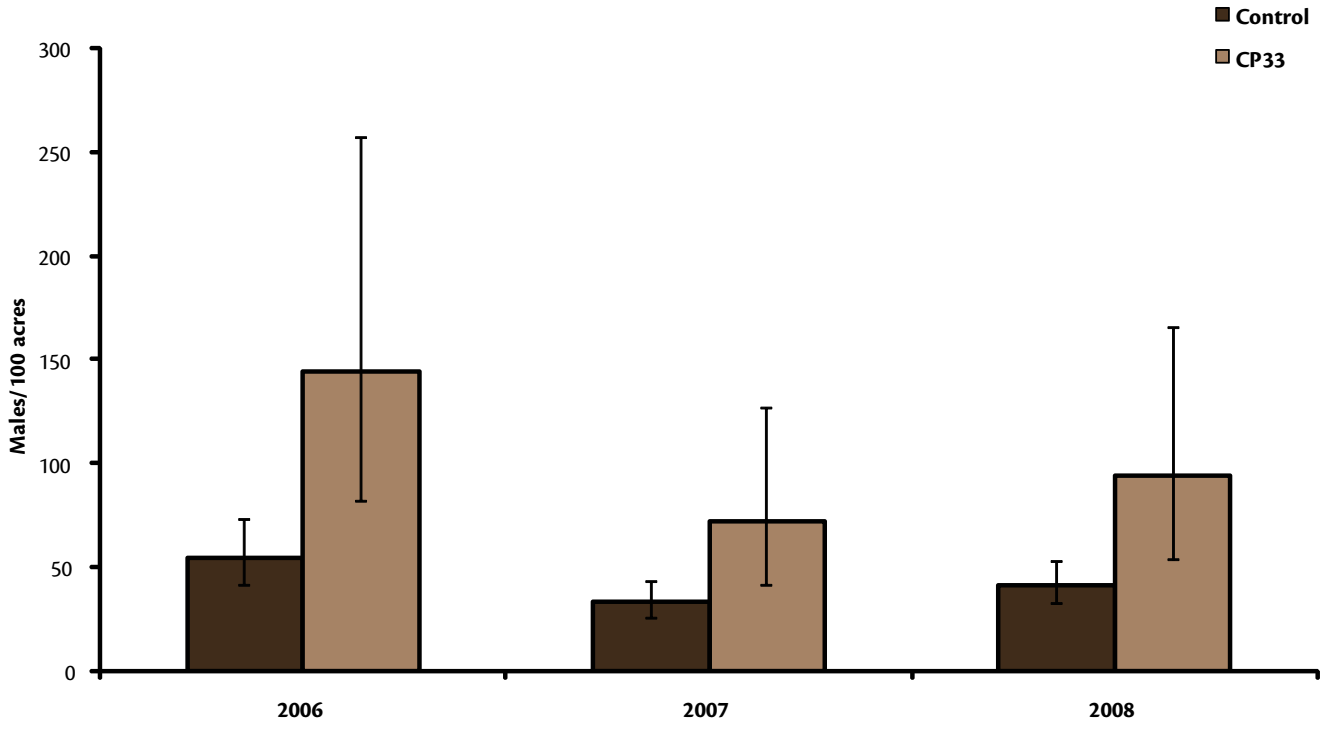


Figure 8. Eastern meadowlark breeding season density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.

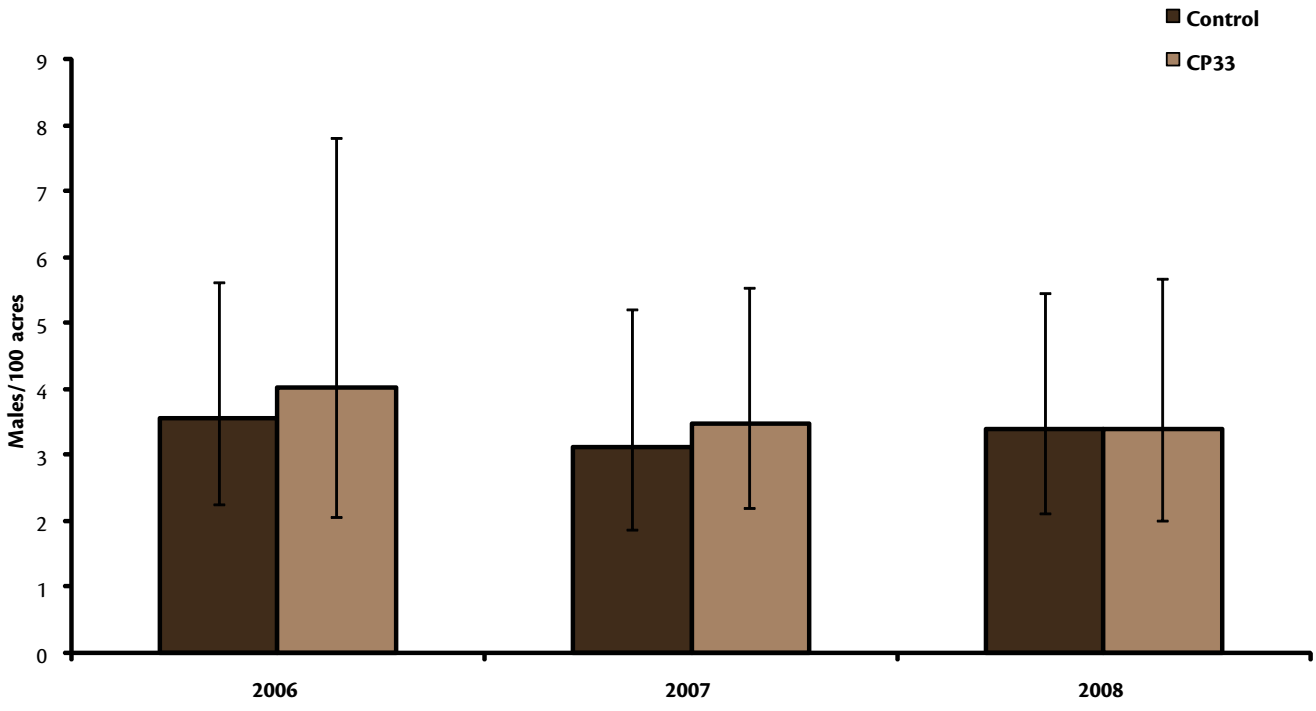


Figure 9. Common yellowthroat breeding season density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.

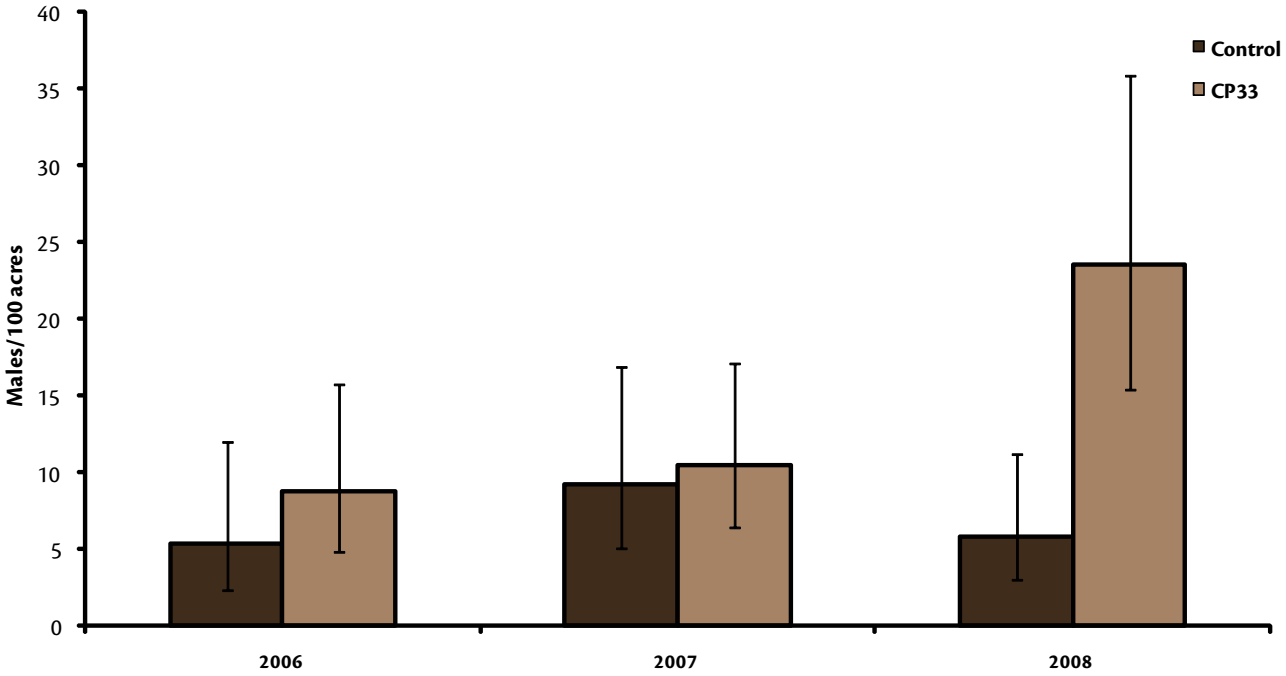
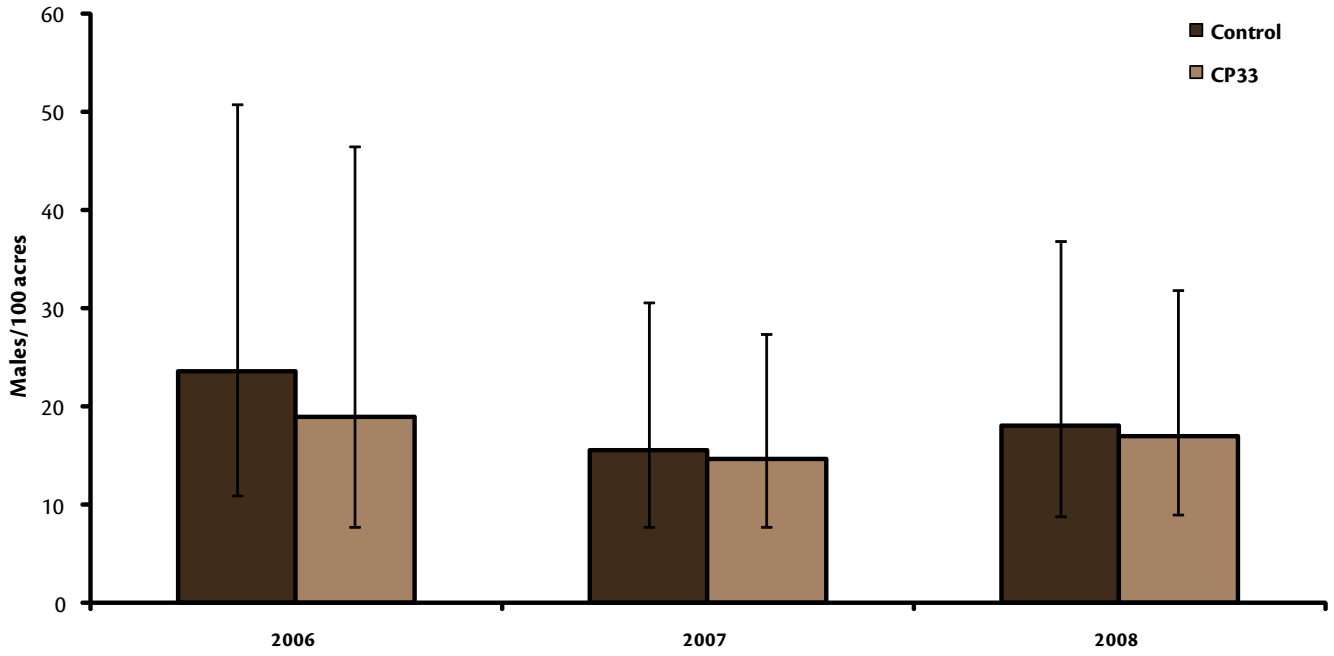


Figure 10. Brown-headed cowbird breeding season density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.



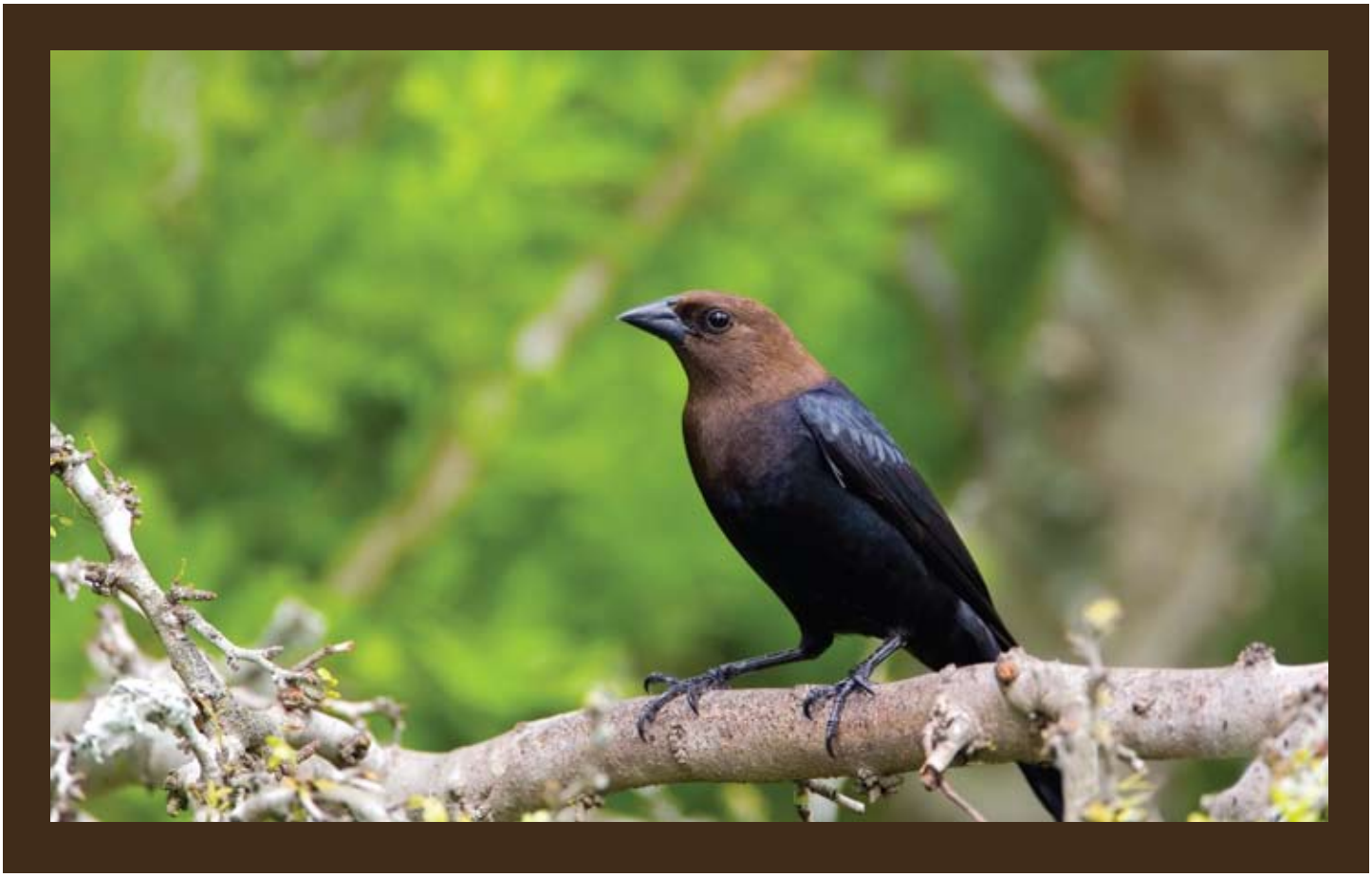


Figure 11. Yellow-breasted chat breeding season density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.

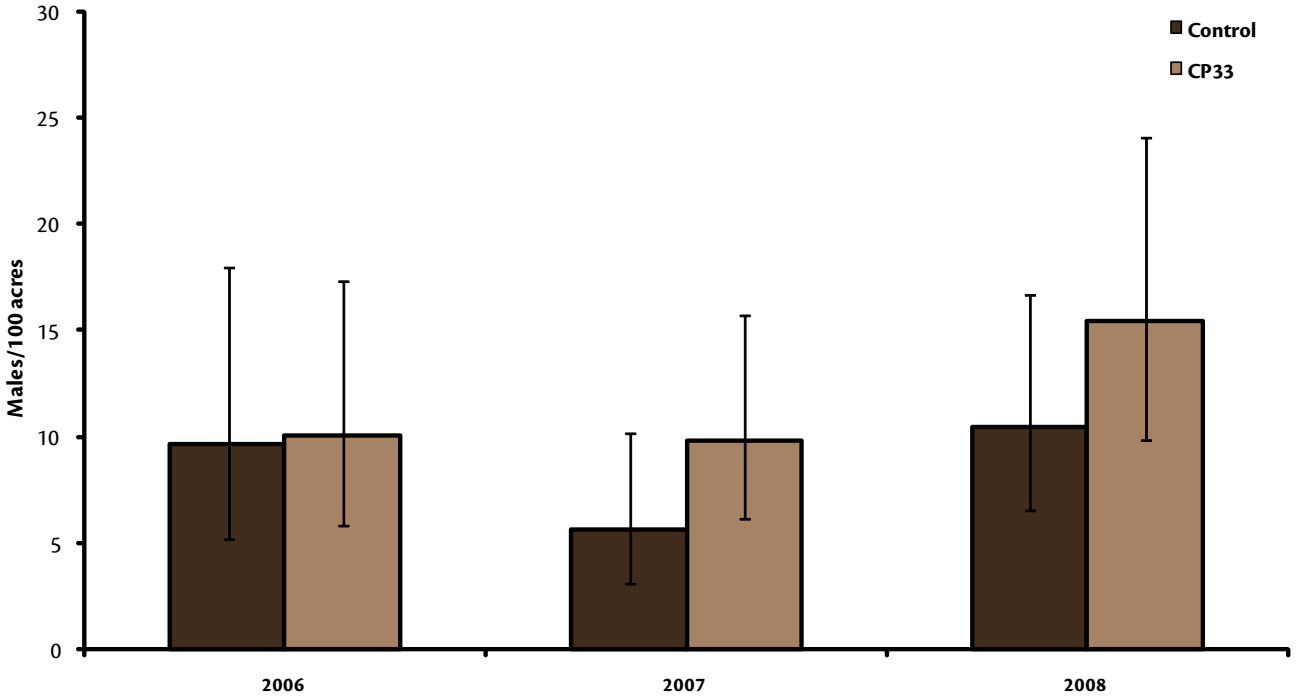


Figure 12. Mourning dove breeding season density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.

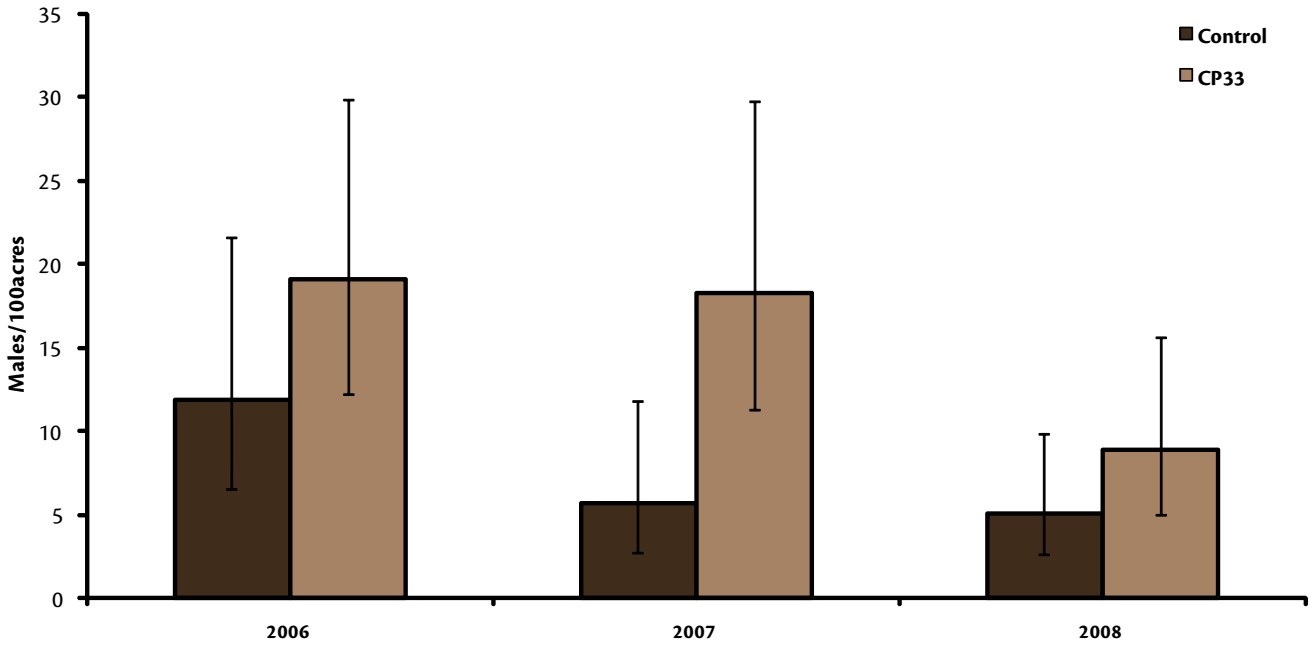


Figure 13. Red-winged blackbird breeding season density with 95% confidence intervals on control and CP33 sites in Mississippi, June 2006-2008.

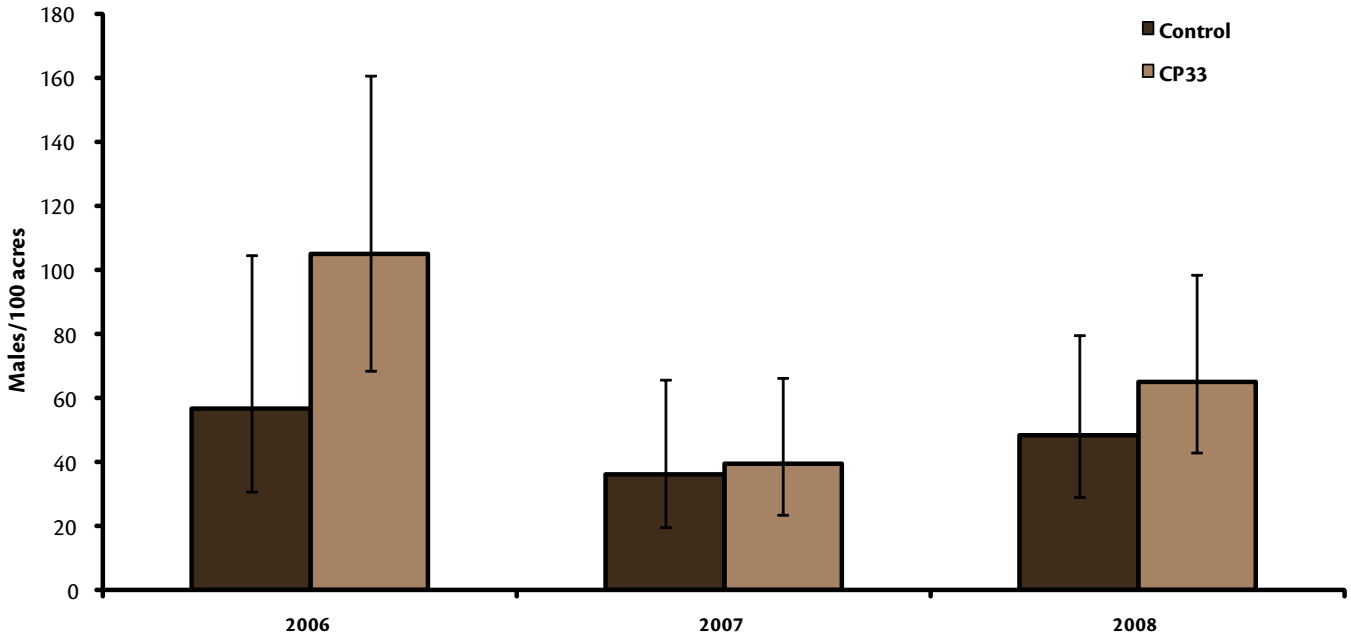


Figure 14. CP33 upland habitat buffer located in Clay county, Mississippi during the first growing season (2006).

Figure 15. CP33 upland habitat buffer located in Clay county, Mississippi during the second growing season (2007).

Figure 16. CP33 upland habitat buffer located in Clay county, Mississippi during the third growing season (2008).

Figure 17. CP33 habitat buffer in Coahoma county, Mississippi located in the Mississippi Alluvial Valley or Delta.

Figure 18. CP33 habitat buffer in Coahoma county, Mississippi located in the Mississippi Alluvial Valley or Delta.

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