Evaluation of Non-Game Bird Conservation in Illinois

Final Report

T-16-P-1

Submitted to:

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Contributors

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Summary. This grant has provided the resources to accomplish several significant studies on non-game birds in Illinois. The most significant accomplishment of the study was the completion of Job 1, A Comparative Study of Bird Populations in Illinois: 1906-1909, 1956-1958, and 2006-2008. This unique study has provided amazing insight into how the population of over 90 species of birds has changed over the last century. Currently it is being produced in the form of a book which will be provided to all interested parties before the end of 2010. Furthermore, this study has attracted wide interest, the principal investigators have presented over 40 presentations about this study to audiences varying from local Audubon societies to scientific conferences. The final report for this study is drawn primarily from the book that is being produced, however we fully expect that given the unique nature of this dataset a series of peer-reviewed publications will also be produced from this study. While the remaining four studies are not nearly at the scale of Job 1 they provided valuable data to be used by conservation agencies in Illinois. Job 2 documented the diversity of grassland birds in reclaimed mine areas and highlights the importance of these sites for species such as Bobolinks and Henslow's Sparrows. Job 3 produced a map and GIS layer overlaying many of the important natural areas with the Illinois Wind Resource Map. This product highlights specific areas such as the areas along the Illinois River that should be avoided when constructing Wind Farms. Job 4 evaluated pheasant habitat areas within Illinois. This report provides a scorecard to evaluate these areas and highlights what aspects of these areas have been beneficial and what can be improved in the future. Job 5 has resulted in recovery plans for twelve endangered or threatened species in Illinois. In addition to producing these plans we have also established a format that will be used to develop recovery plans for all listed species. These plans are being submitted to the Illinois Endangered Species Protection Board to be adopted as status triggers for prioritizing which species should receive additional attention when reviewing current statuses.

Because of the size of this final report we are only providing a paper copy, however it should be noted that all data and information are being archived at the Illinois Natural History Survey, if additional copies are needed please contact the authors. We hope that the Comparative Study of Bird Populations in Illinois will be conducted again in 2050, therefore 100+ pictures, recordings, and all data are being prepared for the University of Illinois/Illinois Natural History Survey archives.

FINAL REPORT

STUDY 1. A Comparative Study of Bird Populations in Illinois: 1906-1909, 1956-1958 and 2006-2008

State Wildlife Grant Program Project T-16-P-1, Job 1

Jeffery W. Walk, Michael P. Ward, Thomas J. Benson, Jill Deppe, and Jeffery Brawn

Abstract. This study is one of the most unique studies in North American avian ecology. The following six chapters highlight the results of this study. No other study in North American has systematically characterized the diversity and abundance of birds across an entire state over the course of 100 years. This study highlights the species of birds that have both increased and decreased over the last century. While there are species whose populations have increased probably in the direct result of conservation efforts, there is also a suite of species that have been largely ignored and are experiencing long-term (100 year declines). While it is impossible to summarize a study at this scope and scale in a few sentences there are some important points. First, the greatest change across the Illinois landscape in the last 100 years has been the loss of rotational farming (loss of pastures, small grains, etc.) and these habitats have been replaced by row crops. This loss of "agricultural grasslands" has resulted in a decline in grassland birds, particularly over the last 50 years. Second, while grassland birds have been in decline so have shrubland birds. In fact many shrubland birds have been declining since 1906. Finally, the species that are the "winners" species whose populations are increasing and whose ranges may be expanding are the species able to use human-modified habitats. Many forest birds appear to have become more likely to use developed (urban) habitats, because of this shift many forest bird population have increased over the last century. In summary, this final report highlights changes in the Illinois landscape, avian diversity, and avian abundances. The following six chapters are being produced as a book in 2010, and please contact the authors for a copy.

Foreword

The Illinois State Natural History Survey (INHS) is unique in the scope of its activities, sponsoring the collection and study of data on non-game species very early in its history. In 1906 the Director of the INHS (Stephen A. Forbes) asked two young men (Alfred O. Gross and Howard A. Ray) to conduct a census of Illinois birds (all species, all over the state).

This was done using random transects, walking at a steady rate through all habitats and counting birds seen within designated parameters of the transects. At that time (early 1900's) it was possible to walk with little interruption (except for natural barriers – streams, lakes, etc.) and at the end of the day to camp or receive lodging at hospitable farmhouses near the end of the transect. Fifty years later (1957) it was still possible to walk across properties though permission was sometimes acquired prior to the census period. The Grabers were once stopped by an armed posse pursuing escaped convicts from a nearby prison. At present date, with the increase in human population, it is more difficult to walk cross-country transects without interruption. Most landowners just want to talk, but this takes precious censusing time. Because of seasonal migration, there is a very limited period of the year for censusing breeding or wintering birds. Every daylight hour (holidays and Sundays included), weather permitting, is used to census. One cannot allow acquaintances to participate as one cannot count with distractions. Censusing requires alert concentration at all times. Birds are difficult to census accurately. The transect method is considered one of the best ways to count birds over large areas (Bibby, Burgess, and Hill 1992). Point counts are not considered accurate (Efford and Dawson 2009). Transect counts are at best an estimate and a record of most of the species present. If a bird is sitting quietly in the upper canopy of a tree, it is probably not counted. At times identification is not possible because of a limited view. It is possible that a single bird might cross the transect more than once and be counted more than once. It is not possible to be exact in a count of large flocks encountered in winter. The best that censuses can show are the trends of populations and the presence of species.

It is important to census at present date. There have been many changes since 1958. There was scarcely any pesticides or herbicides applied to crops. Crops were grown less densely (see fig. 11 in Graber and Graber 1963). Fences and fencerow trees and shrubs have been largely eliminated. The acreage of row crops has increased while grassland (hay and fallow fields), shrubs, older forests, and wetlands have decreased. Habitats are much more disturbed by human recreation. Space occupied by housing and roadways has greatly increased. Tract size of natural habitats has decrease and been fragmented. Some serious predators (raccoons) have increased. Change has always occurred but in recent times has been accelerated allowing little time for adaptation.

We need to know what we have at present and take steps to try to preserve and protect diversity and prevent extinction. It is especially important to preserve old growth forest as it requires a very long time to acquire it. Mitigation is not satisfactory as we do not know enough to really replace destroyed habitats. Large tracts of forest are needed because natural forest is not homogeneous. Timber stand improvement creates tree farms for the lumber industry but destroys natural forest. We need to guard against exotics which complete and/or can destroy native species.

Lastly we must educate people to know and treasure what we have. Ecology and biology ought to be required subjects in grade school. While these are not considered “cutting edge of science”, they are important. Many of our problems arise because politicians who control the management of our resources have not had education grounded in biology and ecology and an appreciation of the natural world. We must try to humanely reduce human population. We cannot increase indefinitely without destroying all other species, and, in the end, ourselves.

-Dr. Jean W. Graber

Golconda, Illinois

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Bibby, C. J., N. D. Burgess, and d. A. Hill. 1992. Bird Census Techniques. Academic Press Ltd. 257 pp (see page 67).

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Introduction

[That species of birds are not equally abundant] is obvious to every one, and it must be equally obvious, consequently, that until we know how abundant, on an average, the various species are in the various parts of the country and throughout the country at large, we can make little definite application, either scientific or strictly practical, of the knowledge we now have. Our present information in this field is like a chain one of the links of which is missing and has been replaced by a piece of twine. To substitute iron for cotton at this point is the object of the studies now in progress in Illinois on the distribution, average numbers, and ecological preferences of the various species of Illinois birds.

- Stephen A. Forbes (1907: 306)

The fauna that we study now is an ever-changing heritage from the past. Though in a broad sense evolution has no beginning and no end, it has directions that are affected by factors untold in numbers… The value of systematic bird censuses increases as the years pass, for without some reference to the past we cannot see the trends of evolution; we can see neither the magnitude nor the direction of change. In terms of quantitative data on bird populations in North America, we have few reference points before 1915. In view of the paucity of quantitative data, and the habitat changes that have occurred in the past half century, the efforts of Stephen A. Forbes and Alfred O. Gross to provide detailed information on the bird life of 1906-1909 in virtually every habitat in Illinois appear particularly farseeing and commendable.

- Richard & Jean Graber (1963: 501)

A project that began with two young men walking across rural Illinois toting shotguns and field glasses evolved into the first systematic bird survey in North America. When Stephen A. Forbes, Director of the Illinois Natural History Survey from its creation until 1930, directed Alfred O. Gross and Howard Ray to travel the state in 1906, no one in the country had yet attempted to count all the species of birds they observed across habitats, with a specific and repeatable method. Through 1909, Gross and Ray crisscrossed the state in all seasons, by foot, horse-back, train, and steam boat, while counting and collecting the birds they saw.

In the mid-1950s, Richard and Jean Graber were newly hired ornithologists at the Illinois Natural History Survey. Among the first projects they undertook was to repeat the 50-year-old surveys during the summer and winter months of 1956-1958. The Grabers' 1963 publication, "A Comparative Study of the Bird Populations of Illinois, 1906-1909 and 1956-1958," remains the standard for assessing changes in bird populations of the state for the first half of the 20th century. With the exception of two obscure summer bird censuses by the U. S. Biological Survey (Cooke 1915, 1916), data on bird populations are scarce for most of North America until the Breeding Bird Survey began in the mid-1960s (Peterjohn et al. 1995).

For the past three years (2007-2009), we continued field work on this project. Here, we present a summary of the changes to the summer bird communities and habitats across the state over the past century. Whereas our use of air-conditioned vehicles on interstate highways, use of Global Positioning System satellites to record our movements, and analysis of data on laptop computers would have been pure fantasy to our predecessors, their methods for counting birds in the field have been essentially retained.

The Grabers benefited from their communications with Alfred Gross during their work, and we are especially grateful to Jean Graber for her helpful insights to the study, as well as the detailed notes and photographs compiled by her and the late Richard (Dick) Graber.

As the Grabers noted, "(t)he value of systematic bird censuses increases as the years pass" (pg. 501). Long-term data provide the best benchmarks to assess changes in the distributions and abundance of birds we observe today. Most bird conservation priorities in North America are driven by trends recorded over the past 40 years by the Breeding Bird Survey (BBS). The Breeding Bird Survey has become the pre-eminent bird monitoring program for the continent, providing annual data on more than 400 bird species collected by volunteers from some 4,100 routes located across the US and Canada. Yet, the Breeding Bird Survey was not designed to evaluate changes in bird populations within specific habitats (Sauer 2000).

With habitat-specific bird survey information reaching back 100 years, Illinoisans have the unique opportunity to better answer important questions. Are abundances and recent trends of bird populations within the 'normal' range of variation and therefore "acceptable," or are abundances and trends outside of what's been recorded over the long term and a cause for concern? How do changing bird distributions relate to factors such as land use and climate?

This study provides three snapshots spanning a century. Important changes in the avifauna undoubtedly occurred unobserved among those windows, such as that documented by Charles Kendeigh at Trelease Woods near Urbana from 1922 to 1976. Kendeigh (1982) reported a spike in the abundance of arthropods and the forest birds that feed on them in the 1950s, when Dutch elm disease eliminated a common canopy tree and there was surge of growth from the understory. The unique span of time and geographic scale of this study are the study's strengths. In Illinois, where land cover and land use have changed dramatically owing to agricultural practices and development, insights into the dynamics of bird communities and populations over a diverse suite of habitats is crucial to understanding the past, present and future sustainability of the avifauna across Illinois and the surrounding region.

Birds are among the most visible, popular, and economically-important types of wildlife. But how well do peoples' perceptions of changes in birds and habitat match what's happened over time? As a part of the third iteration of this study, we asked residents near our bird surveys about their knowledge and opinions of bird populations and habitats in their local areas. The human component of sustaining biodiversity is essential, and we must be able to work with landowners and bird enthusiasts around the state in order to conserve bird populations valued by Illinois residents.

Our goal for this book is summarize results of this project across all three time periods. We direct our findings to a broad audience under four major headings:

The Changing Illinois Landscape. The types of habitats and ecosystems that birds use and their extent and distribution continue to shift. Using information from many sources, we've summarized how the amount and distribution of forest, grassland, wetland, and cropland have changed in Illinois from 1820 to the present. With aerial photos, we have a direct "bird's-eye view" of how the landscape has changed in the places surveyed for birds in the 1950s and 2000s. At ground level, many sites were photographed by Gross in the 1900s, by the Grabers in the 1950s, and by us recently. This series also provides a means to illustrate the changing Illinois landscape.

Bird Communities Through Time. Looking within habitat types, we examine how the kinds of birds and their relative abundances have shifted across the three survey periods. We consider how land use has changed over time to the benefit of some birds and detriment of others. In certain habitats, the species seen by Alfred Gross 100 years ago are similar to what we found there today. In other places, Gross would likely be surprised – and perplexed – by the birds in those habitats now. We were also surprised by the bird communities in different habitats.

Species Accounts. Every species has a unique life history rooted in traits that range from their preferred habitat, diet, and nesting behavior, to the timing and distance of their migration. Because of land use change, competition with introduced species, and climate change, some of these strategies work better than others in the modern Illinois landscape. Forty birds illustrate the successes and failures of these strategies in a landscape that has been fundamentally altered by human activities. Some species are new to Illinois whereas others have been nearly eliminated. Others have apparently adapted and developed behaviors that have led to increases or major changes in their north-south distributions.

Looking Back, Moving Ahead. We conclude with a section that considers all that we've learned about birds in Illinois to shed light on what the future might hold for birds and other wildlife. The human population and the footprint of developed lands are expected to grow, and almost certainly, urban, suburban, and cropland will be the dominant land uses in 2050. But what will those developed areas look like? Will corn and soybeans still be the most common crops, or will feed stocks grown for biofuels dominate the rural landscape? How will the bird communities in forests, savannas, shrublands, grasslands, and wetlands change?

Another large unknown is how much and how quickly climate will change in the region. Several scenarios on future climate change have been derived, and even the most optimistic models indicate that there will indeed be some change in annual temperature and precipitation patterns. How climate change will affect the distribution of plants and other components of bird habitat in Illinois will likely be a major topic of discussion among our scientific descendents

The practice of conservation has made significant progress in the past century, but the century ahead is likely to be even more challenging with more and more species dependent on our interventions to avoid becoming endangered or extinct. We hope that the insights gleaned from this study will set the stage for the continuation of this fascinating and important project in 2056 and help ensure the richness of bird life in Illinois and the region for future generations.

Overview of Methods

From the field notes and publications of Forbes, Gross, and the Grabers (Forbes 1907, 1908, 1913; Forbes and Gross 1921, 1922; Graber and Graber 1963), we have good descriptions of where sampling areas were located, how the birds were sampled, and how the data were analyzed. Nonetheless, we are uncertain about a number of details about the previous surveys. For example, Gross used terms like "grove" and "meadow" to identify habitat types in his field notes, but nowhere can we find his description of those areas. Was a 'grove' planted to trees like an orchard? Did it have an open, savanna-like canopy, or was it an upland forest? Was a 'meadow' hayed, grazed, or idle? Thus, we cannot be sure how certain habitats align with today's methods for classifying habitats and ecosystems. Accordingly, we are explicit and use words and images in defining our habitat classifications. What seems obvious to us today may not be so apparent in 50, 100, or 150 years. Documents and images from this project in the 1900s, 1950s, and 2000s are all archived at the University of Illinois Archives and the Illinois Natural History Survey library in Champaign, Illinois.

WHERE WE COUNTED BIRDS

Selecting Avian Sampling Areas

In the 1900s surveys, Gross and Ray traveled routes they selected between various towns and other landmarks (Fig. 2.1). Many of their starting points were locations they could reach by train, and they would walk towards another rail stop for the trip back to the Illinois Natural History Survey on the University of Illinois campus in Urbana-Champaign. Gross and Ray sampled habitats as they encountered them, and thus covered these habitats in proportion to their occurrence in the areas they surveyed. They began their surveys each morning and often continued them, with interruptions, through the afternoon. At night, they camped or slept in barns, the homes of families who took them in overnight, and hotels when in larger towns.

Graber and Graber visited many of the same counties as Gross and Ray and "deliberately chose a starting point in an area that seemed to represent the region" (Graber and Graber 1963: 384). Ultimately, they surveyed 96 locations, 32 in each the northern, central, and southern regions of Illinois (Fig. 2.2). From these starting points, Graber and Graber also surveyed habitats as they were encountered, ideally walking a giant square, 1.5 to 2 miles on a side, until they returned to their car. In practice, about half of their survey routes were less than 2 miles in total length.

While a few of the Grabers' study sites were easily found (e.g., "Apple River State Park"), descriptions of most of their starting points were somewhat imprecise, described by a distance and direction from the nearest town (e.g., "3 ½ miles northwest of Macomb"). Graber and Graber recorded the distance they traveled through each habitat type sequentially from these starting points but did not note their direction of travel or when they changed directions. We are confident we know most of the Grabers' starting locations to within 1 mile, but the routes they surveyed from those points are often unknown.

We used the 96 starting locations described by Graber and Graber as the basis for our avian sampling locations. In cases where two or more of the Grabers' starting points were less than 5 miles apart, we combined those points into one central point. We also considered two areas near the 1900s survey locations that were not surveyed in the 1950s. Ultimately, we surveyed birds at 76 sites: 24 in northern Illinois, 25 in central Illinois, and 27 in southern Illinois (Fig. 2.3; see also Appendix 1).

Selecting Landscape and Resident Sampling Areas

Seven sites in each region (North, Central, South) were randomly selected to examine land use changes in a 13.9-square mile area based on aerial photographs taken near the time of the 1950s and 2000s surveys. To learn about residents' familiarity with birds and changes they had observed that might affect birds, we contacted individuals living within a 20-mile radius of the avian sampling locations and asked them to complete a mail-back survey about observations in their home county.

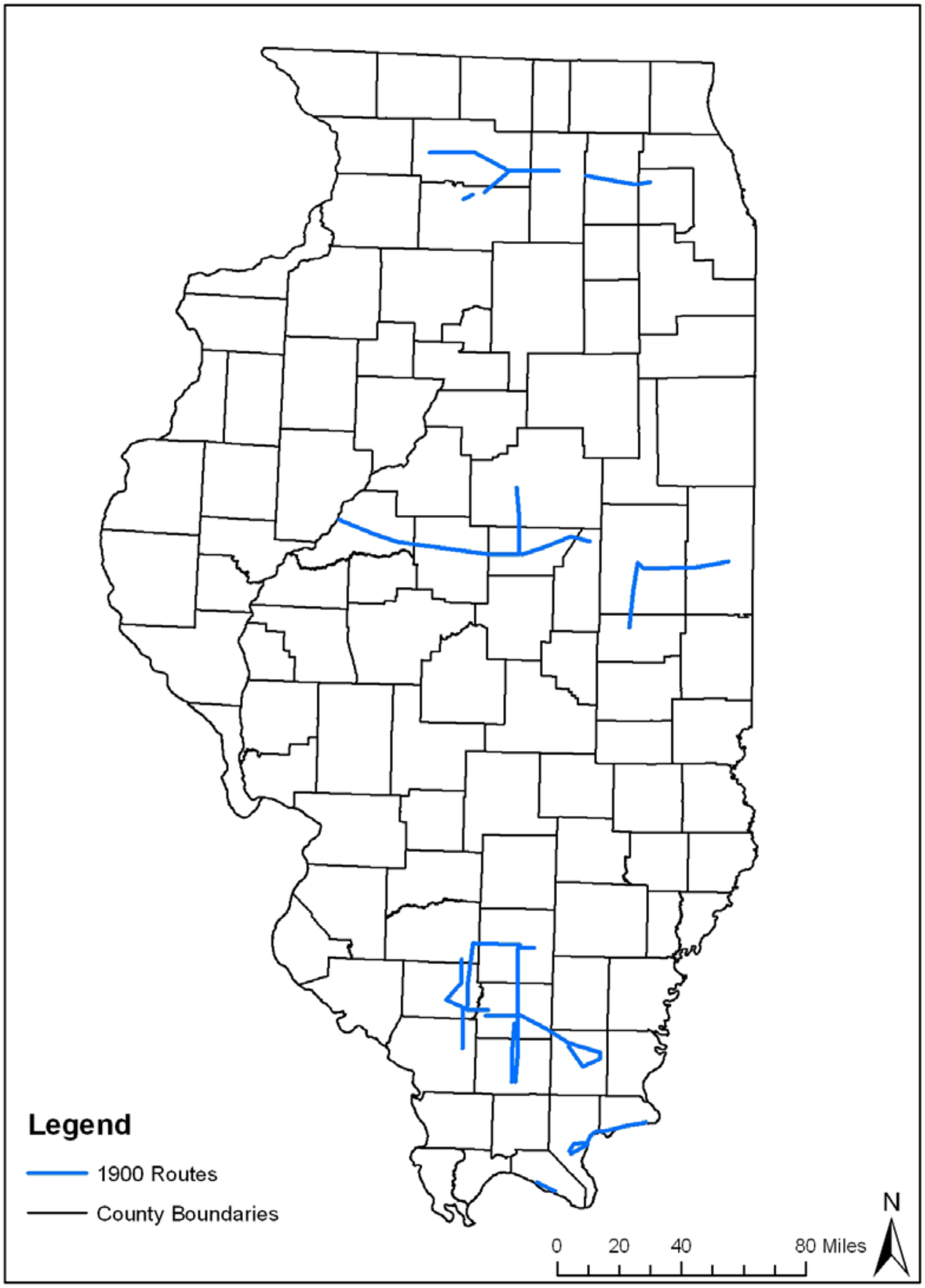


Fig. 2.1. Approximate routes surveyed by Alfred Gross and Howard Ray, 1907 and 1909.

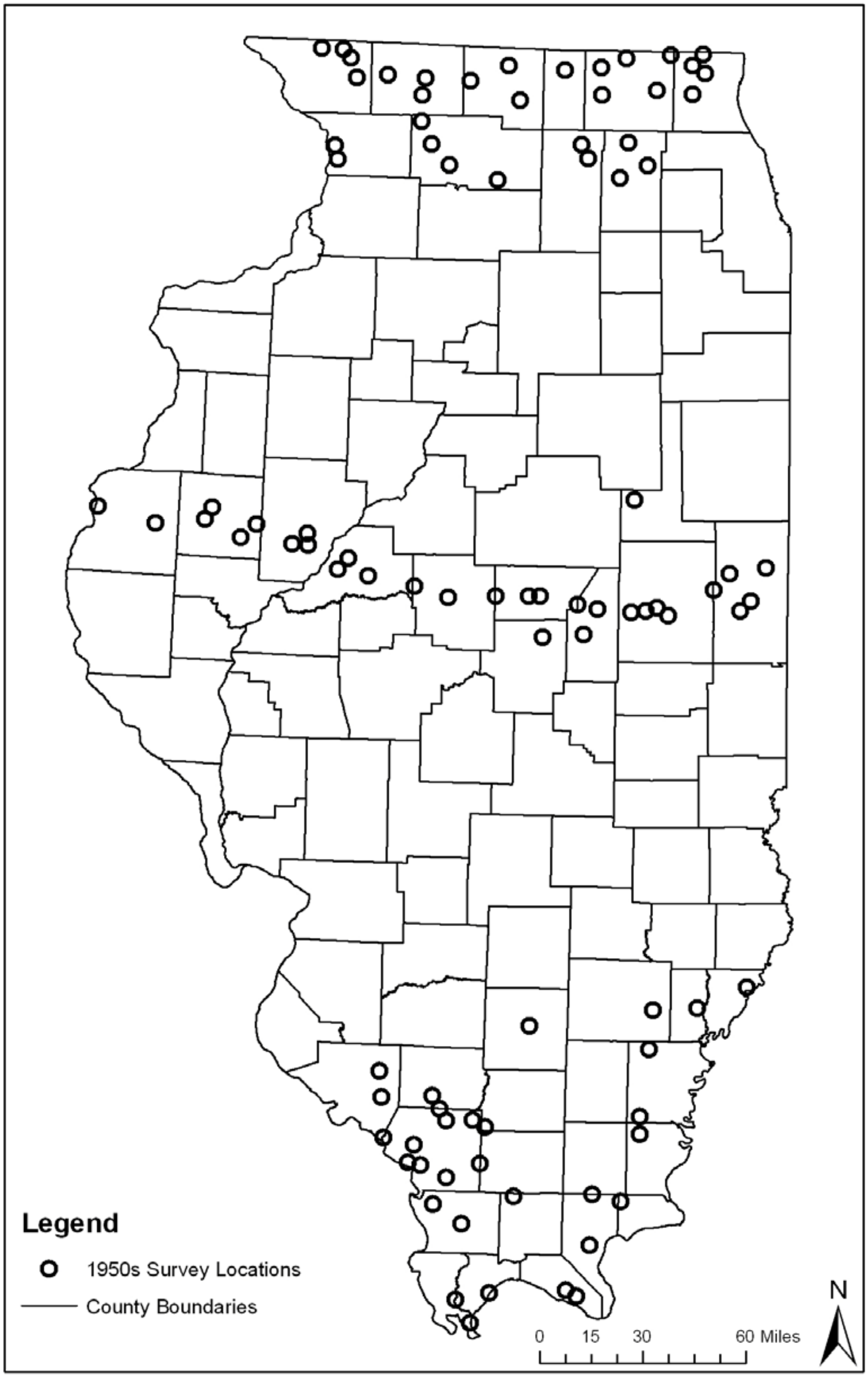


Fig. 2.2. Approximate starting locations of surveys by Richard and Jean Graber, 1957-1958.

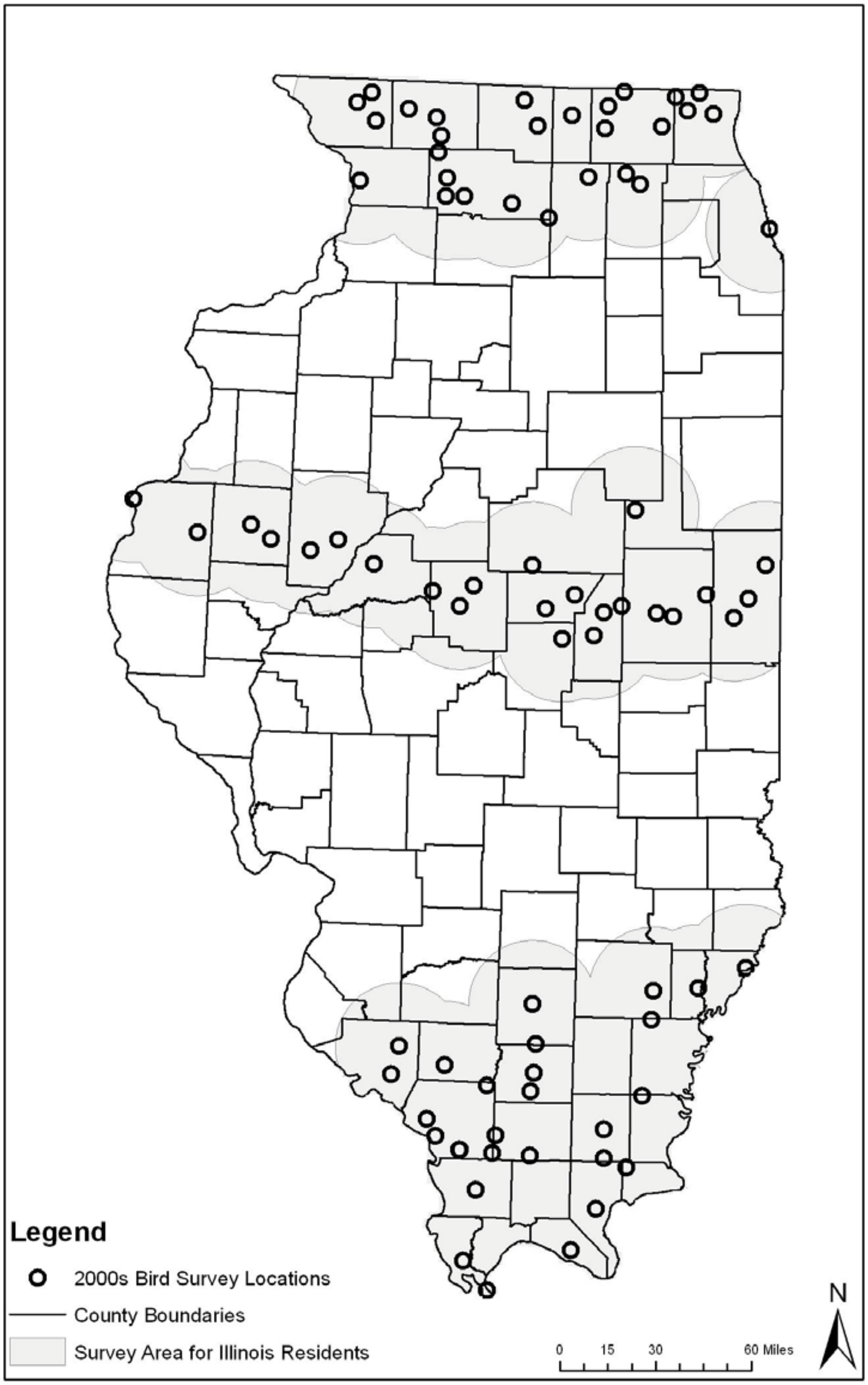


Fig. 2.3. Approximate locations of bird surveys in 2006-2008 (solid and open circles). Residents were surveyed about birds and bird habitat within 20 miles of these points (gray area), and aerial photos from the 1950s and 2000s were analyzed at 21 sites (solid circles).

Classifying Different Habitat Types

In the field, we categorized the areas we surveyed for birds into one of 22 habitat types (Table 2.1). The definitions of these habitat types largely follow the 1999-2000 Land Cover of Illinois classifications (http://www.agr.state.il.us/gis/stats/landcover/mainpages/glossary.htm) and are primarily based on *land cover*, although for grasslands (idle, grazed, hayed) and soybeans (no-till or conventional tillage), we further partitioned these by *land use*. In total, the habitat types we sampled represent more than 99% of the state's current land cover and use. Each of these habitat types is described and pictured in Section IV.

For our analysis of aerial photographs we used a reduced set of 11 habitat (land cover) types to describe the landscape, rather than the full set of 22 habitat types used to classify bird survey areas. We restricted the number of land cover types at this spatial scale for two reasons. First, less information was available for identifying land cover types from the photographs than in the field; vegetation height and color of plants and soil were generally unavailable or unreliable because of the way aerial photographs were taken – for example, differences in light conditions, time of day or the angle of the plane when photographs were taken. Thus, an observer conducting a bird survey in a field could readily identify the crop type planted there because he/she could examine plant height, color and other characteristics. On the other hand, a person looking at that same field in an aerial photograph could identify it as cropland based on its shape and pattern, or texture, but could not reliably identify whether the field was planted with corn, soybeans, or some other crop type. The identification of specific crop types from aerial photographs is possible when a site is photographed repeatedly throughout the growing season; however, photographs were available only from a single date each year. Second, aerial photographs from the 1950s and 2000s differed in color (black-and-white vs. color) and quality, which influences one's ability to identify particular land cover types; in order to maintain consistency between the two time periods, we limited our classification to land cover types that we could reliably identify from both sets of photos. A more detailed technical account of the analysis of aerial photos can be found in Appendix 2.

Table 2.1. Habitat types assigned to all areas surveyed for birds in the field and identified from aerial photographs.

Observed in the Field	Identified from Aerial Photographs
Idle grassland	Grassland
Grazed grassland	Linear grassland, <43.5 yards wide
Mowed or hayed grassland	Forest
Linear grassland, <30 yards wide	Linear forest, <43.5 yards wide
Upland forest	Shrubland
Floodplain forest	Cropland
Coniferous forest	Orchard and nursery
Linear forest, <30 yards wide	Developed area
Savannas-Open woodland	Barren area (quarries, construction sites)
Shrubland	Wetland
Corn	Open water
Soybean (no-till or conventional tillage)	
Wheat	
Oats	
Alfalfa	
Unplanted cropland	
Orchards and other crops	
High-density developed	
Low-density developed	
Developed open space (parks, cemeteries, golf courses)	
Marsh/wetland	
Open water	

HOW WE COUNTED BIRDS

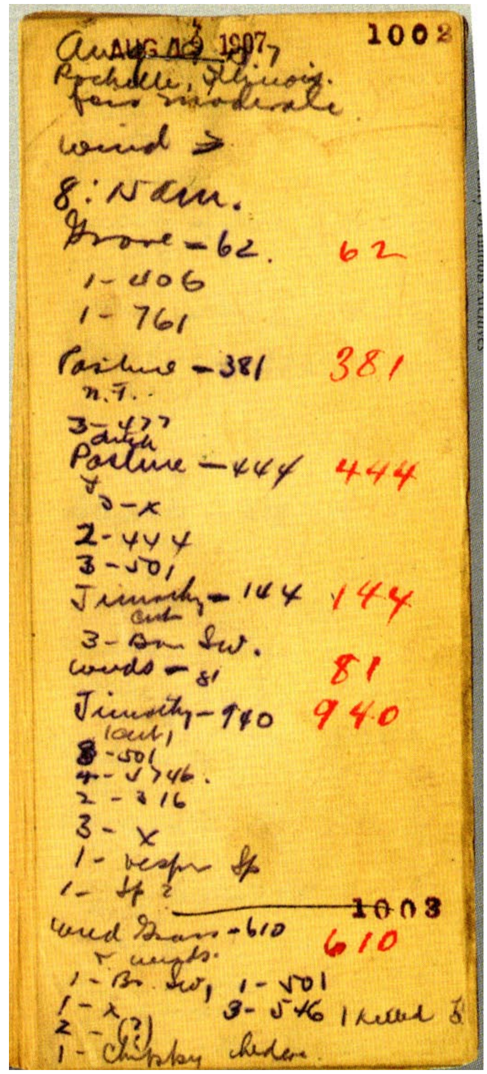
We recorded birds while conducting two types of surveys – transects and point counts. Transect surveys were conducted by one or more people traversing a designated area and counting birds as they moved along. This commonly-used technique is flexible and can be used in different habitats (Bibby et al. 2000). Transect surveys were the only method used in the 1900s and 1950s surveys. Point counts are a stationary survey (Bibby et al. 2000) in which an observer remains in one location and records all of the birds seen or heard within a defined period of time. We used unlimited radius point counts in the 2000s; in other words, we set no defined cutoff distance for recording birds. The North American Breeding Bird Survey is based on a series of 3-minute point counts conducted 0.5 miles apart along roadsides. Depending upon when they are conducted, point counts are a good method for surveying birds that advertise their presence or sing often. Transects allow observers to cover more area, and birds will be seen or flushed at times when they may otherwise have been inactive. In contrast, a moving observer might inhibit singing or movement of other birds.

Drs. Richard and Jean Graber collecting data.

The Transect Method

New methods for counting birds and estimating their abundances are routinely developed. But, when repeating historic biological surveys, it is essential to maintain a consistent methodology among time periods to ensure that comparisons are not confounded by method (Igl and Johnson 2005). Differences in how the locations for the 1900s, 1950s and 2000s surveys were selected are inevitable (see below), but the methods used in the field to observe and record birds have remained consistent. The transect method for sampling birds developed by Stephen Forbes has some features that are peculiar to us today, but to which we remained faithful.

Forbes (1907) gives this brief summary of his method: "Two acute and thoroughly reliable ornithological observers…were sent into the field under instructions to traverse the state in various directions, traveling always in straight lines and always thirty yards apart, and noting and recording the species, numbers, and exact situation of all birds flushed by them on a strip fifty yards in width, including also those crossing this strip within one hundred yards to their front. No attention is paid by them, for this purpose, to any other birds." Thus, birds that were seen or heard behind the observers, or outside the designated transect, were not counted. Gross and Ray modified the technique slightly in dense habitats, where they walked 20 yards apart and counted birds in a transect 30 yards wide and 100 yards long. Similarly, we walked narrower transects in shrublands, forests, and orchards. The Grabers transects were also performed in a manner consistent with that of Gross and Ray.



Original data sheets used by Gross and Ray in 1906-09

In all three time periods, paired observers moved at a pace of 40-50 minutes per mile (about 10-12 minutes to traverse 0.25 miles across a typical 40-acre field). One observer recorded all the birds seen (by both workers), made notes on the habitat, and recorded the distance traveled within each patch of habitat. The transect method was unusual in that the observers were constantly talking to relay sightings and avoid double-counting birds. During our surveys, we recorded all of this information directly into a hand-held computer with a Global Positioning System (GPS) that recorded our location and distance traveled.

To minimize variation among observers, we used as few observers as possible throughout the study. Either Jeff Walk or Mike Ward recorded data on every transect; together, they surveyed several sites at the beginning of each field season to ensure consistency in methods. On about 80% of transects, Steve Bailey was the second observer.

I

Gross, Ray and an assistant in southern Illinois, 1907

Timing of Surveys. In the 1900s and 1950s, surveys typically began early in the morning, usually before 8:30 am but in some cases as early as 4:30 am, and often continued throughout the afternoon. Nonetheless, in the 2000s we limited our transect surveys to the morning hours, beginning at sunrise and typically ending by 10 am but occasionally as late as 11 am. This was necessary for two reasons. First, we conducted point-counts during breaks from our transect counts. Observers rely heavily on vocalizations to detect birds during point-counts, and bird song tapers off dramatically after mid-morning. Second, we spent most afternoons making contacts with landowners to get permission to access areas we wanted to survey the following morning.

In the current study censuses were only conducted between sunrise and 10:00AM.

Surnise at Chain-of-Lakes State Park (McHenry Co)

Gross and Ray conducted transects in all seasons from 1906-1909 but did summer surveys only in 1907 and 1909. Graber and Graber surveyed in both winter and summer. We only conducted surveys during the summer months of 2006, 2007, and 2008. During the 1900s and 1950s, the dates of summer bird surveys ranged from May 22nd through July 15th. We restricted our field work to these earliest and latest dates (May 22nd and July 14th, respectively). Our earliest surveys were in the southern zone, with field work beginning in the next zone northward one week later. Similarly, we stopped sampling in southern Illinois in late June and by mid-July in northern Illinois (Table 2.2).

Table 2.2. Range of dates of bird surveys in each region (North, Central, South) of Illinois in 1907 and 1909, 1957-1958, and 2006-2008.

Region	1900	1950	2000
North	30 June-8 July	25 June-15 July	3 June-14 July
Central	22 May-15 July	15 June-12 July	28 May-3 July
South	4 June-15 July	11 June-10 July	22 May- 27 June

Sampling Habitats. Gross and Ray and the Grabers intended to sample different habitat types as they encountered them along their chosen routes. With this type of haphazard sampling, both teams hoped to generate a representative sample of habitats across the entire state, and habitats should have been sampled roughly in proportion to their occurrence. For example, if an area was covered by 50% corn, 30% forest, 15% grassland and 5% developed, the distance traveled on surveys should have been about 50% though corn, 30% through forest, 15% through grassland, and 5% through developed areas. When land cover types were either very common or scarce, this created problems. In an area 90% dominated by corn and soybeans, observers over-sampled those common habitats. Uncommon habitats, like marshes and shrublands, were encountered too infrequently on these 'random' transects and too little data were collected to make robust inferences. To correct this problem, in 1958 the Grabers did "supplementary sampling" of several scarce habitats they had encountered in small acreages.

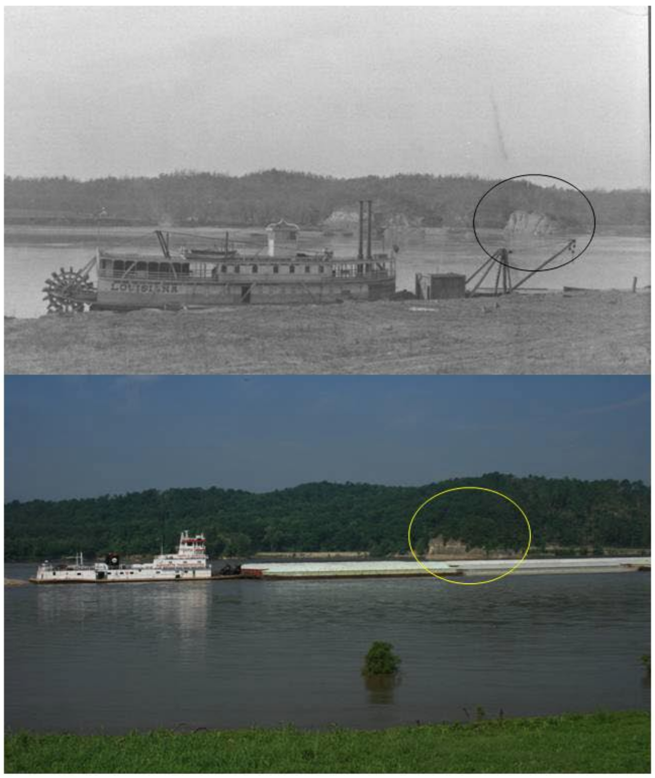


Figure. Every attempt was made to return to the same exact areas where censuses were conducted in 1906 and 1956. The pictures above are from Grand Tower, IL of the Mississippi River. Notice tower rock is still in the River, however the major mode of transportation on the river has changed.

Because the land cover of Illinois is dominated by a few land cover types, if we had surveyed habitats as we haphazardly encountered them from starting locations, our problem of over-sampling common habitats and under-sampling scarce habitats would have been even more severe than faced by the Grabers. Since the 1950s, the Illinois landscape has become more and more homogeneous and encountering only one or two types of habitat at a site was likely – even along a long transect. To counter this problem and avoid bias associated with seeking out scarce habitats for supplemental sampling, we used a different approach.

At each survey area, our intent was to sample birds in as many different habitat types as possible within 3 miles of the starting point. For especially uncommon habitats (e.g., marshes), we surveyed patches located up to 4 miles from the origination points. A cost of this strategy

Figure. Horse and wagon, as well as train appear to be the major means of transportation in 1906-09. Gross, Ray, and technicians in southern Illinois.

was that it required time for scouting habitat types and making landowner contacts the day before our surveys. We typically arrived in a survey area in the afternoon and began mapping habitat types and securing permission to conduct surveys. This process sometimes took several hours. Fortunately, the landowners we met were cooperative. In only three instances throughout the study did landowners decline our requests to count birds in specific areas: two pastures where bulls might present a danger to us, and one wheat field that was ready to harvest where we may have scattered ripe grain. In all three cases, we were allowed to sample other areas on those farms. Most landowners were very interested in our study, and all of them indicated this was the first time they had ever been asked for permission to count birds on their land.

Since the starting points were selected 50 years ago, we avoided the temptation to ‘cherry-pick’ locations to work. With a few exceptions, we surveyed birds in any patch of habitat we could access, regardless of perceived value as bird habitat (e.g., recently mowed alfalfa fields, overgrazed pastures) or convenience (e.g., dense shrublands of thorny vegetation, steep hillsides). We avoided patches too small to accommodate transects at least 100 yards in length and did not survey corn fields that were eye-level or taller, as it was pointless to conduct a visual survey where visibility was so limited.

The length of transects depended upon the size of each patch, and transects were oriented along the patch’s longest axis to minimize the need to cross wide streams and interstate highways. We started a new transect each time we crossed from one habitat type to another. Transitions between most habitat types were obvious (e.g., corn to soybeans), whereas others occurred along a gradient (such as from forest to savanna, and from savanna to grassland). We considered the character of habitat within 50 yards to determine when to end a transect in one habitat type and begin another transect of a second habitat type.

Our method for selecting habitats to sample proved to be effective, in that the transects allowed us to visit all major habitats in roughly even proportions. Our sampling of different habitats therefore contrasted with their availability across the landscape (Fig. 2.4). Available habitat was dominated by corn and soybeans, but the sampled areas included similar amounts of forest, developed areas, and grasslands. When compared to land cover of the 1900s, Gross and Ray appeared to favor grassland habitats and avoid wooded and residential areas on their transect surveys. With supplemental sampling, Graber and Graber achieved a relatively even proportion of habitat types among transects.

Figure. Drs. Richard and Jean Graber conducting the transect methods of bird sampling.

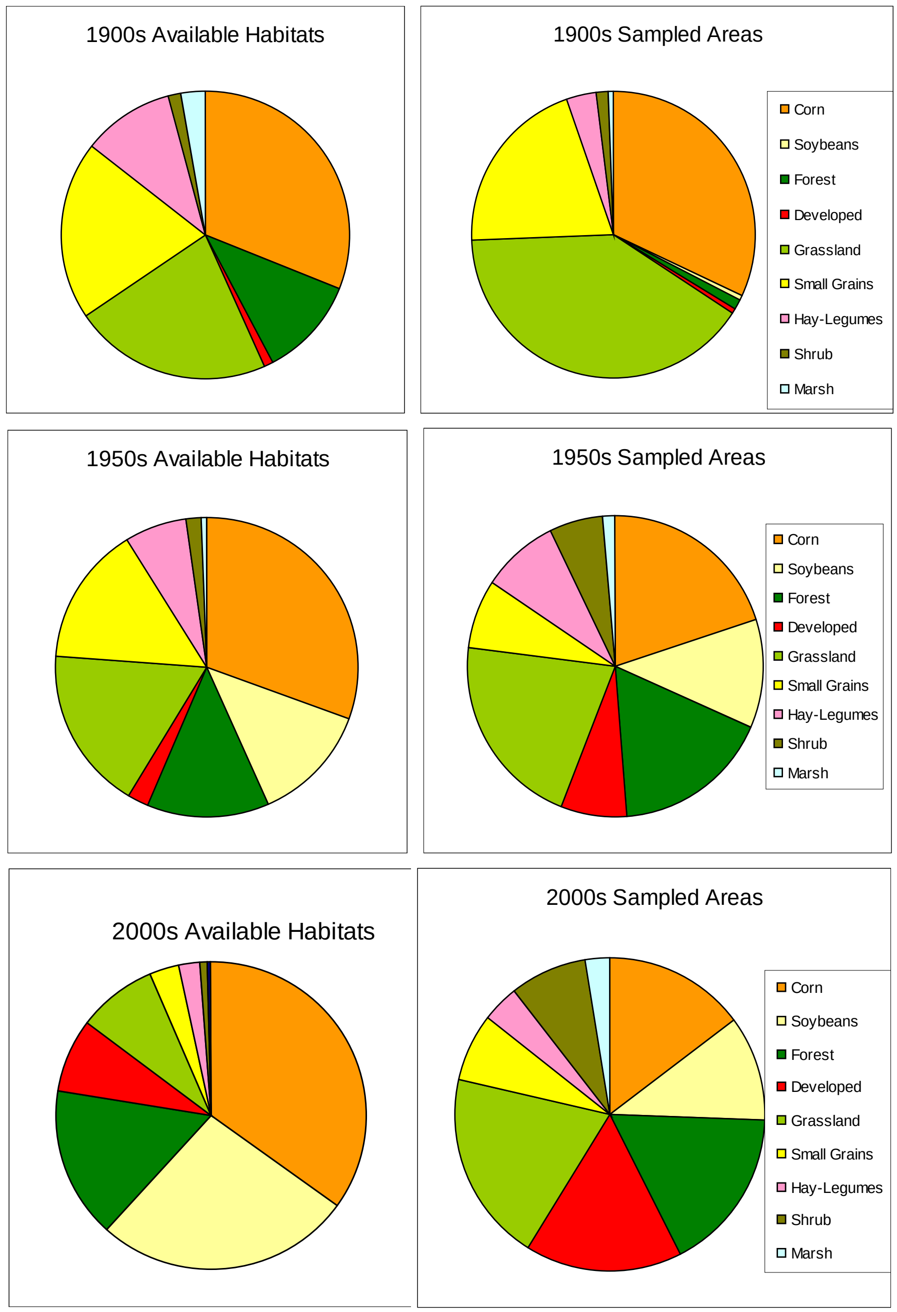


Fig. 2.4. Comparison of available habitats (proportion of statewide land cover) and areas sampled for birds in the 1900s, 1950s, and 2000s surveys (proportion of transects in each habitat type). Forests were under-represented and grasslands over-represented in the 1900s sample. The

latter samples are well-balanced, in part due to supplemental sampling in the 1950s and a revised sampling scheme in the 2000s.

"Did You See It?" Only Birds Seen Were Recorded. Among all of their publications, Gross and Forbes often made reference to the birds *seen* and commented that the transect method restricted them "to birds of more or less open country" (1923:436). The only reference to hearing birds was a comment by Forbes (1907) that Gross and Ray could accurately identify all Illinois birds by sight and "most of them by song." Otherwise, they never described how they dealt with birds that were only heard and not seen. Once in the field, Gross and Ray modified the technique by walking a narrower transect (observers 20 yards apart) and recorded birds seen out to 5 yards to their

Figure. Fields optics were of poor quality and field guides were not in existence, therefore most photographs contain firearms. These guns were used to collect birds sides in dense habitats, such as wooded areas. This modification suggests they were trying to increase the proportion of birds they could see and identify within transects through tall, thick vegetation.

In their field notes and major publication (Graber and Graber 1963), the Grabers were not explicit on how they handled the common situation of hearing but not seeing a bird. They did remark that “reduced visibility in woodlands and dense shrub habitat undoubtedly affected the accuracy of the method” (pg. 386) and “the strip census is not well adapted to woodland areas” (pg. 431). At the beginning of our project, we consulted with Jean Graber, and she confirmed their understanding that Gross and Ray had only counted birds seen, and that she and Dick had done the same. Therefore, we repeated this method and only recorded birds detected visually.

Across all three time periods, nearly 44,000 birds were counted on more than 17,000 acres. In large part due to sampling only during morning hours, the 2006-2008 surveys covered less than one-half as much area as the 1907-1909 or 1957-1958 surveys. However, we recorded more birds during the recent surveys than were seen in either of the two previous periods (Table 2.3).

Why did we count more birds when we sampled a smaller area? One possibility is our deliberate sampling strategy to survey habitat types relatively evenly. As a result, we spent less time walking through bird-poor habitats like soybeans and corn, and considerably more time in bird-dense habitats, like developed areas. Gross and Ray and the Grabers may have over-estimated the distance traveled by counting paces, and it is possible that we were ‘better’ at spotting birds; undoubtedly, we have better optics and field guides than were available 50 or 100 years ago. An intriguing explanation is that a few species have become much more abundant over the past 50 years. Four species – red-winged blackbird, European starling, common grackle, and American robin – made up nearly half of all the birds we saw.

Table 2.3. Number of birds and species recorded and acres covered on transect surveys (all habitat types combined) in each time period.

Time period	Acres	Birds	Species
1900s	7,604	8,980	93
1950s	6,707	16,818	128
2000s	2,975	18,123	133
Total	17,286	43,921	162

Point Counts

We periodically interrupted our transect surveys, but no more frequently than every 400 yards, to conduct point counts. Both observers independently completed 5-minute point counts, during which they remained in their same positions (i.e., 20 or 30 yards apart, depending on habitat type) and counted all birds. Each observer recorded his/her results separately, recording all birds seen or heard and estimating the distance to each bird detected. The point counts and transects were separate surveys in the sense that a bird first seen during a transect could be counted on a point count, and a bird first detected on a point count could be recorded on a transect. Many birds that were "uncountable" on transects (e.g., heard but not seen or outside the sweep area) were "countable" on point counts.

HOW WE SURVEYED THE KNOWLEDGE AND VALUES OF LOCAL RESIDENTS

From May-August 2007, we visited residences within 20 miles of each bird survey area until 15 to 20 individuals accepted a questionnaire. The initial survey was either delivered in person or left at an obvious location near the main entrance to the residence; it included a questionnaire, cover letter, and postage-paid return envelope. At the time of delivery of the initial survey, we recorded participants' addresses for follow-up mailings. Approximately 2-3 weeks after delivery, a reminder postcard was sent to individuals who had not responded. In September 2007, an identical, replacement questionnaire, cover letter, and return envelope were mailed to those who had not responded to the first 2 mailings. A third mailing of the survey, a cover letter, and postage-paid envelope were mailed to remaining non-respondents in October 2007. Due to a lower than desired response rate, a shortened survey was mailed in January 2008 to measure differences between people who had responded to the full-length survey and those who had not. In total, we gave the survey to 1,596 residents, and ultimately received completed surveys from 652, for an overall response rate of 41% (Table 2.4). Response rates to similar surveys of less than 30% are considered suspect, and response rated greater than 65% are exceptional (Dillman 2000).

Individuals were asked to respond to questions in several categories:

- participation in wildlife-related activities;
- whether they own land or manage their property in any way to attract wildlife;
- their perceptions of changes in bird populations, bird habitat, and land use in their home county over the past 5 to 10 years;
- preference for changes in bird populations and habitats in the future;
- motivations for managing wildlife on their own land; and
- demographic information such as age, gender, and education level.

Participants were also given the opportunity to comment on any other issues affecting bird populations in their area that were not otherwise addressed in the survey. The complete questionnaire can be seen in Appendix 3.

Table 2.4. Sampling effort and response to a survey of Illinois residents about birds and bird habitats in each zone.

Region	Sites	Residents contacted	Surveys returned	Response rate (%)
North	27	540	245	47
Central	28	534	207	38
South	27	522	200	37
Total	83	1596	652	41

HOW WE ANALYZED DATA

When trying to characterize the dynamics of bird populations, there are always factors that can confound analyses and apparent population trends. Fortunately, there are techniques to account for some of these sources of variation; nonetheless, we emphasize that making comparisons across the three time periods must be done thoughtfully. A simple method we use in Section IV for describing the bird communities observed in different habitat types across time periods is to report the relative abundances of each species (% of all birds seen), assuming this metric is less prone, although not immune, to error than the estimates of density for each species (e.g., birds/100 acres) due to problems such as variation in bird activity with time of day, judging distances to birds, and estimating the distance traveled (and, therefore, the area surveyed). This is not a perfect solution, however: if only one bird species changes abundance, the relative abundances of all the other birds change by default.

Perhaps the most serious source of potential bias in bird survey data is detection probability - the chance of seeing a bird when it is present within the transect area. This quantity is typically less than 100% and varies by bird species, day of year, time of day, habitat type, and observer. Forbes (1907) did not think detection was an issue for his transect method, and he was confident in the abilities of Gross and Ray: "Their movement is like that of a gigantic sweep-net 150 feet wide and 300 feet deep, so drawn across the country day by day as *to capture every bird which comes in its way*; with this difference, that the birds are not actually caught or even inconvenienced, and that *nothing can escape the meshes of their well-trained observation" (emphasis added)*.

We now have the means to adjust counts based on estimates of detection probability. For this study, we made heavy use of "occupancy modeling" which is a relatively sophisticated technique to account for imperfect detection probabilities (MacKenzie et al. 2006) and is the basis for the species summaries found in Section V. The primary objective of occupancy modeling is to help resolve the problem of whether a species was present but undetected or was truly absent; in other words, we wanted to minimize the effect of "false negatives." This technique allowed us to account for effects of habitat type, amount of habitat surveyed at a location, time of day, and other factors on detection probability of each species and evaluate differences in the probability that transects were occupied by that species. Thus, we could make meaningful comparisons in probability of occupancy among the different time periods (1900s, 1950s, 2000s) and regions of the state (North, Central, South). As an example of the advantages, consider the issue that some 1900s and 1950s transects were done in the afternoon hours, and all of the 2000s transects were conducted during morning hours. Occupancy modeling helps to resolve the problem that most birds are less active later in the day and less likely to be detected.

We used Program DISTANCE 5.0 (Thomas et al. 2006) to model the point count data and estimate densities of birds (birds per hectare) within each site. With DISTANCE, we could also adjust for heterogeneity in detectability with distance from the observer. Due to sample size requirements, we could not derive detection functions (in other words, functions describing how the probability of detecting a bird changes with distance from the observer) and density estimates for each species.

At the 21 sites where we analyzed aerial photographs, we calculated the mean size and number of habitat patches and the percent of the landscape covered by each of the 11 land cover classes. We then compared these habitat attributes among the north, central, and southern regions of the state and between the 1950s and 2000s.

For the human dimensions surveys, we summarized the frequency of participant responses to our questions and compared them among the three regions of the state. Respondents were characterized by several factors. They were nearly evenly split between women and men, and their average age was 56 years old. The average respondent had lived in the area for 35 years, and most respondents lived on a farm (30%) or in a rural area but not a farm (40%). More than 75% of survey respondents had closely observed and tried to identify birds in the past three years, and 67% reported that they feed birds near their homes. Additionally, most people reported that they could identify 1-10 species of birds by sight or sound (Fig. 2.5).

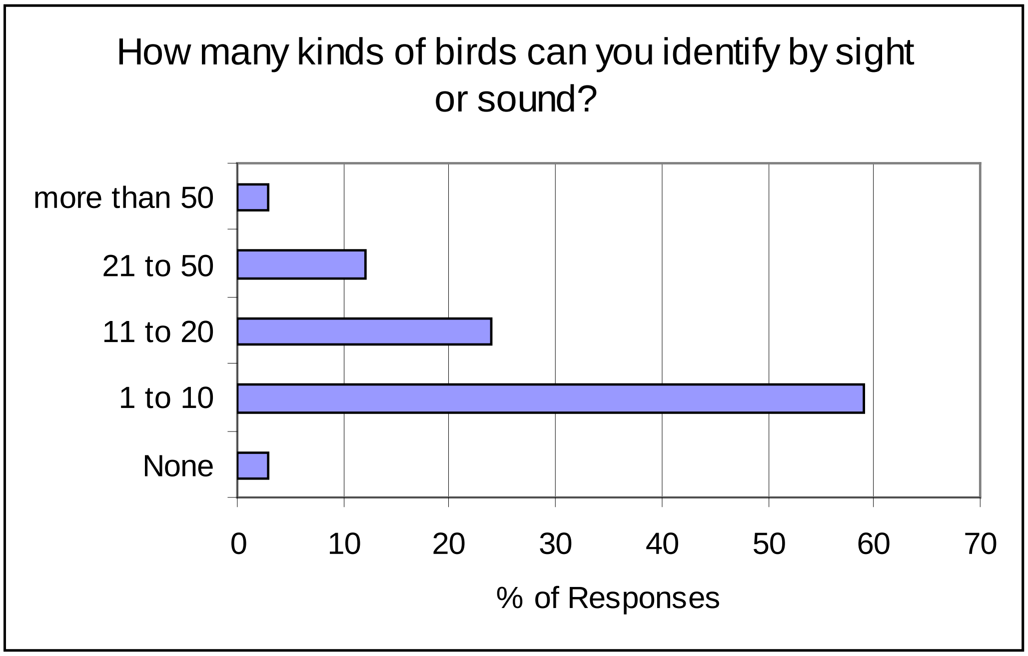


Fig. 2.5. Responses by Illinois residents to the question “How many kinds of birds can you identify by sight or sound?”

Changes in the Illinois Landscape

Natural cataclysms may alter habitats quickly but not widely, or widely but not quickly. It is man who combines the two, who changes the face of the earth not in millennia but in decades.

- Richard & Jean Graber (1963: 515)

The Illinois that birds live in today is far different than what birds experienced in Illinois 100 years ago. For one, there are far more people – 13 million residents now compared to roughly 5 million in 1900. Now there are about 4.5 million fewer acres of pastures, hayfields and other grassland habitats, but, surprisingly, nearly 2 million more acres of forest. Even land use familiar to us today has undergone striking changes; for example, there was roughly the same amount of corn planted in the state in 1900 as 2000, but yield has increased from about 35 to 175 bushels per acre[1]. Birds have responded to these changes in land use in various ways: some dramatic, others subtle, some expected, and others surprising. Here, we describe changes in the Illinois landscape and some of the notable impacts they have had on birds in the state.

Land cover – the vegetation, human-made structures, and waters that occupy the state's surface – has been a dynamic feature of Illinois for the past 200 years (Fig. 3.1). At the time of the General Land Office Survey of the state, conducted around 1820, about two-thirds of Illinois was covered by tallgrass prairie with most of the rest in forest (Anderson 1970). Several hundred thousand acres of prairie would probably be considered wetland or marsh today, but nonetheless, little land was in cultivation or permanent settlements.

[1] Unless otherwise referenced, agricultural statistics are from the US Department of Agriculture, National Agricultural Statistics Service; human population statistics are from the US Census Bureau.

Change came fast to Illinois soon after John Deere's 1837 invention of the self-scouring steel plow that allowed wholesale conversion of native prairie to cropland. Prairie-chickens thrived with the interspersion of cropland and prairies; by some estimates, as many as 10 million birds were in Illinois around 1860 (Westemeier 1985). Market hunters took advantage of this abundance in the mid-1850s, shipping hundreds of thousands of birds each year to Chicago, St. Louis and New York. The boom was short lived, however, and by 1870, numbers were so diminished that hunting was no longer profitable in Illinois (Merritt 1904). Wetter areas, initially spared from cultivation, were quickly drained and tilled when clay tiles came into widespread use by the 1850s. Upland forests in southern Illinois were the first wooded areas to be cleared for agriculture. As the need for farmland, fuel, and lumber grew during the 1800s, the amount of forested land rapidly decreased.

When Gross and Ray conducted their surveys, the Illinois landscape was already dominated by agriculture, though it looked considerably different than it does today. More than 90% of Illinois was in farms, and over 40% or more of the state's residents lived in rural areas. Farms averaged about 130 acres in size. Although corn was the dominant crop, about half of the farmland was devoted to hay, small grains (primarily oats), and pasture. Horses and cattle were present on 94% and 92% of farms, respectively. This landscape was ideal for house sparrows, which became the most common bird in Illinois after first arriving in the state around 1870 (Lowther and Cink 2006). It has been hypothesized that aggressive competition for nest cavities by house sparrows contributed to sharp declines in eastern bluebird populations. Approximately 300,000 acres of native prairie probably remained in the state at the beginning of the century (less than 2% of the amount present in 1820), and wetlands were being drained at a rapid pace. Virtually all of the state's forests had been logged for building materials and fuel (Telford 1926), and field sparrows and brown thrashers were among the most common birds in the cut-over scrub that had previously been forest.

The period when the Grabers were doing their field work was a time of rapid change for agriculture in Illinois, with increasing efficiency, mechanization, and use of synthetic pesticides, herbicides, and fertilizers. Average farm size had increased to about 200 acres, but only 20% of the state's residents were then living in rural areas. The acreage planted to soybeans, which emerged as an important crop after the 1930s, increased by roughly 50% between 1950 and 1960, to nearly 5 million acres. Alternate growing of corn and soybeans displaced a corn-oats-alfalfa rotation. The European starling, first seen in Champaign, Illinois in 1922 (Musselman 1922), had become "the new house sparrow" further displacing eastern bluebirds, red-headed woodpeckers and other native cavity-nesting birds.

Today, the state's land cover falls into three primary categories: corn-soybean row crop, forest, and developed areas (Fig. 3.1). Urban areas, where more than 85% of residents now live, are still a relatively small proportion of the land area of Illinois, but represent the fastest-growing land-use category. Urbanization bodes well for American robins, house finches, and other birds that thrive in developed environments. With population growth in urban areas, the percent of the population living in rural areas has diminished significantly. Since the 1950s, half of Illinois' counties have experienced declines in their population. The change is most profound in southern Illinois, where two-thirds of counties are less populous today than a century ago. Owing to natural regeneration and abandonment of marginal cropland, the amount of forest in Illinois has steadily increased for more than 80 years.

Because of urbanization and the regrowth of forests, the amount of land in farms has declined by about 10% over the past 50 years. Nevertheless, acreage devoted to the two principal crops – corn and soybeans – has increased by roughly 48%. The expansion of row crops has come at the expense of small grains, hay, and pasture. In effect, the agricultural grasslands preferred by meadowlarks have become the row crop fields preferred by horned larks. The number of cattle in the state has dropped from about 4 million in 1957 to 1.2 million in 2007. Average farm size has increased to 370 acres, and there are less than one-third as many farms today as in 1900 (about 76,000 compared to 264,000).

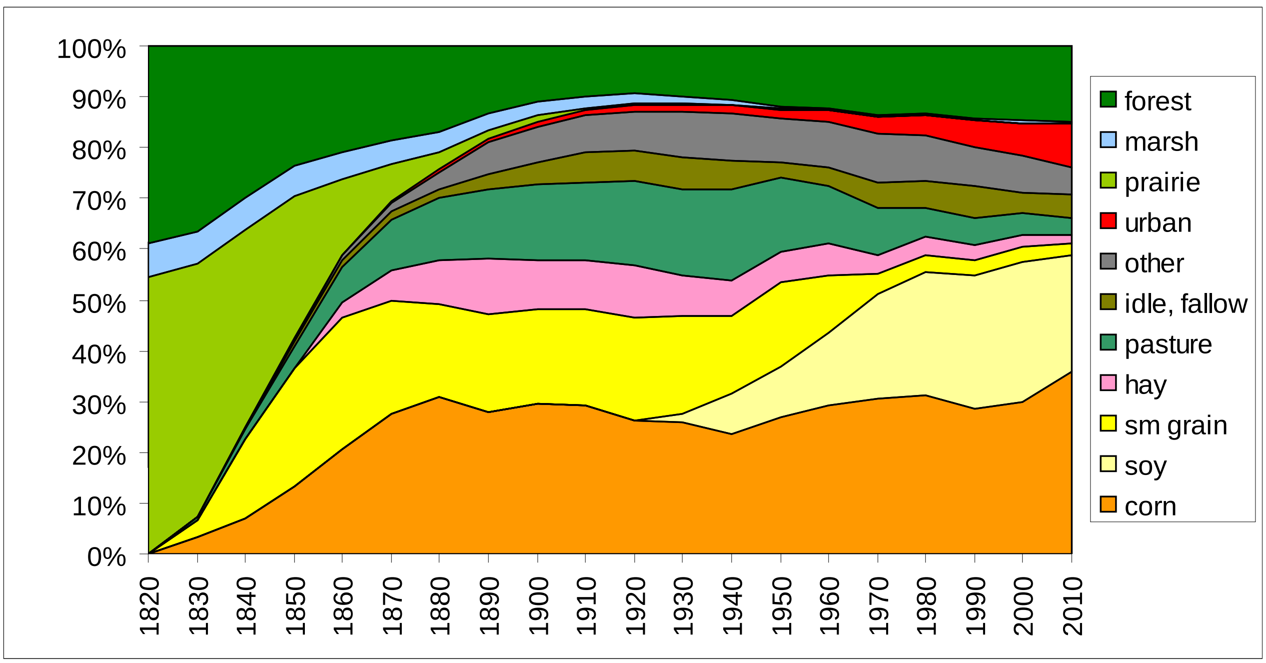


Fig. 3.1. Changes in Illinois land cover and land use, 1820-present. All values are approximate and are derived from several sources, including periodic Censuses of Agriculture from 1850 to 2007, Telford 1926, U.S. Forest Service 1949, Graber and Graber 1963, Essex and Gansner 1965, Anderson 1970, Hahn 1987, Luman et al. 1996, Schmidt et al. 2000, Land Cover of Illinois 1999-2000, Bretthauer et al. 2002, and Crocker et al. 2006.

Regional Changes in Land Cover between the 1950s to 2000s. When considering changes in land cover between the 1950s and 2000s in the counties we surveyed for birds in the three regions (Fig. 3.2), interesting patterns and contrasts emerged among northern, central and southern Illinois (Table 3.1). The abundance of hay and numbers of cattle (and presumably acres of pasture) declined substantially in each region, especially in the 13 central Illinois counties. Ironically, the counties in southern Illinois, which were historically forested, today contain 200,000 more acres of Conservation Reserve Program (CRP) grasslands than either the central or northern regions, which were historically prairie. The Conservation Reserve Program, administered by the USDA Farm Service Agency, is a program in which agricultural landowners voluntarily replace crops with land cover types that promote the conservation of natural resources and wildlife in exchange for annual payments; cropland is often replaced by grassland. Hay and CRP grasslands cover about 9% of the area of southern counties, compared to 6% in the northern region and 3% in central Illinois.

Corn acreage in the 12 northern-most counties dropped by 27%, whereas it increased in the central (71%) and southern regions (30%). Soybeans have become more common statewide, particularly in the southern 21 counties where their cultivation has jumped by nearly 800,000 acres since the 1950s. Wheat production remains most common in the southern counties and scarce in northern Illinois. The central Illinois counties are by far the most intensively cultivated (nearly 85% of the land area), whereas cropland occupies 50-55% of the southern and northern regions.

The southern counties, which were the most forested in the 1950s and remain so today (about 32% of the land area), experienced the smallest percentage increase in forest acreage. In contrast, the northern counties, which were the least forested in the 1950s, had the largest increase in forest cover (now approximately 13% of the land area). Central Illinois has the least forest cover (about 8% of the land area), although forest increased modestly in this region from the 1950s. The steady increase in forested land in Illinois since the 1920s (Bretthauer et al. 2002) bodes well for forest birds such woodpeckers and chickadees.

The human population increased most in the northern counties, which are now about 28% covered by developed areas. These counties were also the most populous in the 1950s. If not for growth in the Bloomington-Normal, Champaign-Urbana and Carbondale-Marion areas, populations in the central and southern regions would have declined between the 1950s and 2000s. Development covers about 4% of the counties in both central and southern Illinois today.

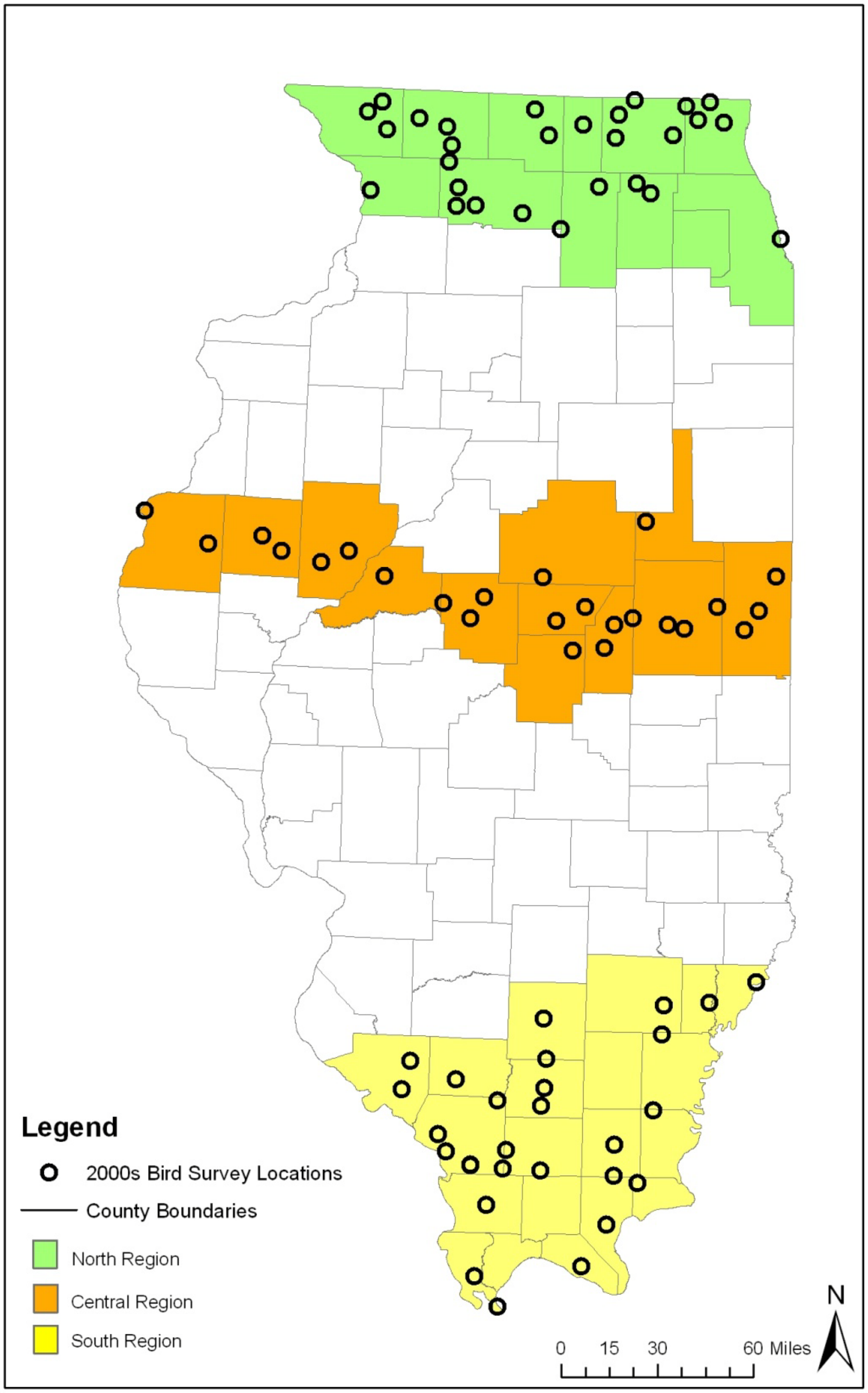


Fig. 3.2. Counties surveyed for birds and considered for land use change between 1957-1958 and 2006-2008.

Perception of Land Cover Change. While changes in the landscape were easily detected by examining aerial photographs from different years, we wanted to understand how residents' perceptions of recent land use change in their area (area around their residence over the past 10 years) compared to the actual longer-term, broader-scale changes. A mismatch between the public's perception of landscape changes and actual events could misguide conservation priorities and the public's resistance or support for managing certain habitats.

We asked residents of each region about land cover/land use changes they had observed in their home county over the past 10 years, and we compared their responses to actual longer-term trends in land cover change in northern, central and southern Illinois. In all regions, a majority of residents reported that the amount of forest was decreasing, whereas forest is actually increasing (Fig. 3.3). On the other hand, a majority of residents thought the number of homes and buildings was increasing in each region, a pattern that is consistent with the changes illustrated by our land cover data. New development tends to occur near existing development, where most residents live, and it generally takes place quickly. Forest regeneration, however, is a slower process that occurs, on average, farther away from where most residents live. Thus, it is likely that changes in development were more noticeable to respondents than changes in forest, causing them to have a more accurate perception of the former.

Hay and pasture have declined precipitously in all three regions, and most residents in northern and central Illinois thought that pasture was in fact becoming less common; however, the majority of southern Illinois respondents believed pasture had stayed about the same (Fig. 3.3). Most northern Illinois residents thought corn and soybeans had decreased (they have slightly), whereas they believed corn and soybeans had remained somewhat constant in central and southern Illinois (where they have increased).

Residents broadly agreed that the number of homes and building was increasing and that forests and pastures were decreasing in their home county over the past 10 years (Fig. 3.3). Responses were more mixed on whether cropland, conservation programs, orchards, or wetlands and ponds had increased, decreased or stayed about the same. Clearly gradual, long-term changes in land cover are not necessarily reflected in what people see and remember from their home area. From this survey, it appears residents would rank conserving forests as an equal or higher priority than conserving grasslands. In contrast, our examination of land use statistics indicates that grasslands are at far greater risk of conversion than forests.

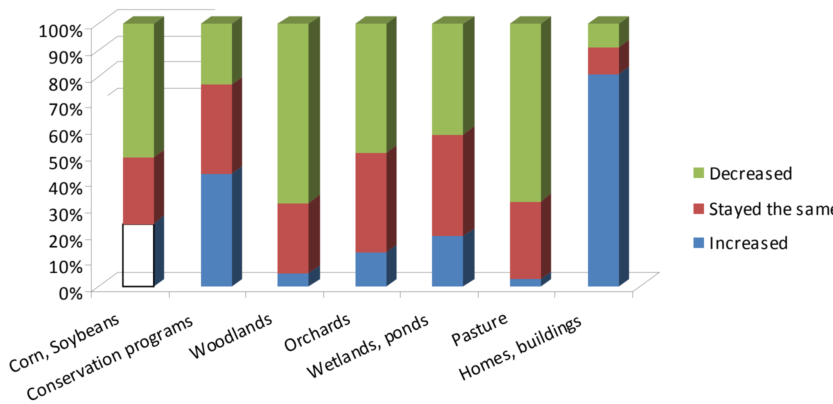
Table 3.1. Summary of land cover (in acres), number of cattle, human population, and their % change in (A) northern, (B) central, and (C) southern Illinois in the 1950s and 2000s. Values rounded to the nearest thousand. Values in red indicate a net percent loss, and values in black indicate a net gain.

A. North	1950s	2000s	% Change
Corn	1,757,000	1,283,000	–27
Soybeans	136,000	472,000	+247
Wheat	24,000	45,000	+88
Oats	505,000	9,000	–98
Hay	476,000	110,000	–77
CRP	n/a	78,000	
Forest	237,000	398,000	+68
Developed	n/a	929,000	
Cattle (head)	853,000	283,000	–67
People (#)	6,437,000	8,337,000	+30

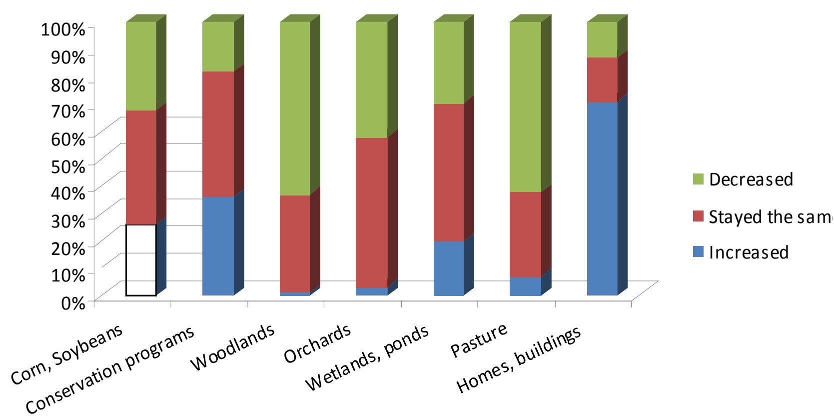
B. Central	1950s	2000s	% Change
Corn	1,473,000	2,512,000	+71
Soybeans	1,141,000	1,608,000	+41
Wheat	275,000	61,000	–87
Oats	482,000	0	–100
Hay	338,000	46,000	-86
CRP	n/a	114,000	
Forest	301,000	367,000	+22
Developed	n/a	205,000	
Cattle (head)	556,000	132,000	–76
People (#)	624,000	724,000	+16

C. South	1950s	2000s	% Change
Corn	662,000	862,000	+30
Soybeans	488,000	1,279,000	+162
Wheat	320,000	309,000	–3
Oats	34,000	0	–100
Hay	303,000	91,000	–70
CRP	n/a	320,000	
Forest	1,361,000	1,431,000	+5
Developed	n/a	160,000	
Cattle (head)	341,000	183,000	–46
People (#)	402,000	434,000	+8

A. **North Region**



B. **Central Region**



C. **South Region**

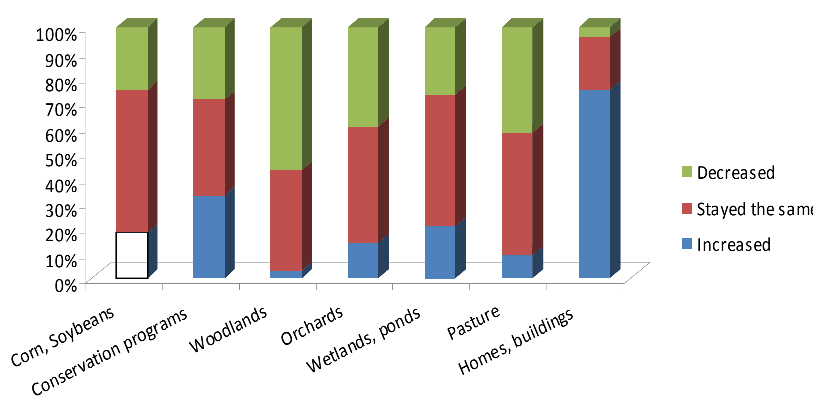


Fig. 3.3. Respondents' perceived changes in land use in their home county over the past 10 years, for (A) northern, (B) central, and (C) southern Illinois.

A Bird's Eye View of Landscape Change: Comparing 1950s and 2007 Aerial Photos

To understand how the landscape has changed over the past 50 years beyond statewide and county land use statistics, we compared aerial photos taken near the time of the 1950s bird surveys and again in 2007. From the land cover types identifiable in the aerial photos (Table 2.1), we summarized changes in the six most common land cover classes over all 21 sites in the three regions (seven sites in each region; each site is nearly 14 square miles, or 36 square km). In addition, we feature the paired photos and case histories of eight of the 21 sites that illustrate the most dramatic and important changes to the Illinois landscape. Throughout our discussion of landscape changes, we highlight how these shifts have impacted bird species and communities in the state since the Grabers' surveys in the 1950s.

Figure. Landscape north of Golconda, Pope County in 1907 and 2009. Much of southern Illinois has become reforested over the last century.

Similar to the previously discussed statewide and regional summaries, our analysis of aerial photographs grassland decreased at sites throughout the state, whereas developed and forested areas increased (Table 3.2). While the amount of cropland decreased significantly in northern Illinois and by small amounts at sites in the central and southern regions, county-level data (Table 3.1) show cropland actually increased in central and southern Illinois between the 1950s and 2000s. In general, the biggest changes in the six land cover types occurred in northern Illinois.

Table 3.2. Change in six land cover classes (as % of landscape) between the 1950s and 2000s at seven sites in each of the three regions of Illinois. For reference, a 1% change in a 14-square mile site equals the net gain/loss of about 90 acres. Values in red indicate a net loss in percent land cover, and values in black indicate a net gain.

Region	Cropland	Developed	Forest	Grassland	Shrubland	Wetland
North	–13.1	11.5	4.3	–6.0	0.3	0.8
Central	–2.4	4.0	3.8	–4.7	–1.7	–0.03
South	–4.8	4.5	1.9	–2.8	0.1	1.2

Cropland. Cropland decreased substantially in the seven sites in northern Illinois over the past 50 years, while the southern and central sites experienced much smaller reductions (Table 3.2, 3.3). Most cropland loss in the north was due to expanding development. At Lake Villa (Fig. 3.4), 22% of the landscape was converted from cropland to development. Interestingly, although we sampled corn and soybean fields at Lake Villa, we found no horned larks, which is the most characteristic cropland bird in Illinois. In other northern sites, cropland-to-development conversion ranged from 1–5%. A substantial proportion of the landscape at some northern sites was also converted from cropland to grassland (7% at Lake Villa).

The smaller losses in cropland acreage in the southern and central regions were caused primarily by conversion to development and forest, although transitions to grassland also contributed to cropland loss. At Goreville in southern Illinois (Fig. 3.5), enrollment of marginal cropland into the Conservation Reserve Program drove a 9% shift from cropland to grassland. A 5% cropland-to-grassland conversion took place at Crab Orchard in the same region (Fig. 3.7), occurring mostly on and near Crab Orchard National Wildlife Refuge.

Across the 21 sites, the number of crop fields decreased while average field size increased by 80–92% (Table 3.3). The move to a smaller number of larger fields was accompanied by a shift to a corn-soybean dominated system. Birds that use grassy or shrubby field borders, such as vesper sparrows and brown thrashers, have become less common as a result of these changes in the agricultural landscape, which are best depicted in the paired photos near Flagg (Fig. 3.10) and Havana (Fig. 3.12).

Table 3.3. Average percent cover of cropland in the landscape and average number and size of crop fields at seven sites in each of the three regions of Illinois. For reference, a 1% change at a 14-square mile site equals the net gain/loss of about 90 acres.

	% Cover		Number of Fields		Average size (acres)	
Region	**1950s**	**2000s**	**1950s**	**2000s**	**1950s**	**2000s**
North	61.5	48.4	344.1	139.6	16.3	31.6
Central	62.0	59.6	313.3	165.9	18.3	34.1
South	45.3	40.4	316.6	150.1	12.8	23.0

Figure. Corn has been the dominant habitat in Illinois for 100 years and in some areas the landscape has not changed. These three picture were taken 1mile north of Buffoal Hart in Sangamon County. Notice the hill (Elkhart Hill) in the distance

Figure. Most of Illinois's wetlands were drained prior to 1907 and the by-product of this is drainage ditches. The biggest difference in these is the addition of grass filter strips as seen in these photographs. This ditch is 2 miles west of Champaign, Champaign County.

Grassland. The largest net reduction in grassland cover occurred at sites in northern Illinois, but this change was less pronounced than the loss of cropland in that region (Table 3.4). Most grassland in the north was converted to development (e.g., 9.3% of the Lake Villa area, Fig. 3.4), spurred by a large increase in population growth there over the past 50 years (Table 3.1). Conversion to forest and cropland also contributed to the reduction of grassland cover at some northern sites. Three to five percent of the Flagg and Lake Villa landscapes were converted from grassland to forest (Figs. 3.10 and 3.4, respectively), while at Apple River 4% of the area shifted from grassland to cropland (Fig. 3.13). The average size of grassland patches decreased considerably at the northern sites (Table 3.4). Bobolinks and savannah sparrows, grassland birds which are largely restricted to northern Illinois, have become much less common since the 1960s (Sauer et al. 2008), likely reflecting the loss of this habitat type. The widespread loss of grasslands is concerning because birds that depend on grasslands have experienced the most consistent, widespread and severe population declines of any group of birds in North America (Peterjohn and Sauer 1999).

Net losses in grassland cover in central and southern Illinois sites were primarily caused by conversion to forest; for example 11% of the landscape in Goreville (southern IL) shifted from grassland to forest since the 1950s (Fig. 3.5). Although there are fewer grassland patches today, the remaining grasslands in southern Illinois are larger on average than grasslands 50 years ago. For Henslow's sparrows, a bird that prefers larger grasslands and denser vegetation, the larger fields enrolled in the Conservation Reserve Program in the southern part of the state since the late 1980s have fueled the recovery of this species (Herkert 2007), despite declines in the total amount of grassland in the region. In 2009, the Henslow's sparrow was removed from the Illinois list of threatened species.

Table 3.4. Average percent grassland cover and average number and size of grasslands at sites in northern, central and southern Illinois. For reference, a 1% change at a 14-square mile site equals the net gain/loss of about 90 acres.

	% Cover		Number of grasslands		Average size (acres)	
Region	**1950s**	**2000s**	**1950s**	**2000s**	**1950s**	**2000s**
North	17.3	11.3	126.9	110.4	12.4	9.4
Central	11.4	6.7	127.4	82.0	8.6	7.7
South	14.7	11.9	180.0	97.7	7.2	11.4

Figure. This field 1 mile southwest of Bluford, Illinois (Jefferson County) represents how rural grasslands have changed. In 1907 this field was probably grazed by cattle, whereas in 2008 this field was enrolled in the Conservation Reserve Program.

Developed. Development increased across Illinois over the past 50 years, and sites in the northern region changed the most. By 2007, developed land cover had increased by 135% in the north, largely due to conversion from cropland and grassland (see *Cropland* and *Grassland* sections above). The average number of developed areas in the three regions changed little, but on average they became much larger (Table 3.5). Average patch size increased by 1,015% at the northern sites, 112% at the central sites, and 160% in the southern areas (Table 3.5). The enormous expansion of developed areas was most pronounced at Lake Villa in northern Illinois (Fig. 3.4), where suburban and urban centers engulfed surrounding cropland, grassland, and forest. In the northern sites, most development occurred in relatively few urban and suburban centers. At central and southern sites, most development took place in many smaller patches in rural areas or small towns, as illustrated in the Crab Orchard in the south (Fig. 3.7).

Table 3.5. Average percent developed cover and average number and size of developed areas at sites in northern, central and southern Illinois. For reference, a 1% change at a 14-square mile site equals the net gain/loss of about 90 acres.

	% Cover		Number of developed areas		Average size (acres)	
Region	1950s	2000s	1950s	2000s	1950s	2000s
North	7.9	19.4	28.7	29.1	35.8	399.4
Central	4.6	8.5	50.0	42.4	8.2	17.3
South	4.5	9.0	65.0	56.0	6.9	18.0

Forest. Forest cover increased across Illinois between the 1950s and 2000s, with the largest change in the northern region (Table 3.6). Interestingly, we measured the largest increase in forest area at the site that also became the most heavily developed, Lake Villa in Lake County (Fig. 3.4). Northern sites tended to have more and larger forest patches in 2007 compared to 50 years ago (Table 3.6). Mirroring county-level data, sites in southern Illinois, where forests are a more dominant landscape component, experienced the smallest increase in forest cover over the same 50-year time period.

Several of our southern sites were in the Shawnee National Forest, established in the early 1930s. As these forests matured over time, we observed a notable increase in canopy closure, best exemplified by Cora (Fig. 3.14). Because of this trend, red-headed woodpeckers, eastern towhees and other birds that prefer open-canopy type woodlands with shrubby openings have been displaced to the benefit of bird species better suited to closed-canopy forests. The statewide increase in forest cover is promising for many birds, including Acadian flycatchers, Kentucky warblers, Carolina wrens, blue-gray gnatcatchers, and red-eyed vireos.

Table 3.6. Average percent forest cover and average number and size of forest patches at seven sites in each of the three regions of Illinois. For reference, a 1% change at a 14-square mile site equals the net gain/loss of about 90 acres.

	% Cover		Number of forest patches		Average size (acres)	
Region	**1950s**	**2000s**	**1950s**	**2000s**	**1950s**	**2000s**
North	4.2	8.5	46.4	74.0	9.6	13.1
Central	12.4	16.2	55.0	55.1	23.0	31.9
South	27.1	29.0	70.7	68.1	49.6	50.4

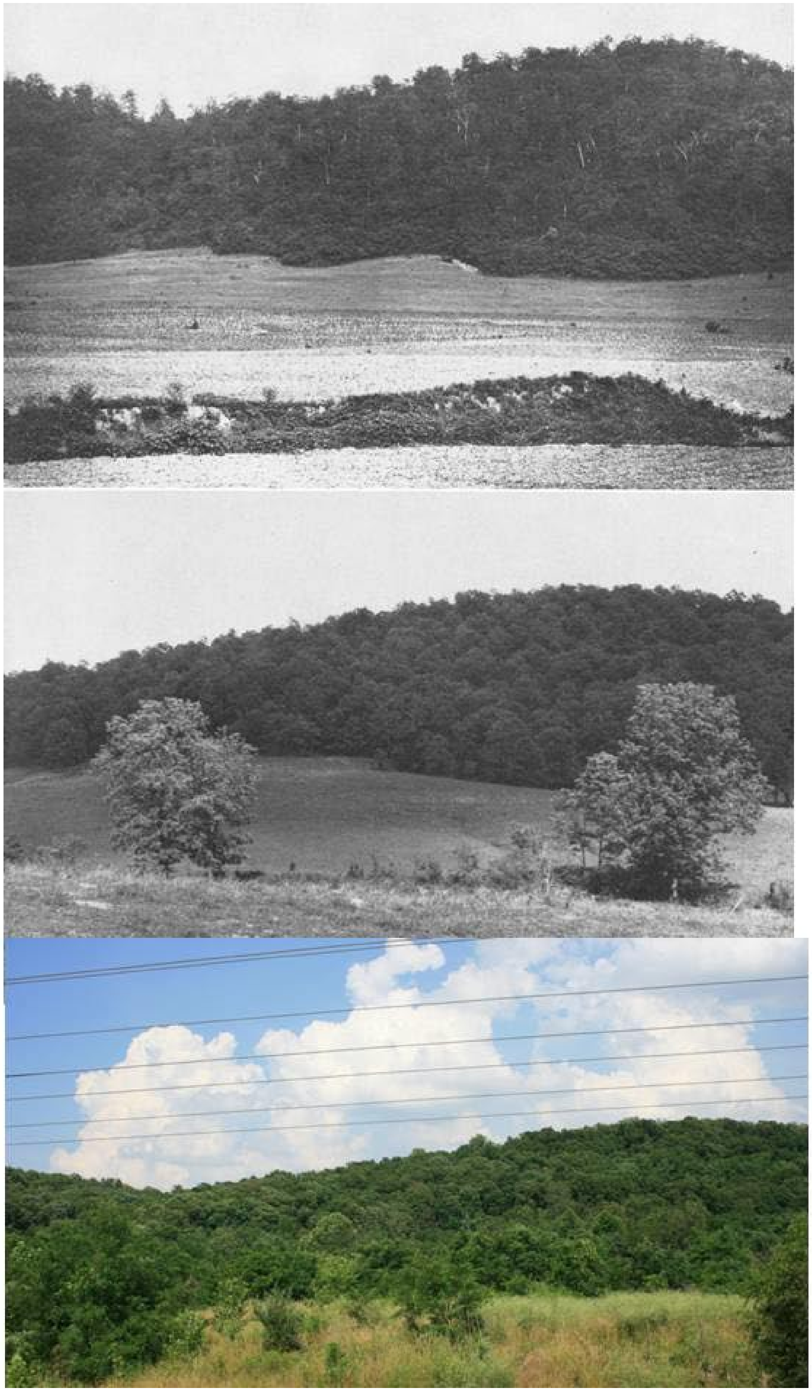


Figure. This hillside near Shelterville (Hardin County) represents how forests in southern Illinois have matured over the last century.

Figure. These Photogrpahs taken on a bluff just northeast of Brownfield (Pope County) represent one of the most dramatic changes document via the three studies. This floodplain area was in agriculture in 1907 by 1963 the area had succeeded into second-growth forest, only to be cleared again before 2008 for corn and soybean production.

Shrubland. Shrubland is not an abundant land cover type in Illinois and comprises less than 3% of the total landscape at the 21 sites we considered (Table 3.7). Only wetlands in central Illinois sites were less common than shrublands in the 2007 aerial photos. Because of the general rarity of shrublands in Illinois, a number of shrubland birds are of conservation concern, including yellow-breasted chats, Bell's vireos, willow flycatchers, northern bobwhites, brown thrashers, and field sparrows. Shrublands are ephemeral by nature since they represent a transitional stage between grassland or cropland and forest, and where they are found in the landscape changes over time. For example, Allerton Park (Fig. 3.16 and 3.17) illustrates the successional change from shrubland to forest. Other land cover types, such as cropland, developed areas, and forests tend to be more stable than shrublands.

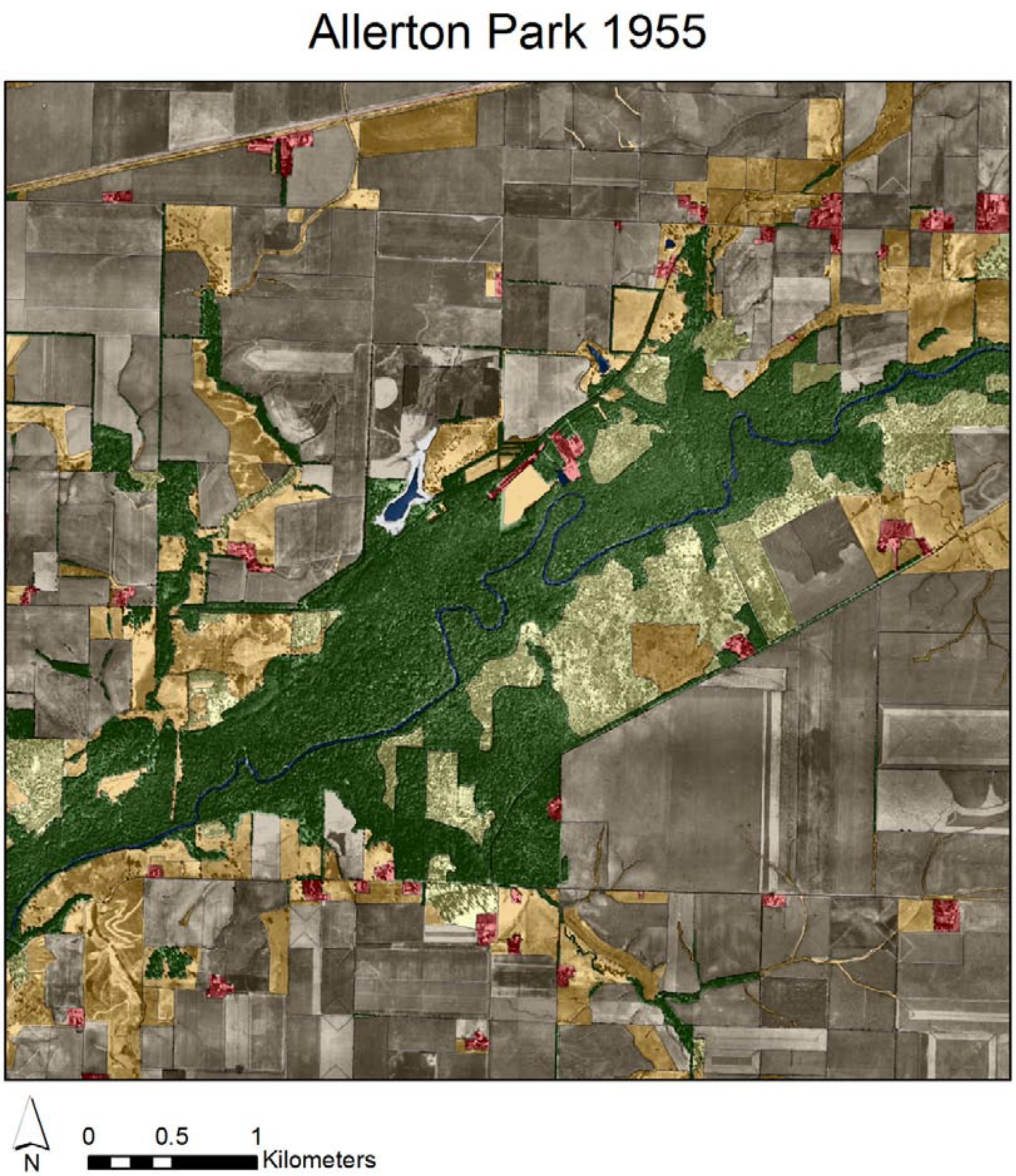
Table 3.7. Average percent shrubland cover and average number and size of shrublands at sites in northern, central and southern Illinois. For reference, a 1% change at a 14-square mile site equals the net gain/loss of about 90 acres.

	% Cover		Number of shrublands		Average size (acres)	
Region	**1950s**	**2000s**	**1950s**	**2000s**	**1950s**	**2000s**
North	0.7	1.0	11.1	19.7	4.7	4.7
Central	2.2	0.5	22.3	10.1	8.4	4.9
South	1.3	1.4	30.0	16.0	4.2	7.2

Wetland. Over time, wetland cover slightly increased at the northern and southern sites and remained essentially unchanged at central sites (Table 3.8). The slight increase in the northern sites may reflect mitigation for urban and suburban development. As with shrublands, wetlands are a minor component of the landscapes we examined but are most prevalent at northern sites. Marshes and other wetlands are important habitat for several familiar birds, including Canada geese, great blue herons, mallards, and wood ducks, as well as less familiar birds, like Virginia rails and least bitterns. A disproportionate number of the state's threatened and endangered species are dependent on wetland habitat.

Table 3.8. Average percent cover of wetlands and average number and size of wetlands at seven sites in each of the three regions of Illinois. For reference, a 1% change at a 14-square mile site equals the net gain/loss of about 90 acres.

	% Cover		Number of wetlands		Average size (acres)	
Region	**1950s**	**2000s**	**1950s**	**2000s**	**1950s**	**2000s**
North	3.3	4.1	27.8	27.7	9.9	15.1
Central	0.1	0.1	2.3	6.0	4.7	1.0
South	0.3	1.5	3.8	6.5	6.4	15.8



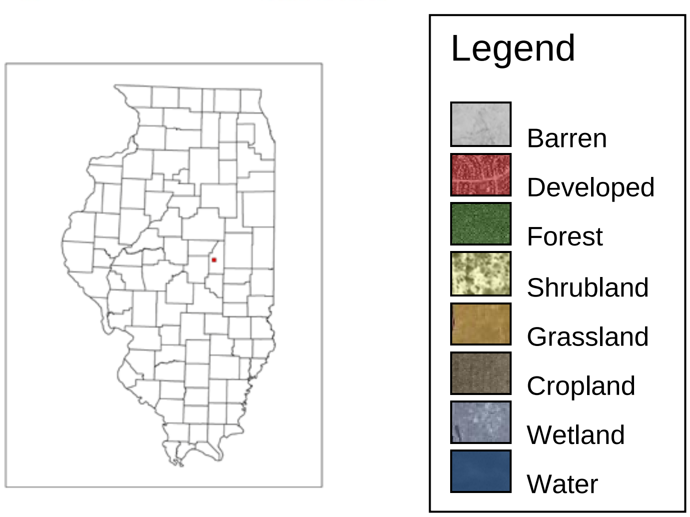


Fig. 3.3. Aerial view of Allerton Park near Monticello, Piatt County, Illinois, 1955 and 2007. The shrubland area south of the Sangamon River has largely become forested over time.

Allerton Park 2007

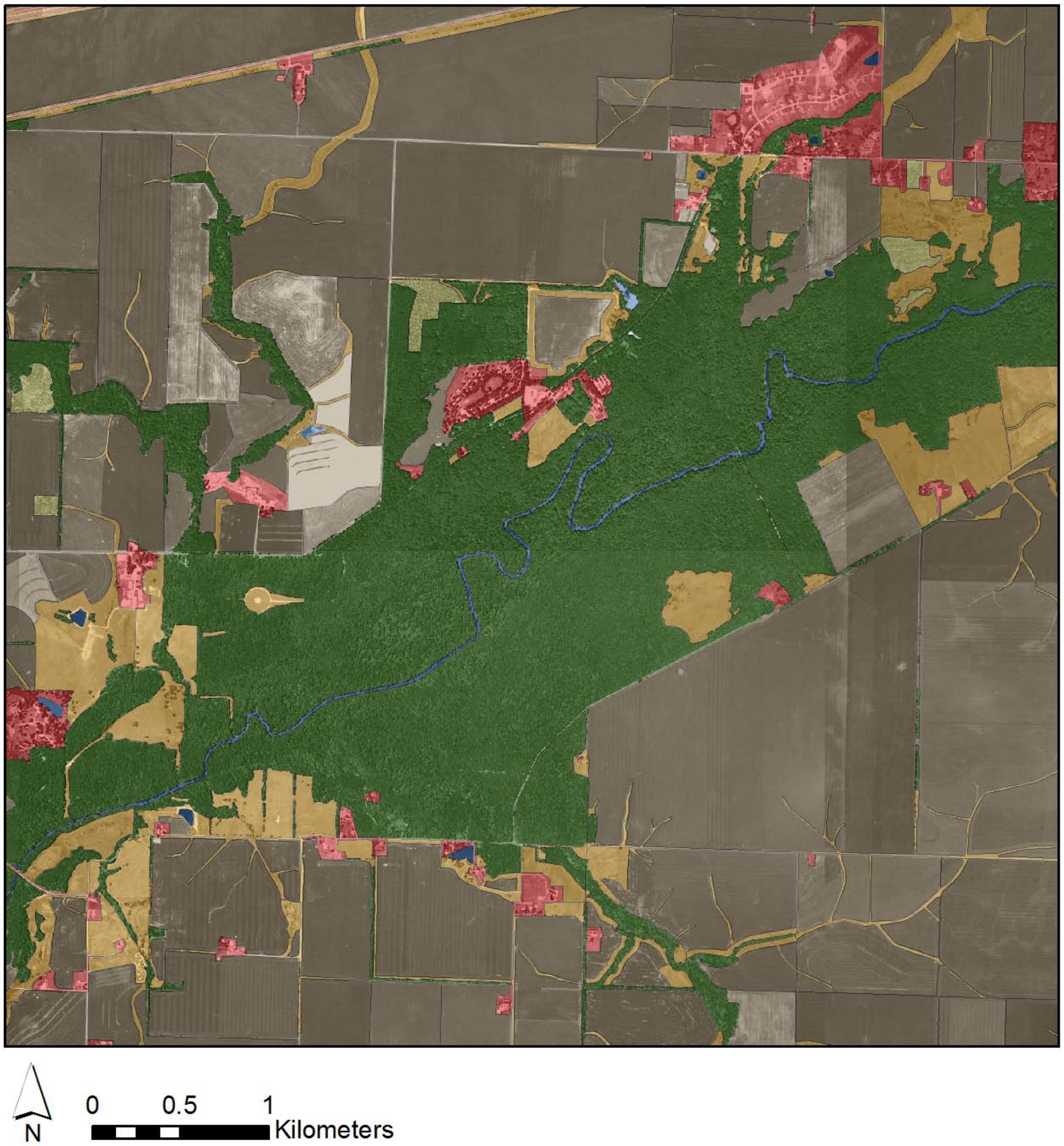


Table 3.9 Changes in dominant land cover classes in Allerton Park from 1955 to 2007.

Land cover	% Cover		Number of patches		Average size (acres)	
type	1955	2007	1955	2007	1955	2007
Forest	17.8	28.0	25	26	63.2	95.8
Shrubland	6.7	0.6	22	6	27.2	8.4
Grassland	14.4	8.3	99	64	12.8	11.6

In 1946, Robert Allerton donated Allerton Park to the University of Illinois for use in education, research, a forest preserve, and public park. The notable changes that have occurred in and near Allerton Park since 1955 are similar to trends across Illinois: an increase in forested and developed areas at the expense of shrublands and grasslands. Over the 52-year period, forest covered an additional 10% of the area, to 28% of the landscape.

A large shrubland area south of the Sangamon River, as illustrated in Fig. 3.4, has become almost entirely forested. In the early 1970s, this area was the site of a study by Louis Best on the nesting biology of field sparrows (Best 1974) – the most common and characteristic bird of shrub areas. The transition of shrublands to forests throughout Illinois has been detrimental to field sparrows, brown thrashers, yellow-breasted chats and many other shrubland birds. The birds we encountered most frequently on transects at Allerton Park were great blue herons, house wrens, and indigo buntings in the floodplain forests.

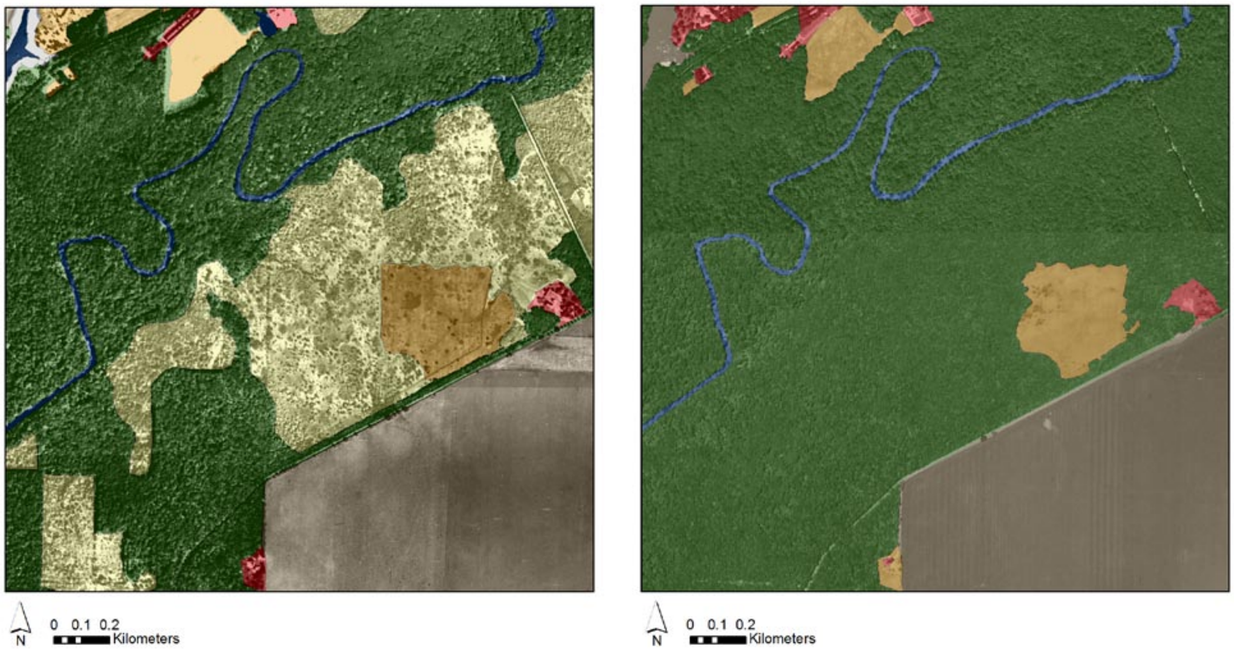


Fig. 3.4. Left image (1955) shows large area of shrubland that by 2007 had been converted to forest (right image).

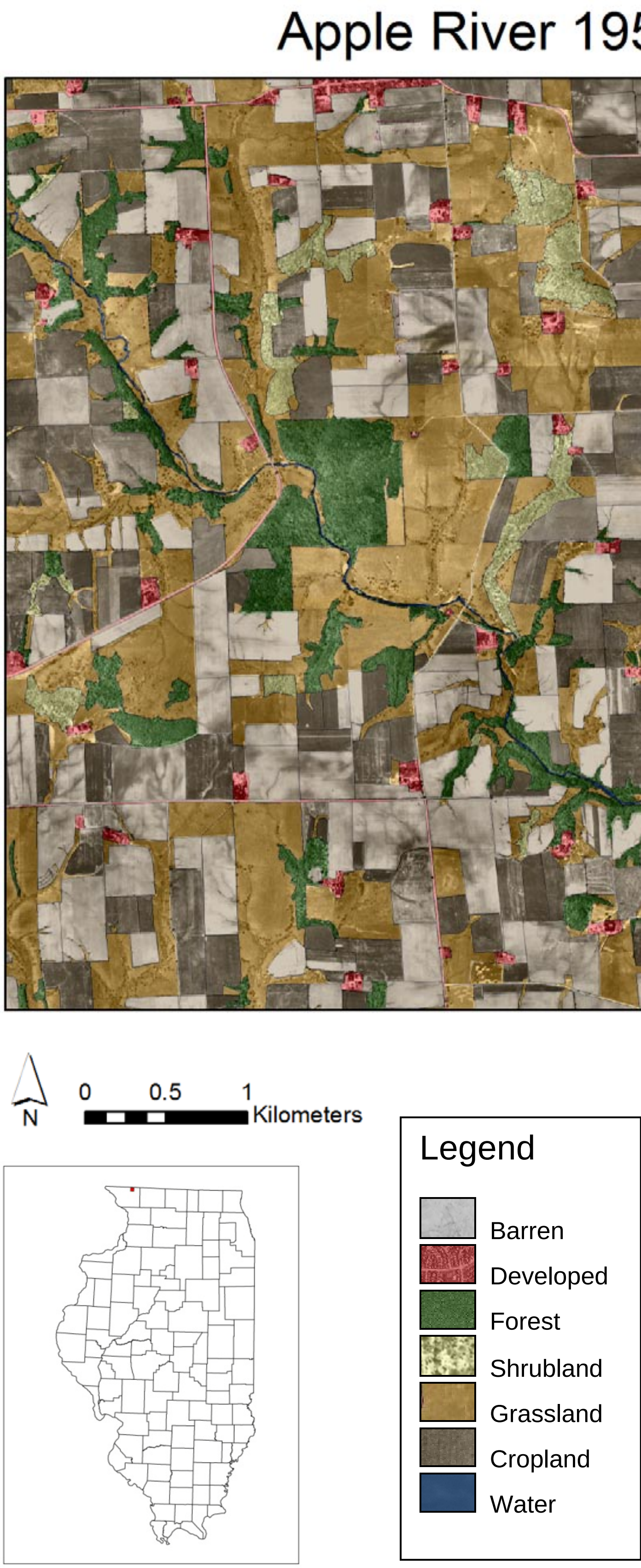


Fig. 3.5. Aerial view of Apple River, slightly south of the town of Apple River (located along northern edge of the images) in JoDaviess County, Illinois, 1958 and 2007. Apple River runs through the center of the images.


Apple River 2007
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Table 3.10 Changes in landscape characteristics along Apple River from 1958 to 2007.

Land cover	% Cover		Number of patches		Average size (acres)	
type	1958	2007	1958	2007	1958	2007
Grassland	30.8	16.2	163	170	16.8	8.4
Forest	10.1	18.3	70	108	12.8	15.1

The area along the Apple River in JoDaviess County in the northwester corner of Illinois changed substantially from 1958 to 2007. Among the sites we considered, the Apple River area best demonstrates the loss of grasslands. In 1958, about 30% of the area was grassland, and JoDaviess County had nearly 57,000 acres of hay. When Dick and Jean Graber surveyed the area in early July 1958, bobolinks and western meadowlarks were the most common birds in the pastures and hay fields they sampled, and they found upland sandpipers in pastures and alfalfa fields.

By 2007, only about one-half as much grassland remained in the Apple River area (16%), with the lost grasslands transitioning about equally to forest and cropland. Hay acreage throughout JoDaviess County was less than 35,000 acres. The most common birds we found in the pastures and hayfields of Jo Daviess County were red-winged blackbirds and European starlings, and we did not record upland sandpipers on any transects across the state from 2006-2008. On average, grasslands that remained in the Apple River area were about half the size of grasslands in 1958. Bobolinks and western meadowlarks were infrequently seen in the Apple River area in 2007, and like several other grassland-nesting birds, are known to prefer larger grasslands (Herkert et al. 1993).

Fig. 3.6. Aerial view of Cora (western edge of images) in the northeastern limit of Shawnee National forest, located north of route 3 which bisects the images. Images show portions of Jackson and Randolph Counties, Illinois in 1959 and 2007.

Of the 21 sites we analyzed, the area near Cora was about the least-changed from 1959 to 2007: 79% of the landscape remained in the same land cover type. Pictured in the lower left of the images is the Mississippi River. To the northeast, the floodplain of the river has continually been cropland. Further from the river, the Ozark Hills rise abruptly from the floodplain and are extensively covered by forest. Despite the stability of land cover types, subtle but important changes are evident.

The upland areas, historically forested, had been cleared for agriculture by the early 1900s. But because of severe soil erosion on the rough terrain, the land quickly lost its value as farmland and was being abandoned. The Shawnee National Forest was established in 1933 to reforest the former cropland, prevent soil erosion, eventually produce timber, and provide economic opportunities for local citizens via recreational activities on the forest. Additionally, most of the wooded, non-farmed areas in the region had been logged at least once, and the existing vegetation when the Shawnee National Forest was begun was secondary forest.

As these forests matured over time, a notable change has been canopy closure. The forested areas in the 1950s aerial photo look blotchy and uneven, and the topography of the ground surface is readily apparent (Fig. 3.7). This was because the trees were different heights and there were many open spaces between trees interspersed with young trees and shrubs nearer the ground – an open canopy. By the time of the 2007 photo, the forest had matured into a closed canopy and looks more like a continuous blanket that obscures the steep-sided ravines of the forest floor.

Fig. 3.7. Shift from open-canopy forest in 1959 (left image) to closed-canopy, mature forest in 2007 (right image) in the northwestern region of Shawnee National forest. In the left image the topography is clearly evident, whereas in the right image, little topographic variation can be seen.

Fig. 3.8. View of Crab Orchard Lake near Carbondale, Jackson and Williamson Counties, Illinois, 1959 and 2007. The area near the dam of the lake is more forested today, and much more development is visible on the west side of the photo, near Carbondale. The area in the upper-left of the image, along Crab Orchard Creek, was a forested block in 1950, and now is a reclaimed strip mine dominated by grassland and lakes.

Crab Orchard 2007

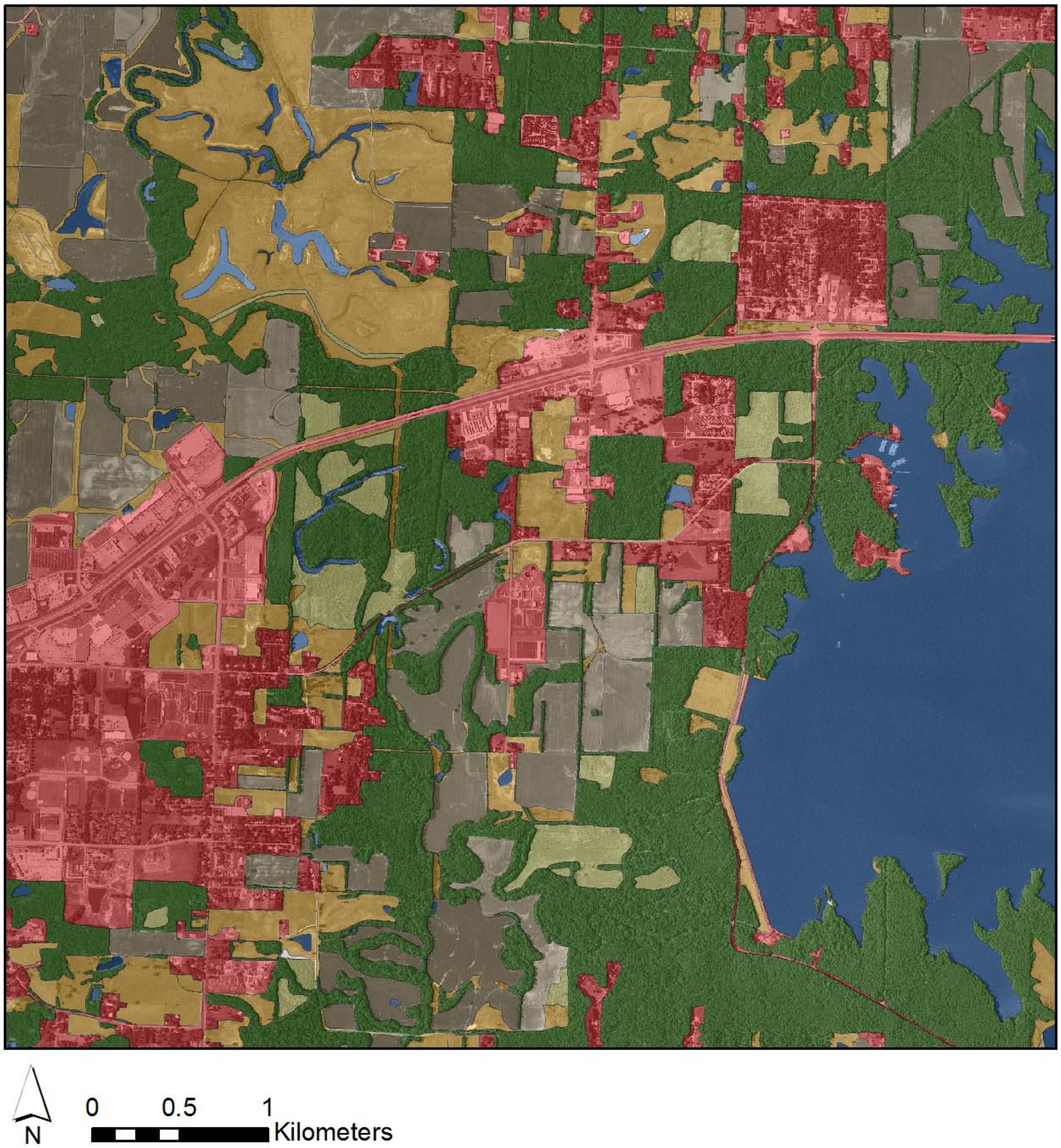


Table 3.11. Landscape changes near Crab Orchard Lake and Carbondale between 1959 and 2007.

Land cover	% Cover		Number of patches		Average size (acres)	
type	1954	2007	1954	2007	1954	2007
Cropland	36.6	15.0	278	86	11.6	15.6
Developed	6.9	21.1	40	40	15.3	46.9
Forest	21.4	29.5	94	82	20.3	31.9

Over the 48-yr period between 1959 and 2007, the area around Crab Orchard Lake and Carbondale experienced a loss of cropland and gain of developed areas and forests. Although those changes are consistent with trends throughout Illinois, the size of the changes was particularly large. Today much more development is visible on the west side of the photo, near Carbondale (Fig. 3.8) and along the Illinois Route 13 corridor (center of images) in locations that formerly were cropland.

Increase in forest cover was concentrated around Crab Orchard Lake and within the Crab Orchard National Wildlife Refuge, established in 1947. This area was occupied by rural homesteads and used for agriculture and logging until 1939 the Resettlement Administration purchased land along Crab Orchard Creek and created the reservoir for recreational uses. The growth in forested areas around the lake between 1959 and 2007 is due primarily to the abandonment of agricultural land (Fig. 3.9).

Fig. 3.9. This pair of images taken in 1959 (left) and 2007 (right) illustrate how forests along the lake within Crab Orchard National Wildlife Refuge and development along route 13 have increased over this 48-year period.

The area located in the northwestern corner of the image, along Crab Orchard Creek (Fig. 3.8), illustrates the dramatic effects of strip mining on the landscape. Although mining activity was not captured by either the 1959 or 2007 photograph, the effects of the strip mine are obvious (Fig. 3.10). The area was a large forest patch in 1959, but was covered by grassland and included several large lakes indicative of a reclaimed strip mine in 2007. Because large patches of grassland, wetland, and shrubland are typically much more common on reclaimed strip mines than in the surrounding landscape, these areas frequently host significant nesting populations of birds such as Henslow's sparrows, and migratory or wintering concentrations of waterfowl.

Pyramid State Recreation Area, Banner Marsh State Fish & Wildlife Area, and Double T State Fish & Wildlife Area are reclaimed mine areas that have been designated Important Bird Areas.

Fig. 3.10. The forested block present in this 1959 image (left) is now is a reclaimed strip mine characterized by grassland and lakes (right).

Flagg Center 1958

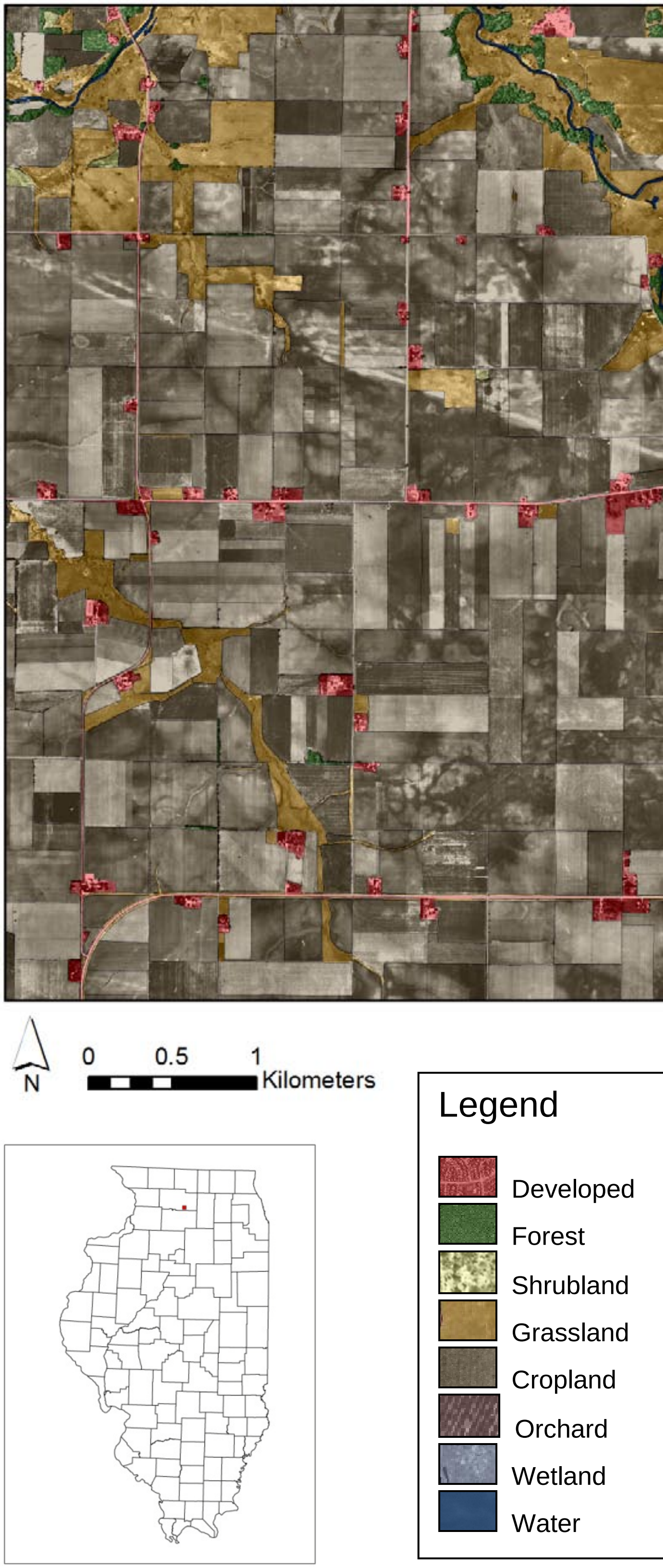


Fig. 3.11. Aerial view near Flagg, Ogle County, Illinois in 1958 and 2007. This pair of images shows the shift in agriculture from small fields of grains, hay, and pasture to large expanses of corn and soybeans. The corridor along the Kyte River (upper right) is forested today but was not 50 years ago.

Flagg Center 2007

Table 3.12. Changes in dominant land cover types near Flagg from 1958 to 2007.

Land cover type	% Cover 1958	% Cover 2007	Number of patches 1958	Number of patches 2007	Average size (acres) 1958	Average size (acres) 2007
Cropland	80.1	77.3	347	159	20.5	43.2
Grassland	12.5	6.5	73	66	15.3	8.6

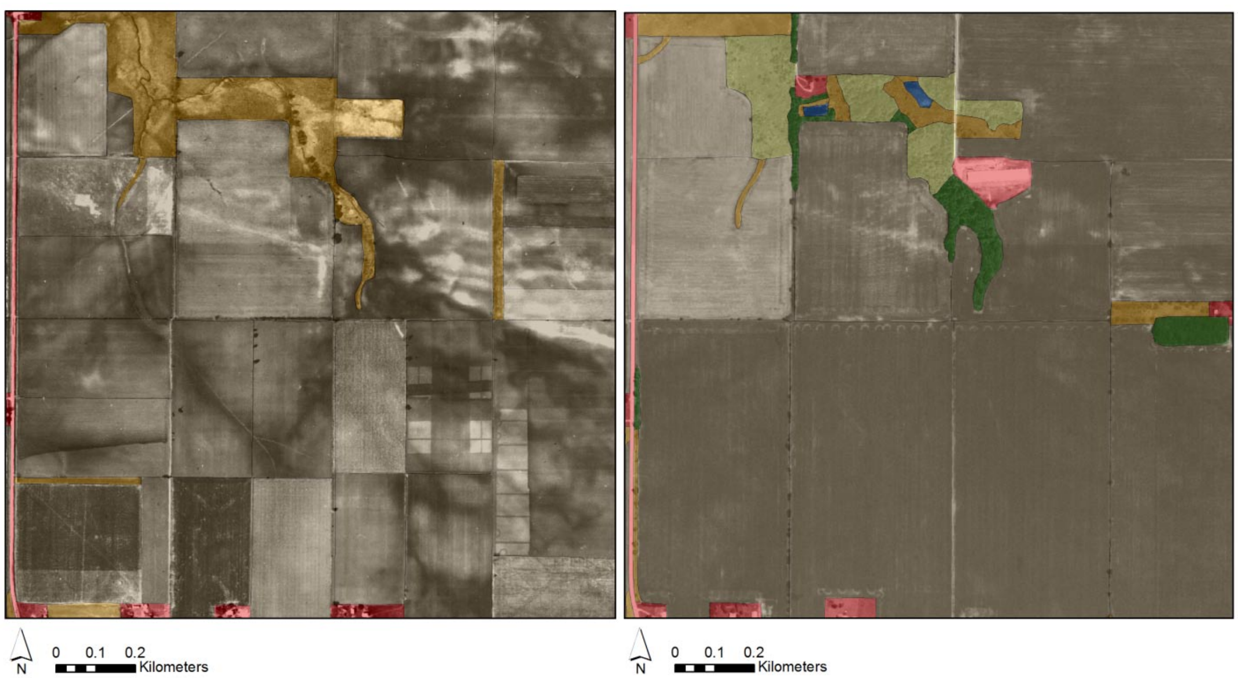


Fig. 3.12. This pair of images illustrates how the size and diversity of crop types has decreased from 1958 (left image) to 2007 (right image).

Over the 50-year period from 1958 to 2007, the amount of cropland near Flagg did not change much, but the composition and configuration of fields changed substantially (Figs. 3.11 and 3.12). Over time, the size of farming equipment has become progressively larger. In 1958, a 4-row corn planter would have been fairly typical, whereas 24-row corn planters were widespread by 2007. Accompanying these changes, cropland near Flagg and throughout the state was consolidated into fewer but larger fields. Field edge habitats – grassy borders and shrubby fence lines – that provide nesting sites for northern bobwhites, brown thrashers, vesper sparrows, and other birds that often feed in cropland were removed to make way for the large equipment. In the1950s variation in soil moisture, apparent as light and dark areas within individual fields, was a common characteristic of the agricultural landscape (Fig. 3.12). Drainage improvements due to tiling have eliminated much of this variation in soil moisture, a common pattern observed in agricultural areas throughout Illinois over the past 50 years.

The crops grown on farms have shifted, too. In the late 1950s, small grains, hay crops, and cattle were considerably more common on the landscape than in the 2000s (Table 3.1). On their haphazard transects near Flagg, the Grabers encountered eight different types of crops, including alfalfa, red clover, yellow sweet clover, oats, and wheat. Besides corn and soybeans, we were only able to locate single examples of wheat and alfalfa in the area. Grasslands no longer needed for haying or grazing have largely been converted to corn and soybeans in areas that can be tilled. Near Flagg, several grassland areas along the Kyte River were abandoned and have grown up into forests.

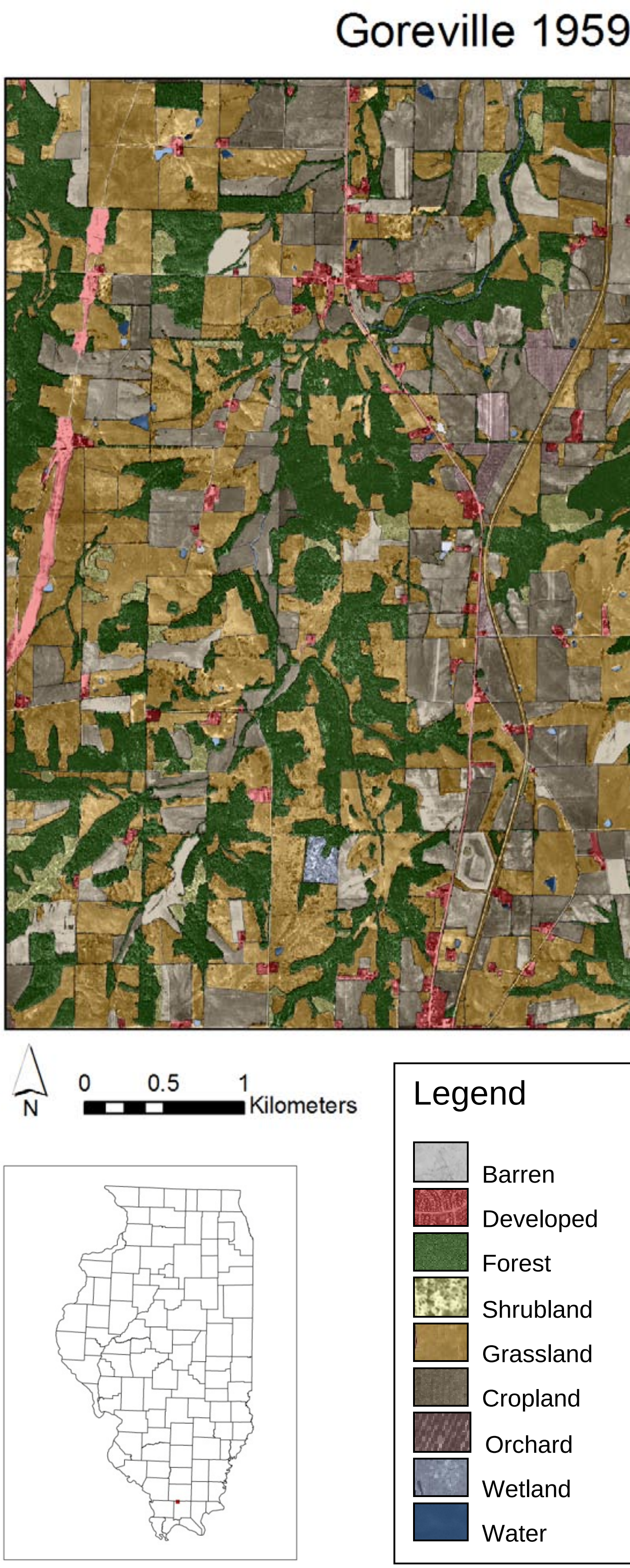


Fig. 3.13. Aerial view of Goreville, Johnson County, Illinois, 1959 and 2007. Interstate 57 was being constructed when the first photo was taken (bright red, exposed area along the left side of the image), and now it and the intersection with Interstate 24 are clearly visible. Forest cover has increased in the landscape primarily at the expense of marginal grasslands. In the northeast (upper right) portion of the 2007 image, an arm of Lake of Egypt and surrounding development have appeared.

Goreville 2007

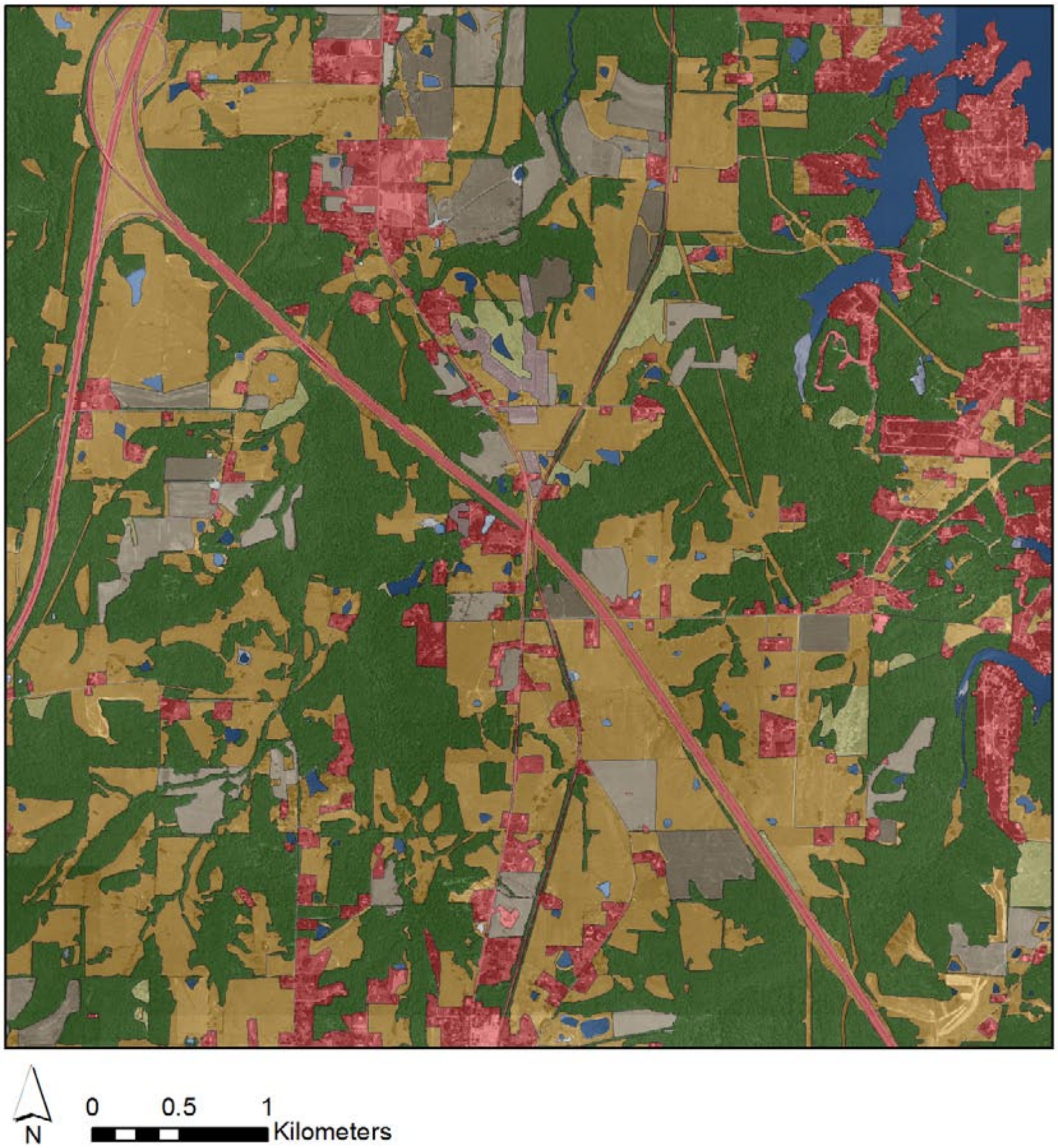


Table 3.13. Changes in dominant land cover classes near Goreville from 1959 to 2007.

Land cover type	% Cover		Number of patches		Average size (acres)	
	1959	2007	1959	2007	1959	2007
Cropland	25.2	7.3	310	71	7.2	9.1
Forest	27.6	40.4	109	136	22.5	26.4
Developed	2.8	13.3	79	116	3.2	10.1
Grassland	35.7	28.8	343	201	9.1	12.8

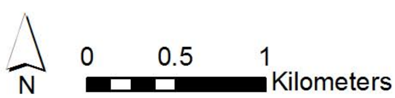
Like Lake Villa and Crab Orchard, the area near Goreville experienced a large shift in land cover over the past 48 years; 54% of the landscape changed from one land cover type to another. As at many sites we analyzed, forest and developed areas increased at the expense of cropland and grasslands. The increase in forest near Goreville was unmatched: an additional 13% of the landscape grew into forest between 1959 and 2007, to just over 40% of the area. We expected the expansion of forested areas to relate to population increases for Acadian flycatchers, red-eyed vireos, scarlet tanagers and other birds typical of southern Illinois forests.

Interestingly, a lot of the areas that were grassland in the 1950s (probably mostly hay fields and pastures) grew up into forest, and large areas of cropland were converted to grassland through the Conservation Reserve Program. As a result, the amount of cropland in the area is greatly reduced, but only modestly so for grasslands (Table 3.13). Hayed and grazed grasslands are now more scarce, and idle grasslands are more common. On our surveys, we encountered just two eastern meadowlarks, which prefer the shorter, more open structure of grazed grasslands. Henslow's sparrows were flushed from the idle grasslands, however, a bird of tall, dense grasses that the Grabers only saw on two transects anywhere in Illinois in the 1950s.

The growth of municipal areas accounts for only a small portion of the expansion of developed areas. In the 1959 photograph, the initial construction of Interstate 57 is visible on the left (west) side of the area; in 2007, Interstates 57 and 24 and their intersection in the upper left (northwest) are obvious (Fig. 3.13). The corridor along Illinois Route 37, which runs north-south in the center of the pictures, shows considerable exurban development between Goreville to the south and the small community of Pulley's Mill to the north. Lastly, part of the Lake of Egypt is captured in the upper right (northeast) corner of the 2007 photograph (see detail in Fig. 3.14). Southern Illinois Power Cooperative dammed the Saline River in 1962 to create Lake of Egypt, and since that time the shoreline has become progressively more developed.

Fig. 3.14. This pair of images illustrates the increase in forest cover as well as the appearance of Lake Egypt and the urban areas that sprung up along the margins of the man-made reservoir.

Havana 1957



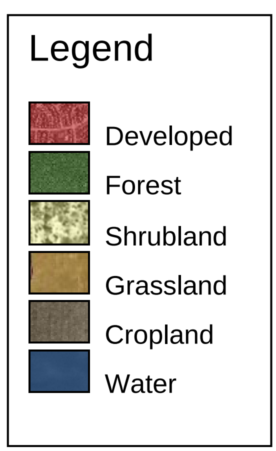


Fig. 3.15. Aerial view of an area east of Havana, Mason County, Illinois, 1957 and 2007. This pair of images clearly illustrates an important change in land use practices over the past 50 years, namely the implementation of center-pivot irrigation

Havana 2007

This area east of Havana was the most stable site we assessed in our study; 79% of the landscape did not change land cover classes from 1957 to 2007. Interestingly, the site showed almost no change in development. Despite this general lack of change in land cover between 1957 and 2007, Havana is an excellent example of how agricultural land use practices have changed over the past 50 years. Consistent with the statewide trends, cropland near Havana shifted from several, smaller fields of diverse crop types to fewer, larger fields cultivated primarily for corn and soybeans. In addition to this shift, farmers near Havana implemented center-pivot irrigation, apparent as the circular field shapes in the 2007 image.

The first center-pivot method of irrigation was built in 1947-48 by Frank Zyback built the first center-pivot irrigation method in 1947-48, but it was only after many years of refinement that the systems finally took off in the 1960s. About a quarter of a century later, more than 10,000 center pivot systems were in use across the Midwest.

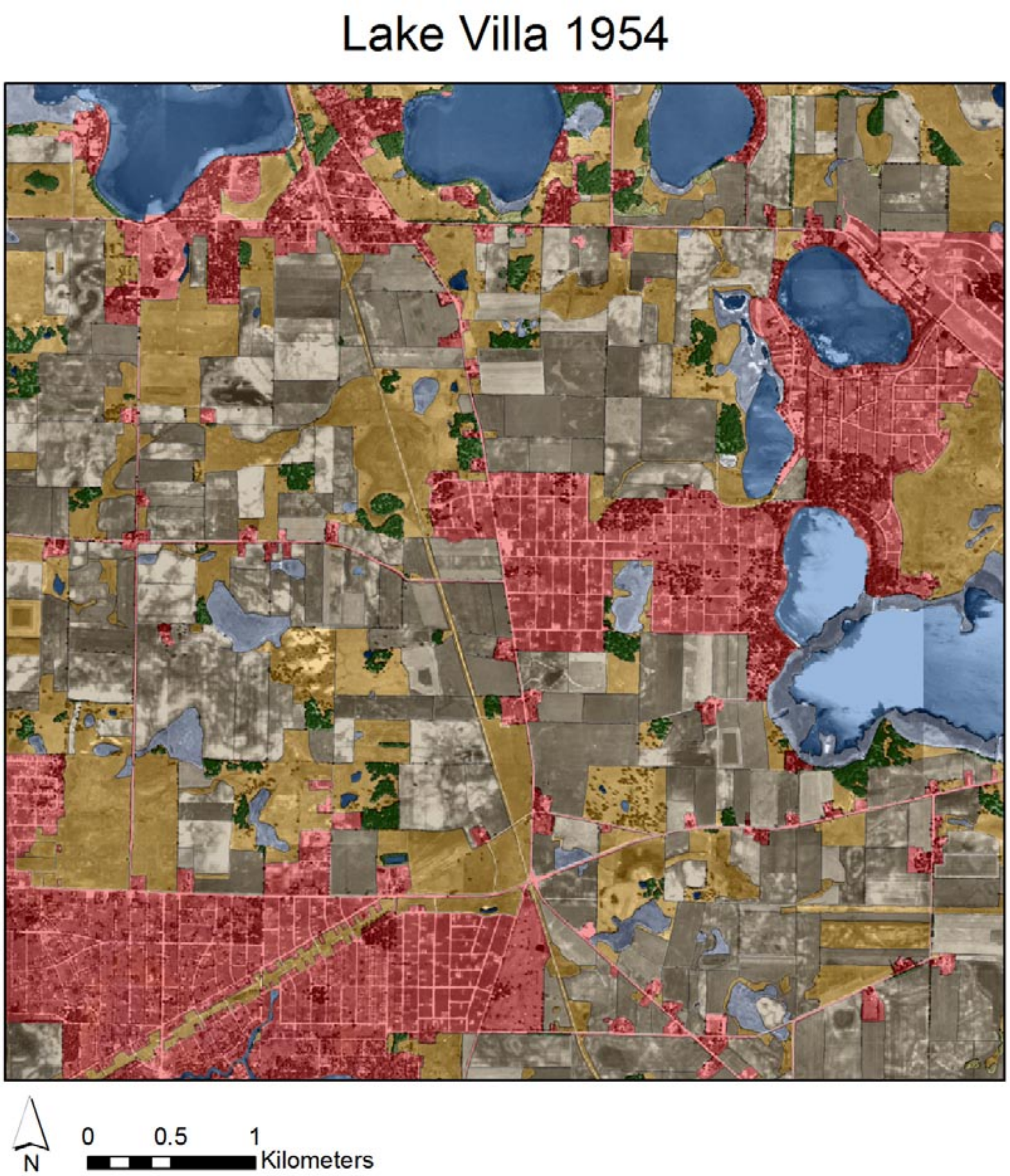
Most cropland in Illinois receives sufficient rainfall and has soils with enough water-holding capacity that irrigation is not economically feasible. But in areas with sandy soils, including much of Mason and Tazewell counties east of the Illinois River in central Illinois, and Whiteside and Carroll counties east of the Mississippi River in northwestern Illinois, center-pivot irrigation is a common practice. A picture taken in 195x near Havana shows sandy soils supporting only sparse vegetation. In 2007, the same location is irrigated and growing corn. The triangular corners of fields, beyond the reach of center-pivot irrigation systems, are often left as patches of idle grass and shrubs, providing some small pieces of habitat for ring-necked pheasants, northern bobwhites, lark sparrows, and dickcissels that are often lacking in more intensively cultivated landscapes.

Figure. Landscape east of Poplar City (Mason County). The sand was mined out of the area and conifers were planted to reduce erosion.

Figure. Aerial view of Poplar City area (Mason County). Notice the large increase in trees between 1954 and 2007. Conifers were planted to reduce erosion in the 1950s and these trees are still present.

Figure. Irrigation in Mason County has resulted in the ability to farm very sandy soil. These pictures taken in 1907 and 2008, approximately 3 miles southeast of Havana illustrate how this landscape has changed. Notice the man to the right of the tree in 1907.

Figure. The forest the remains in the sand areas of Mason County does not receive the periodic fire it did historically. These picture were taken in the same stand of trees in 1907 and 2008. A spring burn in 1907 blackened these oaks, by contrast fire suppression has resulted in the forest being invaded by invasive plants such as honeysuckle.



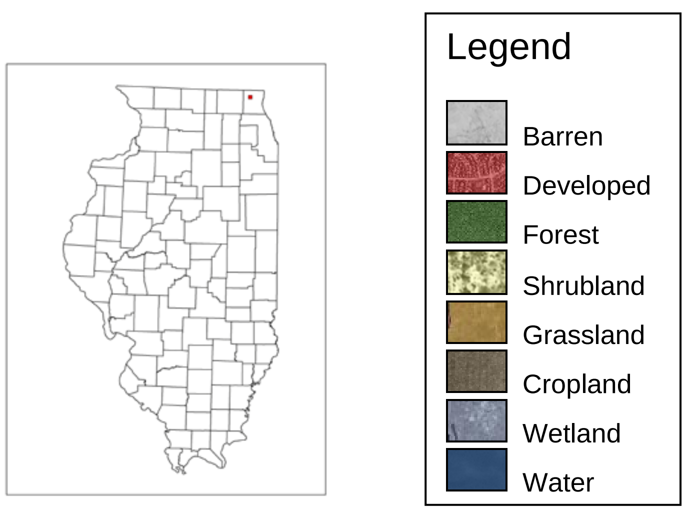


Fig. 3.16. Aerial view of Lake Villa in Lake County, Illinois, 1954 and 2007. Much of this region has been developed since 1954, and in the 1954 image, several areas have been subdivided but not yet built up.

Lake Villa 2007

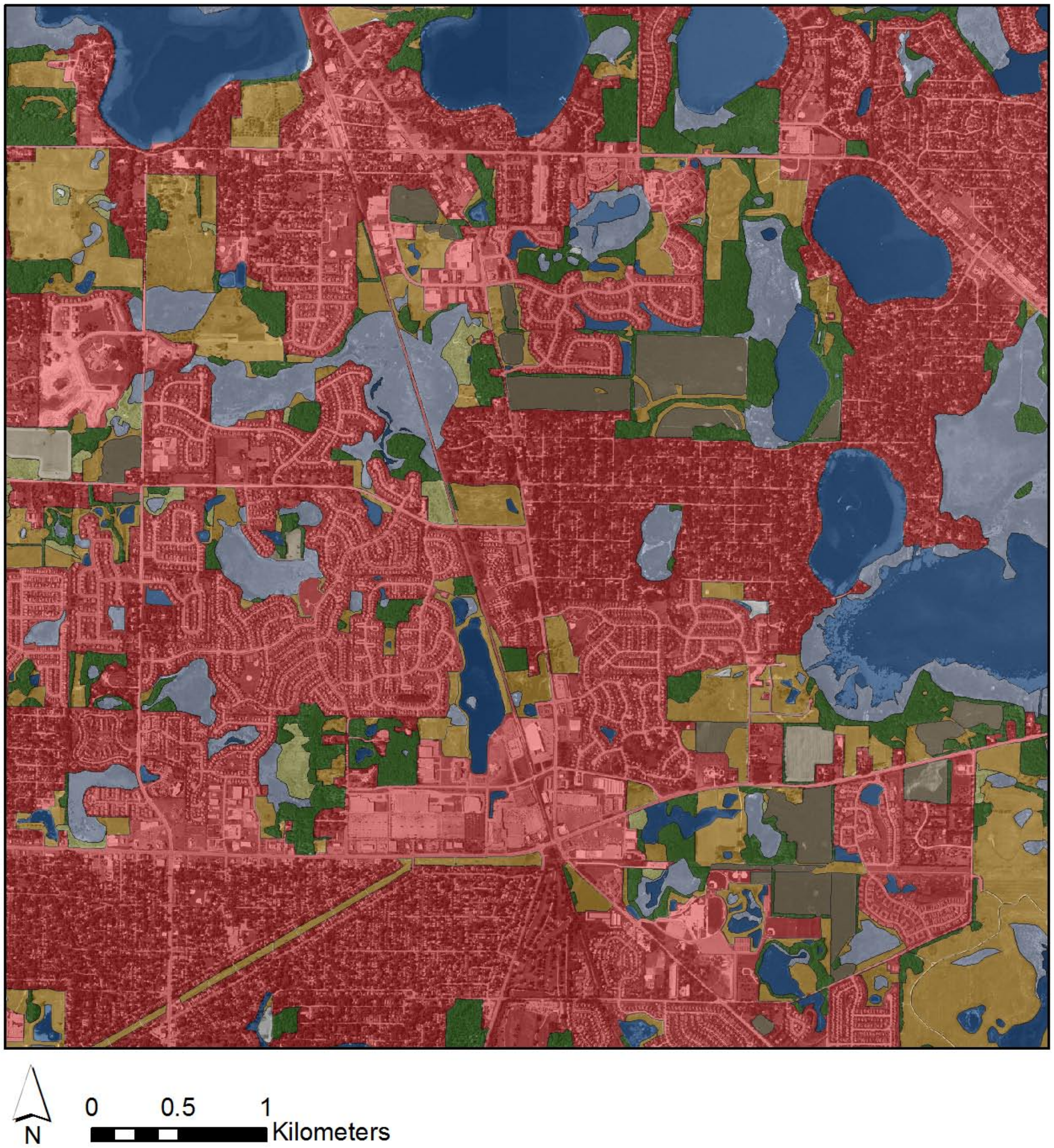


Table 3.14. Changes in dominant land cover classes in Lake Villa from 1954 to 2007.

Land cover type	% Cover		Number of patches		Aveage size (acres)	
	1954	2007	1954	2007	1954	2007
Developed	25.0	57.0	15	2	148.2	2537.0
Cropland	37.1	3.4	248	26	13.3	11.8
Grassland	21.0	9.9	146	87	12.8	10.1
Wetland	3.54	8.17	47	81	6.7	8.9
Forest	2.4	6.4	56	79	3.7	7.2

Lake Villa experienced a dramatic increase in urbanization over the past 50 years, covering an additional 32% of the landscape in 2007 than in 1954. In the 1954 aerial image, several areas have been subdivided but not yet built up. Between 1960 and 2007, the population of Lake County more than doubled, from about 294,000 to 710,000 residents. As development sprawled across the landscape, it engulfed surrounding cropland and grassland (34% and 11% less of the landscape, respectively). Ring-necked pheasants, horned larks, bobolinks, and eastern meadowlarks were among the open-habitat birds found in this area by the Grabers in 1957, but were not detected on transects in 2008.

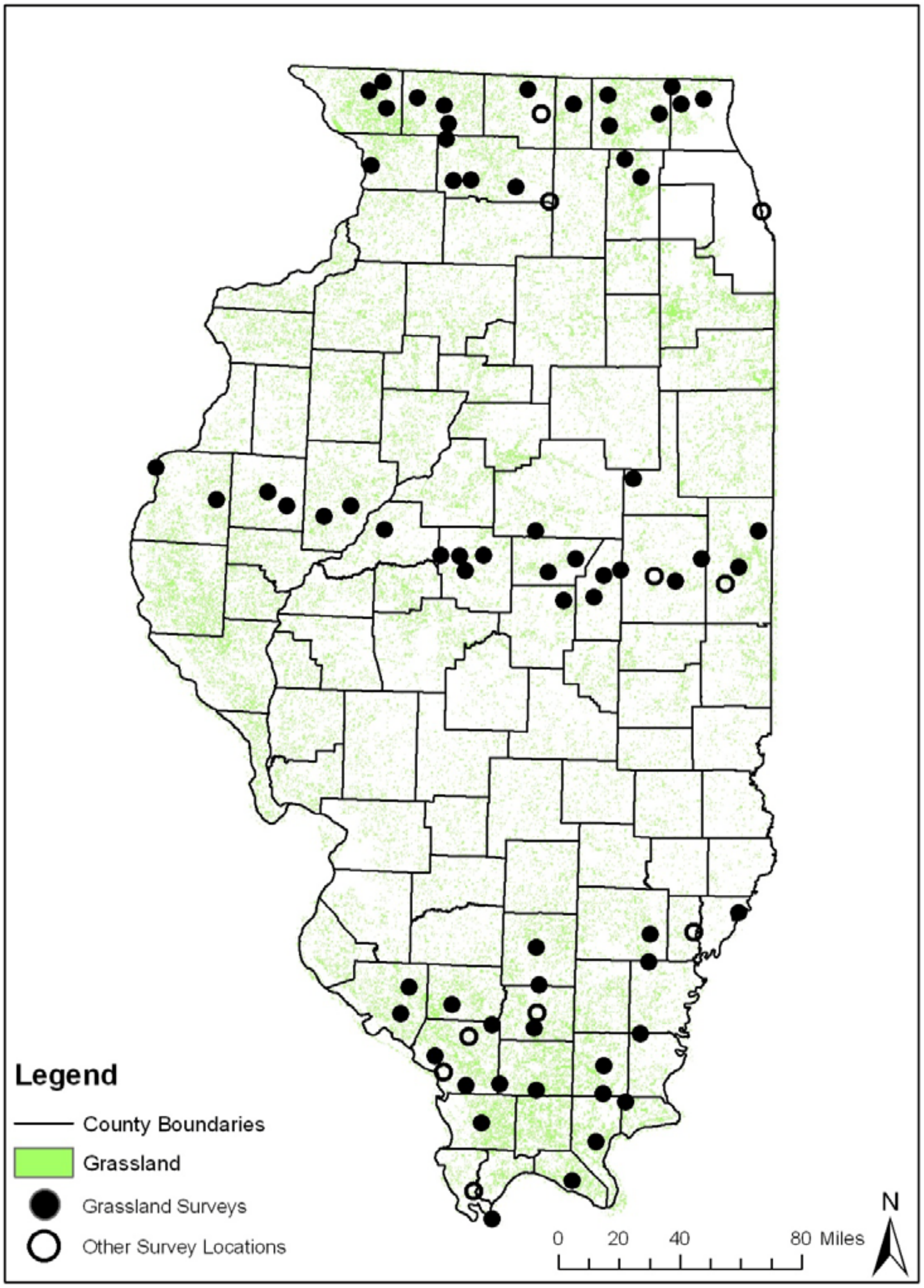
Although wetlands and forests were not dominant land cover types in the Lake Villa area in either time period, both habitat types increased over the past 53 years. Several grassland areas were converted to marshes. Some wetlands were restored as mitigation for damage to other wetlands, and others have expanded due to increased or redirected stormwater run-off from developed areas. We found marsh-dependent birds like Virginia rails, marsh wrens, and swamp sparrows in these wetlands. The increase in forest cover reflects attempts to protect remaining natural areas in the county. The Lake County Forest Preserve District, established in 1958, now includes more than 27,000 acres of forest, prairie, wetlands, and lakes in Lake County. Conservation lands in Lake County sustain populations of many state-endangered birds, including common moorhens, black terns, and yellow-headed blackbirds. During migration these wetlands and small woodlands provide critical stopover habitat in an otherwise inhospitable landscape.

Bird Communities Through Time

In the previous chapter we characterized changes in the overall landscape of Illinois. Here we include summaries of how the extent, regional abundance, and character of each dominant land cover type or ecosystem (e.g., grasslands) have changed from the early 1900s to the present, focusing on changes in finer land cover subdivisions within each dominant land cover type (e.g., idle, grazed, hayed/mowed, and linear grasslands).

In this chapter we also emphasize how the bird communities of each land cover or habitat type have varied over the past century. The bird species commonly seen in each habitat type (representing a total of 95% of the birds seen) are presented in order of their relative abundance for each time period. Forbes and Gross often referred to the species that combine to make up 85% of all birds seen as the "most important species" in each habitat type. This is a quick way of describing the smaller set of birds that are 'typical' or characteristic of a given habitat type. It also provides insight into how the diversity and homogeneity of the community in a habitat has changed over time; in other words has the community become dominated by a few very abundant species or is it comprised of many different species each having a low relative abundance. We summarize our results in this fashion to maintain consistency with the earlier survey periods, although in the following chapters we examine changes in bird species using new analytical techniques not available in the 1900s or 1950s, such as occupancy modeling. In addition to a table summarizing relative bird abundances for the three time periods, we include graphs of the estimated densities of the most important bird species in each region (north, central, and south) in each habitat for the 2006-2008 survey period. We have organized this chapter into sections pertaining to each of the dominant land cover types (e.g., grassland) and then subdivided it into finer land cover types.

GRASSLAND



GRASSLAND
4 million acres
About 11% of Illinois

Fig. 4.1. Distribution of grasslands in Illinois.

Native prairie grasslands were once the dominant ecosystem in Illinois, but by the time of the 1900s surveys they were almost entirely converted to agriculture. Several million acres of substitute grasslands (hay fields and pastures dominated by Eurasian grasses), however, provided suitable habitat for many grassland species. Over time, the extent of even these grasslands has been reduced. The 1999-2000 Land Cover of Illinois estimated that grasslands covered just over 4 million acres, or about 11% of the state. U.S. Department of Agriculture statistics account for about 2.1 million acres among the state's pastures, hay fields, and Conservation Reserve Program enrollments. The remaining grassland is primarily found along roadsides, waterways, field borders and other similar small and/or narrow patches.

Most of the state's fertile prairie soils have been converted to cropland, and grasslands are now most common on soils that formerly supported forests. This accounts for the concentrations of grasslands found in northwestern, western and southern Illinois. Many of these grasslands are near riparian corridors and on sloping lands not suitable for cultivation. Because of their evolutionary history, grassland birds appear to prefer large, open prairies with few trees and avoid small grasslands and areas near woody vegetation (Herkert et al. 1993). Although there may be 4 million acres of grassland in Illinois, most of it is in a landscape context that is intrinsically unattractive to prairie birds like bobolinks and upland sandpipers.

Moreover, the height and density of grasslands has a profound effect on their suitability for different birds. We considered four types of grasslands in our surveys: idle grasslands, or those that had been left undisturbed throughout the growing season; grazed grasslands, or pastures with few or no trees; grasslands that had been hayed or mowed during the growing season; and linear grasslands that were narrower than 30 yards wide.

Idle grasslands

Idle grasslands were those that had not been grazed, hayed or mowed in the year of the survey (Table 4.1). Some areas probably were mixed hay that had not yet been harvested, but most were publicly-owned conservation areas, private lands enrolled in the Conservation Reserve Program, or abandoned pastures. Vegetation in idle grasslands was generally 24 to 36 inches tall and dense. Stands of cool-season grasses (e.g., tall fescue, smooth brome, orchard grass) with variable amounts of legumes and other forbs were the most common, although we visited some areas planted to native warm-season grasses (e.g., big bluestem, switchgrass, Indian grass, little bluestem). Areas with scattered shrubs and saplings, comprising < 10% of the overall cover, were common in idle grasslands that had remained undisturbed for several years.

Table 4.1. Summary of survey effort in idle grasslands in the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	39	205	91
Central	23	101	102
South	359	348	93
Sites surveyed			
North	6	17	14
Central	14	14	15
South	26	19	17

Comparisons among time periods are difficult to make because of differences in definitions and changes in Census of Agriculture reporting, but the amount of idle grassland habitat likely has declined over the past century. Graber and Graber estimated 1.8 million acres of fallow and ungrazed grasses plus an unknown amount of unharvested mixed hay in 1907 declined to 1.2 million acres of fallow and ungrazed grassland plus an unknown amount of unharvested mixed hay in 1957. Today, just over 1 million acres are enrolled in the Conservation Reserve Program in Illinois, and around 800,000 of those acres were established as grassland habitat. We judged that some of these older fields better fit our definition of shrublands because of the growth of woody vegetation. Other idle grasslands, such as those on reclaimed mines and public and private conservation areas, and not managed with haying or grazing, may total another few hundred thousand acres.

As in the 1950s, red-winged blackbirds were the most frequently seen bird species in idle grasslands in the 2000s, comprising nearly 40% of the overall bird community (Table 4.2). Blackbirds comprised only 5.8% of the birds seen in the 1900s. The proportion of meadowlarks seen in idle grasslands, however, has become smaller in each successive time period. Other species were observed only during a single time period. A flock of 14 sandhill cranes – a species not recorded in the 1900s or 1950s in any habitat – was encountered at a single idle grassland site in the 2000s. Henslow's sparrows were also seen at several idle grasslands in the 2000s but not in the other time periods. The idle grasslands of the Conservation Reserve Program played a key role in the rapid population growth of Henslow's sparrows over the past few decades (Herkert 2007), culminating in its removal from the Illinois threatened species list in 2009.

During the 2000 surveys, red-winged blackbirds, the most common species in this habitat type, were particularly concentrated in central Illinois, whereas dickcissels generally decreased in density from the south to north (Fig. 4.2). Field sparrows were densest in the southern zone, while savannah sparrows were only seen in northern Illinois.

Table 4.2. Relative abundance of birds (% of all birds recorded in a specific survey period) observed in idle grasslands in Illinois, 1907-1909, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s		1950s		2000s	
Species	%	Species	%	Species	%
Meadowlarks	**21.0**	**Red-winged blackbird**	**25.2**	**Red-winged blackbird**	**39.4**
House sparrow	**17.1**	**Meadowlarks**	**14.7**	**Dickcissel**	**7.4**
Mourning dove	**6.7**	**Mourning dove**	**11.2**	**Meadowlarks (A)**	**6.5**
Red-winged blackbird	**5.8**	**Dickcissel**	**8.2**	**Barn swallow**	**5.3**
Field sparrow	**4.2**	**Horned lark**	**5.6**	**Common grackle**	**3.6**
Common grackle	**3.4**	**Common grackle**	**5.0**	**American goldfinch**	**3.4**
Dickcissel	**3.1**	**Bobolink**	**3.6**	**Song sparrow**	**3.0**
Eastern kingbird	**2.8**	**Field sparrow**	**3.0**	**Field sparrow**	**2.7**
Red-headed woodpecker	**2.4**	**Barn swallow**	**2.5**	**Common yellowthroat**	**2.5**
American goldfinch	**2.2**	**House sparrow**	**2.5**	**Mourning dove**	**2.2**
American robin	**2.2**	**American goldfinch**	**2.0**	**European starling**	**2.2**
Northern mockingbird	**1.9**	**Grasshopper sparrow**	**1.7**	**Brown-headed cowbird**	**2.0**
Northern flicker	**1.8**	Savannah sparrow	1.5	**Savannah sparrow**	**1.8**
Eastern bluebird	**1.8**	Brown-headed cowbird	1.1	**American robin**	**1.7**
Brown-headed cowbird	**1.5**	Northern bobwhite	0.9	**Cedar waxwing**	**1.7**
Orchard oriole	**1.5**	Common yellowthroat	0.8	Indigo bunting	1.6
Northern bobwhite	**1.5**	Northern cardinal	0.6	Bobolink	1.3
Brown thrasher	**1.5**	European starling	0.4	Grasshopper sparrow	1.0
Blue jay	**1.5**	Eastern kingbird	0.4	Sandhill crane	1.0
Common yellowthroat	**1.3**	Brown thrasher	0.4	Henslow's sparrow	0.9
Bobolink	**1.3**	Swamp sparrow	0.4	Tree swallow	0.8
Lark sparrow	**1.3**	Chimney swift	0.3	Chimney swift	0.7
Barn swallow	1.0	Northern flicker	0.3	Sedge wren	0.7
American crow	1.0	American crow	0.3	Canada goose	0.7
Bewick's wren	0.9	Eastern bluebird	0.3	N. rough-winged swallow	0.4
Grasshopper sparrow	0.7	Upland sandpiper	0.3	Eastern kingbird	0.4
Chimney swift	0.7	Blue jay	0.2	Northern flicker	0.4
Savannah sparrow	0.6	Lark sparrow	0.2	Cliff swallow	0.4
Purple martin	0.6	Killdeer	0.2	Baltimore oriole	0.4
Song sparrow	0.4	Orchard oriole	0.1		
Indigo bunting	0.4	Song sparrow	0.1		
Killdeer	0.4	Bachman's sparrow	0.1		
Northern cardinal	0.4	Common nighthawk	0.1		
American kestrel	0.4	Sedge wren	0.1		
Loggerhead shrike	0.4	Yellow-headed blackbird	0.1		
Number of birds	*672*		*1418*		*1382*
Number of species	*45*		*47*		*59*

A. No western meadowlarks were recorded in idle grassland in 2000, whereas eastern meadowlarks were seen in all three regions during the latest survey.

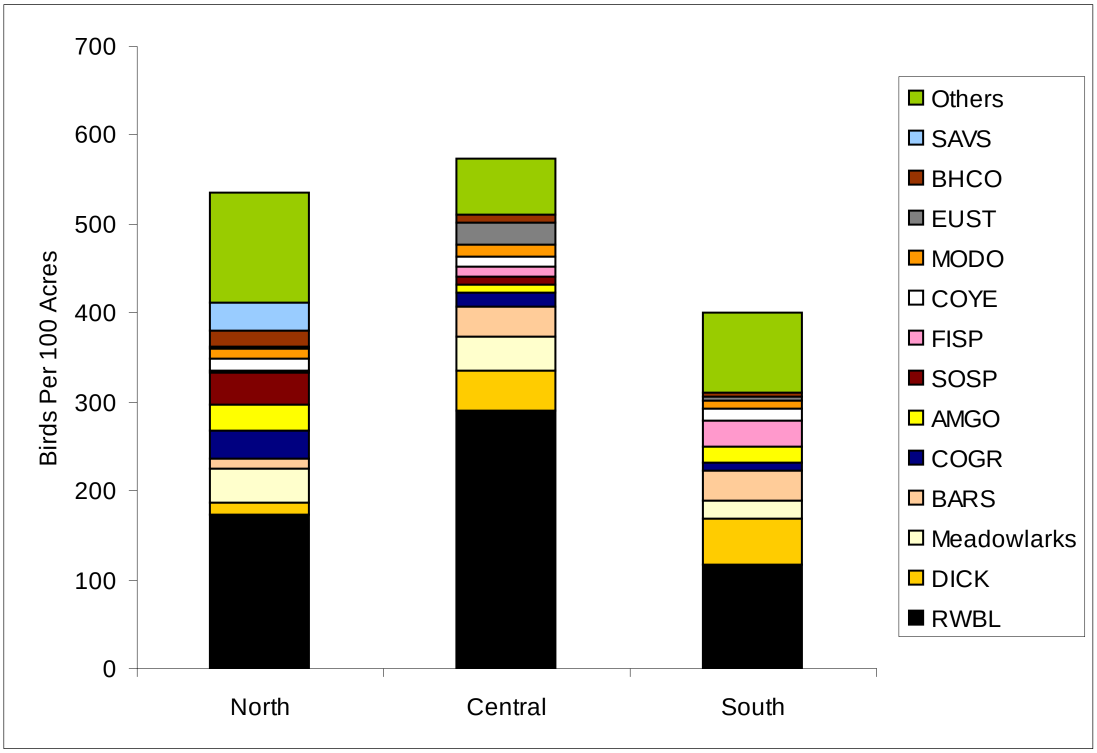


Fig. 4.2. Densities of the most important species observed in idle grasslands in Illinois in each region in 2006-2008. Fifteen species represented 85% of all birds observed.

Grazed Grasslands

"Pasture" is another term for this habitat, but this section specifically considers perennial grasslands used by grazing animals (cattle, horses, sheep, or goats) with less than 20% coverage by trees and shrubs during the same growing season as our surveys (Table 4.3). We, therefore, exclude the 266,000 acres of pastured woodland and 308,000 acres of cropland used only for pasture or grazing estimated by the US Department of Agriculture. Grazed savanna-like areas, with >20% coverage by trees, were sometimes within the same pastures we surveyed. We compiled bird data separately for these areas and report the results in the "Savanna-Open Woodland" Section.

Table 4.3. Summary of survey effort in grazed grasslands in the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	218	285	69
Central	441	171	63
South	882	120	63
Sites surveyed			
North	8	17	10
Central	17	16	8
South	28	17	9

The extent of grazed grassland has decreased from 6.1 million acres in 1907, to 2.0 million acres in 1957, and to 887,000 acres in 2007. Conversion of pastures, hay, and small grain acreage to corn and soybean production has resulted in an increase in area devoted to row crops, while total farm acreage has shrunk. Grazed grasslands largely persist in areas unsuitable for cropland, such as erodible land, flood-prone areas, or reclaimed strip mines.

Graber and Graber wrote, "(t)he characteristics of bluegrass pastures as bird habitats probably have not greatly changed in the present century." Though agricultural statistics are lacking, it is generally believed that modern grazed grasslands are smaller and more heavily grazed than their historical counterparts. Unlike the Grabers, we sampled few areas dominated by bluegrass; the grazed grasslands we visited were generally dominated by tall fescue in southern Illinois and smooth brome in northern Illinois. Near farmsteads, grazed grasslands sometimes approached barren feedlots in character, with patches of bare soil, abundant thistle and other unpalatable weeds. Grazing reduced the height and density of pasture grasses to 6 inches or less; grasses taller than 12 inches were exceptional.

For the first time, meadowlarks were not the most frequently seen species in grazed grasslands, being outnumbered by red-winged blackbirds, barn swallows, and European starlings (Table 4.4). The low relative abundance of savannah sparrows in the 1900s surveys is probably a result of Gross and Ray sampling grazed grasslands mostly in southern Illinois, which lines outside the distribution of this species. House sparrows were far less prevalent among birds in grazed grasslands during the most recent surveys than in the 1900s and 1950s. Regionally, European starlings and savannah sparrows were densest in northern Illinois in the 2000s, grasshopper sparrows and bobolinks reached their highest densities in central Illinois, and barn swallows and eastern bluebirds were densest in southern Illinois (Fig. 4.3).

Table 4.4. Relative abundance of birds (% of all birds recorded in a specific survey period) observed in grazed grasslands in Illinois, 1907-1909, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s		1950s		2000s	
Species	%	Species	%	Species	%
Meadowlarks	**14.9**	**Meadowlarks**	**19.9**	**Red-winged blackbird**	**15.4**
House sparrow	**13.7**	**House sparrow**	**14.6**	**Barn swallow**	**13.7**
Common grackle	**8.4**	**Red-winged blackbird**	**10.8**	**European starling**	**11.1**
Brown-headed cowbird	**5.3**	**Common grackle**	**5.9**	**Meadowlarks (A)**	**9.7**
American robin	**4.7**	**Field sparrow**	**5.3**	**Savannah sparrow**	**5.3**
Field sparrow	**4.4**	**European starling**	**4.7**	**Brown-headed cowbird**	**5.1**
Northern flicker	**4.4**	**Savannah sparrow**	**4.7**	**Killdeer**	**4.0**
Red-winged blackbird	**3.8**	**Barn swallow**	**3.6**	**Horned lark**	**3.9**
Mourning dove	**3.4**	**Bobolink**	**3.1**	**Mourning dove**	**3.7**
Brown thrasher	**3.1**	**Grasshopper sparrow**	**2.8**	**House sparrow**	**3.6**
Northern bobwhite	**2.4**	**Brown-headed cowbird**	**2.5**	**Bobolink**	**2.9**
Red-headed woodpecker	**2.2**	**American goldfinch**	**2.5**	**Grasshopper sparrow**	**2.3**
Horned lark	**2.0**	**Dickcissel**	**1.5**	**American robin**	**2.3**
Dickcissel	**1.9**	**Eastern kingbird**	**1.5**	**Eastern bluebird**	**2.1**
Eastern kingbird	**1.9**	**Vesper sparrow**	**1.3**	Common grackle	1.7
Blue jay	**1.6**	**Mourning dove**	**1.2**	Dickcissel	1.6
Lark sparrow	**1.6**	Eastern bluebird	1.0	Eastern kingbird	1.6
Orchard oriole	**1.4**	Killdeer	0.9	Rock pigeon	1.5
American crow	**1.4**	American robin	0.9	American goldfinch	1.1
Grasshopper sparrow	**1.3**	Song sparrow	0.8	Song sparrow	1.1
Eastern bluebird	**1.3**	Northern flicker	0.8	Cliff swallow	0.8
Barn swallow	1.1	Horned lark	0.7		
Northern mockingbird	1.1	Blue jay	0.6		
Upland sandpiper	0.8	Baltimore oriole	0.6		
Killdeer	0.7	Northern bobwhite	0.6		
Chimney swift	0.7	Chimney swift	0.6		
Savannah sparrow	0.6	Indigo bunting	0.5		
Bobolink	0.5	Brown thrasher	0.5		
Chipping sparrow	0.5	Orchard oriole	0.4		
Common yellowthroat	0.5	House wren	0.4		
Turkey vulture	0.5				
Gray catbird	0.5				
Loggerhead shrike	0.5				
American goldfinch	0.4				
Purple martin	0.4				
Bank swallow	0.4				
Song sparrow	0.3				
Indigo bunting	0.3				
Yellow-billed cuckoo	0.3				
Eastern phoebe	0.3				
Green heron	0.3				

Number of birds	*2386*	*1237*	*827*
Number of species	*72*	*53*	*46*

A. Eastern meadowlarks were seen in all three zones in the 2000s. Western meadowlarks were seen in northern Illinois, where the ratio was 19 easterns:2 westerns.

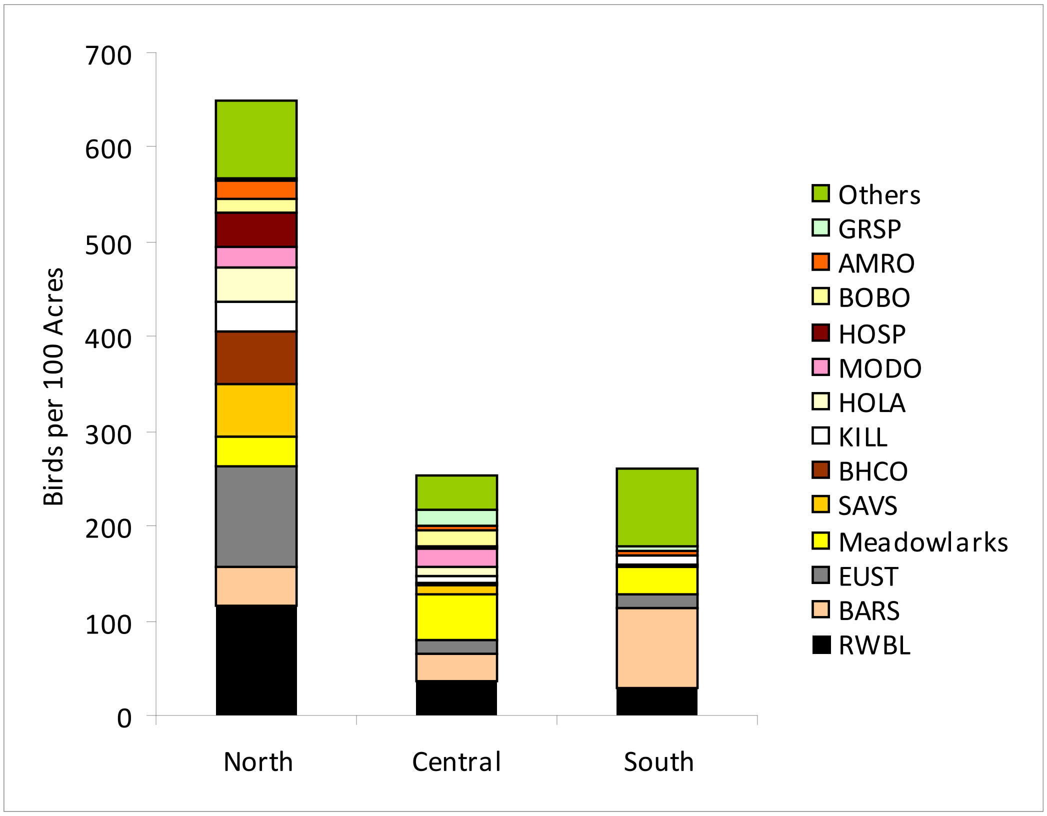


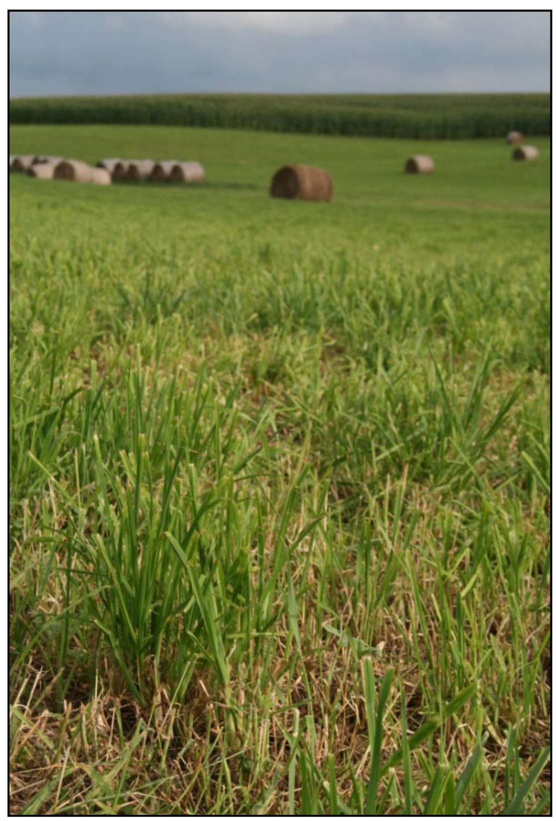
Fig. 4.3. Densities of the most important species observed in idle grasslands in Illinois in each region in 2006-2008. Fourteen species represented 85% of all birds observed.

Hayed and Mowed Grasslands

We use this category for grasslands that were hayed or mowed in the year of our surveys, excluding linear areas such as field borders, waterways and terraces (Table 4.5). Most areas were mixed hay fields, composed of combinations of cool-season grasses (smooth brome, orchard grass, timothy) and legumes (alfalfa, red clover), but also ungrazed (typically fescue) pastures and other areas that had been mowed but not harvested. The distinction between mixed hay and idle grassland was clear in the field, as we encountered very few examples of mixed grass-legumes that were either not already cut or obviously intended to remain unharvested (e.g., wildlife management or conservation lands). Vegetation in hayed or mowed grasslands varied in stages of re-growth from short stubble (3 inches or less) to dense cover 18 inches tall, though most was shorter than 12 inches. Areas that had been mowed but unharvested had abundant litter. Woody vegetation, other than an occasional small stump, was absent.

Table 4.5. Summary of survey effort in hayed and mowed grasslands in the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	175	115	31
Central	126	43	45
South	597	18	44
Sites surveyed			
North	8	16	5
Central	13	9	9
South	27	6	10



The amount of mixed hay in Illinois remained fairly constant, at about 2.5 million acres, from 1907 to 1957. Over the past 50 years, about 90% of that area has been converted to other land cover types, with the U.S. Department of Agriculture estimating approximately 275,000 acres of hay, excluding alfalfa, in 2007. As with alfalfa, contemporary mixed hay fields are harvested earlier and more frequently than in the 1950s, and almost all nests and young birds are destroyed by haying or mowing operations (Warner and Etter 1989, Bollinger et al. 1990, Frawley and Best 1991, Warner 1994).

Because most of the hayed and mowed grasslands we surveyed had been previously cut, we saw relatively fewer meadowlarks, bobolinks, dickcissels, grasshopper sparrows or other grassland-nesting birds in the 2000s compared to the 1900s and 1950s surveys (Table 4.6). We commonly saw European starlings, red-winged blackbirds, common grackles, and barn swallows using these grasslands for foraging. We believe that the regional differences in the densities of grassland birds are an artifact of chance encounters with large flocks of feeding birds (Fig. 4.4). For example, the high densities of European starlings in the central and southern regions and common grackles in the northern region reflect single encounters with large groups. All of the horned larks, rock pigeons, and all but one cliff swallow were seen in single groups of each species.

Table 4.6. Relative abundance of birds (% of all birds recorded in a specific survey period) observed in hayed and mowed grasslands in Illinois, 1907-1909, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s		1950s		2000s	
Species	%	Species	%	Species	%
Meadowlarks	**27.2**	**Red-winged blackbird**	**22.6**	**European starling**	**19.7**
Dickcissel	**13.8**	**Meadowlarks**	**13.0**	**Red-winged blackbird**	**18.9**
House sparrow	**10.2**	**Dickcissel**	**11.4**	**Common grackle**	**14.5**
Red-winged blackbird	**8.3**	**European starling**	**8.4**	**Meadowlarks (A)**	**6.6**
Bobolink	**6.3**	**Bobolink**	**8.4**	**Barn swallow**	**6.6**
Mourning dove	**3.8**	**Grasshopper sparrow**	**5.6**	**Horned lark**	**3.8**
Grasshopper sparrow	**3.5**	**Savannah sparrow**	**5.3**	**Bobolink**	**3.1**
Common grackle	**3.4**	**Horned lark**	**5.1**	**American robin**	**2.7**
Northern flicker	**2.3**	**Common grackle**	**4.2**	**Cliff swallow**	**2.7**
Chimney swift	**2.0**	**House sparrow**	**3.9**	**Dickcissel**	**2.0**
Northern bobwhite	**1.5**	Mourning dove	2.3	**Rock pigeon**	**2.0**
Field sparrow	**1.4**	Vesper sparrow	1.7	**Brown-headed cowbird**	**1.8**
Brown thrasher	**1.4**	American robin	1.5	**Eastern bluebird**	**1.8**
Eastern kingbird	1.2	Barn swallow	0.6	Savannah sparrow	1.6
American robin	1.1	Northern flicker	0.5	Eastern kingbird	1.4
Brown-headed cowbird	0.9	Brown thrasher	0.5	Grasshopper sparrow	1.2
Greater prairie-chicken	0.9	Henslow's sparrow	0.5	Purple martin	1.1
Common yellowthroat	0.8			House sparrow	0.9
Barn swallow	0.7			American goldfinch	0.9
American crow	0.7			Killdeer	0.9
Red-headed woodpecker	0.7			Indigo bunting	0.7
Upland sandpiper	0.7			Canada goose	0.7
Orchard oriole	0.6				
Horned lark	0.5				
American goldfinch	0.5				
Song sparrow	0.5				
Number of birds	*1476*		*665*		*557*
Number of species	*50*		*32*		*37*

A. Western meadowlarks were not encountered in hayed or mowed grasslands during the 2000s surveys.

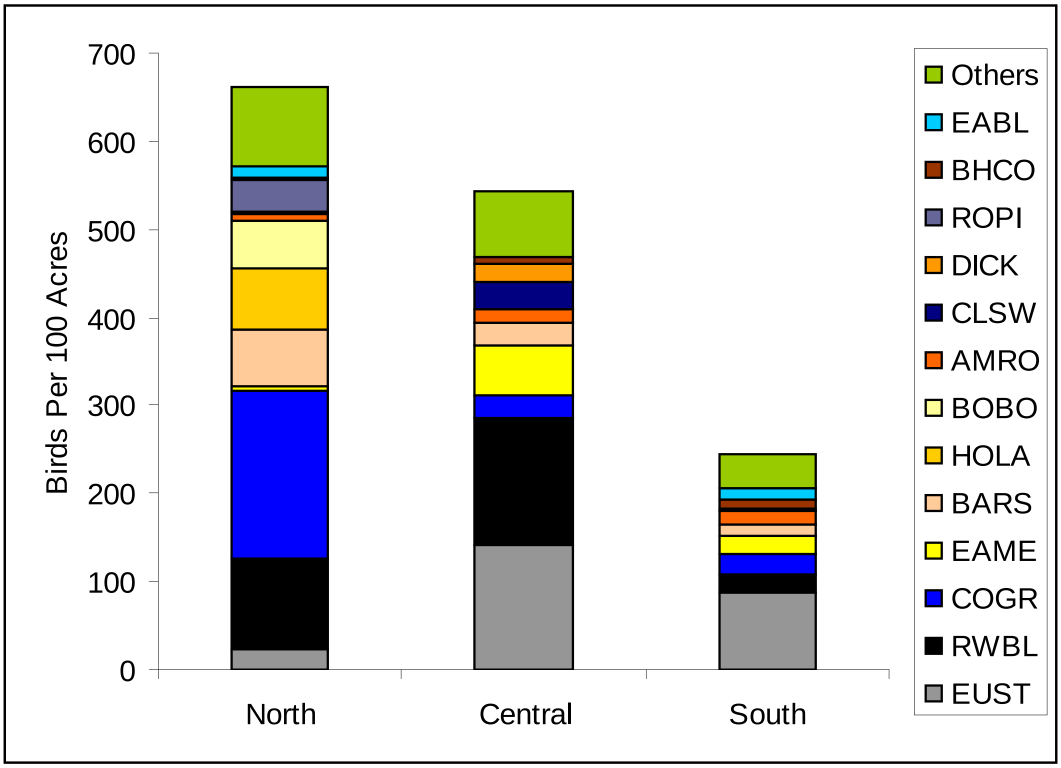


Fig. 4.4. Densities of the most important species observed in hayed and mowed grasslands in the three regions of Illinois during 2006-2008. Thirteen species represented 85% of all birds observed.

Linear Grasslands

This category includes rural roadsides, drainage canals, waterways, field borders, terraces and other linear habitats dominated by grasses with 20% or less coverage by trees and shrubs and too narrow to accommodate a typical transect (50 yards) (Table 4.7). Nearly all of the linear grasslands we surveyed were between 3 to 30 yards wide, and many had been mowed or partially mowed during the current growing season. Some field borders and roadsides included fences, posts or utility lines that birds used as perches.

Table 4.7. Summary of survey effort in linear grasslands in the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	0.05	10	6.5
Central	0.8	14	5.9
South	0	11	0.4
Sites surveyed			
North	1	21	9
Central	2	18	9
South	0	17	2

In the intensively cultivated areas, linear grasslands are about the only potential bird habitat other than cropland. Not surprisingly, the birds observed in linear grasslands were quite similar to those seen in the adjacent corn and soybean fields. Generalist species, such as the red-winged blackbird, European starling and common grackle, dominated these small, heavily disturbed areas, whereas grassland birds, including dickcissels and meadowlarks, were uncommon and present at lower relative abundances than in the 1950s (Table 4.8). There was little difference in bird density between linear grasslands in northern and central Illinois (Fig. 4.5).

Conservation programs provide incentives to landowners to establish grassy buffers in riparian areas and, in recent years, field borders for wildlife. The Illinois Departments of Natural Resources and Transportation discourage the mowing of roadsides during the nesting season. Nonetheless, most studies examining the wildlife benefits of linear grasslands have found that they attract few grassland birds like bobolinks and grasshopper sparrows that typically only settle in larger grasslands, and that the birds nesting in linear grasslands have poor nest success due to destruction by mowing and losses to predators using these travel corridors.

Table 4.8. Relative abundance of birds (% of all birds recorded in a specific survey period) observed in linear grasslands in Illinois, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1950s		2000s	
Species	%	Species	%
Red-winged blackbird	**20.0**	**Red-winged blackbird**	**33.7**
House sparrow	**14.3**	**European starling**	**13.3**
Common grackle	**11.4**	**Common grackle**	**9.6**
American goldfinch	**9.0**	**American robin**	**5.8**
Dickcissel	**8.1**	**Brown-headed cowbird**	**4.2**
Meadowlarks	**4.4**	**House sparrow**	**4.0**
Song sparrow	**4.3**	**Killdeer**	**4.0**
Mourning dove	**4.3**	**Horned lark**	**3.4**
Indigo bunting	**3.4**	**Dickcissel**	**3.0**
Common yellowthroat	**2.3**	**Song sparrow**	**2.9**
European starling	**2.1**	**Barn swallow**	**2.7**
Barn swallow	**1.3**	Mourning dove	1.8
Field sparrow	**1.3**	Chipping sparrow	1.8
Brown-headed cowbird	1.2	American goldfinch	1.4
Ring-necked pheasant	1.2	Meadowlarks (A)	1.4
Brown thrasher	1.1	Vesper sparrow	0.8
Vesper sparrow	1.0	House finch	0.8
Northern bobwhite	0.8	Brown thrasher	0.6
American robin	0.6	Mallard	0.6
Northern cardinal	0.6		
Bobolink	0.6		
Horned lark	0.5		
Red-headed woodpecker	0.5		
Yellow-breasted chat	0.5		
Loggerhead shrike	0.4		
Number of birds	*946*		*623*
Number of species	*48*		*37*

A. Western meadowlarks (2 birds) were recorded in northern Illinois; eastern meadowlarks were found in all three zones.

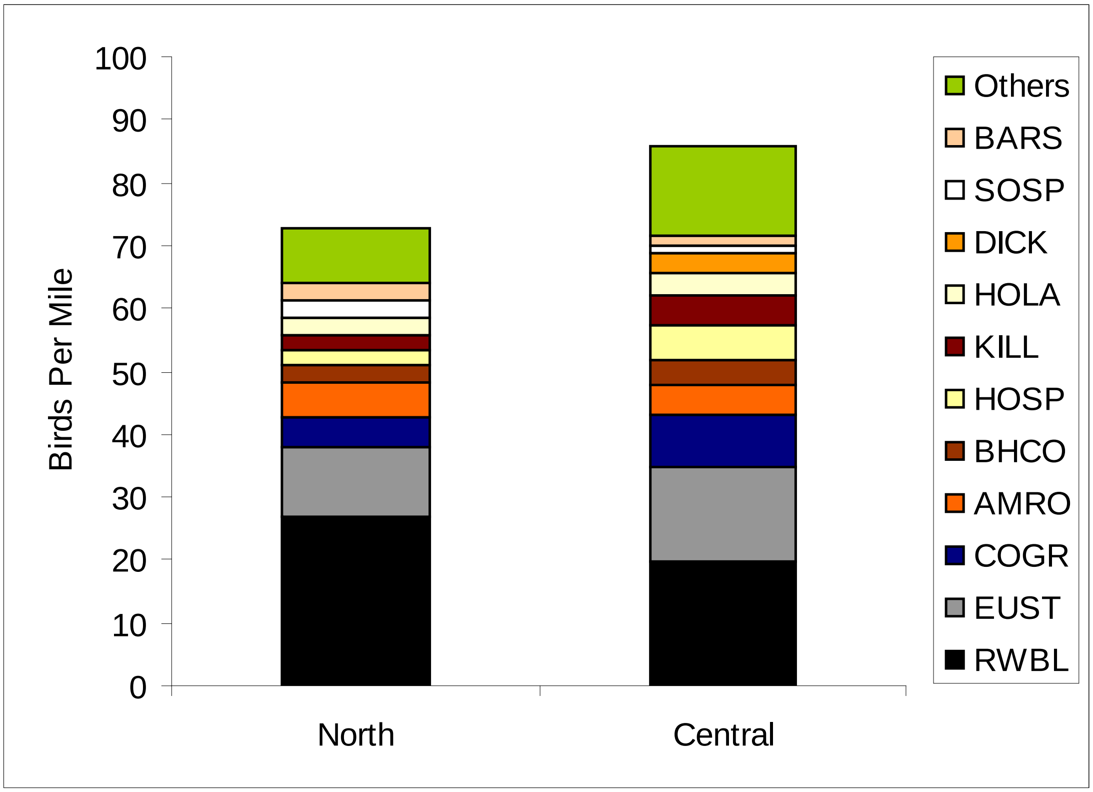
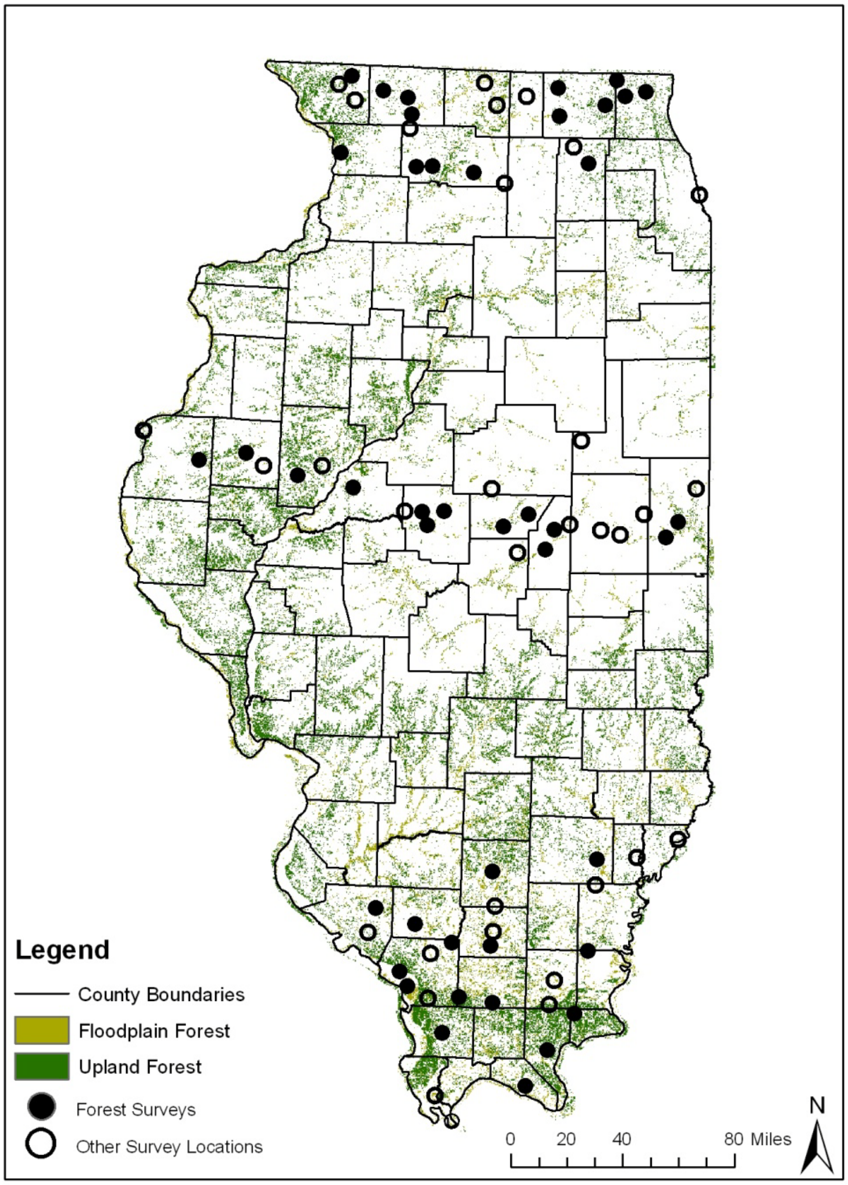


Fig. 4.5. Densities of the most important species observed in linear grasslands in the three regions of Illinois during 2006-2008. Eleven species represented 85% of all birds observed.

FOREST



UPLAND FOREST:
3.5 million acres
About 10% of Illinois

FLOODPLAIN FOREST:
1.1 million acres
About 3% of Illinois

CONIFEROUS FOREST:
80,000 acres
About 0.2% of Illinois

Fig. 4.6. Distribution of forests in Illinois. Approximately 4.7 million acres of forest are currently found in Illinois, covering about 13% of the state.

We use "forest" to describe habitats covered by trees taller than 3 m and with a canopy closure of 80% or greater. We identified three types of forest in the 2000 surveys: upland, floodplain and coniferous (Table 4.9). Upland and floodplain (bottomland) forests were dominated by deciduous trees and roughly divided by the 100-year floodplain. The coniferous forests we sampled were all plantations dominated by pines and spruces. Wooded and savanna habitats with less than 80% canopy coverage, areas dominated by short woody vegetation, and linear forests less than 30 yards wide are discussed in later sections. Previous surveys only rarely distinguished between upland and floodplain forests. Thus, for the 1900s and 1950s time periods, we summarize data in a single "forest" category to compare with recent data for upland and floodplain forests. The Grabers and Gross did not use the term forest in their field notes, but we include here habitats they described as "woods" and "timber."

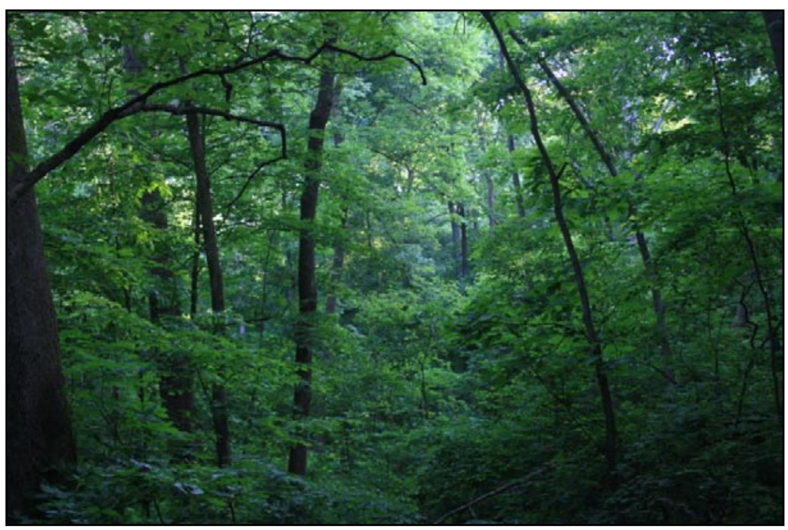
Table 4.9. Summary of survey effort in forests during the three survey periods.

	Time Period				
Zone	**1900s - Forest**	**1950s - Forest**	**2000s - Upland**	**2000s - Floodplain**	**2000s - Coniferous**
Acres surveyed					
North	0.8	176	70	25	9.1
Central	11	216	40	48	9.1
South	58	339	56	46	25
Sites surveyed					
North	1	14	15	6	2
Central	5	10	9	7	3
South	20	21	15	9	6

The General Land Office surveys of 1820 showed more than one-third of Illinois was forested (Anderson 1970). Nearly all of these 13.8 million acres were logged for building material and fuel, and most were cleared for agriculture until just 3 million acres of forest remained around 1920. Gross and Ray surveyed little forested land, and most of what they surveyed was in southern Illinois (Table 4.9). The most common bird they encountered, the field sparrow, suggests that many of these forests were relatively young and open from recent logging or grazing. The amount of forest in Illinois has continued to increase since that time. Graber and Graber estimated about 4 million acres of forest in 1957. At present, about 5.2 million acres are forested, including almost 3.5 million acres of upland forest and 1.1 million acres of floodplain forest.

Upland Forest

Oaks were the dominant trees, along with hickory, maple, and ash, in the upland forests we surveyed in the 2000s. The richness and density of the understory varied, but we could not characterize any upland forest as "without understory," as did the Grabers. Evidence of past grazing was evident in many locations by the presence of plants such as honey locust and multi-flora rose, but we did not sample any forests that were currently hosting livestock.



Although chestnut blight and Dutch elm disease altered the canopy of the state's forests, oaks and hickories have been the dominant canopy trees through the 1900s, 1950s and 2000s surveys. Perhaps reflecting the continuity of the oak-hickory character of forests in Illinois over time, the birds found in upland forests in the 1950s and 2000s surveys were very similar. Twenty-seven of the 33 most important species (again, 85% of all birds seen) in modern forests were also among the most important species of forests in the 1950s (Table 4.10).

Significant changes in forest composition, and perhaps bird communities, are likely by 2057, however. Sugar maple dominance is estimated to have risen by 4,000% since the 1960s. The emerald ash borer is established in several counties and is likely to spread throughout the state. Mortality of infected ash trees is 100%. Invasive shrubs, especially bush honeysuckles and buckthorns, have infested many forests. Garlic mustard blankets the ground layer of many forests, especially in northern and central Illinois, and Japanese stilt grass has invaded some southern Illinois forests.

Regionally in the 2000 surveys, the birds of upland forests are similar (Fig. 4.7), with American robins and house wrens being denser in the north, and tufted titmice, Carolina wrens, and Acadian flycatchers denser in the south. Compared to the 1950s, American robins, house wrens, and brown-headed cowbirds are more abundant in today's upland forests (Table 4.10).

Brown-headed cowbirds lay their eggs in other birds' nests, reducing or eliminating production of "host" young. Fragmented forests are well-suited to cowbirds and generalist nest predators like raccoons, resulting in most of the state's forests being reproductive "sinks" (i.e., areas where recruitment falls short of the number of birds needed to compensate for adult mortality) for many birds, especially Neotropical migrants like warblers (Robinson et al. 1997). Although Brown-headed cowbirds have become relatively more abundant in the upland bird community since the 1900s and 1950s (Table 4.10), we do not see a clear decline in the relative abundances of common Neotropical migrant "hosts" of cowbird eggs and nestlings (e.g., eastern wood-pewee, Acadian flycatcher, red-eyed vireo, Kentucky warbler), which would be expected if cowbirds were limiting their populations.

Floodplain Forest

Silver maple, cottonwood, sycamore, green ash and black willow were the dominant tree species of floodplain forests, though oaks, pecan, hackberry and other species were well-represented in some areas. Compared to the upland forests we surveyed, floodplain forests tended to have taller canopies and sparser understories. Poison ivy and garlic mustard were common ground-level plants.

Current programs to retire flood-prone areas from crop production (e.g., Wetlands Reserve Program, Conservation Reserve Enhancement Program) are resulting in the restoration of more floodplain forest. Due to levees, drainage improvements and other modifications, floodplain forests in many areas are subject to relatively rapid changes in water levels, which favor silver maple and cottonwood dominance at the expense of 'hard mast' trees, such as oaks and pecan.

As expected, floodplain forests differed from upland forests owing to few to no ground-nesting birds (e.g., Kentucky warblers and ovenbirds), and the presence of birds associated with standing water (prothonotary warblers, great blue herons, and wood ducks). Regional variation in local densities of floodplain forest birds in the 2000s was substantial (Fig. 4.8). American robins and house wrens were common overall, but they were rarely seen in the southern zone. In contrast, tufted titmice, blue-gray gnatcatcher and Acadian flycatchers were scarcely seen in the northern or central region's floodplain forests. Red-winged blackbirds and common grackles reached their highest density in the northern region, and gray catbirds were densest in central Illinois floodplain forests.

Coniferous Forest

Plantations of coniferous trees are an uncommon habitat type in Illinois, estimated at about 80,000 acres by the 1999-2000 Land Cover of Illinois. Roughly 4,000 acres of Christmas tree plantations occur in Illinois, but we did not survey any of these patches. The areas we encountered were all mature stands of pines mixed with some hardwoods on public lands, predominantly in southern Illinois.

One species, the pine warbler, is probably restricted to these artificial habitats in the state. Chipping sparrows were especially abundant in the coniferous forest bird community; otherwise, the bird community was similar to other upland forests in southern Illinois (Table 4.10).

Table 4.10. Relative abundance of birds (% of all birds recorded in a specific time period) observed in forests in Illinois, 1907-1909, 1957-1958 and 2006-2008. Upland and floodplain forests were not differentiated and coniferous forests were not sampled in the 1900s and 1950s surveys. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s - Forest		1950s - Forest		2000s - Upland		2000s – Floodplain		2000s - Coniferous	
Species	%	Species	%	Species	%	Species	%	Species	%
Field sparrow	9.2	Northern cardinal	10.1	American robin	9.8	American robin	12.5	American robin	13.8
Blue jay	8.0	Common grackle	8.4	Northern cardinal	7.1	House wren	7.4	Chipping sparrow	12.1
Indigo bunting	6.9	Tufted titmouse	7.1	Indigo bunting	6.0	Indigo bunting	7.2	Northern cardinal	11.2
Great-crested flycatcher	6.1	Chickadees	5.7	Brown-headed cowbird	5.4	Brown-headed cowbird	4.6	Carolina wren	6.9
Northern cardinal	5.3	Indigo bunting	5.0	Tufted titmouse	5.4	Northern cardinal	4.1	Blue jay	5.2
Brown thrasher	4.6	Red-eyed vireo	3.7	Eastern wood-pewee	5.4	Chickadees (A)	4.1	Blue-gray gnatcatcher	4.3
American robin	3.8	E. wood-pewee	3.4	Blue jay	4.2	Gray catbird	3.4	House wren	4.3
Northern flicker	3.4	Acadian flycatcher	3.4	American goldfinch	3.8	Tufted titmouse	3.1	American goldfinch	3.4
Wood thrush	3.4	Blue jay	3.1	House wren	3.6	Eastern wood-pewee	3.1	Chickadees (A)	3.4
Eastern towhee	3.4	Downy woodpecker	2.8	Blue-gray gnatcatcher	3.6	Downy woodpecker	3.1	Kentucky warbler	3.4
Tufted titmouse	3.1	Brown-headed cowbird	2.6	Chickadees (A)	3.3	Red-winged blackbird	3.1	Acadian flycatcher	2.6
Common grackle	3.1	American crow	2.5	Carolina wren	2.9	Common grackle	2.9	American crow	2.6
Eastern wood-pewee	2.7	Blue-gray gnatcatcher	2.4	Gray catbird	2.7	Blue-gray gnatcatcher	2.6	Common grackle	2.6
Yellow-breasted chat	2.7	Carolina wren	2.4	Red-bellied woodpecker	2.7	Red-bellied woodpecker	2.6	Indigo bunting	2.6
Common yellowthroat	2.6	Kentucky warbler	2.4	Downy woodpecker	2.5	Great-crested flycatcher	2.6	Brown-headed cowbird	1.7
Mourning dove	2.3	American redstart	2.2	Acadian flycatcher	2.2	Acadian flycatcher	2.4	Cedar waxwing	1.7
Brown-headed cowbird	1.9	Eastern towhee	2.0	Red-eyed vireo	1.8	European starling	1.9	Eastern towhee	1.7
American crow	1.9	Red-bellied woodpecker	1.7	White-breasted nuthatch	1.8	American redstart	1.9	Ruby-throated hummingbird	1.7
Red-headed woodpecker	1.9	Mourning dove	1.7	Kentucky warbler	1.8	American goldfinch	1.7	Tufted titmouse	1.7
Bewick's wren	1.9	Great-crested flycatcher	1.7	Common grackle	1.6	Blue jay	1.4	Yellow-throated warbler	1.7
Downy woodpecker	1.5	American robin	1.6	European starling	1.3	Baltimore oriole	1.4	Baltimore oriole	0.9

Red-eyed vireo	**1.5**	**American goldfinch**	**1.6**	**Baltimore oriole**	**1.3**	**American crow**	**1.4**	Brown thrasher	0.9
Eastern bluebird	**1.5**	**Field sparrow**	**1.5**	**Mourning dove**	**1.3**	**Orchard oriole**	**1.4**	Eastern wood-pewee	0.9
Northern bobwhite	**1.5**	**White-eyed vireo**	**1.5**	**Northern flicker**	**1.1**	**Wood duck**	**1.4**	Fish crow	0.9
Red-bellied woodpecker	1.1	**Gray catbird**	**1.4**	**Ruby-throated hummingbird**	**1.1**	**Carolina wren**	**1.2**	Great blue heron	0.9
Prothonotary warbler	1.1	**House wren**	**1.3**	**Wild turkey**	**1.1**	**Northern flicker**	**1.2**	Orchard oriole	0.9
American kestrel	1.1	**Wood thrush**	**1.2**	**Great crested flycatcher**	**0.9**	**Common yellowthroat**	**1.2**	Ovenbird	0.9
American goldfinch	0.8	**Ovenbird**	**1.2**	**American crow**	**0.9**	**Great blue heron**	**1.2**	Pine warbler	0.9
Carolina wren	0.8	Summer tanager	1.1	**Wood thrush**	**0.9**	**Prothonotary warbler**	**1.2**	Pileated woodpecker	0.9
Acadian flycatcher	0.8	Red-headed woodpecker	1.1	**Hairy woodpecker**	**0.9**	Red-eyed vireo	0.9	Red-bellied woodpecker	0.9
Chipping sparrow	0.8	Northern flicker	1.0	**Cedar waxwing**	**0.9**	Song sparrow	0.9	Red-eyed vireo	0.9
Orchard oriole	0.8	Hairy woodpecker	1.0	**Eastern towhee**	**0.9**	White-breasted nuthatch	0.7	Summer tanager	0.9
Lark sparrow	0.8	Brown thrasher	1.0	Red-tailed hawk	0.7	Mourning dove	0.7	White-eyed vireo	0.9
Belted kingfisher	0.8	Worm-eating warbler	0.9	Eastern phoebe	0.7	Wood thrush	0.7		
Baltimore oriole	0.4	Song sparrow	0.8	Scarlet tanager	0.7	Red-tailed hawk	0.7		
Barred owl	0.4	Cerulean warbler	0.8	Yellow-billed cuckoo	0.7	Red-headed woodpecker	0.7		
Chimney swift	0.4	Ruby-throated hummingbird	0.6	Red-winged blackbird	0.4	Warbling vireo	0.7		
Gray catbird	0.4	Yellow-breasted chat	0.6	Eastern kingbird	0.4	Unidentified bird	0.7		
Summer tanager	0.4	White-breasted nuthatch	0.5	Louisiana waterthrush	0.4	Ruby-throated hummingbird	0.5		
Ruby-throated hummingbird	0.4	Red-tailed hawk	0.5	Ovenbird	0.4	Hairy woodpecker	0.5		
Red-winged blackbird	0.4	Red-winged blackbird	0.5	Brown thrasher	0.4	Eastern phoebe	0.5		
Yellow-billed cuckoo	0.4	Eastern bluebird	0.5	Worm-eating warbler	0.4	Barred owl	0.5		
House sparrow	0.4			Eastern bluebird	0.4	Rose-breasted grosbeak	0.5		
Eastern kingbird	0.4			Chipping sparrow	0.4	Chimney swift	0.5		
Red-shouldered hawk	0.4			Yellow-throated vireo	0.4	Tree swallow	0.5		
Warbling vireo	0.4								
Number of birds	*300*		*1666*		*448*		*417*		*116*
Number of species	*46*		*72*		*60*		*54*		*34*

A. Carolina chickadees were observed in the southern zone and in east-central Illinois in the 2000s; black-capped chickadees were observed in the northern and central zones.

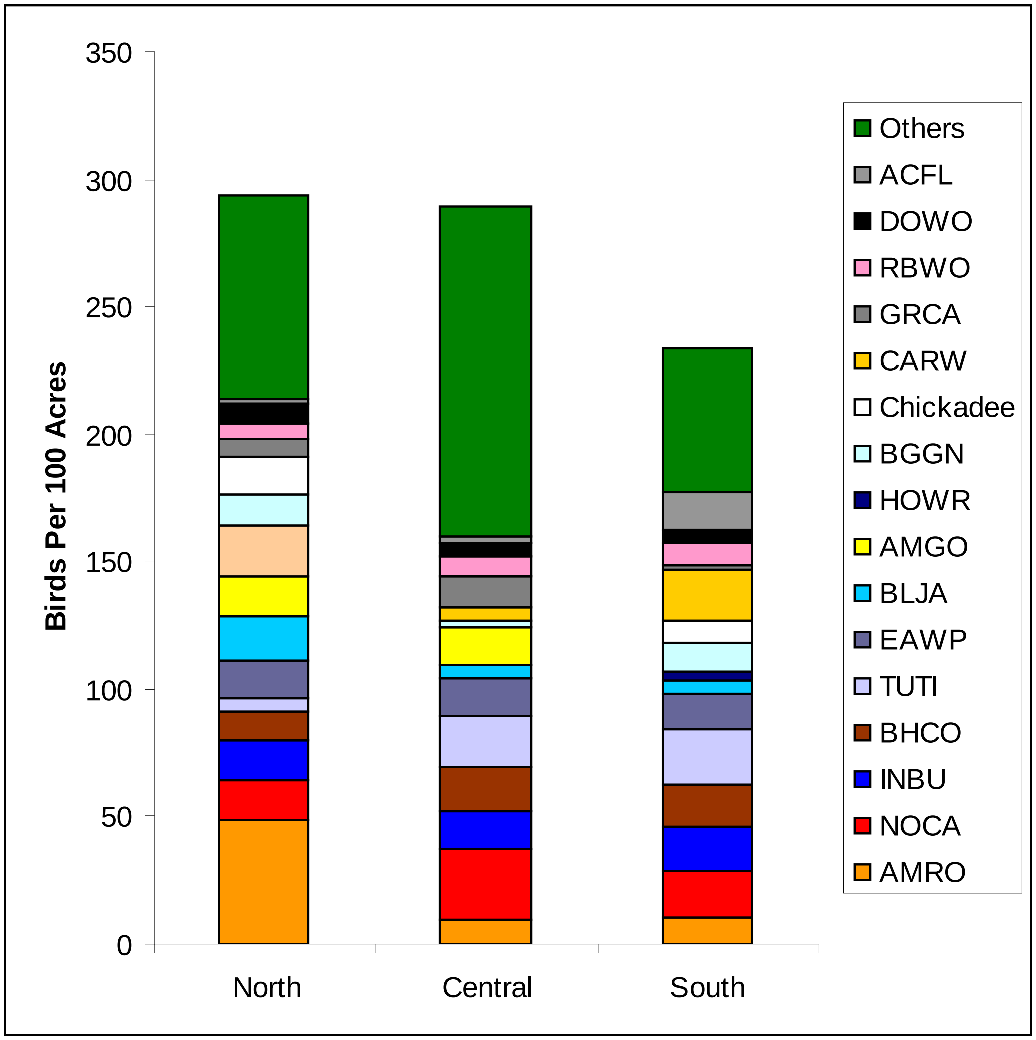


Fig. 4.7. Densities of the 16 most important species observed in upland forest in the three regions of Illinois in 2006-2008. Thirty-three species represented 85% of all birds observed.

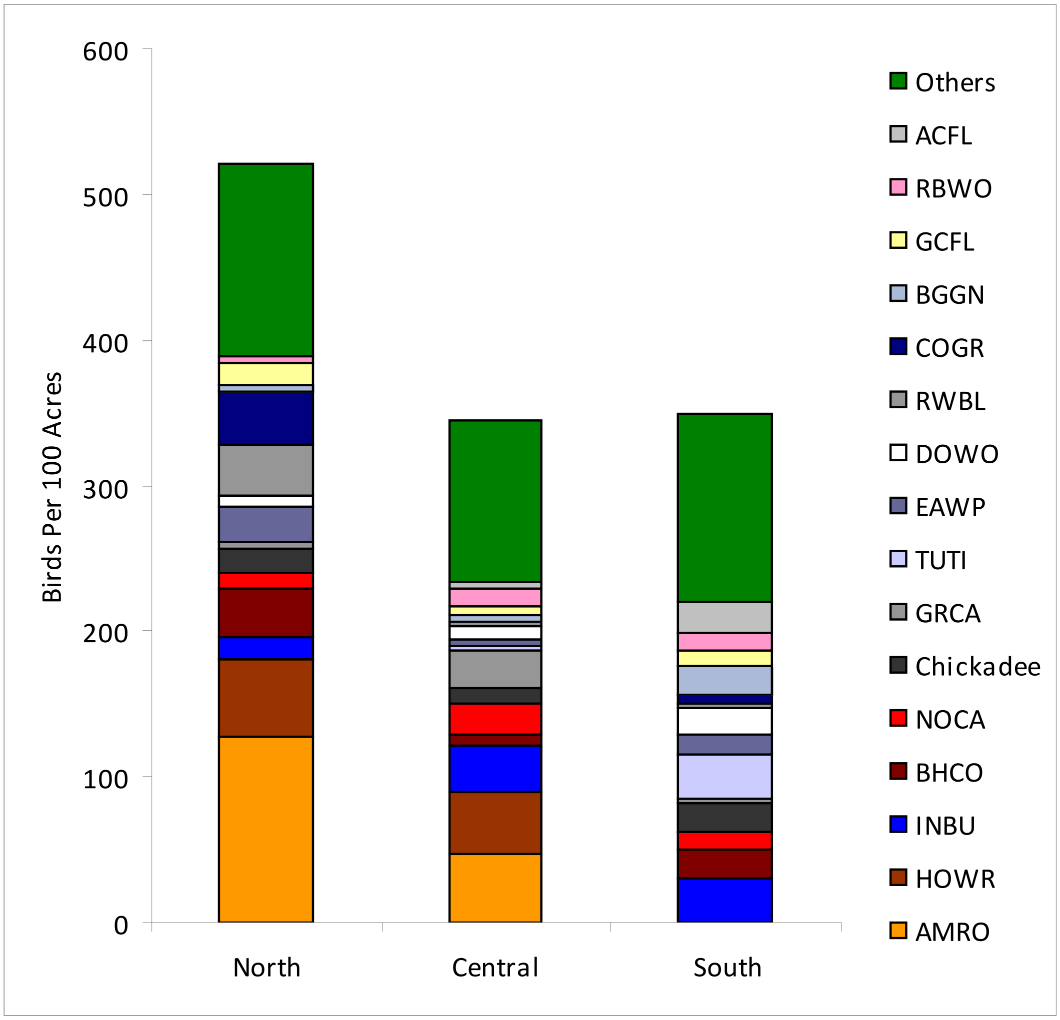
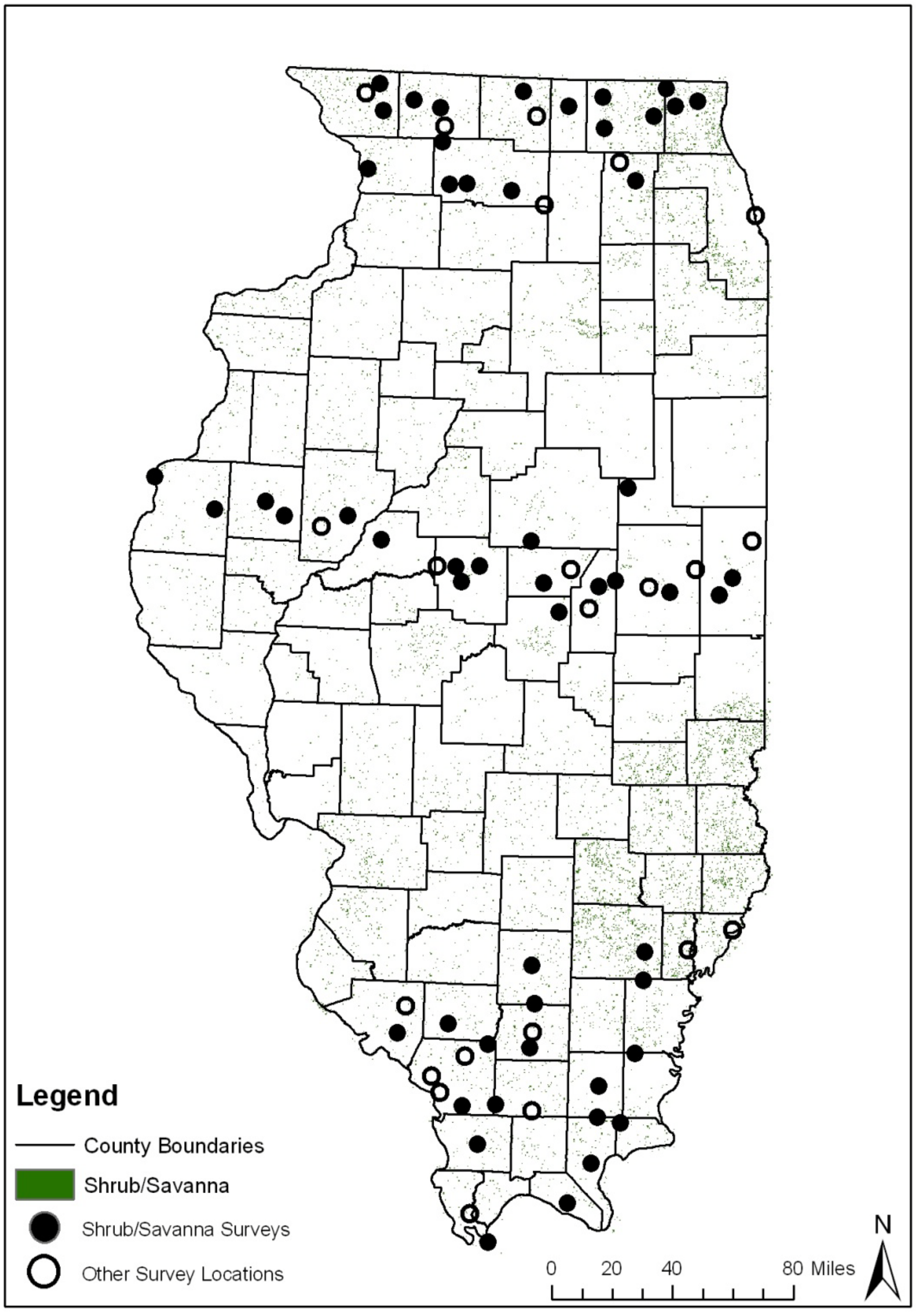


Fig. 4.8. Densities of the 16 most important species observed in floodplain forest in north, central and south Illinois in 2006-2008. Thirty species represented 85% of all birds observed.

SHRUBLANDS, SAVANNA-OPEN WOODLANDS and LINEAR WOODED HABITATS



SHRUB-SAVANNA
Poorly known
Approx. 600,000 acres
About 1% of Illinois

Fig. 4.9. Distribution of shrub-savanna in Illinois.

Shrublands

Shrubland areas constitute a diverse suite of conditions that include grasslands, savanna-like areas, and forests – all with coverage of shrubs and saplings exceeding 20% but few to no canopy-level trees. This habitat does not include linear shrubby areas <30 yards wide, such as fence rows, riparian strips or railroad rights-of-way. We found this habitat at former surface mines, abandoned pastures and abandoned croplands that had not been cultivated for several years. For historical comparison, we consider the areas Gross described as cleared land, clearings, deforested lands, and shrubs, and that the Grabers labeled as forest edge, pasture with shrubs, and shrubs (Table 4.11).

Table 4.11. Summary of survey effort in shrublands during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	3.4	32	18
Central	1.0	50	14
South	85	128	33
Sites surveyed			
North	2	10	8
Central	1	8	6
South	24	17	11

The amount of shrub areas in the state has been consistently small. Graber and Graber estimated 500,000 acres of shrub habitat was present in the 1900s and 1950s. The 614,000 acres of "partial canopy/savanna upland" reported in the 1999-2000 Land Cover of Illinois includes an unknown amount of shrubland. Former surface mines were the only locations where we found extensive areas (i.e., more than about 10 acres) of shrubland. In all three time periods, shrublands were most often encountered in southern Illinois.

Whereas the vegetation structure of shrub-grown areas has likely been consistent over the past 100 years, these habitats are now dominated by invasive plant species. Common shrub and sapling species in these areas included bush honeysuckle, autumn olive, multiflora rose, osage orange, black locust, honey locust and eastern red cedar, and typically vegetation was 4 to 10 feet tall. Dominant herbaceous plants in open spots were fescue, broom sedge, smooth brome, and *Sericea lespedeza*.

American goldfinches, indigo buntings and field sparrows were among the most abundant birds in shrub habitat during the three time periods. By historical standards, the relative abundances of American goldfinches, common grackles and brown-headed cowbirds were higher in the 2000s than the 1900s and 1950s (Table 4.14). American robins and cedar waxwings also are more common than in the past. Both species are fruit-eating birds that perhaps benefit from the fruits of honeysuckles and autumn olive that dominate present-day shrublands.

In light of the regional differences in species' densities observed during our 2006-2008 surveys (Fig. 4.10), comparing our data to the 1900s and 1950s is complicated because of regional differences in sampling effort among the three time periods. Indigo buntings were least dense in northern Illinois, whereas mourning doves and yellow warblers were denser in the northern region of the state than the central or southern region. American robins, song sparrows, cedar waxwings, and gray catbirds were denser in central and northern Illinois than the south, but yellow-breasted chats were only detected in the south.

Savannas – Open Woodlands

The terms savanna, barrens, and open woodlands have technical meanings as distinct natural communities, but we use the phrase 'savanna - open woodland' to define a generic habitat structure that shares characteristics of grassland (a grassy ground layer) and forest (20 to 80% coverage by canopy-height trees). Only about 1,500 acres of high-quality remnant savanna are known to exist in Illinois. The total amount of savanna-type habitat in Illinois – habitat with scattered trees and herbaceous ground cover – is unknown. The 1999-2000 Land Cover of Illinois estimated 615,000 acres of 'partial canopy/savanna upland,' a category that also includes shrub-grown areas.

For savanna-open woodland habitats, it is impractical to make any historical comparison, because little of this habitat type was specified in either the 1900s or 1950s periods (Table 4.12). Gross describes a few areas as "groves," which based on the birds he recorded were probably savanna-like in structure. Graber and Graber (1963: fig. 16, p. 408), and likely Gross and Ray, included some grazed "savanna-like" areas with other grassland pastures. Open woodlands probably were not distinguished from other forest types.

Table 4.12. Summary of survey effort in savannas and open woodlands during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	1.8	15	30
Central	4.2	8.8	28
South	1.8	2.3	10
Sites surveyed			
North	2	6	10
Central	2	4	9
South	2	1	5

Early in the 19th century, savannas and open woodlands were major habitats in Illinois. Most savanna was lost to timber harvest and conversion to agriculture, including the conversion of the native ground layer to introduced pasture grasses, by the early decades of the 20th century. Over the past 50 years, open woodland and savanna-type habitats have almost certainly declined due to development and trends towards closed-canopy forest (forest succession) through fire suppression.

Most of the savanna-open woodland we surveyed had a ground layer of non-native pasture grasses (bluegrass, orchard grass, timothy, fescue, brome) and had been or was being grazed. Mature burr, white and black oaks were the dominant tree species, and surveyed areas typically had 10 to 30% coverage by shrubs, including multiflora rose, gooseberry, raspberry, blackberry, and young trees.

The high dominance of European starlings in the 2000s was skewed by the encounter of a large flock of 64 birds in a single savanna-like pasture in southern Illinois (Table 4.14). Excluding that observation, starlings dropped in rank to be the 4th most frequently seen bird, between common grackles and American goldfinches, and the regional differences in bird communities were diminished (Fig. 4.11). European starlings out-number and compete with native cavity-nesting species, including eastern bluebirds, great crested flycatchers and northern flickers, in savanna-like habitats; thus, they represent an important potential threat to native birds. American robins are abundant in savanna-open woodland areas, as in upland and floodplain forests. The red-headed woodpecker is the signature bird of Midwestern oak savannas. Although we found red-headed woodpeckers more often in savanna-like areas than other habitats, we still encountered them infrequently in savannas. In spite of sampling a relatively small amount of savanna-open woodland habitat, we observed more species (63) in these areas than any other habitat type.

Linear Wooded Habitats

We combined fencerows, railroad rights-of-way, roadsides and riparian areas that had at least 75% tree or shrub cover and were less than 30 yards wide under the heading of linear wooded habitats. We considered these areas to be more similar to shrublands than forests. The narrowest of these linear wooded areas were only 1-2 yards wide. Few linear wooded habitat patches were surveyed in the 1900s, but aware of their importance as bird habitat in agricultural areas and their rapid elimination from those landscapes, Graber and Graber surveyed many fence rows and hedge rows in the 1950s (Table 4.13)

Table 4.13. Summary of survey effort in linear woodlands during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	0	4	2.7
Central	0	5.8	4.5
South	1.9	6.3	3.5
Sites surveyed			
North	0	15	9
Central	0	15	11
South	1	19	12

The extent of these wooded corridors is now much less than it was in the 1950s, when Graber and Graber estimated 86,000 acres of edge shrub habitat and 13,000 acres of hedge rows in the state. Agricultural trends towards larger field size and fewer grazing animals have resulted in the removal of most fences and wooded field borders; these are especially scarce in the intensively-cropped east-central region.

The biggest change in relative bird abundance between the 1950s and the 2000s surveys is the ten-fold increase of American robins (Table 4.15). In contrast, several species characteristic of low shrubs (e.g., brown thrasher, common yellowthroat, field sparrow, northern bobwhite) and grassland-associated birds (e.g., dickcissels, meadowlarks) were relatively less abundant in the most recent surveys. This may be due to greater height or maturity of woody vegetation in these linear habitats, less available grassland habitat near these habitats, or both. In spite of these changes, linear wooded habitats had identical species richness (61 species) and a similar number of most important species (totaling 85% of birds seen) in the 1950s and 2000s periods (19 species and 18 species, respectively).

Among the three regions surveyed in 2006-2008, American robins, song sparrows and gray catbirds had higher densities in northern and central Illinois than in the south (Fig. 4.12). Brown thrashers were not recorded in northern Illinois, and indigo buntings were densest in the south. European starlings and red-winged blackbirds reached their greatest densities in central Illinois linear wooded habitats.

Table 4.14. Relative abundance of birds (% of all birds recorded in a specific time period) observed in Illinois shrublands in 1907-1909, 1957-1958 and 2006-2008 and savanna-open woodlands in 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s - Shrub		1950s - Shrub		2000s - Shrub		2000s – Savanna-Open Woodland	
Species	%	Species	%	Species	%	Species	%
Field sparrow	**11.1**	**Field sparrow**	**17**	**American goldfinch**	**11.0**	**European starling (A)**	**15.0**
Indigo bunting	**8.4**	**Indigo bunting**	**9.6**	**Indigo bunting**	**9.9**	**American robin**	**12.8**
Northern cardinal	**8.0**	**Red-winged blackbird**	**6.8**	**Field sparrow**	**9.4**	**Common grackle**	**7.3**
Red-headed woodpecker	**6.5**	**American goldfinch**	**5.4**	**Common grackle**	**8.4**	**American goldfinch**	**4.3**
Common Yellowthroat	**6.1**	**Brown-headed cowbird**	**5.4**	**Brown-headed cowbird**	**8.0**	**Blue jay**	**3.8**
American goldfinch	**5.7**	**Yellow-breasted chat**	**4.1**	**Mourning dove**	**4.7**	**Mourning dove**	**3.8**
Yellow-breasted chat	**5.7**	**Northern cardinal**	**3.8**	**Song sparrow**	**4.7**	**Barn swallow**	**3.0**
Mourning dove	**4.6**	**Mourning dove**	**3.1**	**Red-winged blackbird**	**4.3**	**Eastern bluebird**	**3.0**
Blue jay	**4.2**	**Eastern towhee**	**2.6**	**American robin**	**3.5**	**Song sparrow**	**3.0**
Brown-headed cowbird	**3.4**	**Gray catbird**	**2.5**	**Gray catbird**	**3.0**	**Brown-headed cowbird**	**2.8**
Yellow-billed cuckoo	**2.3**	**Brown thrasher**	**2.5**	**Yellow warbler**	**2.8**	**Eastern wood-pewee**	**2.8**
Meadowlarks	**2.3**	**Common yellowthroat**	**2.4**	**Cedar waxwing**	**2.8**	**Cedar waxwing**	**2.4**
Eastern towhee	**1.9**	**Chickadees**	**2.4**	**Northern cardinal**	**2.2**	**Chipping sparrow**	**2.4**
Orchard oriole	**1.9**	**Song sparrow**	**2.2**	**Common yellowthroat**	**2.2**	**Indigo bunting**	**2.4**
Carolina wren	**1.9**	**Bank swallow**	**2.1**	**Yellow-breasted chat**	**2.0**	**Red-winged blackbird**	**2.2**
Red-winged blackbird	**1.5**	**Common grackle**	**2.0**	**Bell's vireo**	**1.5**	**Baltimore oriole**	**1.9**
Dickcissel	**1.5**	**Tufted titmouse**	**2.0**	**European starling**	**1.5**	**Northern cardinal**	**1.9**
Northern bobwhite	**1.5**	**Orchard oriole**	**1.4**	**Ruby-throated hummingbird**	**1.3**	**Eastern kingbird**	**1.7**
American robin	**1.1**	**Savannah sparrow**	**1.3**	**Eastern towhee**	**1.0**	**Gray catbird**	**1.5**
American crow	**1.1**	**Eastern kingbird**	**1.2**	**Brown thrasher**	**1.0**	**House wren**	**1.4**
Eastern phoebe	**1.1**	**Prairie warbler**	**0.9**	**Purple martin**	**1.0**	**Common yellowthroat**	**1.3**
Tufted titmouse	**1.1**	**Blue jay**	**0.9**	**Willow flycatcher**	**1.0**	**Blue-gray gnatcatcher**	**1.1**
Wood thrush	**1.1**	**Carolina wren**	**0.9**	Dickcissel	0.8	**Red-bellied woodpecker**	**1.1**
House sparrow	**1.1**	**Bell's vireo**	**0.8**	Downy woodpecker	0.8	**Eastern phoebe**	**0.9**
Great-crested flycatcher	**1.1**	**Meadowlarks**	**0.8**	Barn swallow	0.8	**Great-crested flycatcher**	**0.9**

American kestrel	**1.1**	**Wood thrush**	**0.8**	Prairie warbler	0.7	**Red-head woodpecker**	**0.9**
Ruby-throated Hummingbird	0.8	**Eastern wood-pewee**	**0.8**	Northern bobwhite	0.7	**Wild turkey**	**0.9**
Brown thrasher	0.8	House wren	0.7	American crow	0.7	American crow	0.8
Downy woodpecker	0.8	House sparrow	0.7	Cliff swallow	0.7	Field sparrow	0.8
White-eyed vireo	0.8	Willow flycatcher	0.5	Red-tailed hawk	0.7	House sparrow	0.8
Red-bellied woodpecker	0.8	American robin	0.5	Mallard	0.7	Northern flicker	0.8
Turkey vulture	0.8	Yellow warbler	0.5	Blue jay	0.5	Orchard oriole	0.8
Lark sparrow	0.8	Dickcissel	0.5	Yellow-billed cuckoo	0.5	Rock pigeon	0.8
Bewick's wren	0.8	Northern bobwhite	0.5	Northern flicker	0.5	White-breasted nuthatch	0.8
Summer tanager	0.8	American crow	0.5	House finch	0.5	Brown thrasher	0.6
Common grackle	0.4	White-eyed vireo	0.5			Eastern towhee	0.6
Gray catbird	0.4	American redstart	0.5			N. rough-winged swallow	0.5
Purple martin	0.4	Vesper sparrow	0.5			Warbling vireo	0.5
Eastern kingbird	0.4	European starling	0.4			Chimney swift	0.3
Eastern wood-pewee	0.4	Downy woodpecker	0.4			Cooper's hawk	0.3
Northern mockingbird	0.4	Yellow-billed cuckoo	0.4			Double-crested cormorant	0.3
Eastern bluebird	0.4	Eastern phoebe	0.4			Killdeer	0.3
Red-eyed vireo	0.4	Warbling vireo	0.4			Red-eyed vireo	0.3
Scarlet tanager	0.4	Ruby-throated hummingbird	0.3			Red-tailed hawk	0.3
Bachman's sparrow	0.4	Barn swallow	0.3			Summer tanager	0.3
Belted kingfisher	0.4	Red-bellied woodpecker	0.3			Tree swallow	0.3
Hairy woodpecker	0.4	Chimney swift	0.3			Tufted titmouse	0.3
		Red-headed woodpecker	0.3				
		Great-crested flycatcher	0.3				
		Northern mockingbird	0.3				
		Baltimore oriole	0.3				
		Blue-gray gnatcatcher	0.3				
		Gray partridge	0.3				
		Kentucky warbler	0.3				
		Northern parula	0.3				
Number of birds	*261*		*750*		*598*		*632*
Number of species	*48*		*74*		*51*		*63*

A. A flock of 64 European starlings was encountered on a savanna transect in southern Illinois.

Table 4.15. Relative abundance of birds (% of all birds recorded in a specific time period) observed in linear woodlands in Illinois, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1950s		2000s	
Species	%	Species	%
Red-winged blackbird	**12.6**	**American robin**	**16.7**
Common grackle	**11.3**	**Red-winged blackbird**	**16.0**
Indigo bunting	**8.3**	**Indigo bunting**	**6.6**
House sparrow	**7.9**	**Common grackle**	**5.4**
Dickcissel	**5.7**	**American goldfinch**	**4.9**
Northern cardinal	**5.1**	**Song sparrow**	**4.9**
Field sparrow	**5.0**	**European starling**	**4.4**
Mourning dove	**4.8**	**Mourning dove**	**4.1**
Brown thrasher	**3.8**	**Northern cardinal**	**3.7**
Common yellowthroat	**3.5**	**Brown-headed cowbird**	**3.7**
European starling	**3.3**	**Barn swallow**	**3.3**
Gray catbird	**2.6**	**Gray catbird**	**3.0**
American goldfinch	**2.4**	**House sparrow**	**2.1**
Brown-headed cowbird	**2.3**	**Brown thrasher**	**2.1**
Song sparrow	**1.6**	**Chipping sparrow**	**1.5**
Northern bobwhite	**1.5**	**Tree swallow**	**1.5**
Yellow-breasted chat	**1.5**	**Eastern kingbird**	**1.2**
American robin	**1.4**	**House wren**	**1.2**
Meadowlarks	**1.3**	Common yellowthroat	1.0
Blue jay	1.1	Field sparrow	0.9
Barn swallow	1.0	Eastern bluebird	0.9
Bell's vireo	0.8	Northern bobwhite	0.8
Northern mockingbird	0.8	Cedar waxwing	0.7
Vesper sparrow	0.7	Blue jay	0.5
Chickadee	0.6	Baltimore oriole	0.5
Yellow-billed cuckoo	0.6	Eastern phoebe	0.5
Willow flycatcher	0.5	Yellow-breasted chat	0.4
Eastern kingbird	0.5	Bell's vireo	0.4
Orchard oriole	0.5	Tufted titmouse	0.4
House wren	0.4	Red-bellied woodpecker	0.4
Eastern bluebird	0.4	Blue grosbeak	0.3
Northern flicker	0.4	Orchard oriole	0.3
Eastern towhee	0.4	Northern flicker	0.3
Carolina wren	0.4	American crow	0.3
		Downy woodpecker	0.3
		Lark sparrow	0.3

		Warbling vireo	0.3
Number of birds	*1331*		*1206*
Number of species	*61*		*61*

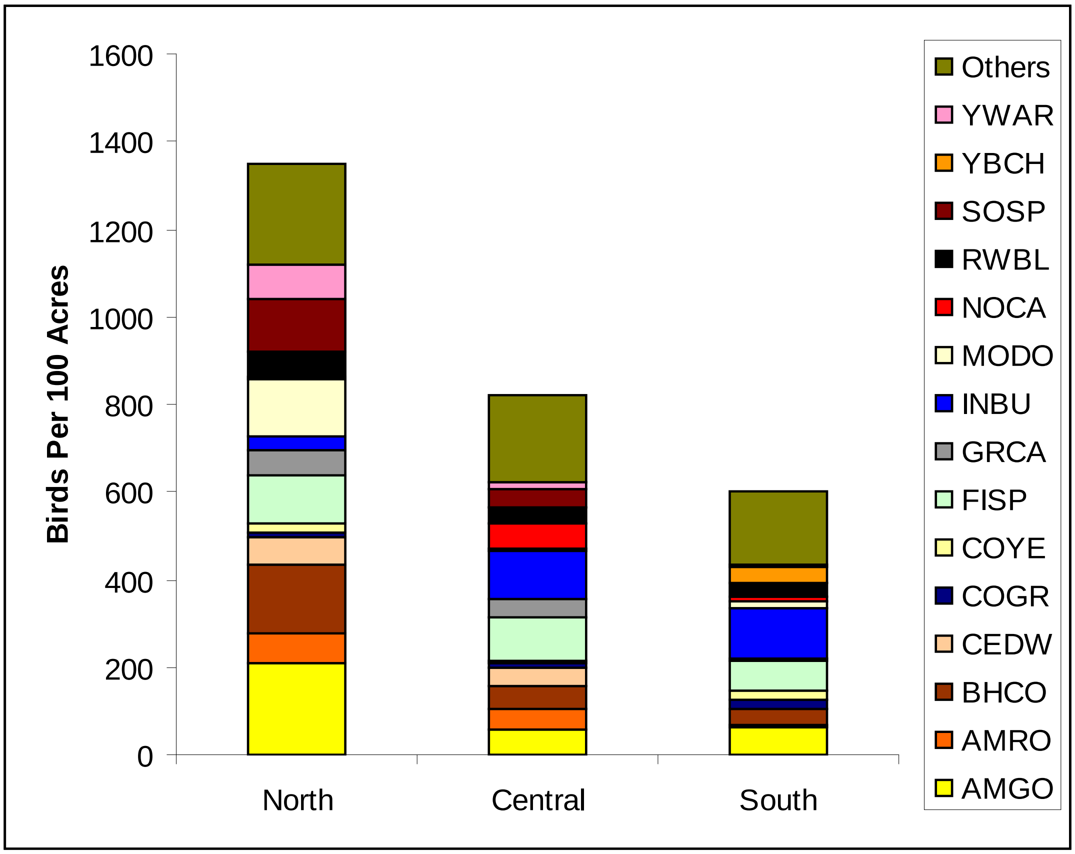


Fig. 4.10. Densities, by region, of the 15 most important species observed in shrubland habitats in Illinois, 2006-2008. Twenty-two species represented 85% of all birds observed. One transect in northern Illinois, where 41 common grackles were encountered, is excluded from this graph.

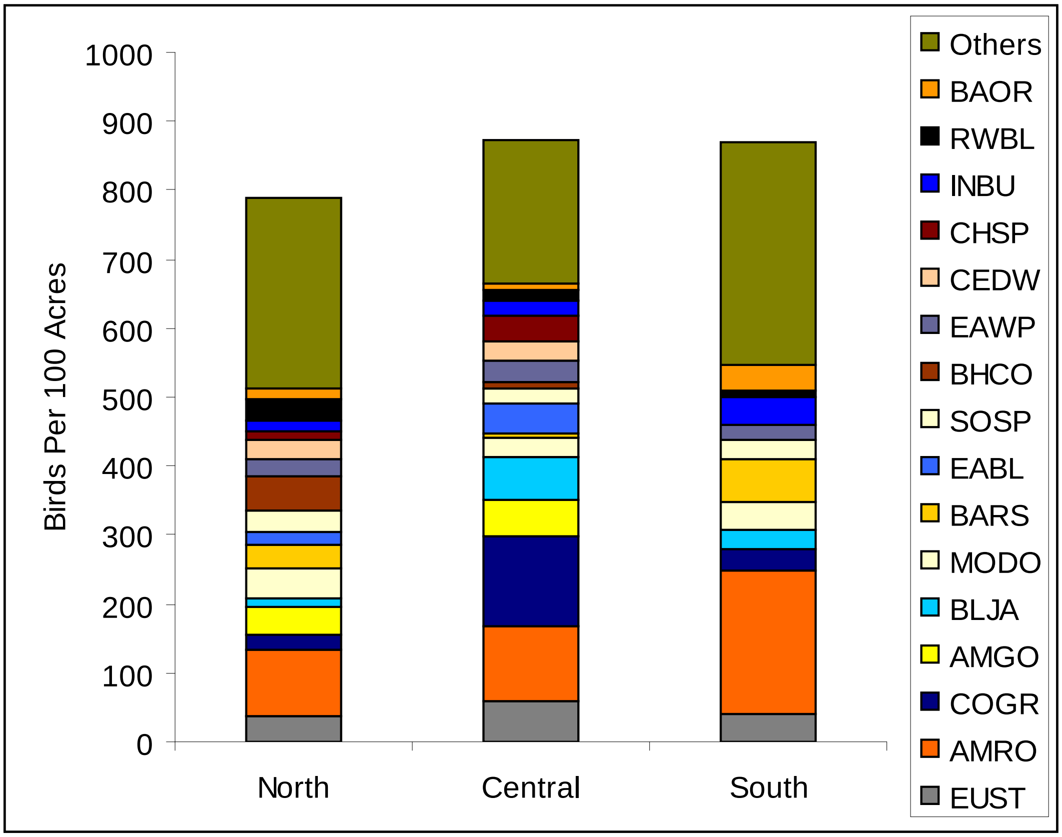


Fig. 4.11. Densities of the 16 most important species observed in savanna-open woodland in the three regions of Illinois during 2006-2008 surveys. Twenty-six species represented 85% of all birds observed. A flock of 64 European starlings encountered in southern Illinois is excluded from this graph.

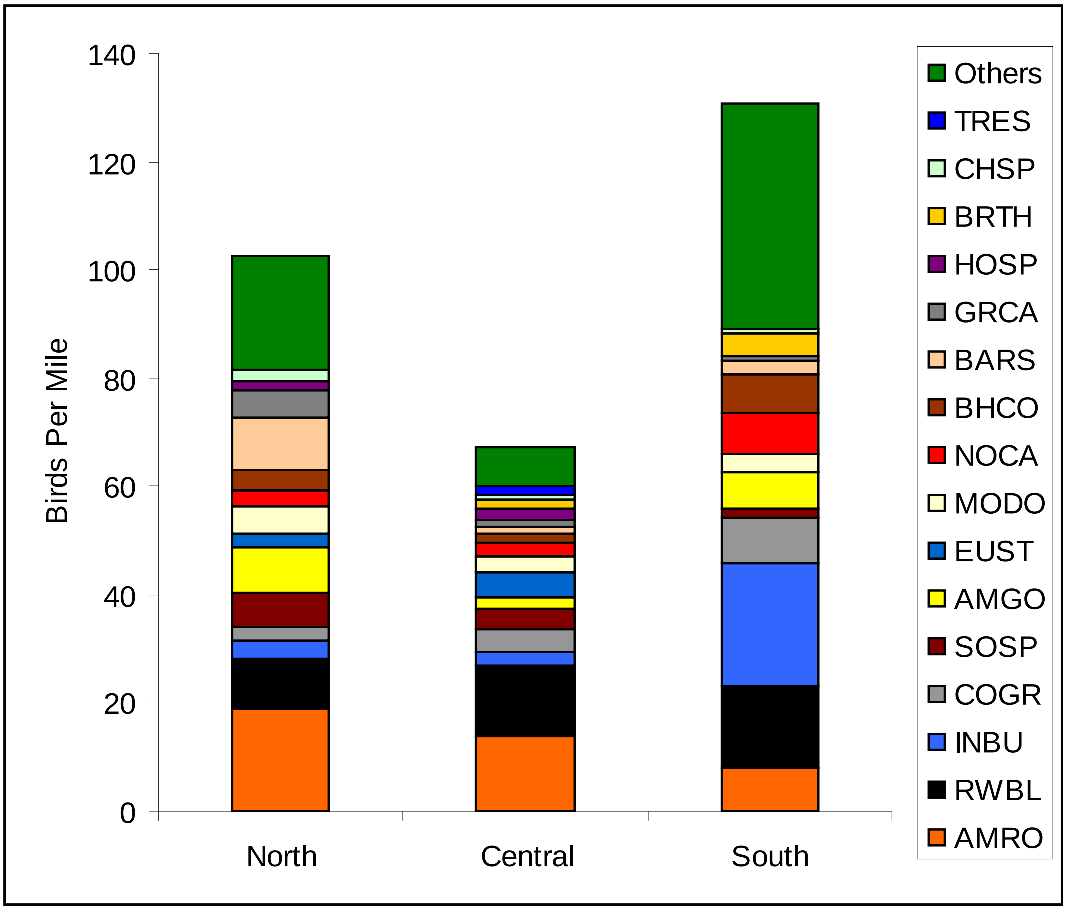
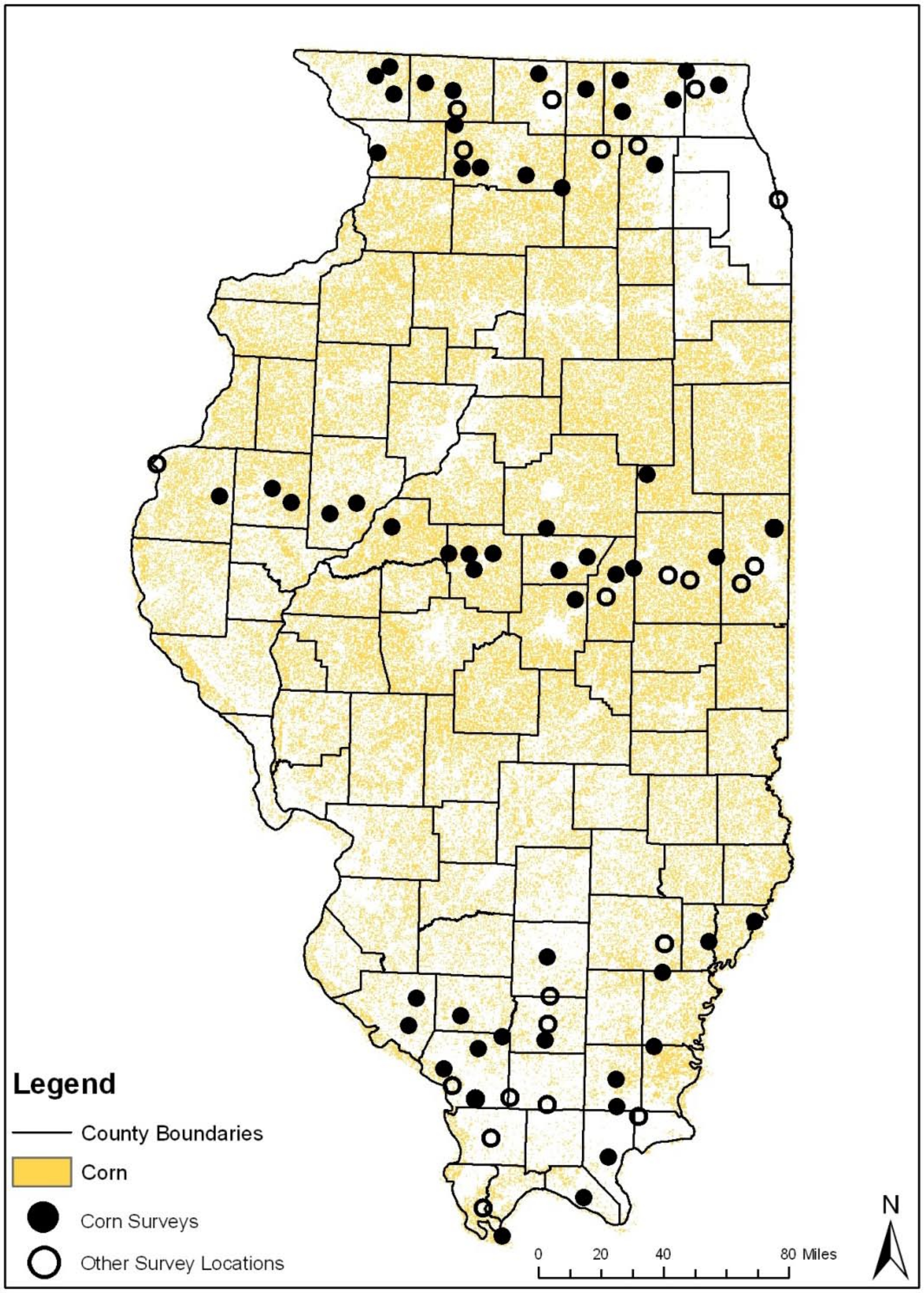


Fig. 4.12. Densities of the 16 most important bird species observed in linear wooded habitats in the three regions of Illinois in 2006-2008. Eighteen species represented 85% of all birds observed.

CORN



CORN
11.3-13.2 million acres
About 33% of Illinois

Fig. 4.13. Distribution of corn in Illinois during the most recent survey period.

Corn has been the dominant land cover of Illinois for about 140 years. Graber and Graber thought the characteristics of corn as bird habitat had changed little from the 1900s to the 1950s, but since the 1950s changes have been dramatic (Fig. 4.14A-C). Corn has become a taller, denser, and less weedy habitat. The median planting date of corn has advanced by 3 weeks since the 1950s to about April 20th, and by May 20th 99% of corn plantings are complete. “Knee-high by the Fourth of July,” the old adage for monitoring a mid-summer corn crop, no longer applies. Graber and Graber primarily sampled corn that was shorter than 24 inches, whereas we mostly sampled corn that was 24 to 60 inches tall. We had difficulty locating fields less than shoulder-height by late June in the south and early July in the north. Additionally, rows of corn have narrowed from about 40 inches wide to 30 inches wide today with nearly 28,000 plants/acre. Nowadays, corn fields typically have very few live weeds, and the areas between rows are characterized by variable amounts of bare soil, previous year crop residues, and dead weeds and grasses killed by pre-emergence or post-emergence applications of herbicides. As a result of significant advances in corn genetics, changing cultural practices, and intensive inputs, the average corn yield in the 2000s is 163-179 bushels/acre in compared to 35-39 bushels/acre in 1906-1908 and 64-69 bushels/acre in 1956-1958. Table 4.16 provides data on survey effort in corn during the three time periods.

A B C

Fig. 4.14. From left to right these three photographs were taken in corn fields in June 1907, 1963, and 2008. Gross and Ray did not take any pictures of corn fields per se, but they captured this image of a field near Wapello, IL while attempting to photograph a skunk. The 1963 picture was taken in Champaign County, and the 2008 picture was taken near Ina, IL.

Table 4.16. Summary of survey effort in corn during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	352	616	116
Central	1225	618	128
South	984	258	115
Sites surveyed			
North	8	24	17
Central	17	21	18
South	27	18	19

Graber and Graber regarded corn as the poorest bird habitat in the state, and our surveys corroborate this finding. Nine species now constitute 85% of all birds observed in corn, compared to 11 species in the 1950s, and 21 species in the 1900s (Table 4.17), emphasizing the relative reduction in diversity and increase in homogeneity of the bird community since the 1900s. This simplification of the bird community is further supported by the decrease in total number of species seen in corn over the past 100 years. Horned larks and killdeer are the only birds commonly seen in corn that nest there; the other bird species were found foraging in corn fields or flying over them. Excluding two flocks of European starlings, we observed little regional variation in bird densities in corn during the 2006-2008 surveys (Fig. 4.15).

Several grassland and shrubland birds, such as northern flickers, brown thrashers and meadowlarks, were commonly observed in corn a century ago but are rarely found there now. A century ago, corn fields were relatively small and weedy, most were enclosed by fences and shrubby hedgerows and most were near pastures and hayfields. These characteristics made corn a more suitable habitat for these bird species in Illinois during previous time periods. Today the reverse is true: corn fields are large and clean of weeds, few are bordered by shrubby hedgerows, few are near pastures or hayfields, and, consequently, grassland and shrubland birds are scarce throughout the state.

Table 4.17. Relative abundance of birds (% of all birds recorded in a specific time period) observed in corn in Illinois, 1907-1909, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s		1950s		2000s	
Species	%	Species	%	Species	%
Common grackle	**15.3**	**Horned lark**	**40.4**	**European starling (A)**	**19.4**
Horned lark	**9.8**	**Common grackle**	**9.8**	**Horned lark**	**18.8**
House sparrow	**9.2**	**House sparrow**	**7.1**	**Red-winged blackbird**	**15.8**
Mourning dove	**8.7**	**Red-winged blackbird**	**6.6**	**Common grackle**	**8.5**
Killdeer	**3.9**	**European starling**	**4.0**	**Barn swallow**	**6.7**
Meadowlarks	**3.8**	**Meadowlarks**	**4.0**	**Brown-headed cowbird**	**5.5**
Brown-headed cowbird	**3.4**	**Mourning dove**	**3.8**	**American robin**	**4.9**
American crow	**3.3**	**Barn swallow**	**2.7**	**Killdeer**	**3.3**
Red-winged blackbird	**3.2**	**Brown-headed cowbird**	**2.6**	**House sparrow**	**3.0**
American robin	**3.1**	**Killdeer**	**2.5**	Mourning dove	2.7
Brown thrasher	**3.1**	**Vesper sparrow**	**2.1**	Indigo bunting	1.9
Northern flicker	**2.9**	American robin	1.4	Dickcissel	0.9
Eastern kingbird	**2.2**	Dickcissel	1.0	Meadowlarks (B)	0.7
Red-headed woodpecker	**2.2**	American goldfinch	1.0	Song sparrow	0.7
American goldfinch	**1.8**	Field sparrow	0.7	American goldfinch	0.7
Vesper sparrow	**1.8**	American crow	0.7	Chipping sparrow	0.7
Lark sparrow	**1.8**	Ring-necked pheasant	0.7	N. rough-winged swallow	0.7
Northern mockingbird	**1.8**	Chimney swift	0.6	Field sparrow	0.6
Loggerhead shrike	**1.7**	Northern flicker	0.6		
Eastern bluebird	**1.5**	Upland sandpiper	0.6		
Field sparrow	**1.2**	Indigo bunting	0.5		
Indigo bunting	1.1	Brown thrasher	0.5		
Upland sandpiper	1.1	Eastern kingbird	0.5		
Blue jay	1.1	Bobolink	0.5		
American kestrel	1.0	Northern bobwhite	0.3		
Chimney swift	0.7	Loggerhead shrike	0.3		
Gray catbird	0.7				
Dickcissel	0.6				
Northern bobwhite	0.6				
Common yellowthroat	0.6				
Purple martin	0.5				
Northern cardinal	0.5				
Orchard oriole	0.4				
Barn swallow	0.3				
Eastern towhee	0.3				
Number of birds	*1255*		*1024*		*670*
Number of species	*60*		*44*		*37*

A: Two large flocks of starlings recorded in the northern zone represented 17% of all birds tallied in corn.

B: Only eastern meadowlarks were encountered in corn in 2006-2008.

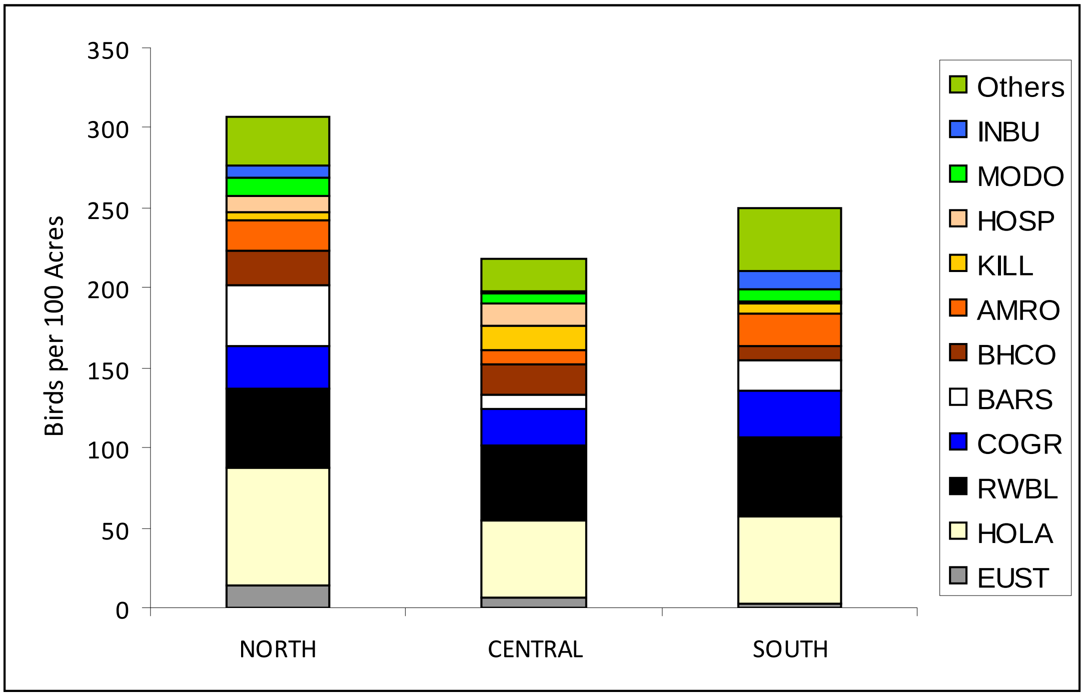
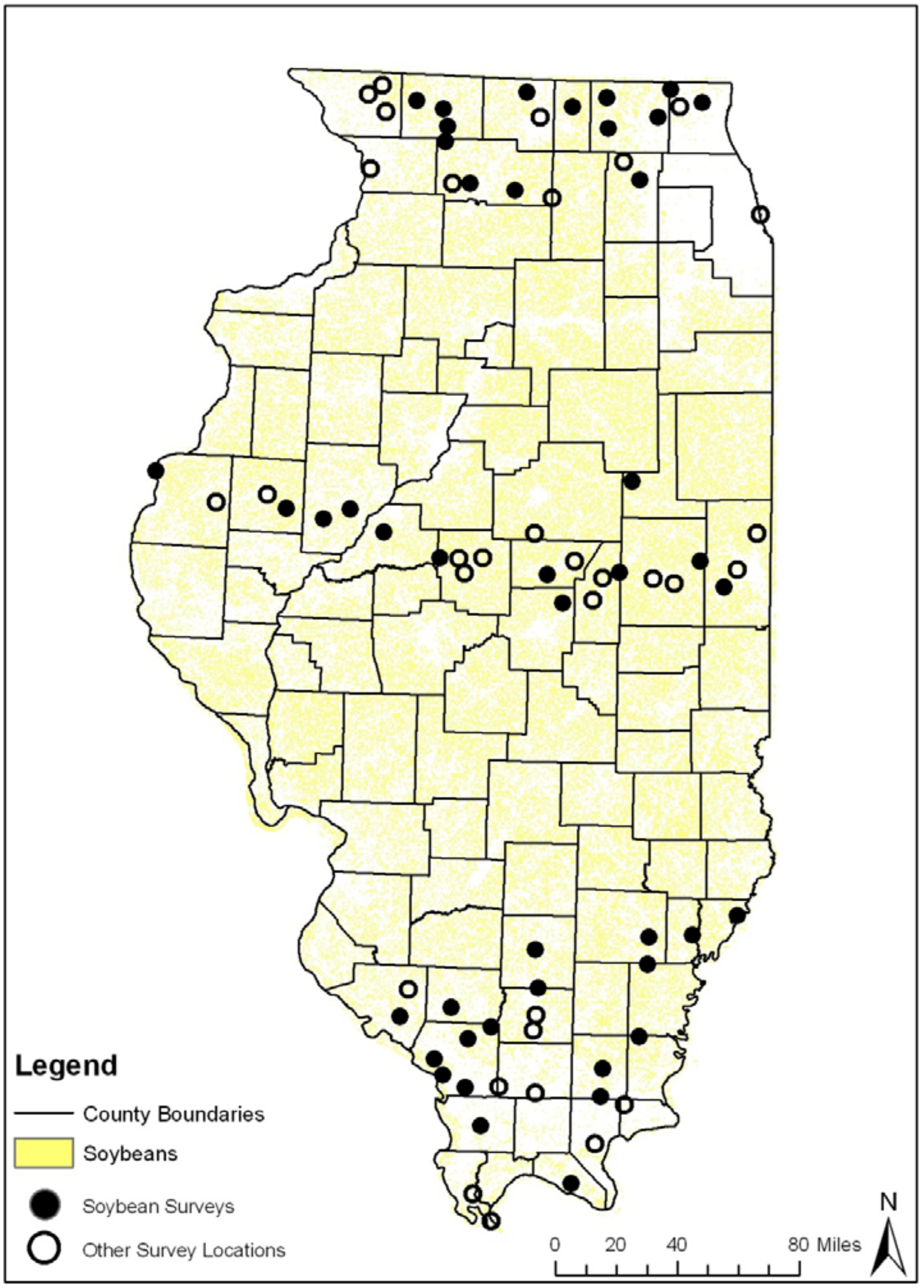


Fig. 4.15. Densities, by region, of the most important bird species observed on transects through corn in Illinois during 2006-2008 surveys. Nine species represented 85% of all birds observed. Note: two large flocks of starlings recorded in the northern zone represented 17% of all birds tallied in corn, and we excluded them from this graph.

SOYBEANS



8.3-10.1 million acres

About 26% of Illinois

Fig. 4.16. Distribution of soybeans in Illinois during the most recent survey period.

In the fields that we surveyed, soybeans varied from a few inches tall in late May to 18 inches or taller by early July. While the width of rows in some soybean fields is similar to that of corn (30 inches), most soybeans are now commonly drilled or planted in narrower (about 15-inch) rows. Crop residue (typically corn stubble) and dead weeds (killed by herbicides prior to or following planting) provide some additional structure in "no-till" soybean fields (Fig. 4.17A), whereas bare soil is the dominant feature of conventionally tilled soybeans early in the season (Fig. 4.17B). More than half of the state's soybeans are grown with no-till methods, and the practice is most prevalent in southern Illinois.

Figure 4.17. No-till (A) and tilled (B) soybean fields in 2006-2008.

Soybean was a very minor crop prior to 1920, but by 1954 it had expanded to about 4.0 million acres. The increase in soybean cover was reflected in the greater survey effort allocated to this crop type in the 1950s (Table 4.18). The increasing trend in soybean cultivation has continued to the present, with soybeans typically planted on 9.5 to 10.5 million acres over the past decade. The average soybean yield in Illinois was 44-48 bushels/acre in 2006-2008 compared to 25.5-28.5 bushels/acre in 1956-1958. The median date for soybean planting in Illinois is about May 15th, with planting virtually complete by June 20th. "Roundup Ready" soybeans, a genetically modified variety resistant to glyphosate (a herbicide sold under the trade name "Roundup" by Monsanto Corporation), became commercially available in 1996. This technology has been quickly adopted, and by 2003, 81% of the Illinois soybean crop was planted to herbicide-resistant varieties.

Table 4.18. Summary of survey effort in soybeans during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	0	188	125
Central	4	476	114
South	26	121	98
Sites surveyed			
North	0	10	17
Central	1	21	13
South	9	17	16

While soybeans host one of the least diverse bird communities in the state, we recorded more species in soybeans in the 2000s than in the 1950s (41 vs. 31; Table 4.19). Horned larks are the most common species in soybean fields, though their relative abundance in the 2000s is about one-half of what it was in the 1950s. Eleven species now comprise the most important species (again, totaling >85% of birds recorded), versus just 6 birds in the 1950s. In contrast to corn, where we observed almost no nesting birds, nests or young of horned larks, red-winged blackbirds, killdeer and dickcissels were observed several times in soybeans, suggesting that soybeans provide nesting habitat for some birds. The increases in species richness and the relative abundances of many species (e.g., red-winged blackbird, killdeer, brown-headed cowbird, European starling, dickcissel, and American robin) from the 1950s to the 2000s suggest that birds have adopted soybean fields as habitat. Furthermore, these changes indicate that the soybean bird community has become more diverse, unlike most other crop types, where bird communities have generally become simpler and more homogeneous.

Regional differences in the birds found in soybeans are partly related to species' ranges and cultivation practices (Fig. 4.18). Vesper sparrows, as expected, were densest in northern Illinois but absent in the south. No-till fields tended to host far greater proportions of dickcissels, meadowlark and grasshopper sparrows than more traditionally managed fields (Table 4.20).

Table 4.19. Relative abundance of birds (% of all birds recorded in a specific time period) observed in soybeans in Illinois, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed. Soybean survey effort was too small to allow a comparison with the 1900s.

1950s		2000s	
Species	%	Species	%
Horned lark	**55.5**	**Horned lark**	**24.3**
Common grackle	**7.4**	**Red-winged blackbird**	**17.3**
Mourning dove	**6.8**	**Killdeer**	**8.1**
House sparrow	**6.6**	**Brown-headed cowbird**	**6.5**
Red-winged blackbird	**5.2**	**Barn swallow**	**5.4**
Meadowlarks	**3.6**	**European starling**	**5.4**
Barn swallow	2.2	**Common grackle**	**4.8**
American goldfinch	2.2	**American robin**	**4.8**
Killdeer	1.6	**Mourning dove**	**3.3**
Vesper sparrow	0.8	**Dickcissel**	**3.0**
Indigo bunting	0.8	**Vesper sparrow**	**2.2**
Chimney swift	0.8	Meadowlarks (A)	2.1
European starling	0.6	House sparrow	1.8
American robin	0.6	American goldfinch	1.8
Dickcissel	0.6	Chipping sparrow	1.5
Lark sparrow	0.6	Indigo bunting	0.8
		Grasshopper sparrow	0.7
		Lark sparrow	0.5
		Field sparrow	0.5
		Savannah sparrow	0.5
		House finch	0.5
		Song sparrow	0.5
Number of birds	*501*		*757*
Number of species	*31*		*41*

A: Eastern meadowlarks outnumbered western meadowlarks 15 to 1; western meadowlarks were only found in soybeans in northern Illinois.

Table 4.20. Relative abundances of bird species (% of all birds recorded in a specific time period) seen in no-till and conventional tillage soybeans in 2006-2008.

2000s – No-Till		2000s – Till	
Species	**%**	**Species**	**%**
Red-winged blackbird	12.7	Horned Lark	34.2
American robin	10.7	Red-winged blackbird	16.3
Barn swallow	10.0	Killdeer	11.1
Horned Lark	10.0	Brown-headed cowbird	7.0
Common Grackle	7.3	Barn swallow	4.1
Dickcissel	7.3	Common Grackle	2.9
Killdeer	6.0	American robin	2.3
Mourning Dove	4.7	Mourning Dove	2.0
American goldfinch	4.0	Dickcissel	1.8
Brown-headed cowbird	4.0	Meadowlarks	1.4
Meadowlarks	4.0	American goldfinch	1.1
Grasshopper sparrow	3.3	Grasshopper sparrow	0
Field Sparrow	2.7	Field Sparrow	0
Others	13.3	Others	15.8

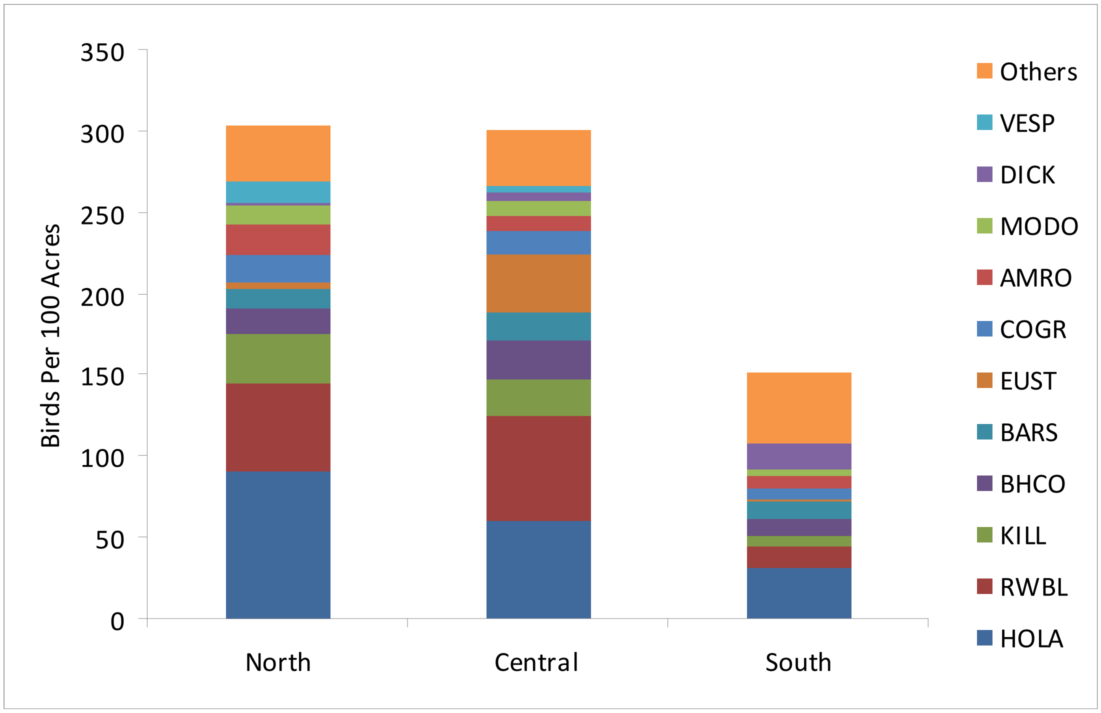
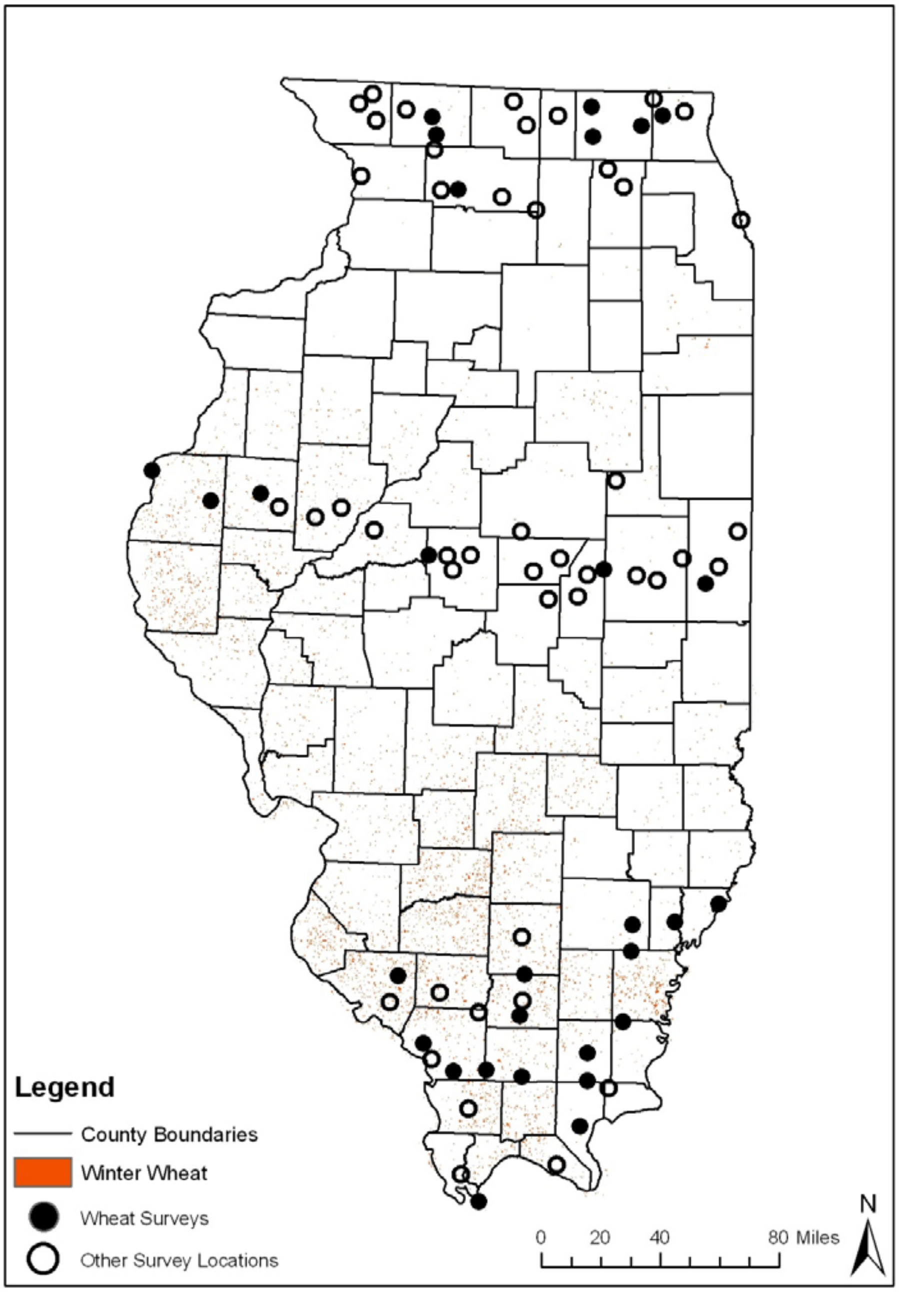


Fig. 4.18. Densities of the most important bird species observed in soybeans in northern, central, and southern Illinois in 2006-2008. Eleven species represented 85% of all birds observed.

WHEAT



890,000-1.2 million acres

About 3% of Illinois

Fig. 4.19. Distribution of wheat in Illinois during the most recent survey period.

During our surveys, wheat plants were 24-30 inches tall, headed out and beginning to ripen in southern Illinois by late May. Harvest in southern Illinois begins in mid-June and rapidly progresses northward. We sampled a few fields of wheat stubble after harvest, but none after double-cropping to soybeans, tillage or other alterations. Gross noted that about one-tenth of the fields they sampled in 1906-1909 were 'cut and shocked' (all in southern Illinois), and Graber and Graber described most wheat fields they surveyed in the 1950s as green or ripening, and few as stubble. Figure 2.20 shows a typical wheat field in the 1900s and 2000s, and Table 4.21 shows how survey effort in this crop type has changed over the past century.

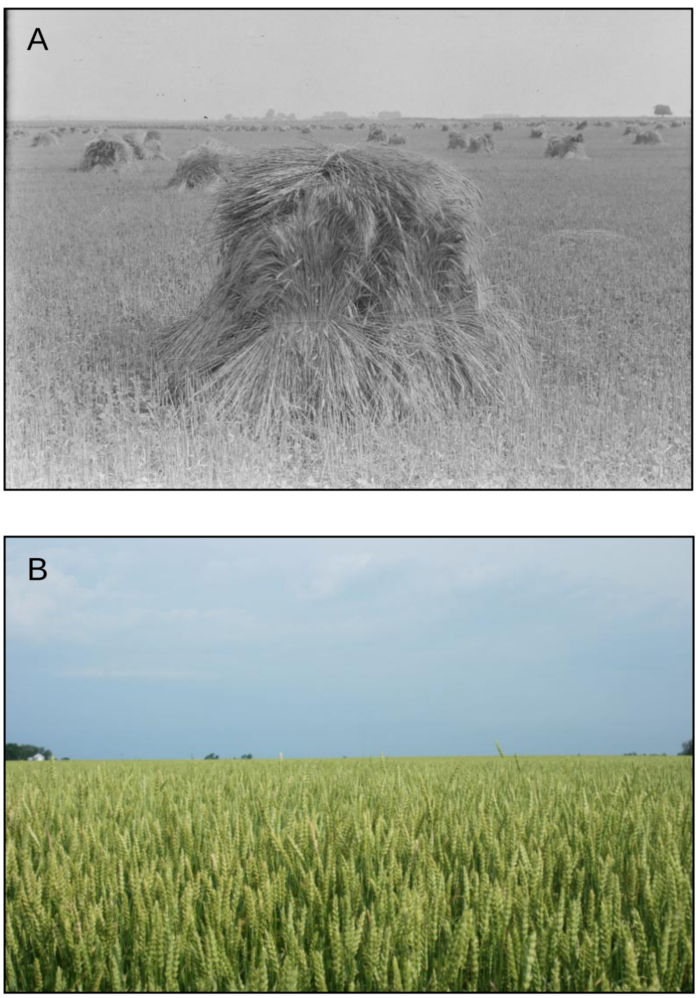


Fig. 4.20. Typical wheat field in the 1900s (A) and 2000s (B).

Table 4.21. Summary of survey effort in wheat during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	6	16	30
Central	168	69	36
South	387	214	83
Sites surveyed			
North	2	6	7
Central	12	14	9
South	26	16	15

Acreage of wheat in Illinois has varied greatly over time (see Fig. 3.1), and was probably about 2.0 million acres during the 1907-1909 surveys and 1.5 million acres during the 1957-1958 surveys. From 2004-2008, 630,000 to 1.2 million acres have been planted to wheat, with yields of 55-67 bushels/acre compared to 21-37.5 bushels/acre in 1956-1958. Red clover was commonly planted with wheat in previous decades, although this seldom occurs now. Rather, soybeans are often planted into wheat stubble in late-June or early July after harvest, particularly in years with adequate soil moisture and in southern Illinois, where there is a longer growing season for the soybeans to mature before frost. The timing of the wheat crop appears to have accelerated in recent decades with a far greater proportion of the statewide crop now harvested by early July (90% completed in Illinois by July 4th).

Modern wheat fields support only a sparse bird community, with red-winged blackbirds comprising more than 60% of all birds seen, nearly double their relative abundance in the bird community 50 years ago (Table 4.22). By contrast, house sparrows were the most common birds in wheat a century ago, and northern bobwhites, an important species that was observed in the 1900s, was not seen during our 2006-2008 surveys in wheat fields. The number of important species (totaling 85% of birds recorded) in 2006-2008 was only 8 species, compared to 10 species in the 1950s and 11 species in the 1900s. This slight decrease in the number of important species over time combined with the increasing relative abundance of red-winged blackbirds in the community suggest that the bird community is becoming simpler.

Red-winged blackbirds were the most commonly encountered bird in wheat in all three zones, although the species was less dense in northern Illinois (Fig. 4.21). House sparrows were densest in northern Illinois wheat, whereas the density of eastern meadowlarks and indigo buntings was greatest in the southern region of the state.

Table 4.22. Relative abundance of bird species (% of all birds recorded in a specific time period) observed in wheat in Illinois, 1907-1909, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s		1950s		2000s	
Species	%	Species	%	Species	%
House sparrow	**30.5**	**Red-winged blackbird**	**31.4**	**Red-winged blackbird**	**60.4**
Mourning dove	**16.2**	**Meadowlarks**	**10.4**	**Barn swallow**	**6.3**
Meadowlarks	**8.7**	**Mourning dove**	**9.7**	**House sparrow**	**4.8**
Red-winged blackbird	**6.1**	**Dickcissel**	**9.4**	**Common grackle**	**4.1**
Dickcissel	**5.8**	**Indigo bunting**	**7.1**	**Meadowlarks (A)**	**2.9**
Common grackle	**4.7**	**Common grackle**	**6.8**	**Mourning dove**	**2.3**
Horned lark	**4.3**	**Barn swallow**	**5.2**	**European starling**	**2.3**
Northern bobwhite	**3.2**	**Field sparrow**	**2.6**	**Indigo bunting**	**1.9**
Brown-headed cowbird	**2.8**	**House sparrow**	**2.3**	Dickcissel	1.6
Field sparrow	**1.9**	**Brown-headed cowbird**	**2.3**	Brown-headed cowbird	1.4
American crow	**1.5**	**N. rough-winged swallow**	**2.3**	N. rough-winged swallow	1.2
Red-headed woodpecker	**1.5**	European starling	1.9	Horned lark	1.1
Grasshopper sparrow	1.3	Chimney swift	1.6	Cliff swallow	1.1
Lark sparrow	1.1	Horned lark	1.3	American goldfinch	1.0
Indigo bunting	0.9	Gray catbird	1.0	American robin	1.0
American goldfinch	0.7			House finch	1.0
American robin	0.7			Field sparrow	0.7
Purple martin	0.6			Rock pigeon	0.7
Chimney swift	0.6				
Common yellowthroat	0.6				
Northern flicker	0.6				
Upland sandpiper	0.6				
Yellow-billed cuckoo	0.6				
Number of birds	*537*		*309*		*733*
Number of species	*37*		*23*		*36*

A. Only eastern meadowlarks were observed in wheat in 2006-2008.

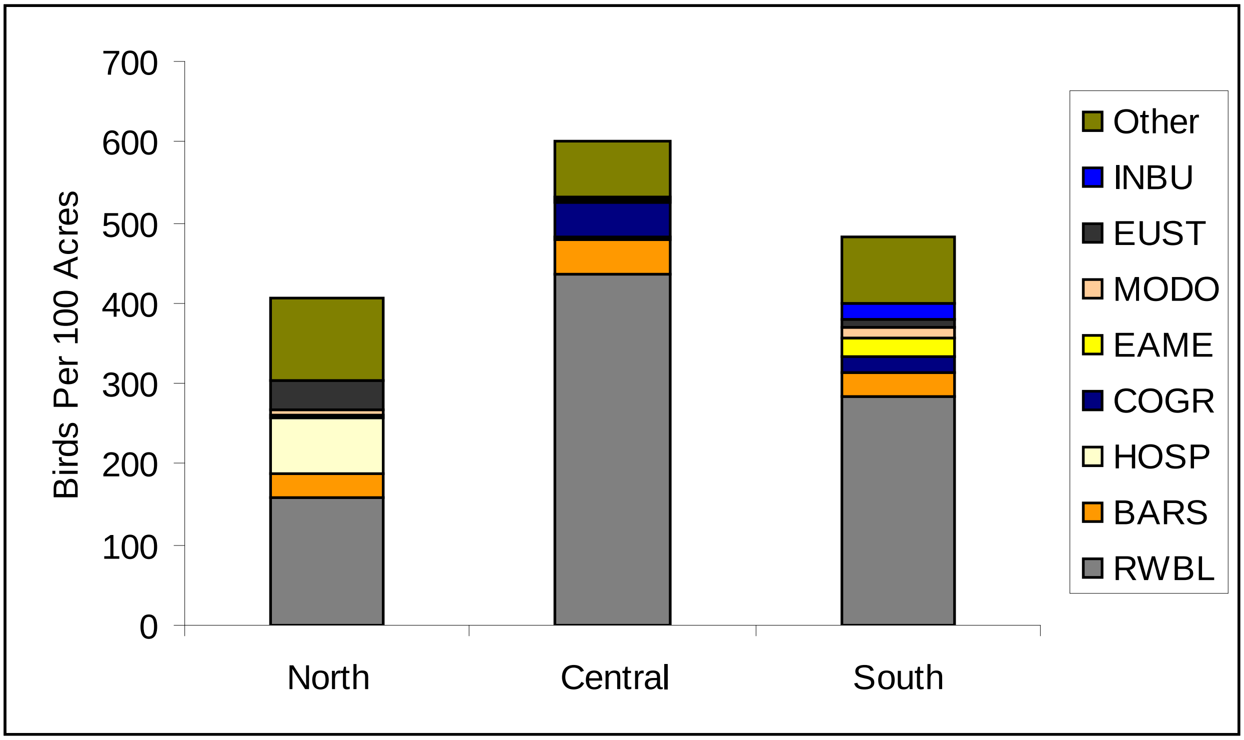
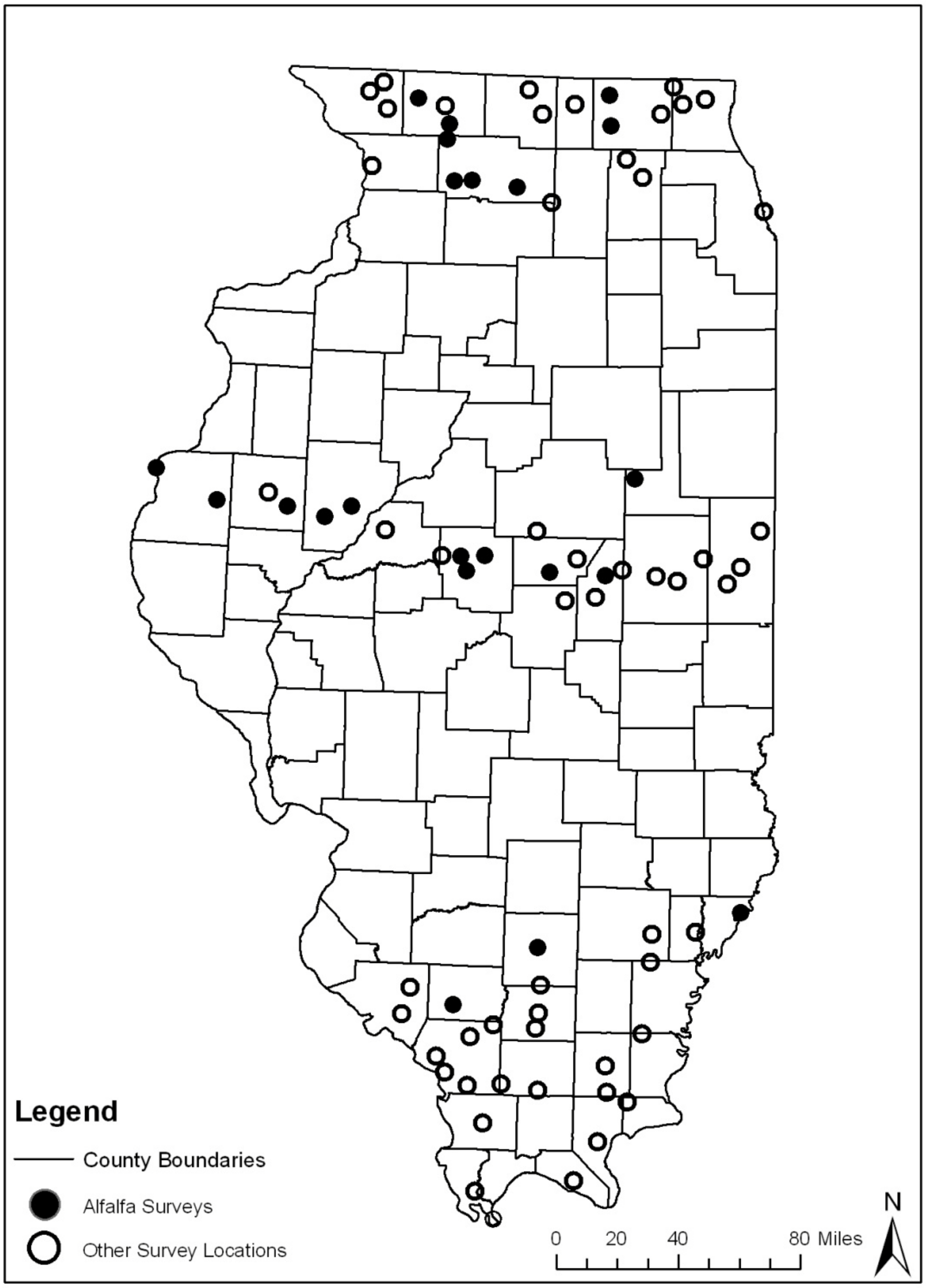


Fig. 4.21. Densities, by region, of the most important bird species observed in wheat in Illinois during the 2006-2008 survey period. Eight species represented 85% of all birds observed.

ALFALFA



370,000-430,000 acres

About 1% of Illinois

Fig. 4.22. Distribution of alfalfa in Illinois in 2006-2008.

Alfalfa is now a minor crop in Illinois, although it is the most common legume grown for hay in the state. More alfalfa fields occur in the northern and central zones than the southern zone. At maturity, alfalfa forms a dense cover roughly 18 to 24 inches tall, but immediately after harvesting it is reduced to 2-inch stubble. We sampled alfalfa fields at all stages of growth, although nearly all had been harvested at least once prior to our surveys. This section describes fields that were >80% dominated by alfalfa. Mixed hay fields of grasses and alfalfa or other legumes are considered in "Hayed & Mowed Grasslands" (pages 97-100). Too few alfalfa fields were sampled in the 1900s surveys to permit an assessment of their bird communities (Table 4.23).

Table 4.23. Summary of survey effort in alfalfa during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	2	138	57
Central	7	42	40
South	0	53	23
Sites surveyed			
North	2	20	10
Central	2	9	10
South	0	7	4

The acreage of alfalfa in Illinois increased from only 18,000 acres in 1909 to 1.4 million acres in 1957. Since the 1950s, alfalfa acreage has decreased to about 400,000 acres, although per-acre yield has increased to about 4.2 tons/acre in 2006 (compared to 2.3 tons/acre in 1957). Modern cultivars of alfalfa allow early and frequent cuttings. Median date of first cuttings of alfalfa is about May 25th, compared to mid-June as observed by Graber and Graber (1963), and more than two-thirds of alfalfa has been cut twice by the 2nd week of July. Third, and occasionally fourth, cuttings are made into late summer and early fall.

Because of early and frequent cuttings, alfalfa and other legume hay crops are widely regarded as "ecological traps." Some birds, including ring-necked pheasants, dickcissels and bobolinks, are attracted to these lush fields early in the season and attempt to nest in them. Haying operations destroy virtually 100% of the eggs and young, however, as well as many adult birds. The intervals between the initial harvest of alfalfa and subsequent cuttings is generally too short for birds to recolonize the field, build replacement nests, lay and incubate eggs, and raise their young (Warner and Etter 1989, Bollinger et al. 1990, Warner 1994).

Red-winged blackbirds made up more than one-half of all the birds recorded in alfalfa fields during the latest surveys, and its relative abundance in the bird community was twice as large in the 2000s than in the 1950s. On the other hand, the relative abundance of meadowlarks, horned larks and bobolinks in alfalfa was far less in the 2000s compared to the 1950s. The overall number of species seen (29-30 species) and the number of most important species (8-9 species) were similar among the two time periods in alfalfa. Nevertheless, the increasing dominance of red-winged blackbirds combined with the decreasing relative abundance of these other bird species indicate that the alfalfa bird community is becoming simpler and more homogeneous (Table 4.24). Notably, we did not find any upland sandpipers in alfalfa in 2006-2008 (Table 4.24).

The density of the most important bird species varied by region (Fig 4.23). Dickcissels were denser in alfalfa fields in central and southern Illinois than in the north, whereas savannah sparrows were densest in the northern region (Fig. 4.23). Although red-winged blackbirds were common throughout the state, they reached their highest density in the central region.

Table 4.24. Relative abundance of bird species (% of all birds recorded in a specific time period) seen in alfalfa in Illinois, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed. Too few alfalfa fields were surveyed in the 1900s to permit a summary of the bird community during that time period.

1950s		2000s	
Species	%	Species	%
Red-winged blackbird	**23.3**	**Red-winged blackbird**	**56.3**
Meadowlarks	**17.5**	**Dickcissel**	**7.0**
Horned lark	**11.1**	**Barn swallow**	**5.2**
Bobolink	**10.4**	**European starling**	**5.1**
Dickcissel	**6.0**	**Common grackle**	**4.2**
Barn swallow	**5.3**	**Savannah sparrow**	**3.5**
House sparrow	**5.1**	**Meadowlarks (A)**	**3.0**
European starling	**4.4**	**Mourning dove**	**2.1**
Grasshopper sparrow	**3.7**	American robin	1.7
Mourning dove	1.9	Bobolink	1.4
Vesper sparrow	1.5	House sparrow	1.4
Common grackle	1.0	Horned lark	1.2
Upland sandpiper	1.0	American goldfinch	1.2
Savannah sparrow	0.7	Indigo bunting	0.9
Indigo bunting	0.5	Chipping sparrow	0.9
Brown-headed cowbird	0.5		
Ring-necked pheasant	0.5		
American robin	0.3		
Northern bobwhite	0.3		
Number of birds	*587*		*572*
Number of species	*30*		*29*

A. Eastern meadowlarks outnumbered western meadowlarks 7.5 to 1; western meadowlarks were only found in alfalfa in the northern zone.

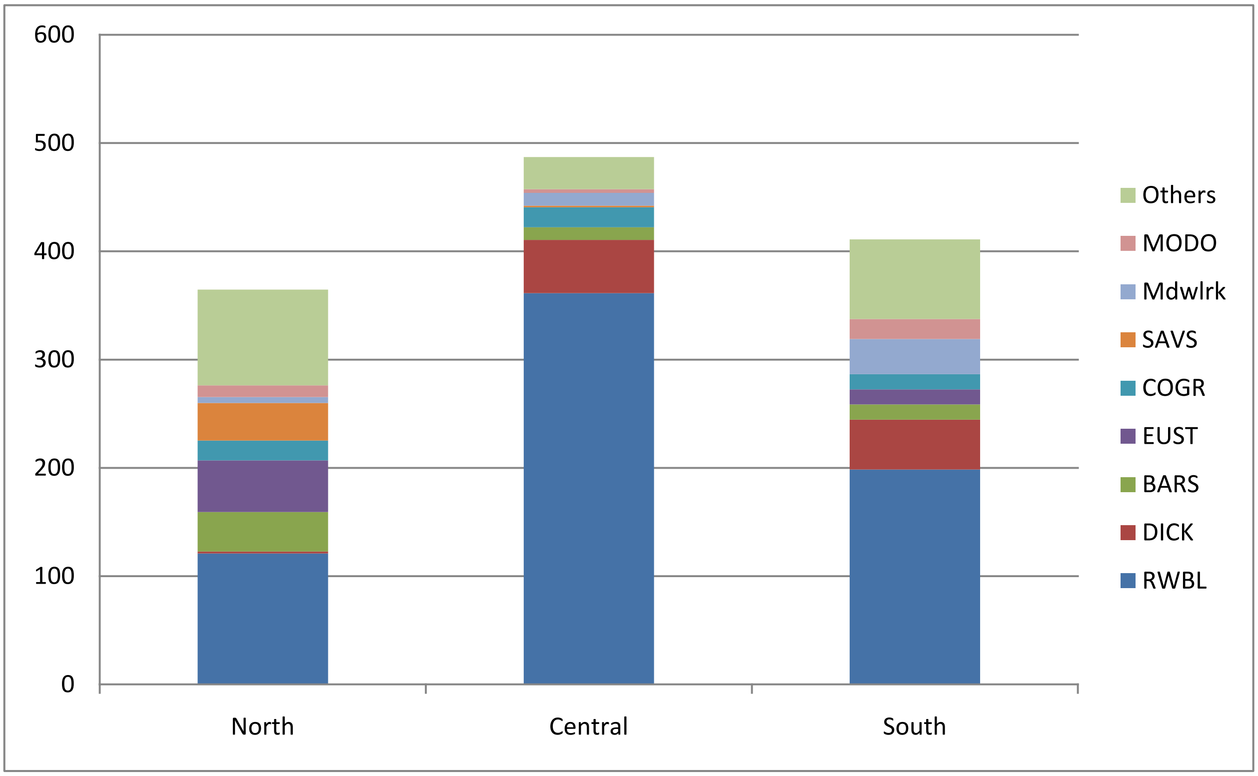


Fig. 4.23. Densities, by region, of the most important species seen in alfalfa in Illinois, 2006-2008. Eight species represented 85% of all birds observed.

OATS

Oats are most common in northern Illinois, but they have become a minor crop in all regions of the state. An estimated 4.3 million acres of oats were planted in 1907; this area declined to 2.8 million acres in 1957 and to 35,000 acres in 2007. This decline in acreage of oats is reflected in the declining number of acres surveyed in oats since the 1900s (Table 4.25). In late May and early June, plants are about 18 inches tall and headed out, and they are ripened by early July. Scattered weeds are common in oats, and oats were a nurse crop for alfalfa in many of the fields we sampled.

Table 4.25. Summary of survey effort in oats during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	241	169	33
Central	597	129	23
South	183	10	0
Sites surveyed			
North	8	19	5
Central	16	18	2
South	19	4	0

Though we sampled considerably less oats than did Graber and Graber or Gross and Ray, we recorded more individual birds (Table 4.25). Almost all of these were red-winged blackbirds and European starlings, often in large flocks suggesting post-nesting concentrations. We found a few bobolinks in these large blackbird flocks, but otherwise there was no indication bobolinks nesting in oat fields or that contemporary oat fields are important bobolink habitat, as were oat fields in the 1950s. House sparrow, which was the most abundant species in the bird community in oat fields in the 1900s, was much less abundant in the 1950s and especially the 2000s. Meadowlarks, dickcissels, horned larks and several other species also declined in abundance from the 1900s to the 2000s. Overall, the total number of species seen in oats decreased from 44 to 21 over the past century. This decrease was mirrored by a decline in the number of most important species from 17 in the 1900s, to 7 in the 1950s, and finally to 2 in the 2000s. The decrease in species richness, decline in relative abundance of many bird species, and the increase in dominance of red-winged blackbirds and European starlings has resulted in a much simpler and more homogeneous bird community.

Because of the small number of oat fields available to us, we did not consider regional variation in the birds found in this crop type. Red-winged blackbird, however, was the most common bird in every field we sampled.

Table 4.12. Relative abundance of birds (% of all birds recorded in a specific time period) observed in oats in Illinois, 1907-1909, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s		1950s		2000s	
Species	**%**	**Species**	**%**	**Species**	**%**
House sparrow	**16.4**	**Red-winged blackbird**	**38.0**	**Red-winged blackbird**	**80.9**
Common grackle	**11.9**	**Bobolink**	**17.8**	**European starling**	**4.9**
Meadowlark	**10.6**	**House sparrow**	**12.8**	Dickcissel	2.9
Dickcissel	**8.8**	**Meadowlark**	**5.4**	Barn swallow	2.8
Red-winged blackbird	**7.3**	**Dickcissel**	**5.0**	Common grackle	2.4
Horned lark	**5.6**	**Common grackle**	**3.3**	House sparrow	0.9
Mourning dove	**5.1**	**Horned lark**	**3.1**	Cliff swallow	0.7
American crow	**2.8**	Ring-necked pheasant	2.1		
Brown-headed cowbird	**2.7**	American goldfinch	2.1		
Northern bobwhite	**2.5**	Barn swallow	1.6		
Grasshopper sparrow	**2.3**	European starling	1.2		
Northern flicker	**2.0**	Mourning dove	0.8		
American goldfinch	**1.7**	American robin	0.6		
Eastern kingbird	**1.7**	Killdeer	0.6		
Bobolink	**1.5**	Northern flicker	0.6		
Brown thrasher	**1.5**				
Indigo bunting	**1.0**				
American robin	0.8				
Field sparrow	0.8				
Barn swallow	0.7				
Chimney swift	0.7				
Gray catbird	0.7				
Lark sparrow	0.7				
Loggerhead shrike	0.7				
Red-headed woodpecker	0.7				
Song sparrow	0.7				
Savannah sparrow	0.5				
Killdeer	0.5				
Vesper sparrow	0.5				
Blue jay	0.5				
Common yellowthroat	0.5				
Upland sandpiper	0.3				
Eastern bluebird	0.3				
Eastern phoebe	0.3				
Number of birds	*603*		*516*		*680*
Number of species	*44*		*28*		*21*

UNPLANTED CROPLAND

This category includes fields that were cultivated cropland the previous year but not yet cultivated or planted in the year when the bird surveys were done. The fields were either bare soil or crop stubble, with highly variable growth of annual and biennial plants. The vast majority of these fields occurred where weather-related delays had prevented planting and spring cultivation prior to our surveys. Construction was scheduled, but had not yet started, on a few of the unplanted/fallow areas that we surveyed near cities. A field of mare's tail and ragweed near Freeport was razed the same day as our survey and converted into a large retail outlet center within a few months. Very little of this habitat, in patches more than a few square yards, likely 'survives' through the entire growing season uncultivated, unmowed or unsprayed. Patches of annual weed habitat probably were more common during the late spring and early summer survey periods in 1906-1909 and 1957-1958, because corn and soybean planting did not occur as early as it does today. Figures 4.24 A and B show unplanted croplands in the 1900s and 2000s.

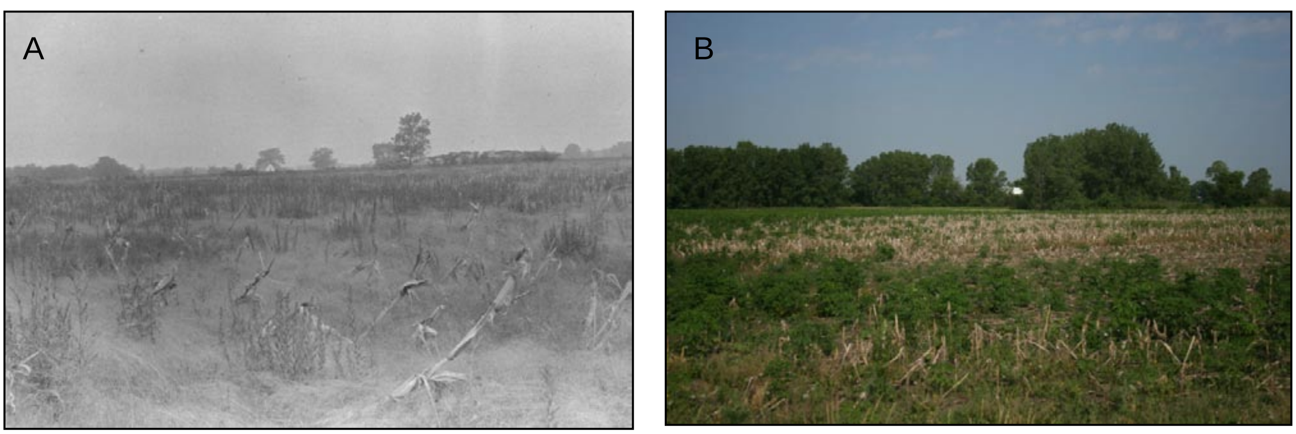


Fig. 4.24. Unplanted cropland in the 1900s (A) and 2000s (B).

The most analogous habitat to unplanted cropland considered by Graber and Graber (1963) is “plowed field.” Unplanted cropland is distinct from “fallow fields” defined by Graber and Graber (1963) as “having been cultivated and then unused for a year or longer” and described as having a dense cover of grasses and weeds and scattered small shrubs. Depending on the age and composition of these ‘old fields,’ we would have classified them as idle grasslands or shrub areas. Table 4.27 shows how survey effort in unplanted cropland has changed from the 1900s to 2000s.

Table 4.27. Summary of survey effort in unplanted cropland during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	3.5	20	29
Central	16	28	7.8
South	131	141	12
Sites surveyed			
North	3	5	5
Central	4	9	2
South	21	16	3

Unplanted cropland and plowed fields are an imperfect comparison. Graber and Graber (1963) remarked on the “total lack of cover” in plowed fields, with horned larks, killdeer, brown-headed cowbirds and mourning doves being among the most common birds reported in these fields in the 1950s (Table 4.28). Annual weeds in some of the unplanted fields we surveyed attracted concentrations of dickcissels and grasshopper sparrows. Both the vegetation structure and bird community of unplanted fields in 2006-2008 suggest a blending of cropland and grassland habitats.

Whereas other crop types are generally characterized by a simplification and homogenization of the bird community over time, unplanted croplands show relatively little reduction in the number of most important species over the past century, and the total number of species seen in this habitat may have increased. The ranking of species based on their relative abundance appears to have changed substantially over time, suggesting that the compositional nature of the bird community in this habitat has been quite dynamic. Although due to possible differences in the definition of unplanted cropland among the time periods, any patterns in the bird community need to be interpreted with caution.

Table 4.28. Relative abundance of bird species (% of all birds recorded in a specific time period) seen in unplanted fields in Illinois, 1907-1909, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s		1950s		2000s	
Species	%	Species	%	Species	%
Brown-headed cowbird	**14.5**	**Horned lark**	**31.8**	**Red-winged blackbird**	**24.8**
Mourning dove	**12.7**	**Red-winged blackbird**	**19.5**	**European starling**	**17.9**
Horned lark	**12.0**	**Killdeer**	**8.2**	**Barn swallow**	**8.1**
House sparrow	**9.6**	**Mourning dove**	**7.2**	**American goldfinch**	**7.2**
Common grackle	**7.8**	**Brown-headed cowbird**	**5.6**	**Brown-headed cowbird**	**4.6**
American robin	**6.0**	**Brewer's blackbird**	**5.1**	**American robin**	**4.6**
Brown thrasher	**4.2**	**Meadowlarks**	**3.6**	**Indigo bunting**	**3.6**
Vesper sparrow	**3.6**	**Common grackle**	**2.6**	**Grasshopper sparrow**	**3.6**
Field sparrow	**3.0**	**American crow**	**2.6**	**Dickcissel**	**3.3**
Killdeer	**3.0**	Eastern kingbird	2.1	**Horned lark**	**2.9**
Chimney swift	**2.4**	Lark sparrow	2.1	**Field sparrow**	**2.3**
Eastern kingbird	**2.4**	Indigo bunting	1.5	**Meadowlarks (A)**	**2.0**
Eastern bluebird	**2.4**	American robin	1.0	Mourning dove	1.6
Red-headed woodpecker	**2.4**	Dickcissel	1.0	Common grackle	1.6
Indigo bunting	1.8	Yellow-headed blackbird	1.0	Vesper sparrow	1.6
Lark sparrow	1.8	American goldfinch	0.5	Savannah sparrow	1.6
Bewick's wren	1.8	Field sparrow	0.5	Chimney swift	1.0
Loggerhead shrike	1.8	Vesper sparrow	0.5	Killdeer	0.7
Northern mockingbird	1.8	Northern flicker	0.5	Northern flicker	0.7
Meadowlarks	1.2			Chipping sparrow	0.7
				Mallard	0.7
				Sandhill crane	0.7
				Song sparrow	0.7
				Tree swallow	0.7
Number of birds	*166*		*195*		*307*
Number of species	*26*		*23*		*34*

A. Only eastern meadowlarks were encountered in unplanted fields.

OTHER AGRICULTURE

Orchard Crops

Only about 8,000 acres of orchard crops are estimated to remain in the state compared to about 31,000 acres in 1957 and 300,000 acres in 1909. Most orchards in Illinois are found in the southern region where they produce apples and peaches. We also sampled one section of an orchard growing blueberries. Vineyards are an increasing crop in Illinois, though we did not sample any. Changes in survey effort in orchards over the past 100 years are shown in Table 4.29.

Table 4.29. Summary of survey effort in orchards during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	0.1	2	22
Central	6.4	36	7.9
South	48	78	36
Sites surveyed			
North	1	2	4
Central	8	1	2
South	20	8	6

In the 2000s, the trees in orchards are heavily pruned, typically reach less than 10 feet tall, and are planted in evenly spaced rows. Tall fescue, which is kept mowed, is the normal ground cover. A variety of pesticides are applied to many orchards to improve yield and fruit quality.

American robins, European starlings and common grackles were the bird species most often seen in orchards during the 2000s surveys (Table 4.30). We saw no house sparrows, which were the most common birds found in orchards during the 1900s and 1950s surveys. Otherwise, the birds found in orchards are similar to those observed in residential or low-density developed areas. The relative abundances of several “shrub-nesting” birds, including mourning dove, field sparrow, brown thrasher, northern mockingbird and orchard oriole, appear to have decreased across successive time intervals. Overall, the bird communities in orchards have become less diverse, with a lower total number of species and fewer “most important species” (Table 4.30). Changes in the bird community of orchards likely reflect the yard-like, manicured appearance of modern orchards (Fig. 4.25B) compared to the more natural character of orchards in the past (Fig. 4.25A).

Fig. 4.25. Photographs of orchards in the 1900s (A) and 2000s (B), illustrating the changes in their understory structure over the past 100 years.

Table 4.30. Relative abundance of bird species (% of all birds recorded in a specific time period) observed in orchards in Illinois, 1907-1909, 1957-1958 and 2006-2008. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s		1950s		2000s	
Species	%	Species	%	Species	%
House sparrow	**19.8**	**House sparrow**	**14.3**	**American robin**	**26.3**
Field sparrow	**8.2**	**Common grackle**	**10.5**	**European starling**	**25.6**
Mourning dove	**7.3**	**American goldfinch**	**10.5**	**Common grackle**	**10.5**
Orchard oriole	**5.8**	**Mourning dove**	**10.2**	**Red-winged blackbird**	**8.3**
American robin	**5.5**	**European starling**	**6.4**	**Mourning dove**	**3.8**
Common grackle	**4.3**	**Red-winged blackbird**	**6.1**	**American goldfinch**	**3.0**
Gray catbird	**3.7**	**Field sparrow**	**6.1**	**Northern cardinal**	**3.0**
Brown thrasher	**3.7**	**Northern cardinal**	**4.0**	**Indigo bunting**	**3.0**
Blue jay	**3.7**	**Indigo bunting**	**3.8**	**Chipping sparrow**	**3.0**
House wren	**3.4**	**Barn swallow**	**2.8**	Field sparrow	2.3
Northern flicker	**2.7**	**Brown thrasher**	**2.3**	Brown-headed cowbird	2.3
Meadowlark	**2.4**	**American robin**	**2.1**	Barn swallow	1.5
Northern mockingbird	**2.4**	**Meadowlark**	**1.5**	Gray catbird	1.5
Bewick's wren	**2.1**	**Chimney swift**	**1.5**	Cedar waxwing	1.5
American crow	**2.1**	**Blue jay**	**1.2**		
Northern cardinal	**1.8**	**Northern bobwhite**	**1.2**		
Indigo bunting	**1.8**	**Dickcissel**	**1.2**		
Tufted titmouse	**1.8**	**Yellow-breasted chat**	**1.2**		
Northern bobwhite	**1.5**	Gray catbird	1.0		
Loggerhead shrike	**1.2**	Song sparrow	1.0		
American goldfinch	0.9	Common nighthawk	1.0		
Common yellowthroat	0.9	Eastern phoebe	1.0		
Eastern kingbird	0.9	Brown-headed cowbird	0.8		
Eastern towhee	0.9	Common yellowthroat	0.8		
Yellow-billed cuckoo	0.9	Eastern kingbird	0.8		
Chickadee	0.9	Eastern towhee	0.8		
Carolina wren	0.9	Ring-necked pheasant	0.8		
Red-headed woodpecker	0.9	Chipping sparrow	0.5		
Yellow warbler	0.9	Northern mockingbird	0.5		
Chipping sparrow	0.6	Bewick's wren	0.5		
Baltimore oriole	0.6	Yellow-billed cuckoo	0.5		
Great-crested flycatcher	0.6				
Number of birds	*328*		*387*		*133*
Number of species	*44*		*37*		*20*

Other Legumes

We sampled a single field of red clover in southern Illinois. Of the 54 birds recorded, 38 were red-winged blackbirds. Dickcissels, eastern meadowlarks, common grackles and grasshopper sparrows were also present.

In the past, red clover and sweet clover were important legume crops. Sweet clover is an abundant plant that is considered invasive in grasslands and is no longer grown as a crop. Red clover was commonly found in fields mixed with various grasses, and most of these fields were harvested for hay. See "*Hayed & Mowed Grasslands*" for a description of the birds in this land cover type.

Other Small Grains

We sampled two fields of rye, and while it is impractical to draw conclusions from such a small sample of a scarce land cover type, the birds we found in these fields were not substantially different from the birds seen in oats or wheat (i.e., they were dominated by red-winged blackbirds).

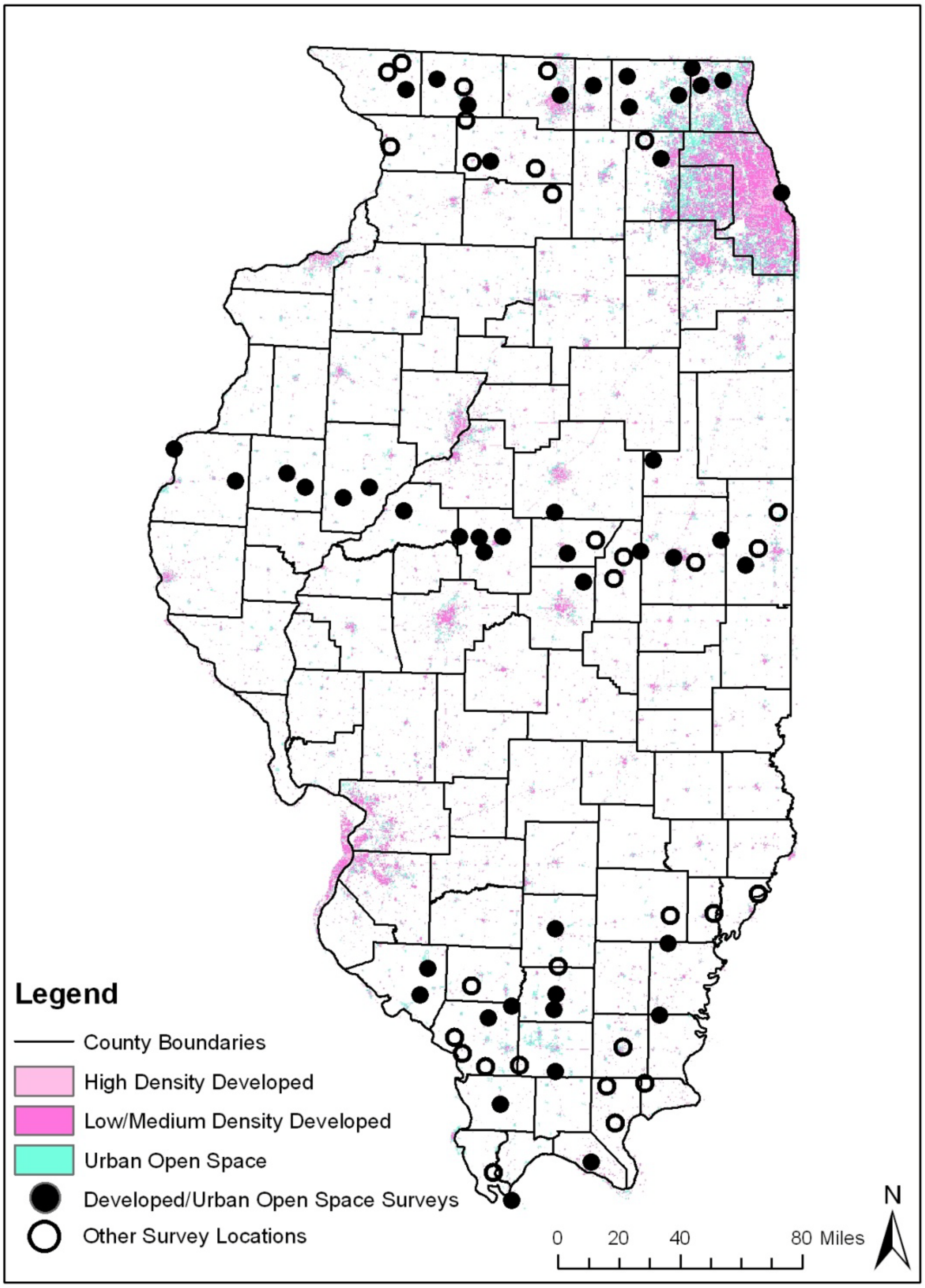
Barley and rye are no longer crops of any importance in the state; the National Agricultural Statistics Service has no information on recent acreage of barley in the state, and in 1999 only 7,000 acres of rye was harvested. However, 40,000 acres were planted to rye during the time of the most recent bird survey; the most common uses of rye today are for soil improvement and quickly establishing erosion control.

<u>Other Field Crops</u>

About 75,000 to 80,000 acres of sorghum are grown in southern Illinois for grain and silage. In late spring and early summer, fields of sorghum appear very similar to corn, both in vegetation structure and in bird use.

Potatoes, green beans, green peppers, sunflower and sod were encountered during our surveys. From our limited samples, birds in these areas were similar to other croplands, dominated by common, generalist species.

DEVELOPED AREAS



2.3 million acres
About 9% of Illinois

Fig. 4.26. Distribution of developed areas in Illinois in 2006-2008.

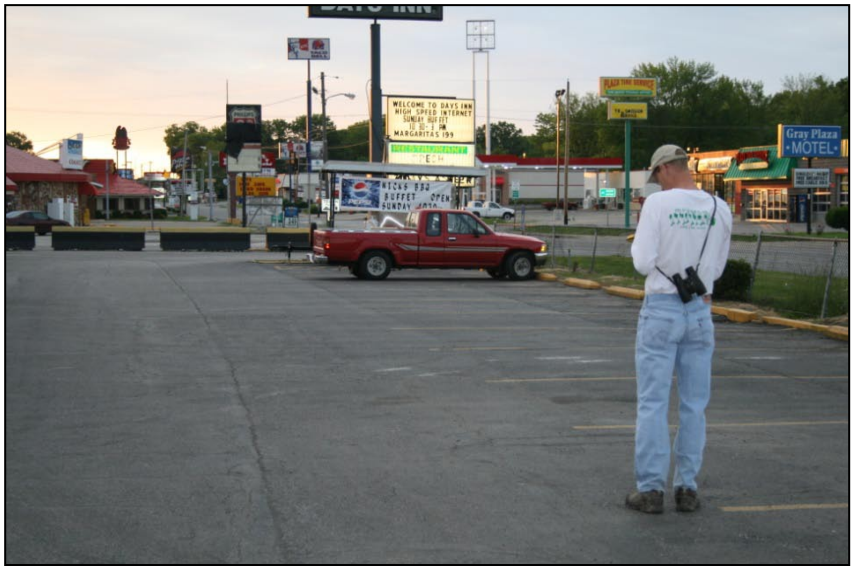
The dominant feature of developed areas is human-built structures and infrastructure, such as buildings, roads and bridges. Developed areas typically have a high proportion of impervious surfaces (concrete or pavement) and landscaping vegetation. Because developed areas are the most rapidly increasing land cover type in Illinois, we sampled three distinct types of development: high-density developed locations that are predominantly covered by structures of pavement, low-density developed areas with up to 50% coverage by structures, and developed open spaces such as parks, cemeteries, and golf courses. In the 1900s and 1950s surveys, habitats comparable to high-density developed and developed open space were not sampled (Table 4.31).

Table 4.31. Summary of survey effort in developed areas during the three survey periods.

	Time Period				
Zone	**1900s – Low-density**	**1950s – Low-density**	**2000s - High-density**	**2000s - Low-density**	**2000s - Open space**
Acres surveyed					
North	9	160	40	90	70
Central	6.2	75	29	71	58
South	20	98	42	81	47
Sites surveyed					
North	3	5	9	12	8
Central	4	2	7	10	9
South	8	3	8	9	8

High-density Developed Areas

High-density developed areas include downtown districts, industrial parks, commercial complexes and other areas covered almost entirely by buildings, utility lines and transportation infrastructure; they are unlike low-density urban areas where vegetation eventually becomes a dominant habitat feature. Buildings in high-density developed areas tend to be larger, taller, and



except for parking areas, more closely spaced than their counterparts in low-density developed areas.

The amount of high-density urban land cover, estimated at 616,000 acres in the 1999-2000 Land Cover of Illinois, continues to increase, although at a slower rate than low-density developments. In many cities, high-density downtown areas have seen a net loss of residents to suburban areas and a shift of commercial and retail activity to new complexes in suburban-type areas.

While the abundance of birds in high-density developed areas was high during the 2006-2008 surveys, species diversity was lower than in low-density and open-space developed areas. Just five species, European starling, chimney swift, house sparrow, common grackle, and rock pigeon, totaled 85% of all birds seen (Table 4.32), with very little difference in composition among northern, central, and southern Illinois (Fig. 4.27). Perhaps the most surprising bird was an adult bald eagle that flew over us in downtown Freeport, Illinois, in 2006. European starlings and common grackles reached their lowest densities in northern Illinois, and house sparrows were least dense in the south; otherwise regional differences in the bird community of high-density developed areas were minor. Overall, the bird communities in high-density developed areas were the least variable over time and space when compared to low-density and open-space developed areas.

Low-density Developed Areas

Low-density developed areas were characterized by up to 75% scattered buildings, roads, parking lots and other impervious surfaces and the balance in "green space" of highly manicured lawns, trees, shrubs and other landscaping. These areas are mostly residential, as were the developed areas surveyed by Graber and Graber. Mature neighborhoods had an open canopy of tall trees, whereas new developments were dominated by buildings and lawns with few or small trees.

Graber and Graber estimated 350,000 acres of urban residential area in 1907 and 820,000 acres in 1957. At present, low-density developed areas cover more than 1.0 million acres and are expanding rapidly. Between 1940 and 2002, the US Census Bureau documented a reduction in average household size from 3.7 to 2.6 people, while average home size more than doubled from 1,100 to 2,340 square feet. New residential areas typically

have much larger lots as well; thus, the amount of low-density developed area is increasing at a greater rate than population growth. Suburban development is most extensive and most rapid in the collar counties of Chicago in northeastern Illinois, but is also apparent on the edges of cities throughout Illinois.

Just seven species totaled 85% of all birds seen in low-density developed areas (Table 4.32). The relative abundance of house sparrows was much lower in the recent surveys compared to the 1900s and 1950s surveys. Unless it is an observer effect, the increase in the relative abundance of chimney swifts seems curious, given fewer buildings have chimneys than 50 or 100 years ago. House finches, which initially colonized Illinois in the 1980s, are now one of the most common birds in low-density developed areas. The common birds of low-density developed areas do not vary much among the regions of the state (Fig. 4.28).

Developed Open Space

Developed open space – parks, cemeteries, and golf courses – were mostly located within and on the edges of towns and cities. Developed open space is most similar to low-density developed areas, with deliberate plantings of trees, shrubs, and flowers, mowed lawns, some roads or paths, but few buildings. Many locations had a savanna-like character.

While specific data are not available, urban open space probably is increasing at a rate similar to low-density development, as green space is incorporated into suburban areas, and residents seek outdoor recreation opportunities. As of 2008, there were at least 770 golf courses in Illinois. Some of these are designed and managed for better compatibility with birds and other wildlife, including the use of native vegetation along fairways. Pesticides and herbicide use, however, can be fairly intense in some of these areas.

The birds seen in developed open areas were similar to those in low-density and high-density developed areas, with American robins, common grackles and European starling making up more than half the individual birds recorded (Table 4.32). American robins were less dense in the northern zone, and house sparrows were less dense in the south (Fig. 4.29). Both common grackles and European starlings reached peak densities in the southern zone.

Table 4.32. Relative abundance of birds (% of all birds recorded in a specific time period) observed in developed areas in Illinois, 1907-1909, 1957-1958 and 2006-2008. Open space and high-density development were not surveyed in the 1900s or 1950s. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s – Low-density		1950s – Low-density		2000s – High-density		2000s – Low-density		2000s – Open Space	
Species	%	Species	%	Species	%	Species	%	Species	%
House sparrow	**58.9**	**House sparrow**	**39.3**	**European starling**	**28.5**	**American robin**	**18.8**	**American robin**	**24.1**
American robin	**7.0**	**European starling**	**14.5**	**Chimney swift**	**24.2**	**European starling**	**17.4**	**Common grackle**	**17.6**
Brown thrasher	**4.2**	**Common grackle**	**12.5**	**House sparrow**	**17.0**	**House sparrow**	**14.3**	**European starling**	**13.6**
Orchard oriole	**3.3**	**American robin**	**12.4**	**Common grackle**	**9.5**	**Common grackle**	**13.3**	**House sparrow**	**6.2**
Common grackle	**2.8**	**Rock pigeon**	**5.7**	**Rock pigeon**	**7.3**	**Chimney swift**	**9.9**	**Chipping sparrow**	**4.7**
Purple martin	**2.8**	**Mourning dove**	**3.0**	American robin	3.4	**Mourning dove**	**8.0**	**Mourning dove**	**3.3**
Chipping sparrow	**2.3**	Purple martin	2.6	Mourning dove	2.5	**House finch**	**4.3**	**Red-winged blackbird**	**3.1**
Eastern kingbird	**1.9**	Blue jay	1.9	House finch	2.3	Chipping sparrow	2.7	**Chimney swift**	**2.8**
N. mockingbird	**1.9**	Chimney swift	1.7	Ring-billed gull	1.2	Northern cardinal	1.6	**Ring-billed gull**	**2.7**
Gray catbird	**1.9**	House wren	1.7			Cedar waxwing	1.3	**Brown-headed cowbird**	**2.4**
Northern flicker	**1.9**					Purple martin	1.2	**American goldfinch**	**2.0**
Blue jay	1.4					American goldfinch	1.0	**House finch**	**2.0**
Chimney swift	0.9					Brown-headed cowbird	0.9	**Cedar waxwing**	**1.8**
House wren	0.9					Barn swallow	0.9	**Barn swallow**	**1.8**
Bewick's wren	0.9							Rock pigeon	1.4
Yellow-billed cuckoo	0.9							Caspian tern	0.9
								American crow	0.7
								Purple martin	0.7
								Canada goose	0.7
								Northern cardinal	0.7

					Eastern bluebird	0.6
					Easter wood-pewee	0.6
					Tree swallow	0.6
Number of birds	*214*	*3165*	*1279*	*2773*		*1375*
Number of species	*28*	*27*	*29*	*43*		*48*

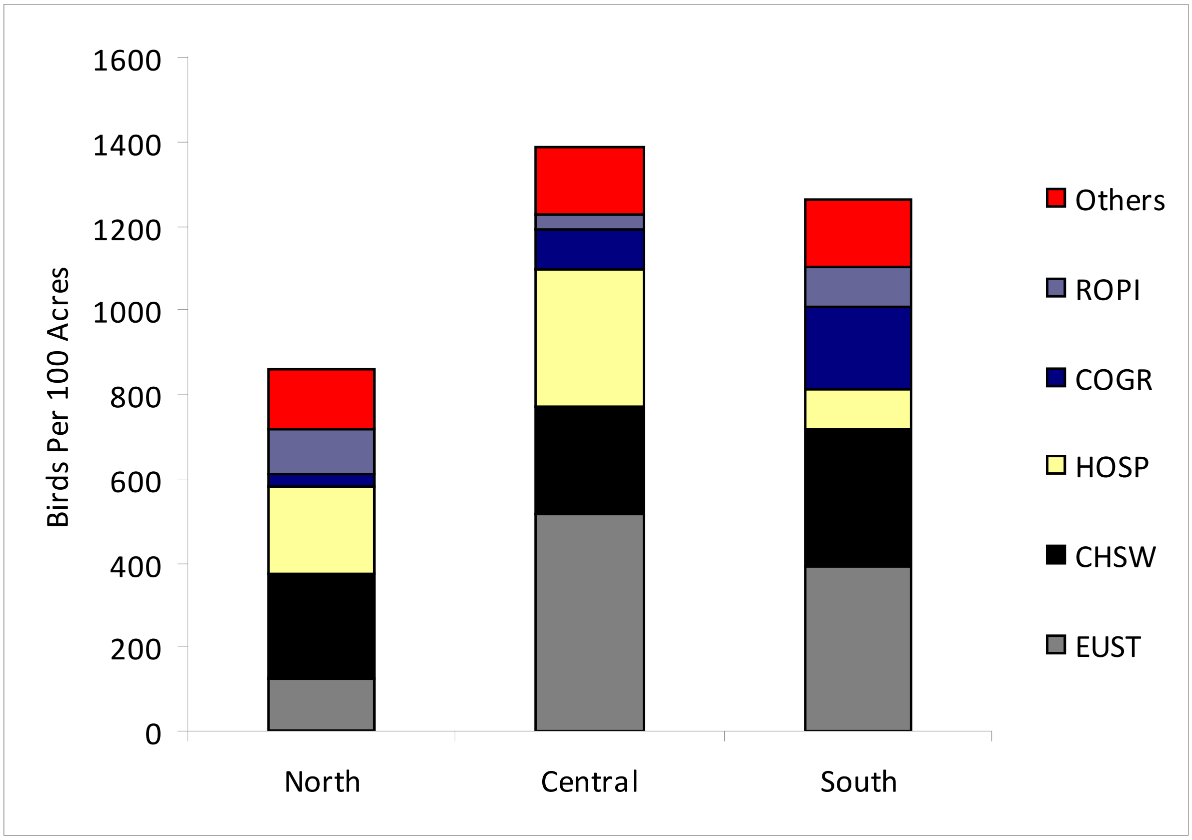


Fig. 4.27. Densities of the most important species observed in high-density developed areas in the three regions of Illinois, 2006-2008. Five species represented 85% of all birds observed.

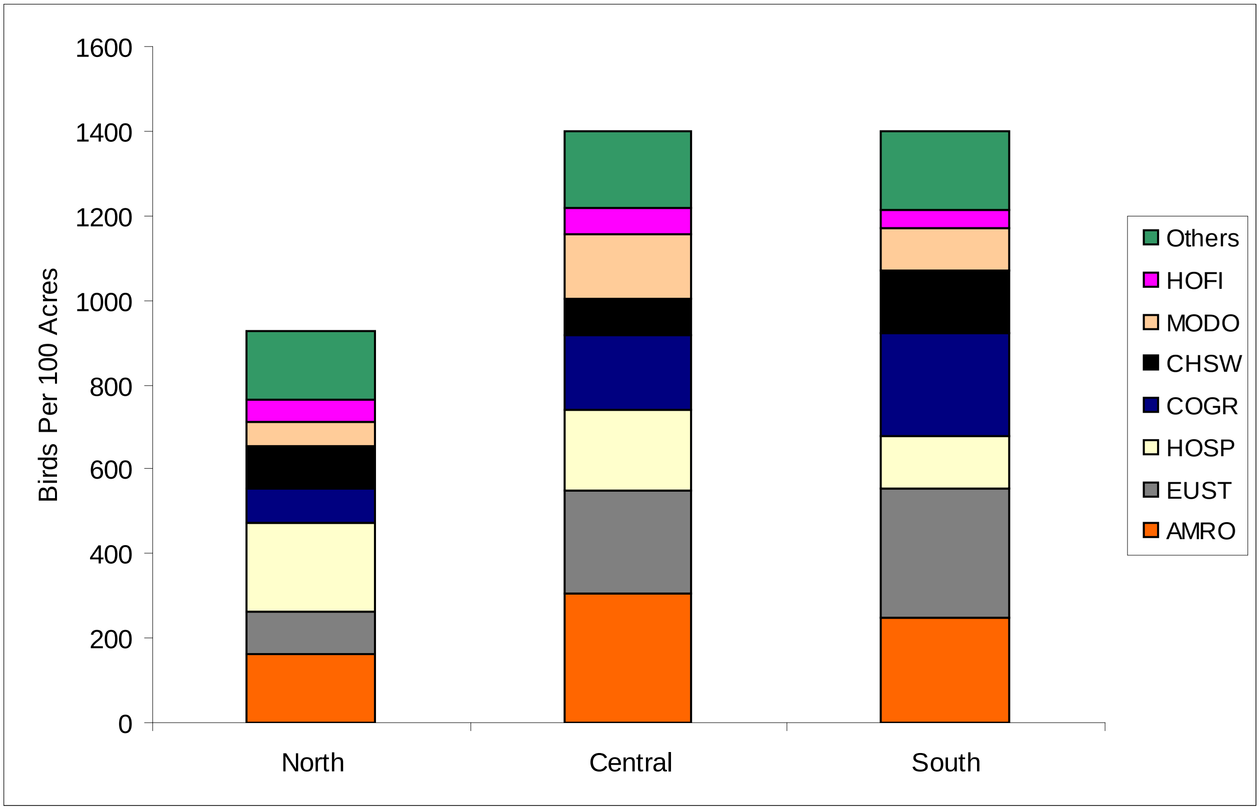


Fig. 4.28. Densities of the most important species observed in low-density developed areas in the three regions of Illinois, 2006-2008. Seven species represented 85% of all birds observed.

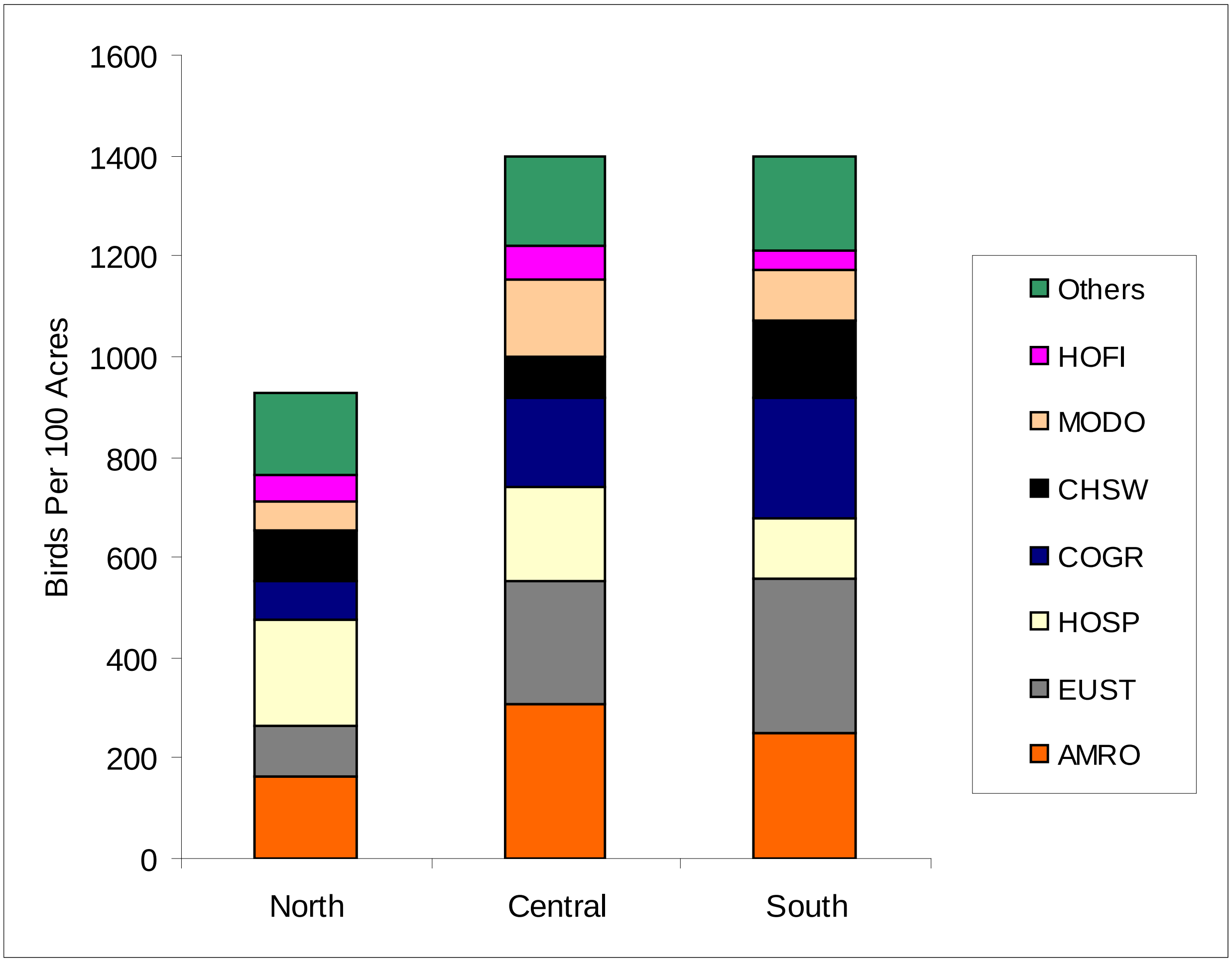
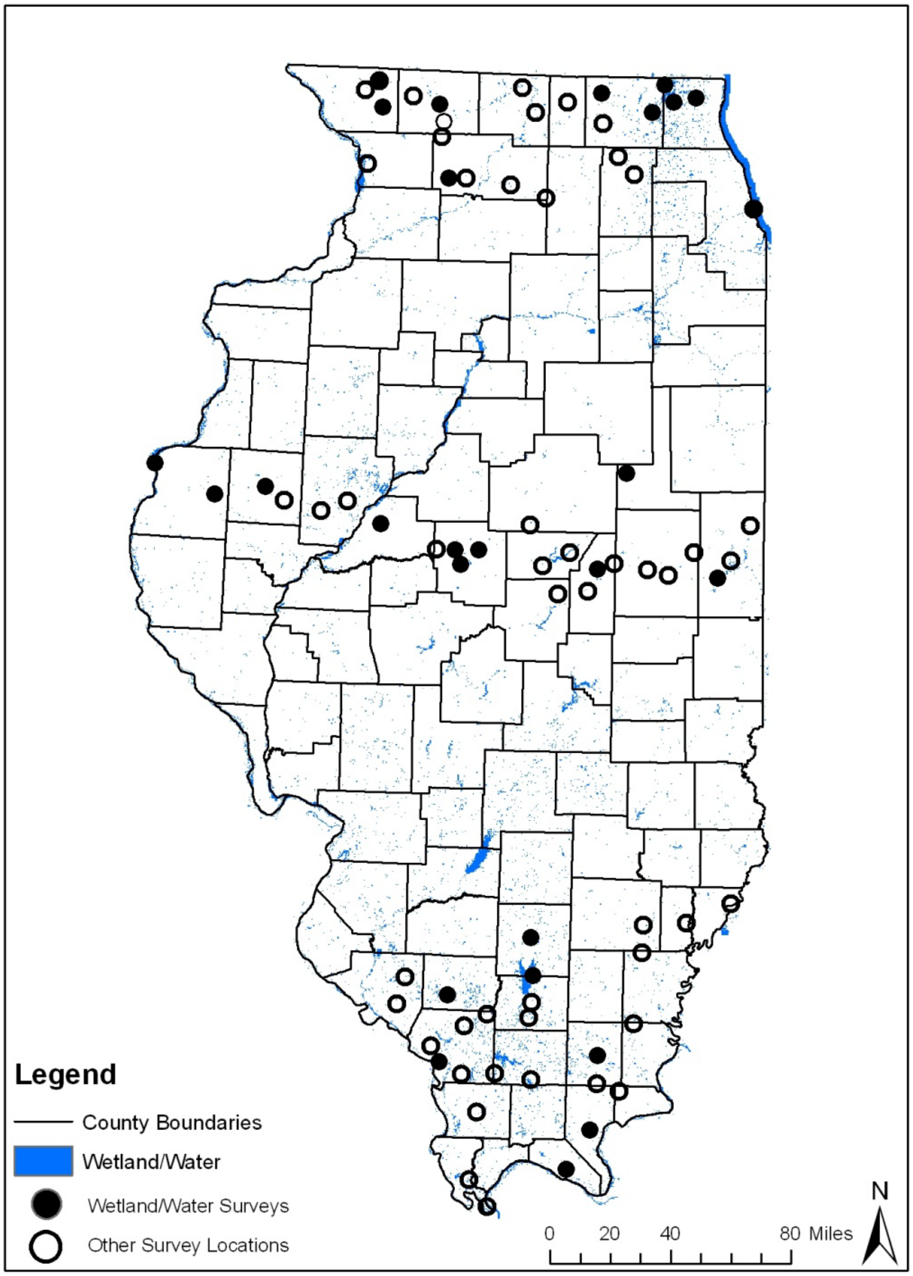


Fig 4.29. Densities, by region, of the most important species observed in developed open space in Illinois, 2006-2008. Fourteen species represented 85% of all birds observed.

MARSH and OPEN WATER



MARSH:
134,000 acres
About 0.3% of Illinois

OPEN WATER:
600,000 acres
About 2% of Illinois

Fig. 4.30. Distribution of wetlands and open water in Illinois during the most recent survey period.

<u>Marsh</u>

Marshes are characterized by hydric soils, emergent or moist soil plants, and intermittent to semi-permanent surface water, generally less than 3 feet deep. Because they are now so scarce, we included wet meadows, true marshes, and artificial wetlands managed for marsh-like, shallow water conditions. Wet meadows were near-monocultures of reed canary grass with some sedges in most areas. Emergent vegetation in natural and artificial marshes included cattails, rushes, and bulrushes, but also invasive reed canary grass and phragmites. Open water varied from near-zero in wet meadows to roughly 60% in some newly-created artificial marshes. If water depth, soil conditions, and vegetation allowed, we surveyed transects through wetlands. Many patches were small enough that we could enclose the entire wetland within a transect. At larger wetlands that were impractical to walk across due to vegetation density, water depth, or flocculent soil, we surveyed them from the perimeter.

While the 1999-2000 Land Cover of Illinois project estimated about 134,000 acres of shallow marsh/wet meadow and deep marsh in the state, the amount of this habitat has probably seen a net decrease since the 1950s, when Graber and Graber estimated just 60,000 acres of marsh in Illinois. The Grabers estimated 558,000 acres of marsh existed in Illinois in 1906. The survey effort in marshes over the past 100 years is shown in Table 4.33. Over the past 20 years, wetland mitigation, restoration and creation on public lands, and restoration on private lands through programs including the Wetlands Reserve Program and Conservation Reserve

Enhancement Program, may have resulted in a net increase in wetlands in Illinois. It is not clear what proportion of these created or enhanced wetlands are marsh-like, compared to forested wetlands and open water. Invasive plants, among them reed canary grass, phragmites and purple loosestrife, have significantly degraded the condition of marsh habitat in the state. Isolation, siltation, and altered hydrology are also important degrading factors.

Table 4.33. Summary of survey effort in marshes during the three survey periods.

	Time Period		
Zone	**1900s**	**1950s**	**2000s**
Acres surveyed			
North	6	6	8
Central	3	1	5
South	8	6	5
Sites surveyed			
North	19	89	33
Central	3.2	0.6	16
South	28	9.2	19

More than half of the birds seen in marshes were red-winged blackbirds (Table 4.34). The high relative abundances of three state-endangered species – black tern, little blue heron, and yellow-crowned night-heron – were caused by encounters of several birds of each species at single locations. Mallards and great blue herons were among the common wetland-dependent birds we recorded. Regional differences in bird communities and species densities also reflect the clumped distribution of some birds (Fig. 4.31), such as a large concentration of tree swallows encountered along the Mississippi River near Nauvoo in central Illinois.

<u>Open Water</u>

While this is a category for the open water of rivers, streams, ponds, reservoirs, lakes, and waste water treatment lagoons, the birds detected are better described as shoreline observations. In our surveys, the two observers either walked opposite sides of narrow ponds or steams, or they both walked along a single bank of wider water bodies and counted birds out to 50 m over the water. Open water was not a habitat type we actively sought out, but rather one that we surveyed whenever convenient relative to sampling other land-cover types. As a result, much of the water we sampled was associated with developed areas where the shoreline was accessible and easily traversed.

The amount of surface water in the state has increased from the 1900s, to the 1950s and to the 2000s sampling periods, as impoundments of all sizes have been created for water supply, recreation, and flood control. In general, there are relatively few natural lakes in the state of Illinois. Open water/shorelines were not sampled for birds in the 1900s or 1950s.

Canada geese and red-winged blackbirds made up the bulk of birds seen along shorelines, on, or over water, but mallards, wood ducks, great blue herons, ring-billed gulls, spotted sandpipers and other aquatic birds were well-represented in our sample (Table 4.34). Several species of swallows were often seen foraging over water. The density of bird species seen on the water in the three regions differed because of encounters with flocks of birds (Fig. 4.32). As examples, 24 mallards were found at one urban site in northern Illinois, flocks of 25 and 69 Canada geese were found at two sites in central Illinois, and 29 great blue herons were seen at a fish hatchery in southern Illinois. Other results may reflect true regional differences: the density of common grackles and cliff swallows was greatest in southern Illinois, and song sparrows, tree swallows and northern rough-winged swallows were densest in the northern and central zones.

Table 4.34. Relative abundance of bird species (% of all birds recorded in a specific time period) seen in marshes, 1907-1909, 1957-1958 and 2006-2008, and over open water, 2006-2008, in Illinois. Species are listed in order of decreasing abundance in each survey period. Boldfaced text indicates species totaling 85% of birds recorded within each time period; only species totaling 95% of all birds seen are listed.

1900s - Marsh		1950s - Marsh		2000s - Marsh		2000s – Open Water	
Species	%	Species	%	Species	%	Species	%
Red-winged blackbird	**71.6**	**Red-winged blackbird**	**36.8**	**Red-winged blackbird**	**54.3**	**Canada goose**	**21.9**
Common grackle	**12.6**	**Common grackle**	**15.3**	**Common grackle**	**7.7**	**Red-winged blackbird**	**15.6**
Bobolink	**7.7**	**Black tern**	**5.8**	**Tree swallow**	**6.1**	**Common grackle**	**9.3**
Green heron	1.4	**Yellow-headed blackbird**	**5.2**	**Black tern**	**4.0**	**Mallard**	**7.1**
Com. yellowthroat	0.9	**Mourning dove**	**4.7**	**Barn swallow**	**3.1**	**Great blue heron**	**6.3**
Dickcissel	0.9	**Swamp sparrow**	**4.0**	**Mallard**	**2.1**	**Barn swallow**	**4.2**
Eastern meadowlark	0.9	**Sedge wren**	**2.3**	**Great blue heron**	**1.6**	**Cedar waxing**	**3.2**
Yellow-breasted chat	0.9	**Killdeer**	**1.9**	**Little blue heron**	**1.6**	**European starling**	**2.8**
		American robin	**1.5**	**American robin**	**1.5**	**Tree swallow**	**3.0**
		Blue-winged teal	**1.5**	**Common yellowthroat**	**1.5**	**Cliff swallow**	**2.5**
		Common yellowthroat	**1.4**	**Song sparrow**	**1.2**	**N. rough-winged swallow**	**2.0**
		Song sparrow	**1.4**	**American goldfinch**	**1.2**	**Killdeer**	**2.0**
		Eastern meadowlark	**1.2**	Wood duck	0.9	**Song sparrow**	**1.8**
		Brown-headed cowbird	**1.2**	Yellow-crowned night-heron	0.9	**American robin**	**1.7**
		Spotted sandpiper	**1.1**	Killdeer	0.7	**Ring-billed gull**	**1.3**
		European starling	1.0	Green heron	0.7	**Chimney swift**	**1.3**
		Least bittern	1.0	Great egret	0.7	American goldfinch	1.1
		American goldfinch	0.8	Indigo bunting	0.7	Eastern kingbird	1.0
		Barn swallow	0.7	Blue-winged teal	0.6	Wood duck	0.8
		Brewer's blackbird	0.7	Mute swan	0.6	Mourning dove	0.8
		Prothonotary warbler	0.7	Turkey vulture	0.6	Gray catbird	0.8
		American coot	0.5	Mourning dove	0.4	Baltimore oriole	0.8
		Marsh wren	0.5	Swamp sparrow	0.4	House sparrow	0.7
		Mallard	0.4	Dickcissel	0.4	Bank swallow	0.7

		Dickcissel	0.4	Cliff swallow	0.4	Spotted sandpiper	0.5
		Brown thrasher	0.4	Yellow warbler	0.4	Rock pigeon	0.5
		American bittern	0.4	Sedge wren	0.3	Indigo bunting	0.5
		Ring-necked pheasant	0.4	European starling	0.3	House wren	0.5
		Great blue heron	0.3	Brown thrasher	0.3	Great egret	0.5
		Green heron	0.3	N. rough-winged swallow	0.3	Brown-headed cowbird	0.5
		American crow	0.3	Eastern kingbird	0.3		
		Louisiana waterthrush	0.3	Chimney swift	0.3		
		Northern cardinal	0.3	Common moorhen	0.3		
		Savannah sparrow	0.3	Ruby-throated hummingbird	0.3		
		Carolina wren	0.3	Sandhill crane	0.3		
		Pied-billed grebe	0.3				
		Northern bobwhite	0.3				
		Upland sandpiper	0.3				
		White-breasted nuthatch	0.3				
Number of birds	*222*		*726*		*675*		*599*
Number of species	*16*		*57*		*53*		*48*

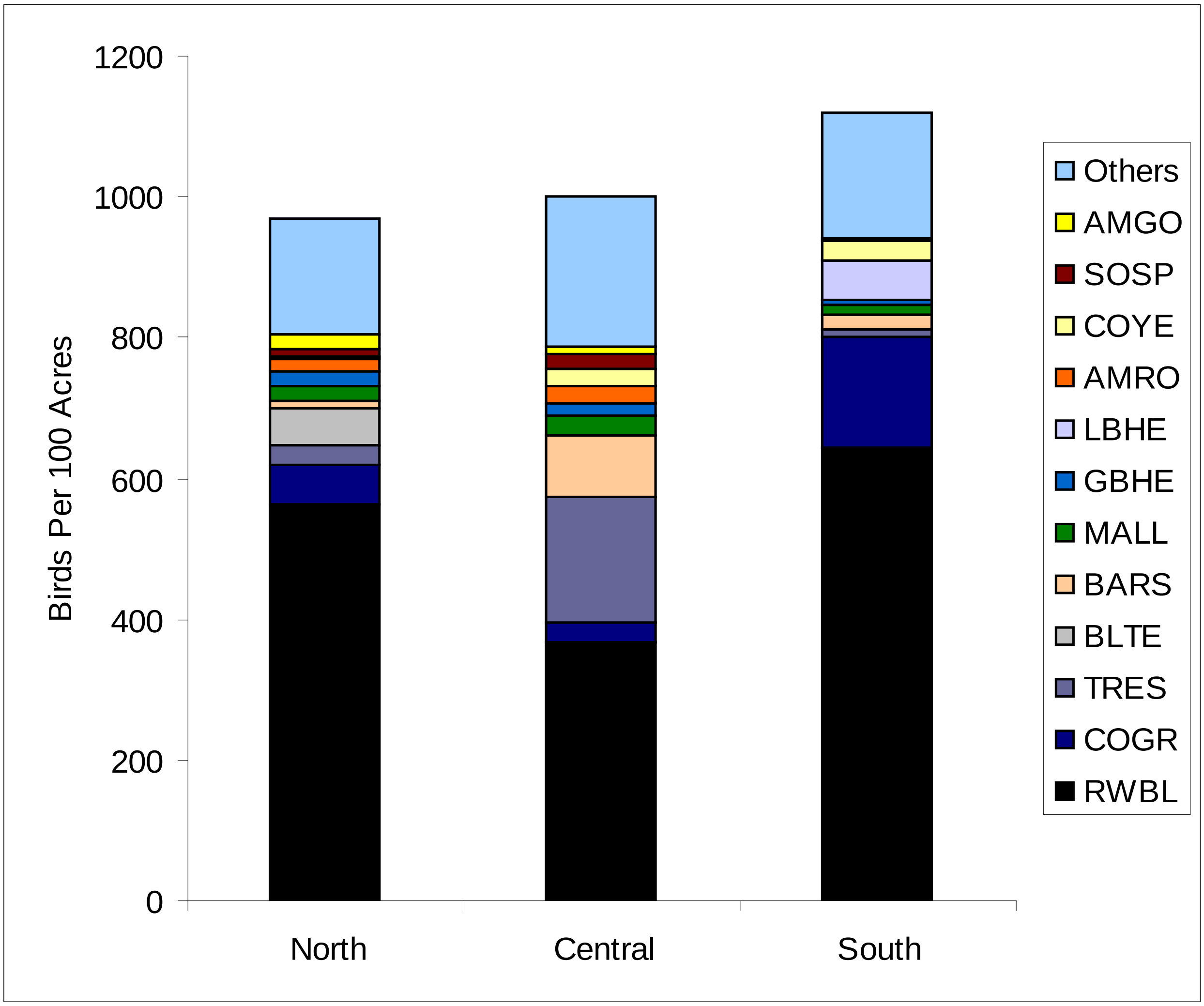


Fig. 4.31. Densities of the most important species observed in marshes in the three regions of Illinois, 2006-2008. Fifteen species represented 85% of all birds observed.

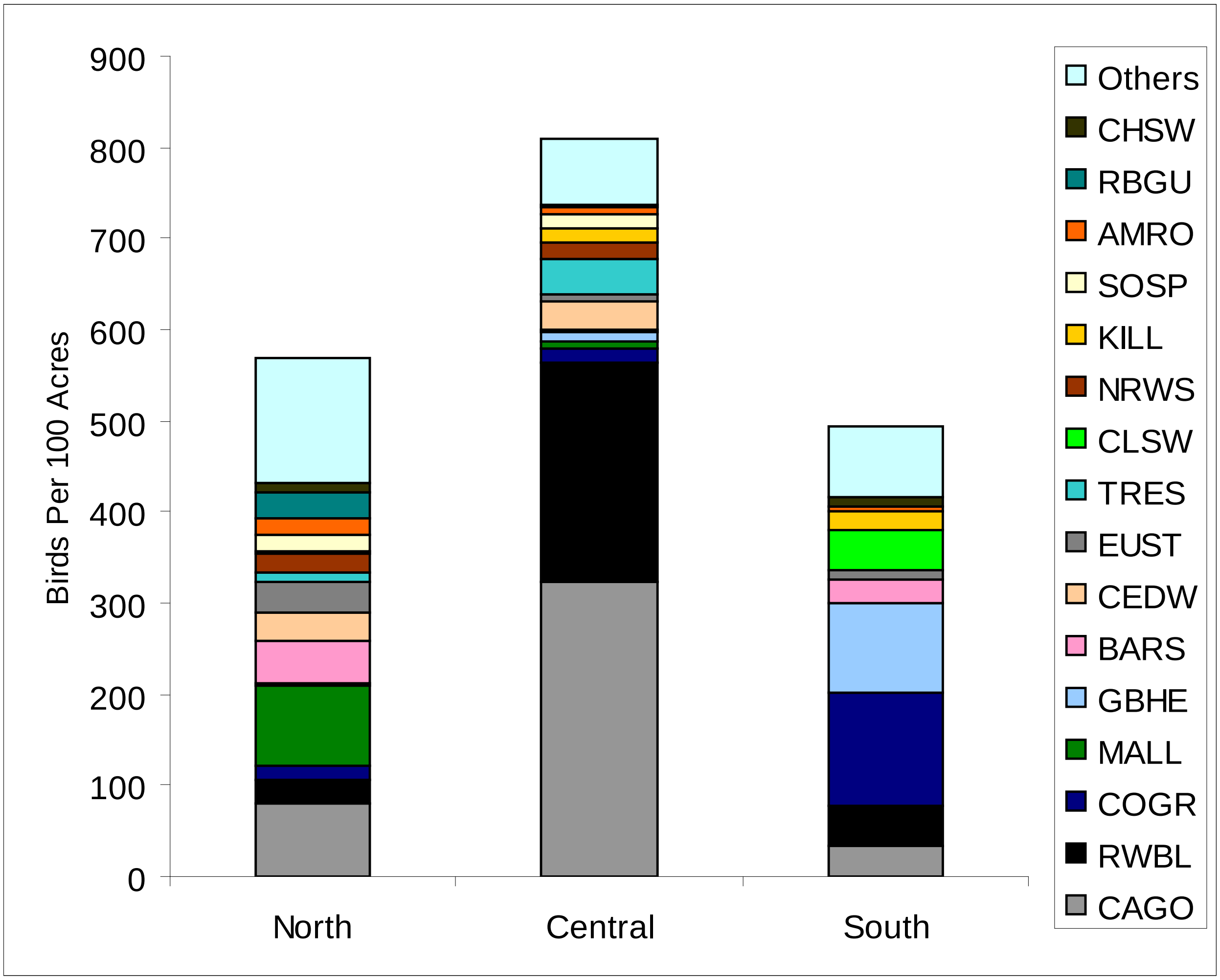


Fig. 4.32. Densities of the most important bird species observed in open water in northern, central and southern Illinois, 2006-2008. Sixteen species represented 85% of all birds observed.

Summary

Within habitat types, our estimates of bird densities are greater now than the estimates of 50 or 100 years ago (Fig. 4.33). This can be explained partially by the hours during which Gross and Ray and the Grabers conducted their surveys; during both the 1900s and 1950s some surveys were conducted in the afternoon hours, when bird activity is less than in the morning hours and when they recorded fewer birds. However, even when only comparing data from morning surveys, density estimates were higher for the 2000s than either the 1900s or 1950s, suggesting that other factors contributed to this pattern.

Increased abundance of a few birds, including American robins, common grackles, and European starlings, was an important factor in our higher density estimates. For instance, the average number of American robins recorded on a Breeding Bird Survey route in Illinois increased from about 40 birds in the late 1960s to over 100 birds in the early 2000s. Some of the differences in densities may have been attributed to errors and observer differences among the three time periods; thus, we urge caution in comparing unadjusted densities among the time periods.

The overall trends of bird density are similar however, with more birds per area in developed areas, marshes and shrublands, intermediate densities in grasslands, and lowest densities in corn and soybeans (Fig. 4.33). Bird diversity, as indexed by the most important species (totaling 85% of all birds recorded), is lowest at the extremes of bird density (Fig. 4.34). In developed areas, high bird densities are recorded, but the majority of birds belong to just a few species, in other words bird communities are quite simple (Table 4.32). Corn and soybeans, on the other hand, have relatively low bird densities and there are few individuals of any species (Tables 4.17 and 4.19), resulting in more diverse communities.

Just as the amount of forest and average forest maturity increased across the 20th century, so did the number of most important bird species in forest. Unique among habitat types, the most important species, their rank, and their relative abundance in the forests of Illinois was similar in the 1950s and 2000s (Table 4.10). In most other habitats, diversity (# of most important species) was highest during the 1900s survey period (Fig. 4.34). Grassland diversity was similar between the 1950s and the 2000s, although the rank of true grassland birds (meadowlarks, dickcissels, bobolinks, grasshopper sparrows and others) fell between the two periods (Tables 4.2, 4.4 and 4.6). Several generalist birds – European starlings, barn swallows, common grackles, and American robins – were among those increasing in relative abundance in grassland areas. Due to a reduction in crop diversity, increased field sizes, fewer edge habitats for shelter and nesting sites, and changes in agricultural practices, bird diversity in cropland has decreased over all three intervals.

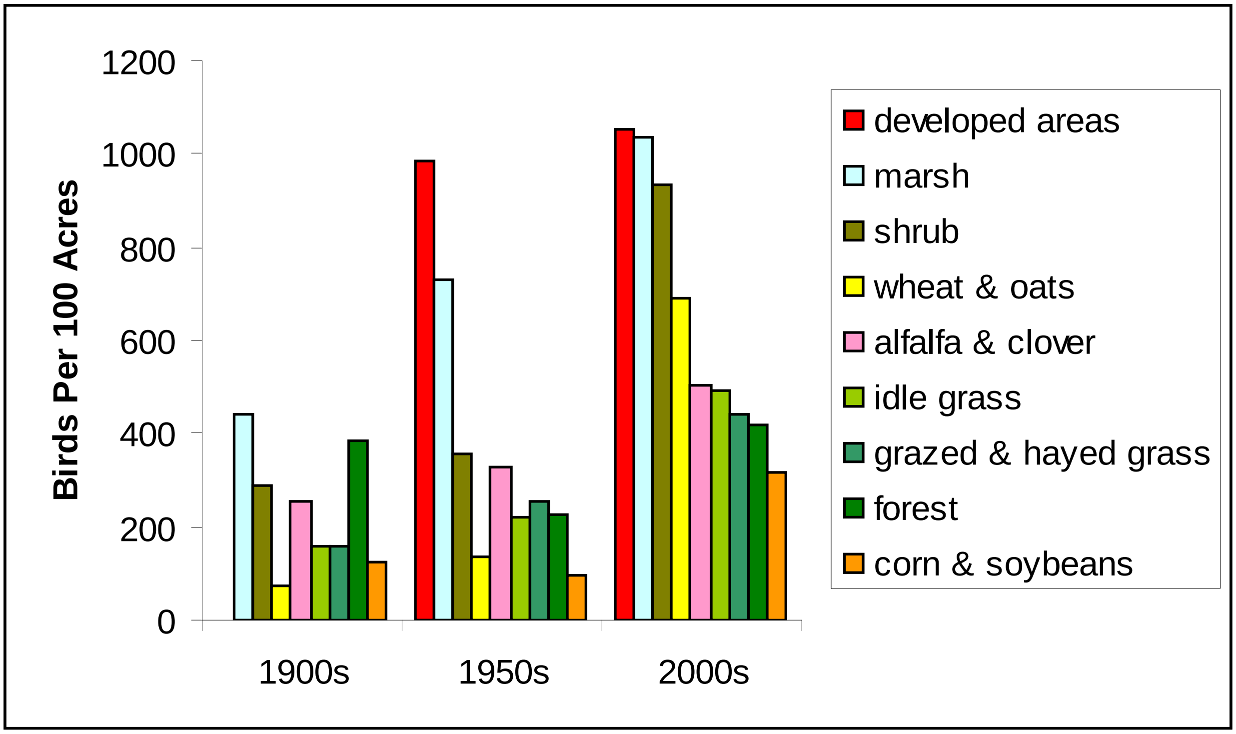


Fig. 4.33. Total density of birds in various habitat types sampled by transect surveys in Illinois, 1907-1909, 1957-1958 and 2006-2008.

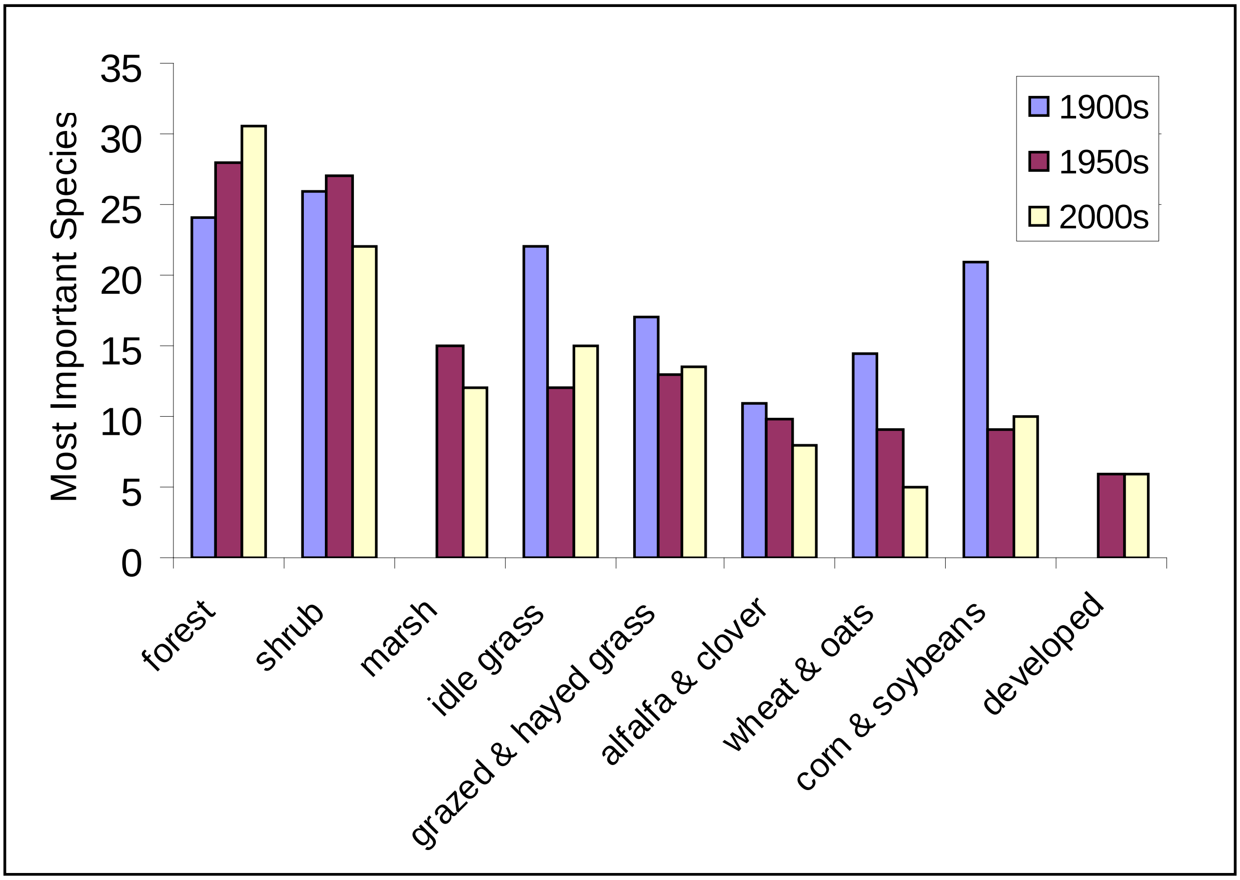


Fig. 4.34. Number of “Most Important Species,” totaling 85% of all birds seen, in various habitat types in Illinois, 1907-1909, 1957-1958 and 2006-2008.

Species Accounts

Changes across the landscape and within habitats have changed the abundance and distribution of many of Illinois' birds. Some species, such as Canada Geese, were not found during the 1900s or 1950s surveys, but currently are one of the more common birds in Illinois. Others such as the Bewick's Wren have the opposite trend – they were once common birds that have become rare in Illinois. These changes (and in some cases lack of changes) cause us to ask many questions. For example, why have mourning doves been consistently abundant? Have forest birds increased as the extent of forest in the state has expanded? Are the northward shifts in some birds' ranges the consequence of a warming climate? Why were the 1950s apparently such a poor time for many birds?

In this section, we discuss 40 species (in standard taxonomic order) that represent how the bird community has changed over the past century. For each species, we present one or more charts to illustrate habitat preferences and how occupancy and abundance have changed over time. Occupancy is a model-generated estimate of the proportion of sampling locations where a particular bird is present, by taking into account factors such as detectability, the amount of survey effort, and types of habitats surveyed. These results can be compared by regions of the state (North, Central, and South) and time periods (1900s, 1950s, and 2000s). Because a bird species that is widespread and abundant or widespread and uncommon would have similar high occupancy rates, occupancy alone can hide changes in abundance. The North American Breeding Bird Survey offers an excellent annual abundance index for most birds. The graphs presented here show the average number of birds counted on BBS routes in Illinois for each year from 1966 to 2006. To show habitat preferences, we calculated the density of birds found on transects (shown as birds per 100 acres) within the different habitat types we surveyed.

Canada Goose – The ‘giant’ subspecies of Canada goose, which commonly nests around

suburban ponds in northern and central Illinois today, was thought to be extinct by the time of the Grabers’ surveys in the 1950s. In 1962, their colleague at the Illinois Natural History Survey, Harold Hanson, discovered a small flock of this subspecies in Minnesota. Previously, Canada geese had been known to nest in northern Illinois (Musselman 1922). Through careful protection and reintroductions, the giant Canada goose recovered (Fig. 5.1) – perhaps too well for many residents. The lush grasses (not to mention frequent hand-outs of bread, crackers, and popcorn) at lawns, parks and golf courses make these preferred foraging areas (Fig. 5.2), and goose droppings can be a nuisance. Geese vigorously defend their nests and goslings, and particularly aggressive individuals occasionally attack people. Flocks of geese near airports are an obvious concern for air traffic. Giant Canada geese are sometimes referred to as ‘resident’ Canada geese because they migrate a short distance or not at all. Warm-water discharge and aerators maintain open water in urban areas where Canada geese are less vulnerable to hunting, and only deep snow that covers their food supplies for many days forces them to move southward.

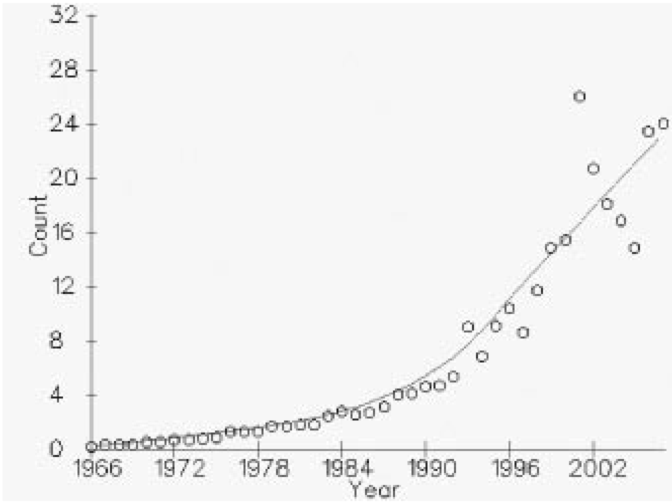


Fig. 5.2. Abundance of Canada geese on North American Breeding Bird Survey routes in Illinois, 1966-2006.

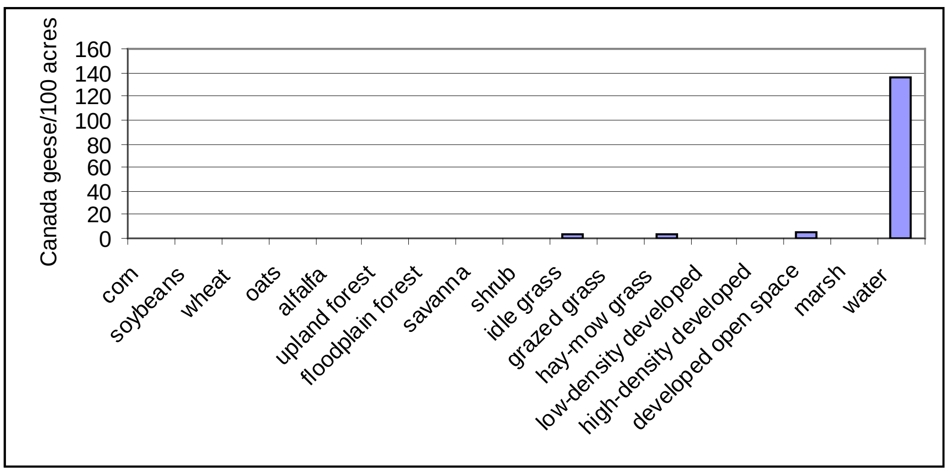
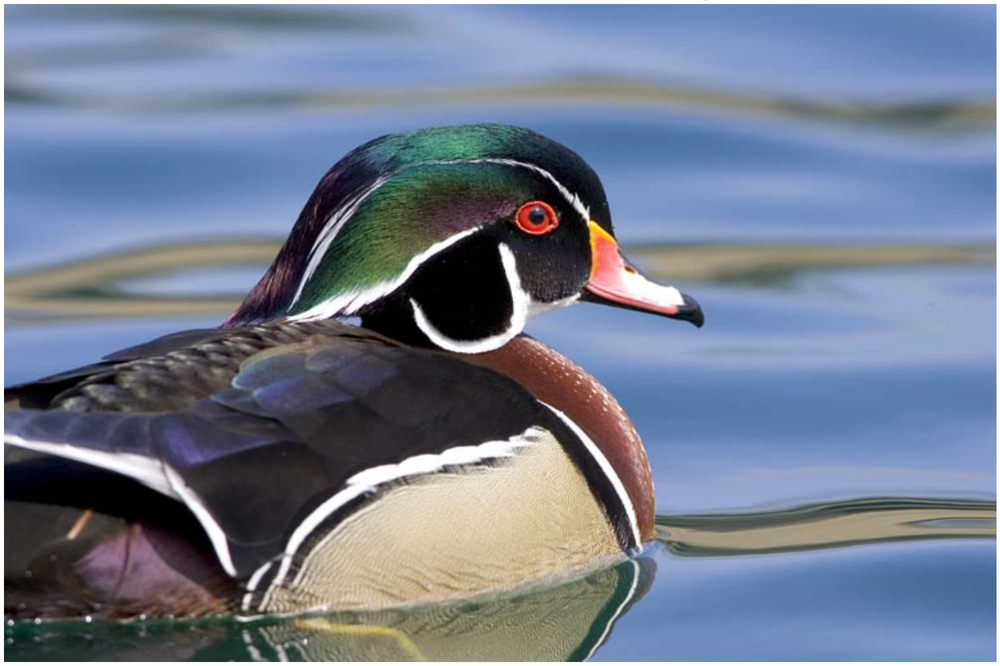


Fig. 5.2. Average density (birds per 100 acres) of Canada geese in various habitat types from transect surveys in Illinois, 2006-2008.

Wood Duck – We regularly observed wood ducks in floodplain forests where they were nesting in natural tree cavities and in marshes where nest boxes were erected (Fig. 5.4). However, Gross and Ray and the Grabers saw no wood ducks during their summer surveys in the 1900s or 1950s.



By 1913, many naturalists including George Grinnell predicted the extinction of wood ducks was imminent. Market hunting for their plumage and meat, combined with the drainage of swamps and cutting of forests, left wood duck populations in a free-fall. With the passage of the Migratory Bird Treaty Act in 1918, wood ducks were given complete protection and began a steady recovery (Fig. 5.3). In 1939, Frank Bellrose of the Illinois Natural History Survey put up the first wood duck nest boxes and more than half had nests in the first year. With improved designs, other states followed suit with massive nest box programs. Thanks to legal protection, nest boxes, and improved habitat conditions, wood ducks are now one of the more common ducks in eastern North America. After becoming a legal game bird again in 1941, wood ducks are now second only to mallards in number of ducks harvested along the Mississippi Flyway.

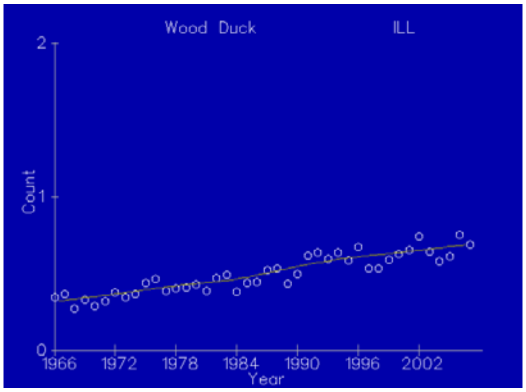


Fig. 5.3. Abundance of wood ducks on North American Breeding Bird Survey routes in Illinois, 1966-2006.

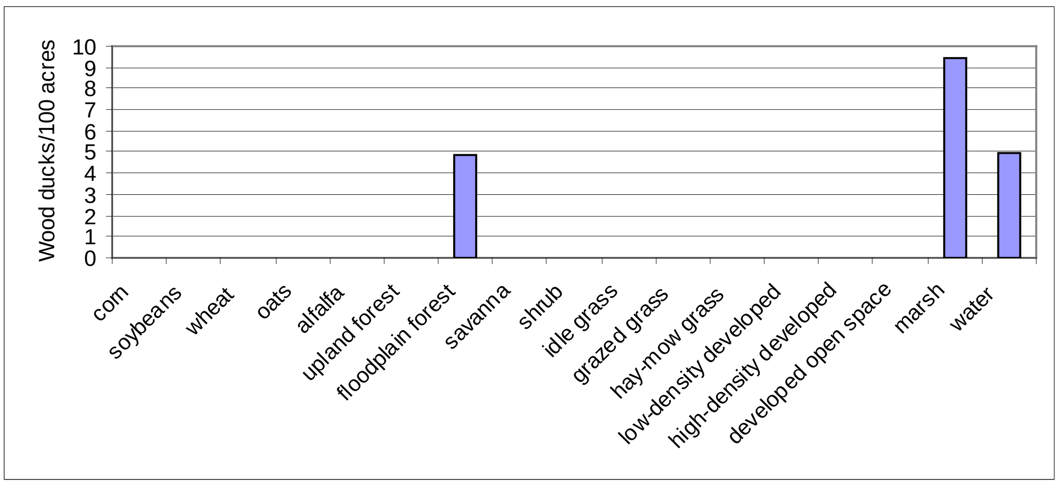
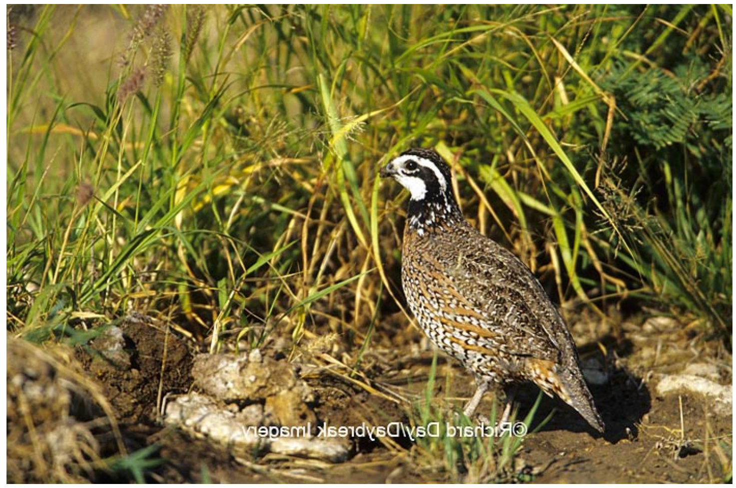


Fig. 5.4 Average density (birds per 100 acres) of wood ducks in various habitat types from transect surveys in Illinois, 2006-2008.

Northern Bobwhite – In all three survey periods, the bobwhite has been most common in the south and least common in the north (Fig. 5.6). However, bobwhites were once fairly common in northern areas and were abundant enough in southern Wisconsin in the late 1920s and early 1930s to be the subject of some of Paul Errington's pioneering research in population ecology. Sadly, this popular game bird and its familiar namesake whistle have become less common across the state between each survey period (Fig. 5.6). In our conversations with landowners, one of the most common concerns was the scarcity of bobwhites. We encountered few bobwhites on our transects. Because they can be heard at long distances on point counts, we recorded bobwhites at low densities in all habitats except forest and developed areas. The highest densities recorded on point counts were a mere 0.05 birds per acre in southern Illinois grasslands.



Wildlife biologists have effective techniques for managing habitats at a small-scale for bobwhites, but thus far they have been unable to stop long-term, large-scale declines driven by land use change (Fig. 5.5). The bobwhite population has been sharply curtailed by changes in agricultural practices, including reductions in grassland nesting habitat, the application of herbicides and insecticides that decrease the availability of insect-rich weedy areas preferred by young broods, and the elimination of shrubby habitat and connecting features like hedgerows that are crucial for winter survival. As landscape changes have made survival more challenging for bobwhites, populations of predators such as raccoons, opossums, red-tailed hawks and great horned owls have increased.

The conservation of farmland birds, such as bobwhites, will require cooperation among private landowners, conservation organizations and public agencies for developing effective strategies that fit into the working lands of Illinois. A recent Conservation Reserve Program practice to establish field borders of native grasses has been widely adopted in some parts of the state. Initial results are encouraging for bobwhites and other birds (Evans et al. 2008); whether the practice will be adopted widely enough to stabilize regional or statewide populations remains to be seen.

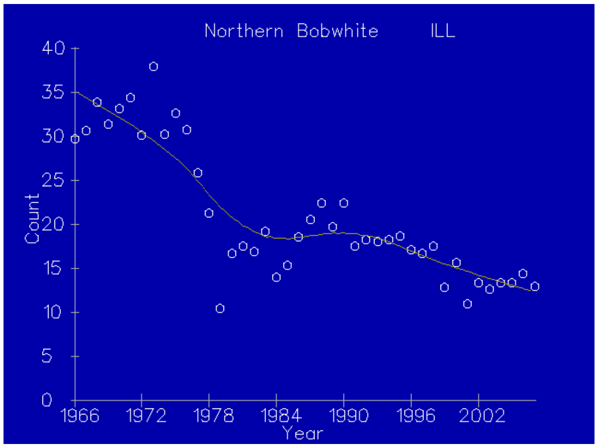


Fig. 5.5. Abundance of northern bobwhites on North American Breeding Bird Survey routes in Illinois, 1966-2006.

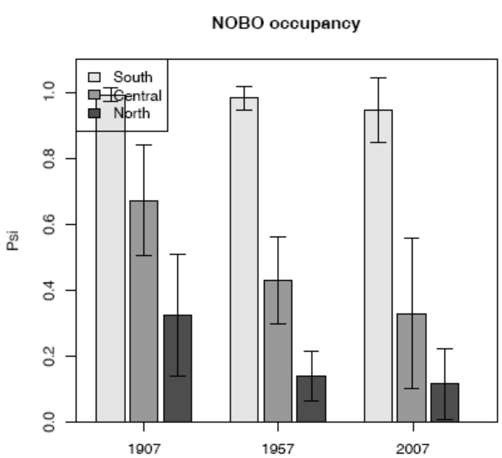


Fig. 5.6. Occupancy rates of northern bobwhites at North, Central, and South locations in the 1900s, 1950s, and 2000s.

American Kestrel – The kestrel, or 'sparrow hawk,' is frequently seen perched on utility lines or hovering over grassy rights-of-way along roads, hunting for large insects and small vertebrates.

The Grabers noted that "farmers have become less tolerant of trees at the margins of their cultivated fields" and the cavities in those "trees are ideal nesting sites for the sparrow hawk (pg. 465)." Today, kestrels regularly nest in utility poles along rural roads, as well as in trees and old structures in farmsteads. We found a surprising number of kestrels in developed habitats, including the downtown areas of several cities as well as suburban and park settings. Our results suggest kestrels are more widespread today than in the 1950s, but less abundant than a century ago. The North American Breeding Bird Survey shows a steady growth in the number of kestrels in the state since the mid-1960s (Fig. 5.7). Studies of American kestrels were important in showing the effects of organochlorine pesticides like DDT on birds. Eggshell thinning caused by organochlorine pesticides nearly caused the extinction of the kestrel's larger relative, the peregrine falcon. Those persistent chemicals probably depressed kestrel abundance and occupancy rates in the mid-20th century, and we are now witnessing their rebound (Fig. 5.8).

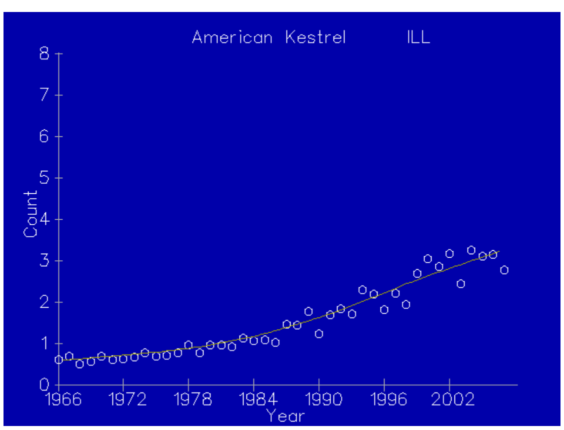


Fig. 5.7. Abundance of American kestrels on North American Breeding Bird Survey routes in Illinois, 1966-2006.

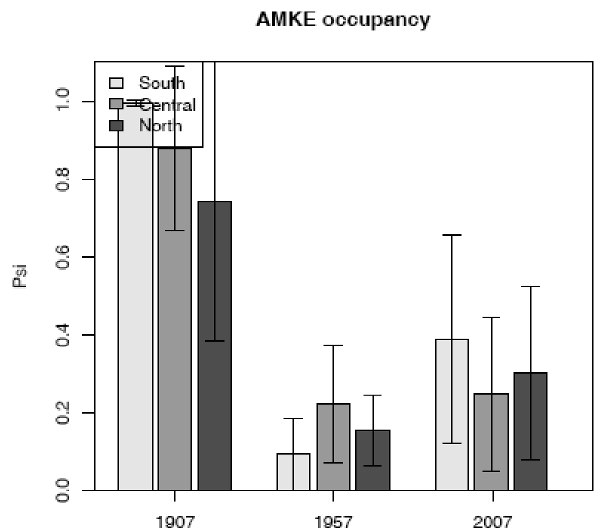


Fig. 5.8. Occupancy rates of American kestrels at North, Central, and South locations in the 1900s, 1950s, and 2000s.

<u>*Great Blue Heron*</u> –Theodore Roosevelt, President of the United States while Alfred Gross and Howard Ray were conducting most of their field work, established the first federal bird sanctuary at Pelican Island, Florida in 1903 in response to the slaughter of herons and egrets for their plumage. By the 1950s, pollution had seriously impaired water quality in the state. Passage of the Clean Water Act led to tremendous improvements in water quality and fish populations in Illinois, and consequently an increasing population of great blue herons (Figs. 5.9. 5.10,). Though the transect method is not an effective way to survey herons and egrets, we encountered several great blue herons in marshes and along shorelines of water bodies (Fig. 5.11). Today, great blue heron rookeries can be found in nearly every county of Illinois. The recovery of other fish-eating birds – great egrets, bald eagles, double-crested cormorants, and others – can also be attributed to improvements in water quality.

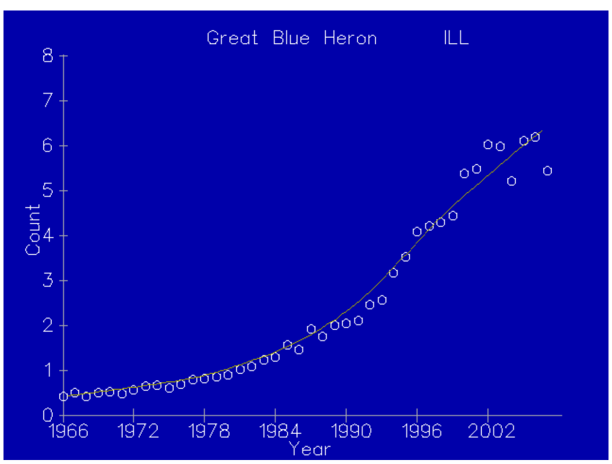


Fig. 5.9. Abundance of great blue herons on North American Breeding Bird Survey routes in Illinois, 1966-2006.

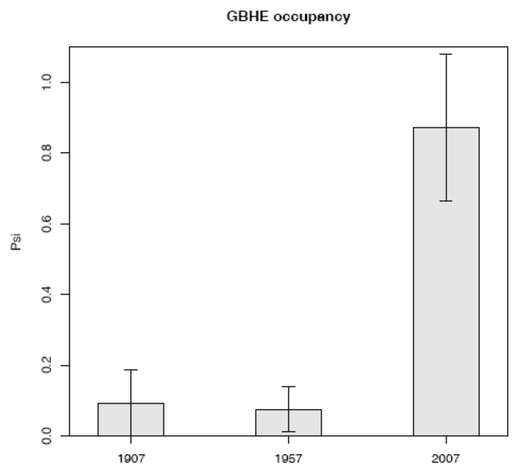


Fig. 5.10. Occupancy rates of great blue herons in the 1900s, 1950s, and 2000s.

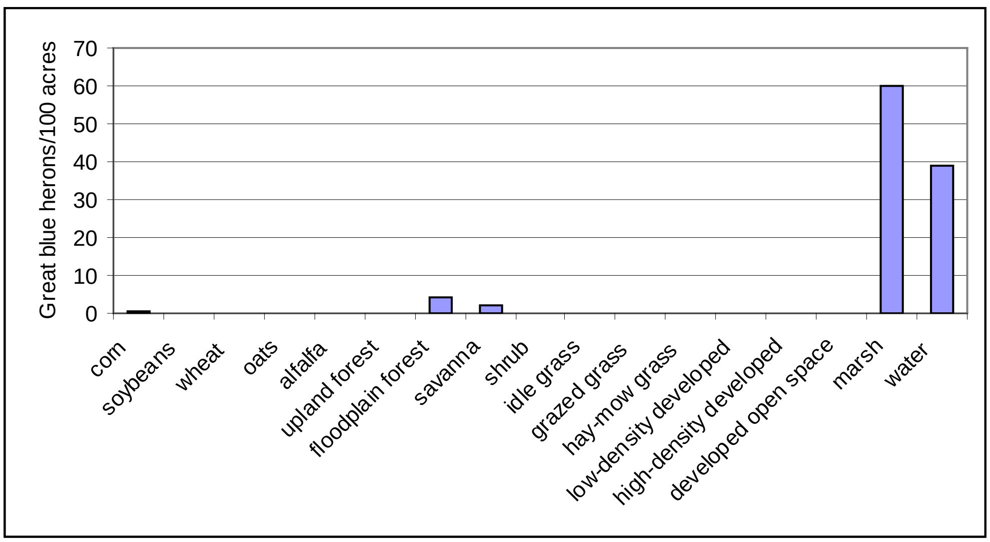


Fig. 5.11Average density (birds per 100 acres) of great blue herons in various habitat types from transect surveys in Illinois, 2006-2008.

Killdeer – Killdeer are by far the most common shorebird nesting in Illinois. Though widely distributed in all three survey periods (Fig. 5.13), their regional occupancy rates have shifted over time. Most of the state's killdeer were in the southern region in the 1900s surveys (83% by the Grabers' estimate), decreasing in occurrence northward. By the 1950s, killdeer occurrence was about the same in northern and southern Illinois, but lowest in the central region. In 2006-2008, we found killdeer to be about twice as common in the central region than in northern or southern Illinois.

Killdeer nest on bare soil in cropfields and along gravel roadsides early in the spring. Their eggs have often hatched by the time farmers begin spring field work; the downy young leave the nest within hours of hatching and are soon able to run and escape the path of machinery. Since the average planting date has advanced by a few weeks, corn may have become less suitable for nesting killdeer since the 1950s. Soybeans are planted later than corn and appear to be great habitat for killdeer with twice the density of birds as corn (Fig. 5.14). The increase in acres planted to soybeans since the 1950s, largely at the expense of oats and alfalfa, has probably benefitted killdeer. In our 2006-2008 surveys, grazed grasslands and shorelines also hosted high densities of killdeer. Breeding Bird Survey data show a 5.5% annual rate of increase from 1966 to 2007 (Fig. 5.12)

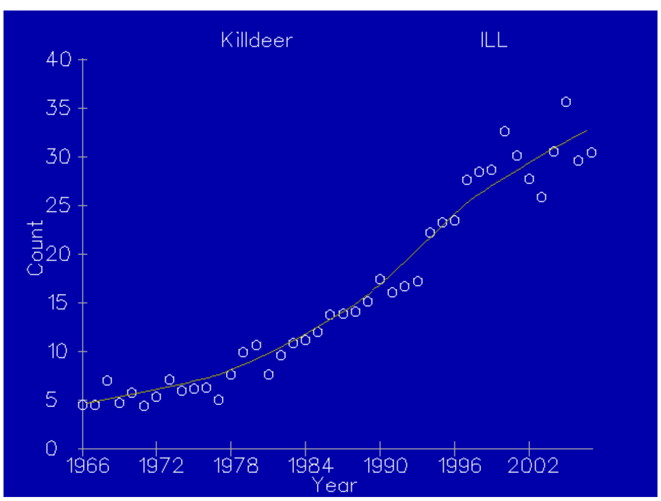


Fig. 5.12. Abundance of killdeer on North American Breeding Bird Survey routes in Illinois, 1966-2006.

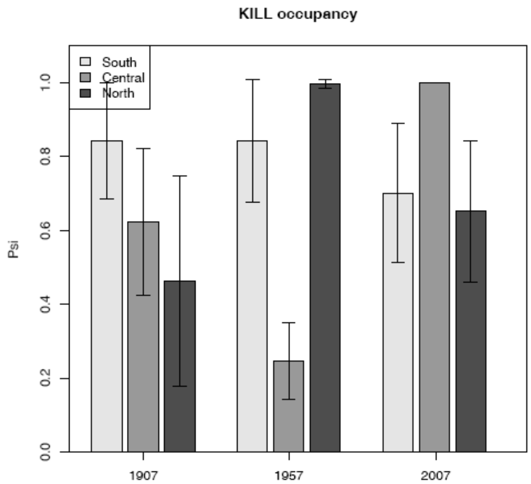


Fig. 5.13. Occupancy rates of killdeer at North, Central, and South locations in the 1900s, 1950s, and 2000s.

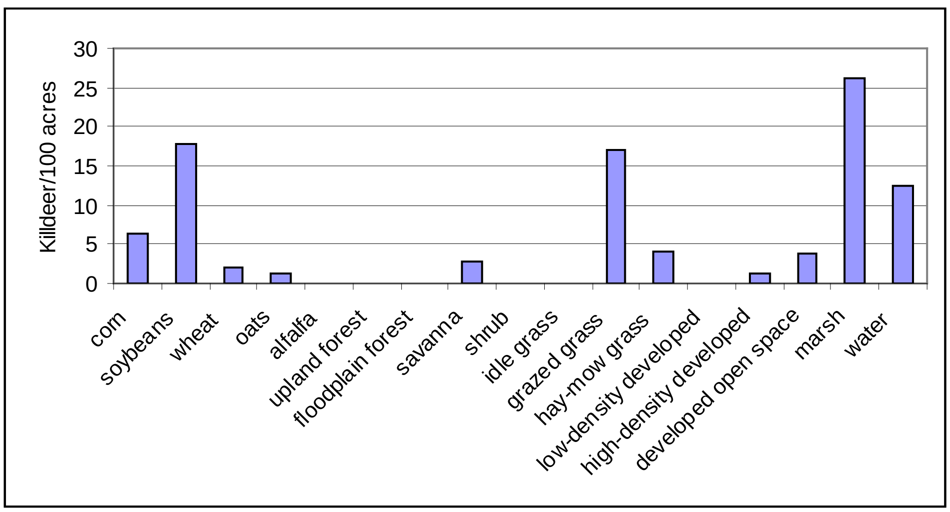


Fig. 5.14. Average density (birds per 100 acres) of killdeer in various habitat types from transect surveys in Illinois, 2006-2008.

Upland Sandpiper – The Grabers estimated about 200,000 upland sandpipers remained in the state in the 1950s. Upland sandpipers have experienced one of the most dramatic declines of any bird in Illinois. The population has almost certainly declined by more than 99%, as it seems likely there are far less than 1,000 nesting pairs remaining. The upland sandpiper has been on the Illinois list of endangered species since the first official list in 1978, and the Illinois Department of Natural Resources' database for tracking endangered species includes just 17 occurrence records from 1997 to 2007. So few sandpipers are detected on Breeding Bird Survey routes that accurate population trend estimates cannot be determined. Only a few conservation areas including Midewin National Tallgrass Prairie, Lost Mound National Wildlife Refuge, and Prairie Ridge State Natural Area reliably host more than one or two nesting pairs each year, making the upland sandpiper one of the species most vulnerable to extirpation in Illinois.

In the Midwest, upland sandpipers are most strongly associated with lightly to moderately grazed grasslands and hayfields. Upland sandpipers are among the most area-sensitive and tree-averse grassland bird species in Illinois (Herkert 1991, Herkert et al. 1993). In the 1950s, the Grabers thought upland sandpipers were becoming less dependent upon pastures and increasingly dependent on hay and alfalfa. Regardless, the availability and suitability of grazed grasslands, hay and legumes for nesting has dropped precipitously. Upland sandpipers are occasionally found in no-till soybean fields, but it is not known if birds are trying to nest in these areas at very low densities. Upland sandpipers are long-distance migrants and little is known about their winter ecology in South America or how factors there may contribute to the decline in upland sandpiper populations.

Mourning Dove – The highly adaptable mourning dove has maintained a consistently high occupancy rate throughout the state and across the three survey periods (Fig.5.16), and we saw mourning doves in all habitats we sampled (Fig.5.17). Dick and Jean Graber described mourning doves as having the largest "ecological distribution" of any bird in Illinois. They also suggested that doves were expanding their distribution north. Only two native species, red-winged blackbird and common grackle, were recorded more often on transects in each time period. Mourning doves are thought to be among the ten most abundant bird species in North America. Though they are the most harvested game bird on the continent (estimated at about 20 million birds per year, nearly 1 million harvested in Illinois), hunting appears to have no significant adverse effect on the overall population.

Mourning doves nest early and often, which compensates for their small, 2-egg clutches. Although mourning doves occasionally nest on the ground in grasslands and crop fields, the vast majority of the birds we encountered in these habitats appeared to be feeding. Shrublands and savannas hosted more doves than closed-canopy forests (Fig.5.17). The highest densities of mourning doves were recorded in low-density developed areas. The combination of evergreens and dense shrubbery for nesting and winter roosting, short vegetation at ground level, and availability of grain at bird feeders and near grain elevators make low-density developed areas well suited to mourning doves. On point counts, we estimated three times the density of mourning doves in developed areas than other habitats. Within developed areas, density estimates were highest in central Illinois (3.26 birds/acre) and lowest in northern Illinois (1.34 bird/acre). The Grabers listed developed habitats as the seventh most preferred habitat, suggesting that over the last 50 years the species may have changed it preferred habitat.

Eurasian collared-doves, which have colonized most of the state since the mid-1990s, are also primarily found in developed areas. Despite the similar ecology of these two species, so far there is no conclusive evidence of competition or antagonism between collared-doves and mourning doves. Mourning doves have been very successful over the last century and there is no reason to expect this to change into the future.

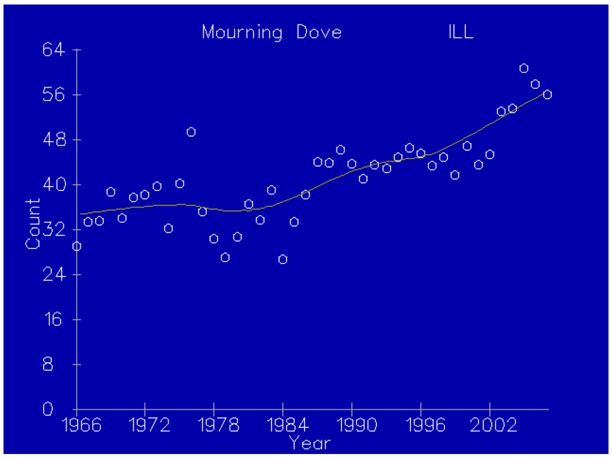


Fig. 5.15. Abundance of mourning doves on North American Breeding Bird Survey routes in Illinois, 1966-2006.

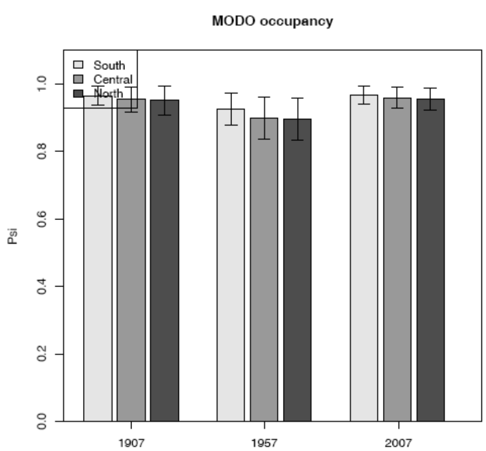


Fig. 5.16. Occupancy rates of mourning doves at North, Central, and South locations in the 1900s, 1950s, and 2000s.

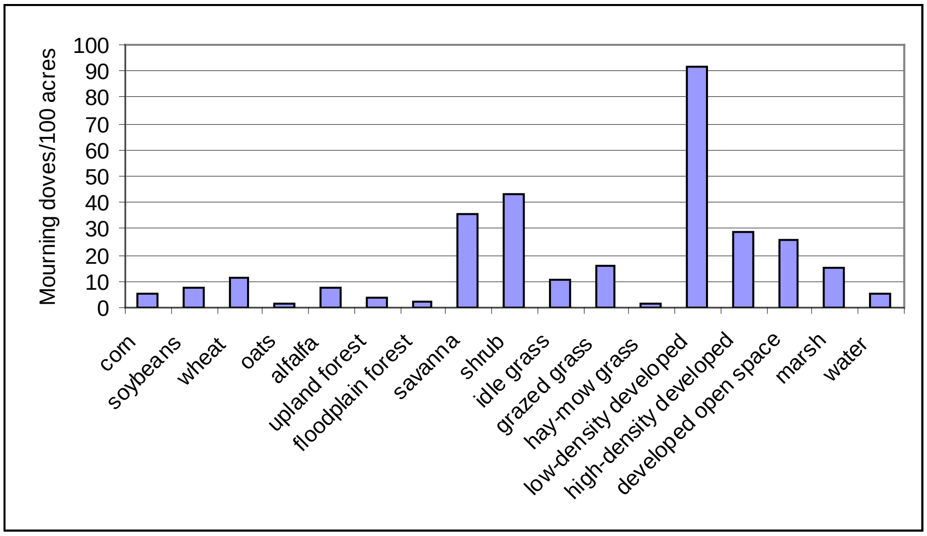


Fig. 5.17. Average density (birds per 100 acres) of mourning doves in various habitat types, from transect surveys in Illinois, 2006-2008.

<u>Yellow-billed Cuckoo</u> – Because they tend to sit motionless and skulk through leafy branches, yellow-billed cuckoos were difficult to spot during transect surveys. We found them most often in shrublands but also commonly in savannas and upland forests (Fig.5.20). In contrast, point count surveys indicated densities of cuckoos in forests were twice those of shrublands. Cuckoos occur statewide (Fig.5.19), but are about twice as common in southern Illinois than the other regions.

Yellow-billed cuckoos are known as a facultative brood parasite – from time to time, they will lay their eggs in other birds' nests. Unlike brown headed cowbirds, which are 'obligate' brood parasites, cuckoos also build nests and raise their own young. Cuckoo populations have been suggested to be highly variable because they track the emergence of periodic cicadas and caterpillars. Because of this variability, the three "snapshots" in time might not accurately represent the species population trend. While birds that prefer forest edges, such as indigo buntings and summer tanagers, are generally increasing, yellow-billed cuckoos appear to be declining across the state in a pattern similar to shrubland birds such as bobwhites and brown thrashers (Fig.5.18).

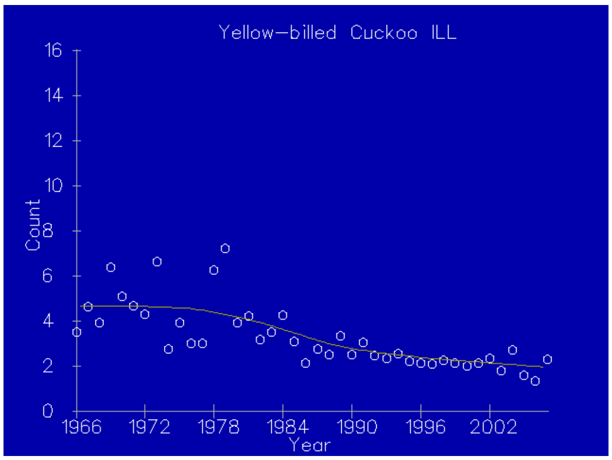


Fig. 5.18. Abundance of yellow-billed cuckoos on North American Breeding Bird Survey routes in Illinois, 1966-2006.

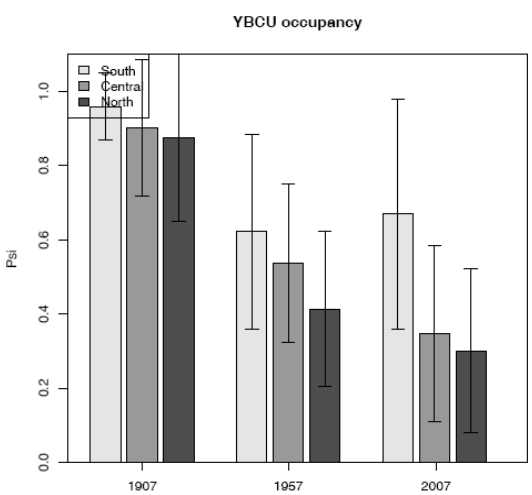


Fig. 5.19. Occupancy rates of yellow-billed cuckoos at North, Central, and South locations in the 1900s, 1950s, and 2000s.

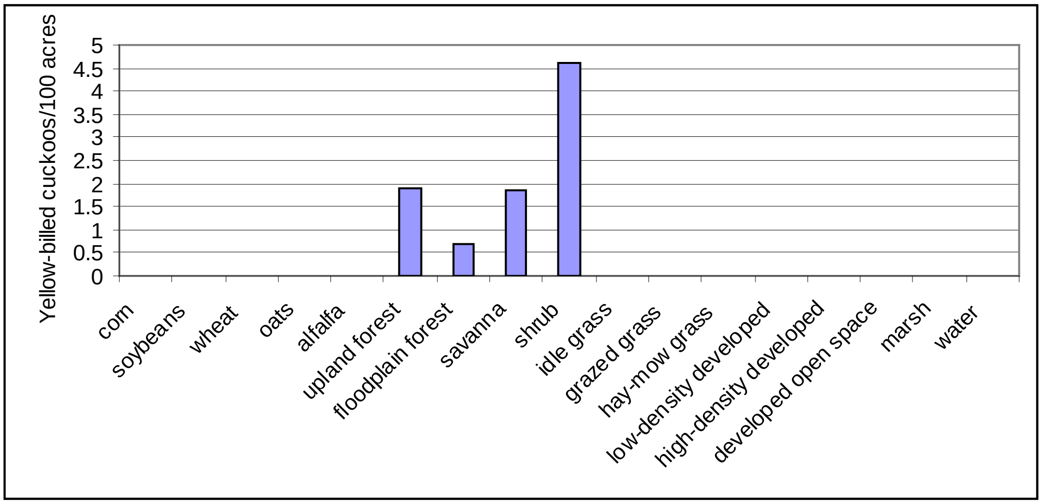


Fig.5.20. Average density (birds per 100 acres) of yellow-billed cuckoos in various habitat types from transect surveys in Illinois, 2006-2008.

Chimney Swift – As their name suggests, chimney swifts are largely dependent on human structures, especially chimneys, for nesting sites. Not surprisingly, high-density developed areas with the highest densities of chimneys had the highest densities of chimney swifts (Fig.5.23). Our point counts estimated that swifts were 20 times more abundant in developed areas than other habitats, and abundances were similar among northern, central and southern Illinois.

Comparable high-density developed areas were not surveyed in the 1900s or 1950s. In low-density developed areas, however, we recorded a greater proportion of swifts (9.9% of all birds) than did the Grabers (1.7% of all birds). In contrast, the North American Breeding Bird Survey shows a declining trend for chimney swifts (Fig.5.21). While it seems plausible that the gradual loss of old buildings with open masonry chimneys has reduced nesting sites for swifts, Breeding Bird Survey routes are regularly moved out of developed areas, where swifts are most common, because of noise and safety concerns for roadside surveys. Further, the extent of developed areas preferred by swifts is rapidly expanding. While their population trend is unclear, chimney swifts are currently common throughout the state (Fig.5.22). The only potential threat to this species are more modern building codes that require chimney caps which may reduce the number of breeding sites for this species.

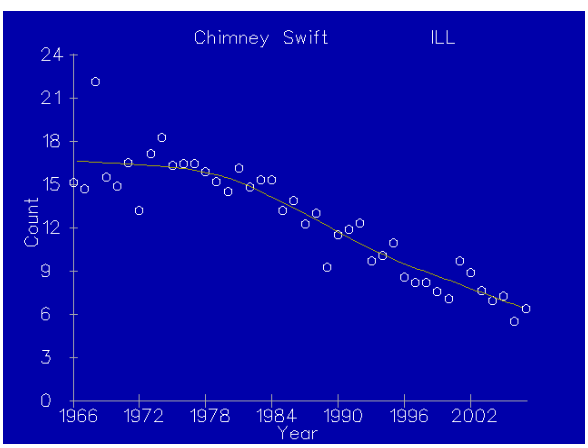


Fig. 5.21. Abundance of chimney swifts on North American Breeding Bird Survey routes in Illinois, 1966-2006.

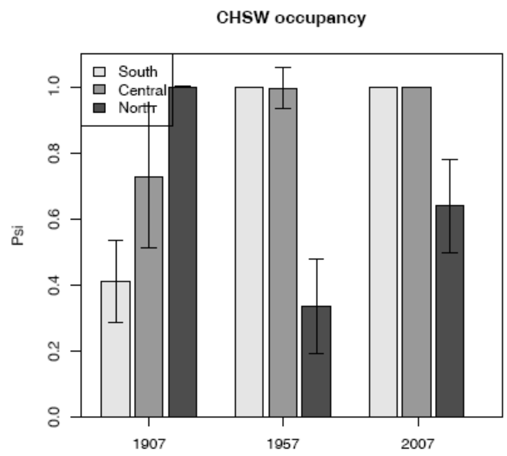


Fig. 5.22. Occupancy rates of chimney swifts at North, Central, and South locations in the 1900s, 1950s, and 2000s.

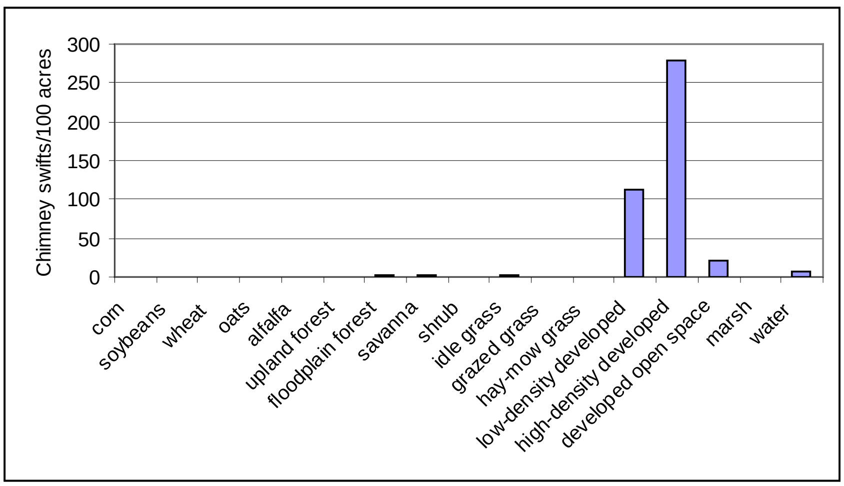


Fig. 5.23. Average density (birds per 100 acres) of chimney swifts in various habitat types from transect surveys in Illinois, 2006-2008.

Woodpeckers

Six species of woodpeckers commonly nest in Illinois (downy, hairy, red-bellied, red-headed, pileated, and northern flicker). These six birds can be broken down into the recent “winners” (downy, hairy, red-bellied and pileated) and “losers” (red-headed and flicker) based on their very different population trajectories and occupancy patterns. The “winners” have expanded their ranges northward over the past 100 years and become more common. The most plausible reason for this pattern is that the availability of mature forest for these four woodpeckers has increased over the past century, especially in central and northern Illinois. All four of these birds are non-migratory, and downy and red-bellied woodpeckers are the woodpeckers most likely to be found in developed areas.

The two “losers” are both migratory and are birds that prefer open woodlands and savanna-like habitats; the transition of open- to closed-canopy forests likely has likely contributed to the declines in these populations. Competition with European starlings for nest cavities has been suggested as one reason for the decline of red-headed woodpeckers and flickers. While competition with starlings certainly occurs, we would expect similar competition between starlings and red-bellied woodpeckers. The most important factors driving declines in populations of red-headed woodpeckers and northern flickers are not clear.

Red-bellied Woodpecker – A century ago, the red-bellied woodpecker was rarely found in central or northern Illinois (Fig.5. 25). In the 1950s surveys, it was still scarce in northern Illinois but about equally widespread in the central and southern zones. Today, the red-bellied woodpecker is found well northward throughout most of Wisconsin, and it may be the most common woodpecker in Illinois. Their expansion from southern Illinois in the 1900s to other regions of the state by 2006-2008 represents a roughly 500 km expansion of their distribution. The increase in forest cover, due primarily to the transition of shrublands, savannas and open woodlands into closed canopy forests, has helped the red-bellied woodpecker and its abundance has been steadily increasing (Fig. 5. 24).

Red-bellied woodpeckers are a non-migratory bird; they regularly take advantage of suet, sunflowers and other resources at bird feedings and seem to thrive better in developed areas than red-headed woodpeckers (Figs. 5.26 and 5.29). The red-bellied woodpecker’s use of developed habitats may be a new phenomenon as the Grabers suggested that the species was not associated with humans and, therefore, was not in competition with starlings. If red-bellied woodpeckers have moved into developed habitats it does not appear that competition with starlings is limiting their population growth.

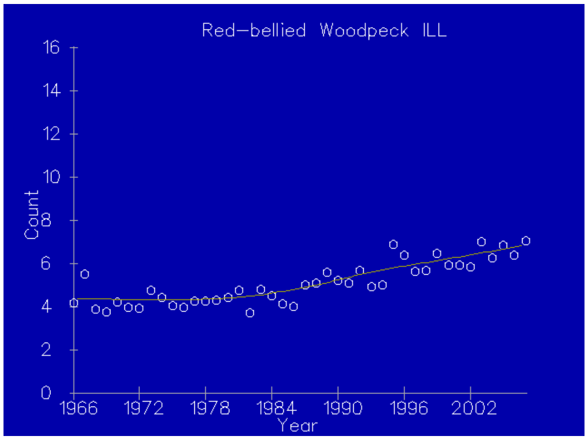


Fig. 5.24. Abundance of red-bellied woodpeckers on North American Breeding Bird Survey routes in Illinois, 1966-2006.

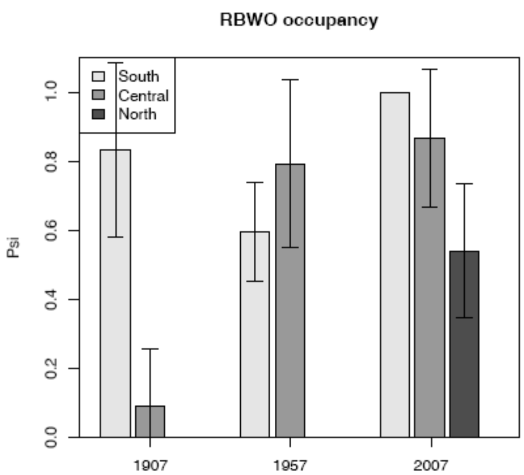


Fig. 5.25. Occupancy rates of red-bellied woodpeckers at North, Central, and South locations in the 1900s, 1950s, and 2000s.

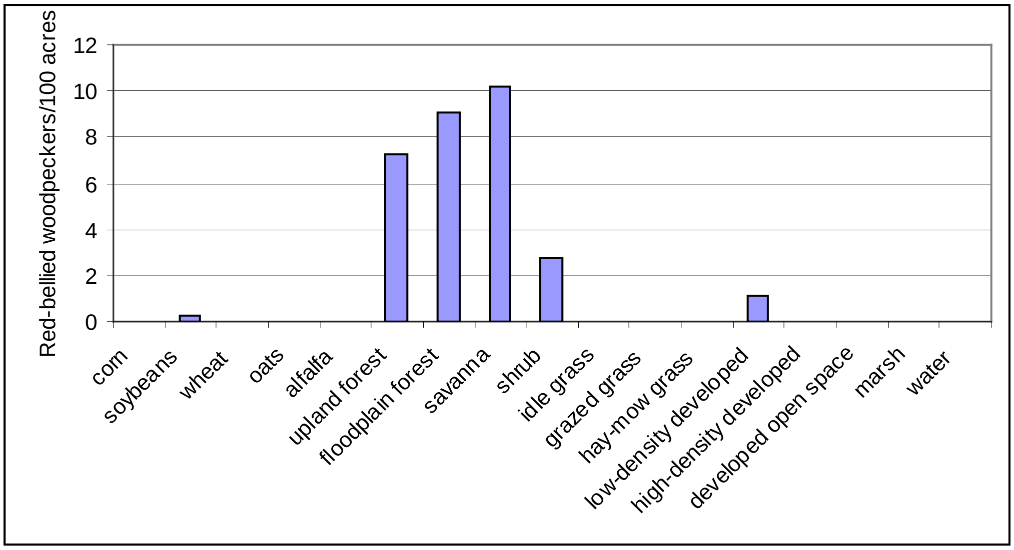


Fig. 5.26. Average density (birds per 100 acres) of red-bellied woodpeckers in various habitat types from transect surveys in Illinois, 2006-2008.

Red-headed Woodpecker – The red-headed woodpecker is the signature bird of the Midwest's oak savannas, but it is also found in floodplain forests and savanna-like cemeteries, parks, and golf courses (Fig.5.29). Red-headed woodpeckers are short-distance migrants, but their winter abundance at any one location varies considerably from one year to the next, as they tend to congregate in floodplain forests with an abundant crop of acorns.

Red-headed woodpeckers have declined since the 1900s as their preferred savanna-type nesting habitats have become increasingly scarce due to outright habitat destruction and succession into closed forests through fire suppression and reductions in grazing.. Ridgway (1889) reported that red-headed woodpeckers were the most numerous woodpecker in wooded areas of the state. Gross and Ray saw more red-headed woodpeckers in corn fields than we did in all habitats combined; overall, they recorded about ten times as many red-headed woodpeckers as we did.

Occupancy models show that the occurrence of red-headed woodpeckers crashed between the 1900s and 1950s surveys, during the interval when European starlings colonized and increased in abundance in Illinois (Fig. 5.28). Though red-headed woodpeckers aggressively defend their nest cavities, the sheer number of European starlings competing with them for nest sites in savannas and developed open areas may have influenced their populations by reducing the recruitment of young. Red-headed woodpeckers appear to have been more widely distributed in the northern than the southern region in the 1950s, but that pattern was reversed by the 2000s. This could be associated with the fondness of starlings for developed areas and increasing development in the northern portion of the state. Overall, the Breeding Bird Surveys illustrate a negative population trend for the species in the state of Illinois over the past four decades (Fig.5.27), blurring some of the regional changes in occupancy patterns during this time period.

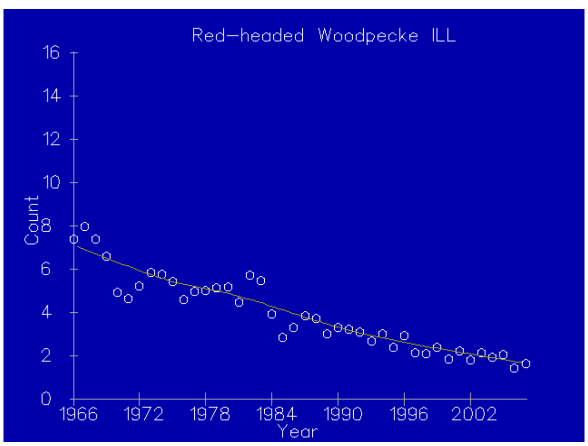


Fig. 5.27. Abundance of red-headed woodpeckers on North American Breeding Bird Survey routes in Illinois, 1966-2006.

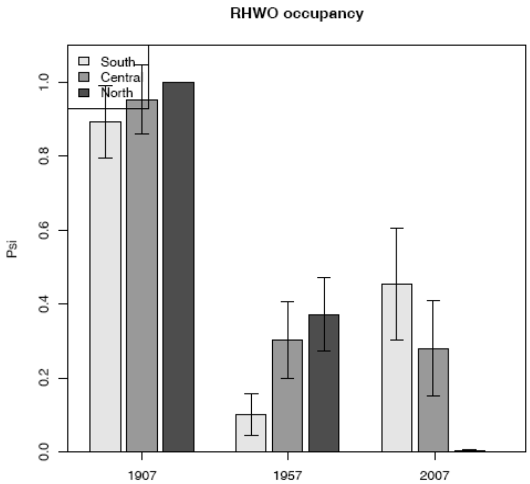


Fig. 5.28. Occupancy rates of red-headed woodpeckers at North, Central, and South locations in the 1900s, 1950s, and 2000s.

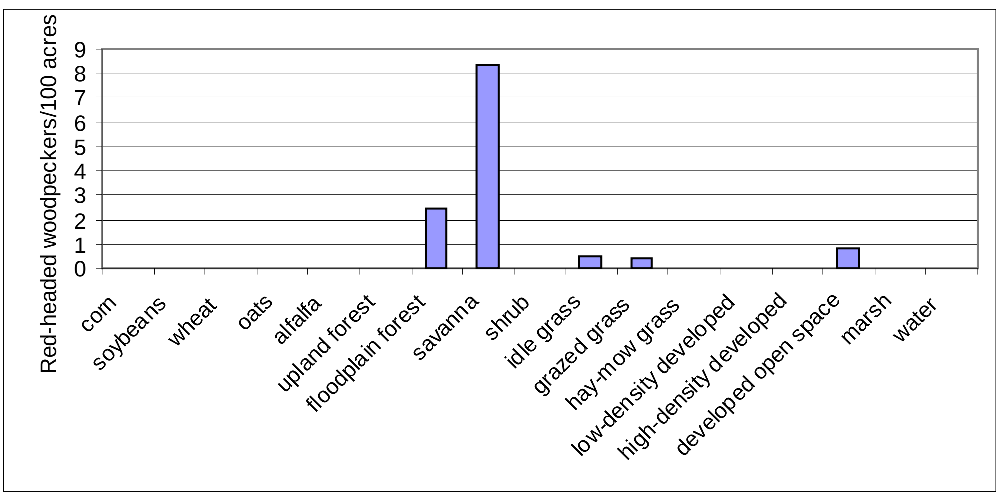


Fig. 5.29. Average density (birds per 100 acres) of red-headed woodpeckers in various habitat types from transect surveys in Illinois, 2006-2008.

Northern Flicker – Ecologically, the northern (yellow-shafted) flicker is similar to the red-headed woodpecker and is most common in savanna-like habitats; however, the species nests in all forest types and is regularly seen feeding on the ground in grasslands, along roadsides, and in crop fields (Fig.5.32). Both species experienced significant population reductions between the

1900s and 1950s surveys (Figs.5.28 and 5.31), and the North American Breeding Bird Survey demonstrated declines since the 1960s (Figs. 5.27 and 5. 30).

Unlike the red-headed woodpecker, flickers are more frequently found in low-density developed and developed open space areas. In the 1950s, the Graber's stated that flickers were more closely associated with man than any other woodpecker. They suggested that competition with starlings drove the large declines they noticed between the 1900s and 1950s. The decline of flickers in southern Illinois is one of the more dramatic and unexplained changes we have observed. In the 1900s the species was common statewide to but is now scarce in the southern region (Fig.5.31). One possible contributing factor in southern Illinois is the recovery of forests from extensive timber harvesting in the late 1800s; as a result of this recovery, preferred open-forest habitat gave way to closed-canopy forests between the 1900s and 1950s. This reasoning is supported by increases in other species that prefer closed-canopy forests in southern Illinois.

There are several unanswered questions about flickers, in particular why are they associated with different habitats in different regions of the state. In northern and central Illinois, flickers were found primarily in shrublands, savannas and forests. In southern Illinois, we found few flickers outside of developed areas, where flickers were about four times more common than in developed areas of central and northern Illinois. Unlike the other woodpeckers, flickers spend a large percentage of their time on the ground feeding on ants. It is possible that widespread use of insecticides has reduced an important food source for flickers and contributed to their overall declining abundance. Additional research may help resolve the puzzling habitat distributions and population trend of this species.

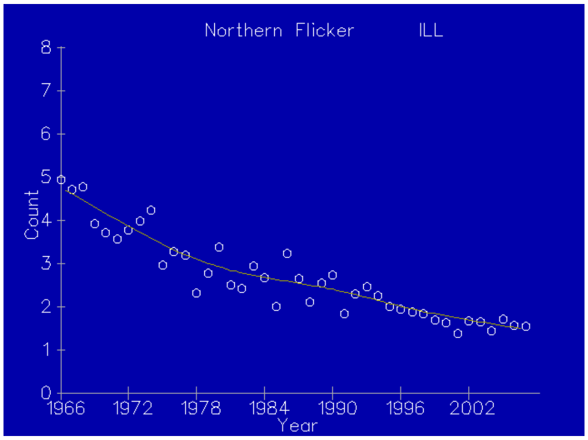


Fig. 5.30. Abundance of northern flickers on North American Breeding Bird Survey routes in Illinois, 1966-2006.

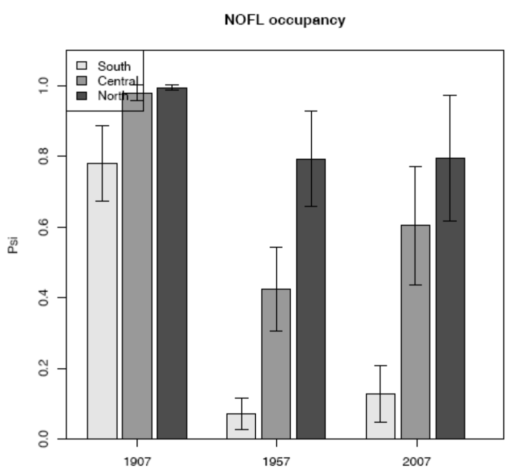


Fig. 5.31. Occupancy rates of northern flickers at North, Central, and South locations in the 1900s, 1950s, and 2000s.

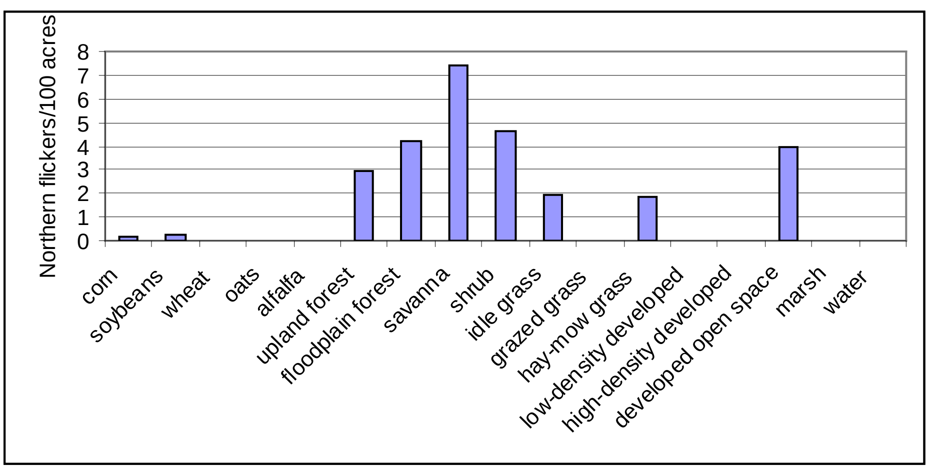


Fig. 5.32. Average density (birds per 100 acres) of northern flickers in various habitat types from transect surveys in Illinois, 2006-2008.

Eastern Wood-pewee – Pewees are broadly tolerant of different types of wooded habitats: upland and floodplain forests, savannas/open woodlands, and developed open space with mature trees (5.35). We found pewees were one of ten birds whose occupancy pattern had not changed among the three survey periods or regions of the state (Fig.5.34). Additionally, our point count data indicated their density was about equal in all three regions of the state in the 2000s. Likewise, the North American Breeding Bird Survey shows this Neotropical migratory bird has had a stable population in Illinois (Fig.5.33). The consistency of the pewee's population over the last century highlights their adaptability to changes within forested habitats; this is remarkable given the many changes that have occurred in Illinois forests over the last century and to forests on their wintering grounds in northern South America. Hopefully this resilience will continue into the future.

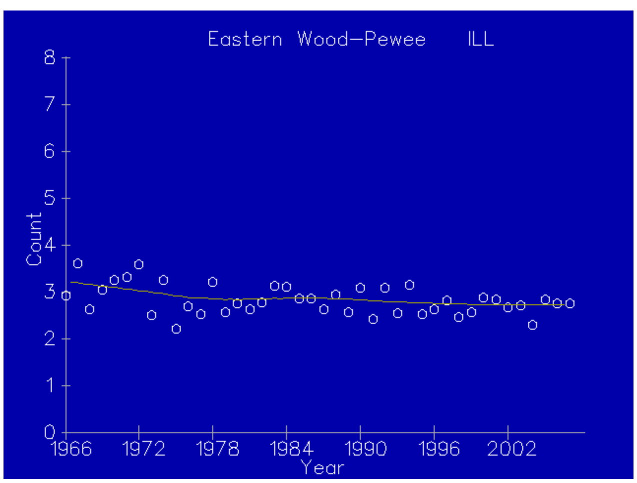


Fig. 5.33. Abundance of eastern wood-pewees on North American Breeding Bird Survey routes in Illinois, 1966-2006.

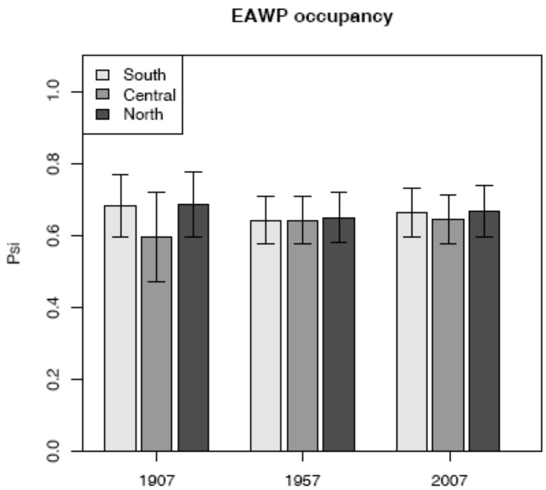


Fig. 5.34. Occupancy rates of eastern wood-pewees at North, Central, and South locations in the 1900s, 1950s, and 2000s.

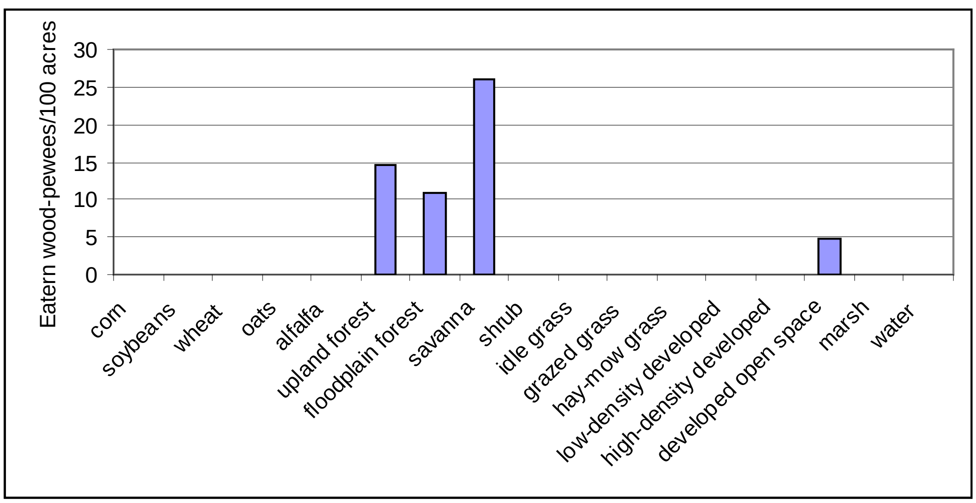


Fig. 5.35. Average density (birds per 100 acres) of eastern wood-pewees in various habitat types from transect surveys in Illinois, 2006-2008.

Acadian Flycatcher – In all periods, Acadian flycatchers had far greater occupancy rates in the southern than central or northern regions of Illinois (Fig.5.37). Floodplain forests and steep ravines extending into upland forests are the Acadian flycatcher's preferred habitats (Fig. 5.38). Because Acadian flycatchers are common and their nests are relatively easy to find, they have been one of the most frequently studied Neotropical migratory birds. Research by Illinois Natural History Survey scientists Jeff Hoover and Leonarda Chapa found that Acadian flycatcher nests within 600 m of forest edges experience higher rates of predation and brood parasitism by brown-headed cowbirds. At his Hutchin's Creek study site, where The Nature Conservancy and the U.S. Forest Service are working to reforest a narrow opening, Hoover estimates that every acre reforested will add up to 6 acres of 'interior' forest conditions to the landscape where Acadian flycatchers will be much safer from predators and cowbirds.

Similar to eastern wood-pewees, Acadian flycatcher populations have been among the most stable in the state (Figs. 5.36 and 5.37). Unlike northern cardinals, indigo buntings, tufted titmouse and other forest birds with similar regional distributions in the 1900s, Acadian flycatchers have they not expanded their distribution northward. The Grabers thought there was some indication that their range was starting to move, and we recorded Acadian flycatcher on point counts at a few sites in northern Illinois. Why Acadian flycatchers have not expanded north as available habitat has increased in the central and northern regions of the state is not known.

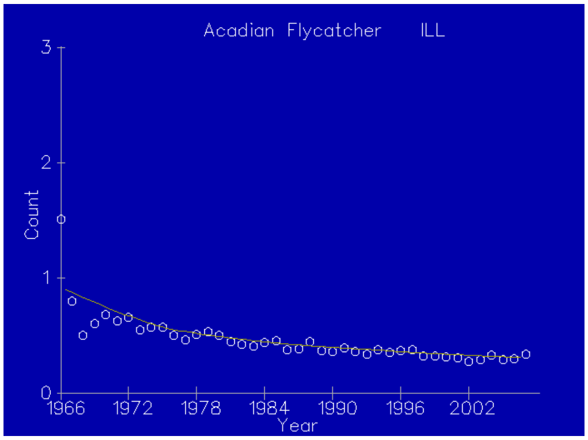


Fig. 5.36. Abundance of Acadian flycatchers on North American Breeding Bird Survey routes in Illinois, 1966-2006.

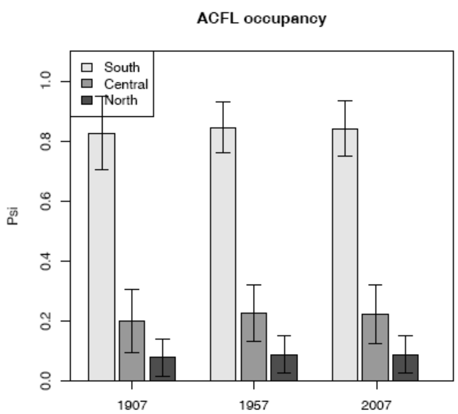


Fig. 5.37. Occupancy rates of Acadian flycatchers at North, Central, and South locations in the 1900s, 1950s, and 2000s.

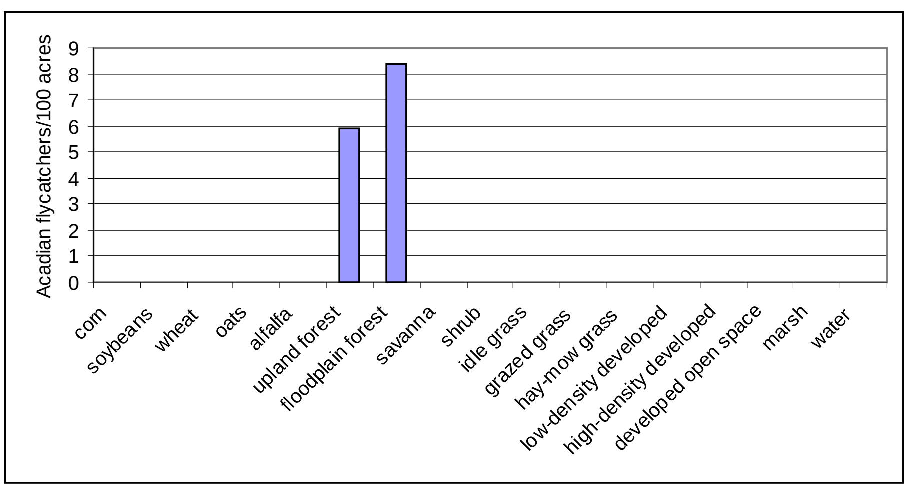


Fig.5.38 Average density (birds per 100 acres) of Acadian flycatchers in various habitat types from transect surveys in Illinois, 2006-2008.

Eastern Kingbird – Kingbirds are a familiar site in the open spaces of Illinois, where they are often seen perched on fences, utility lines and exposed tree branches and sallying out to catch insect prey on the wing. Areas with grassy openings and scattered trees, such as savannas, shrublands, grasslands with scattered trees or adjacent tree lines, and developed open spaces, provide hunting perches and nesting sites and, therefore, are good habitats for kingbirds (Fig. 5.41). Kingbirds seem to be particularly fond of placing their nests in tree branches that over-hang water, and we found high densities of kingbirds in marshy areas and along shorelines.

In spite of sharp declines in their preferred savanna, pasture, and linear wooded habitats, the North American Breeding Bird Survey shows only slight declines in eastern kingbirds in the state since the mid-1960s (Fig. 5.39). During our transects surveys in the 2000s, kingbirds were distributed throughout the state (Fig. 5.40), but point count data demonstrated that the species was most abundant in southern Illinois and least abundant in the central region. The Grabers noted that eastern kingbirds had declined substantially between the 1900s and 1950s surveys, especially in southern Illinois. They speculated that the change could be related to either a reduction in orchards or other preferred habitats or to a change in their insect prey. Specifically, they thought spraying herbicides and insecticides in orchards and along roadsides had played an important role in the decline of kingbirds. Our occupancy analyses show a similar pattern of mid-century declines for many birds, including American robins, common grackles, and brown-headed cowbirds, that feed primarily on invertebrates and are most often found in habitats likely to be sprayed with insecticides.

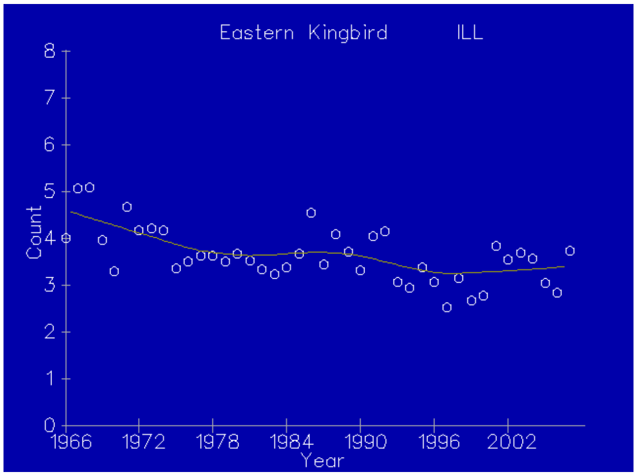


Fig. 5.39. Abundance of eastern kingbirds on North American Breeding Bird Survey routes in Illinois, 1966-2006.

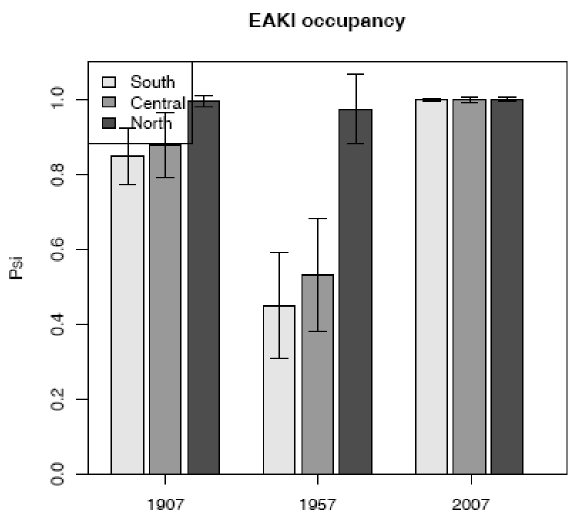


Fig. 5.40. Occupancy rates of eastern kingbirds at North, Central, and South locations in the 1900s, 1950s, and 2000s.

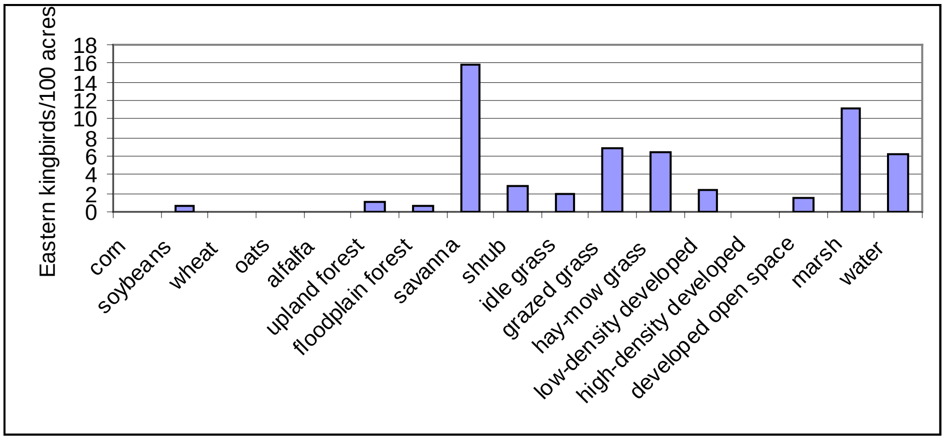


Fig. 5.41. Average density (birds per 100 acres) of eastern kingbirds in various habitat types from transect surveys in Illinois, 2006-2008.

Bewick's Wren – To Gross and Ray, Bewick's wren was the most common wren species found in residential areas of Illinois rather than the house wren. Ridgway reported that Bewick's wrens were the most common wren in Illinois in the late 1800s, often nesting in barns, and Musselman (1922) thought Bewick's wrens were still expanding their range north and west. However, the Bewick's wren population crashed in Illinois before the 1950s, and the species has since become scarce throughout eastern North America. The Grabers recorded just two Bewick's wrens at one location in the 1950s, and we did not find any (Fig. 5.42). Bewick's wrens are endangered in Illinois and known to nest at just one location.

The reasons for the decline in Bewick's wrens are a mystery, but competition with house wrens is strongly suspected. They may also compete with Carolina wrens, starlings, and house sparrows. Bewick's wrens have a strange affinity for human junk. The 'classic' Bewick's wren nest is constructed in a dilapidated building, shell of an automobile, or pile of abandoned farm equipment being swallowed by brushy growth at the edge of a forest, such that a lack of potential nesting sites would not seem to explain the extreme rarity of Bewick's wrens during the past half century. The decline of a common bird associated with human structures and degraded habitats with no obvious threats, highlights the difficulty in predicting vulnerable species and why monitoring programs that consider all birds are imperative.

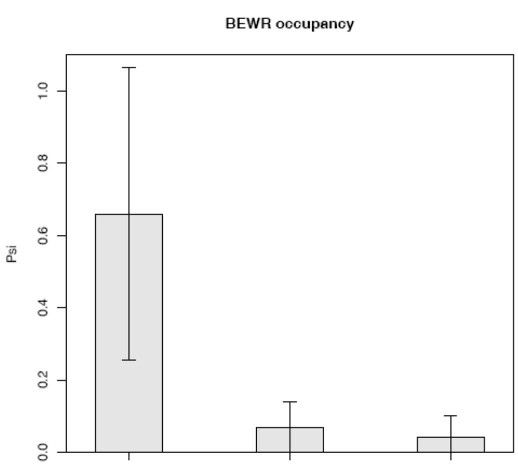


Fig. 5.42. Occupancy rates of Bewick's wrens in the 1900s, 1950s, and 2000s.

Carolina Wren – North American Breeding Bird Survey and Christmas Bird Count results clearly show Carolina wrens are increasing and expanding their range northward, but we encountered them at too few of our random locations in northern Illinois to suggest much change in occupancy across regions of the state over the past century (Fig. 5.44). All data confirm that Carolina wrens are far more common in southern Illinois than other regions of the state. While not as common as house wrens in residential areas, Carolina wrens were regularly found in neighborhoods with a canopy of mature trees (Fig.5.45).

Overall, we found a tendency for non-migratory birds of forested and developed habitats to have northward expanding ranges. But for Carolina wrens, there is good evidence that winter weather limits the distribution of the only non-migratory wren in Illinois. Northerly populations are markedly smaller following winters with colder temperatures and longer periods of snow cover, and rebound over the course of a few years. The dip in abundance shown by Breeding Bird Survey data in the mid-1970s is associated with several particularly severe winters (Fig. 5.43). Global climate change models that suggest Illinois winters will become milder support the prediction that the Carolina wren's range will expand northward.

One behavior that Carolina wrens employ to survive winter weather is to use developed habitats. In winter, they are known to forage in barns, out buildings and garages looking for spiders, insect pupae and other invertebrate prey. We found Carolina wrens were about twice as common in forests in southern Illinois compared to central Illinois, but densities in developed areas were about the same between the two regions. This result supports the hypothesis that developed areas help the species survive harsher winter conditions farther north.

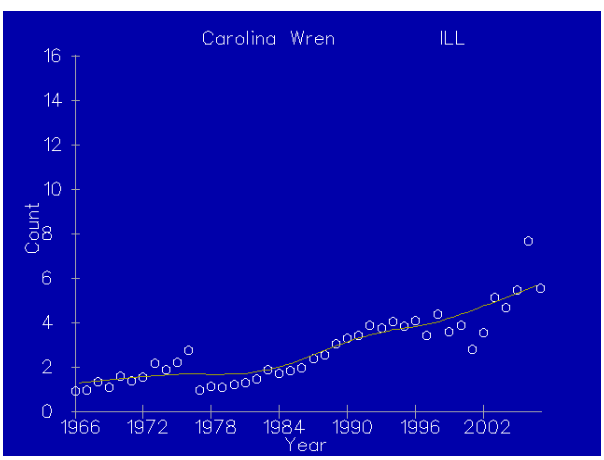


Fig. 5.43. Abundance of Carolina wrens on North American Breeding Bird Survey routes in Illinois, 1966-2006.

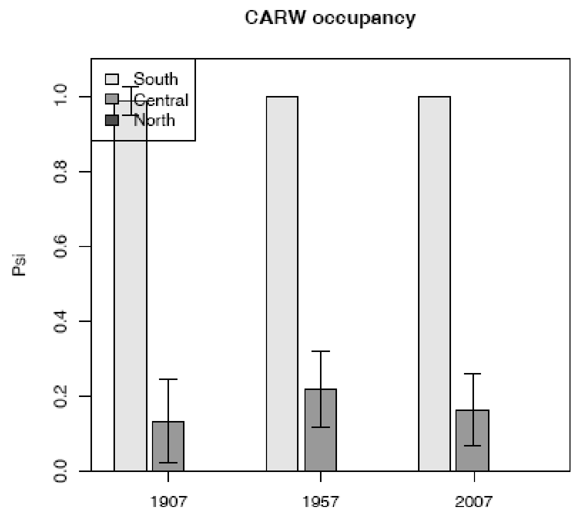


Fig. 5.44. Occupancy rates of Carolina wrens at North, Central, and South locations in the 1900s, 1950s, and 2000s.

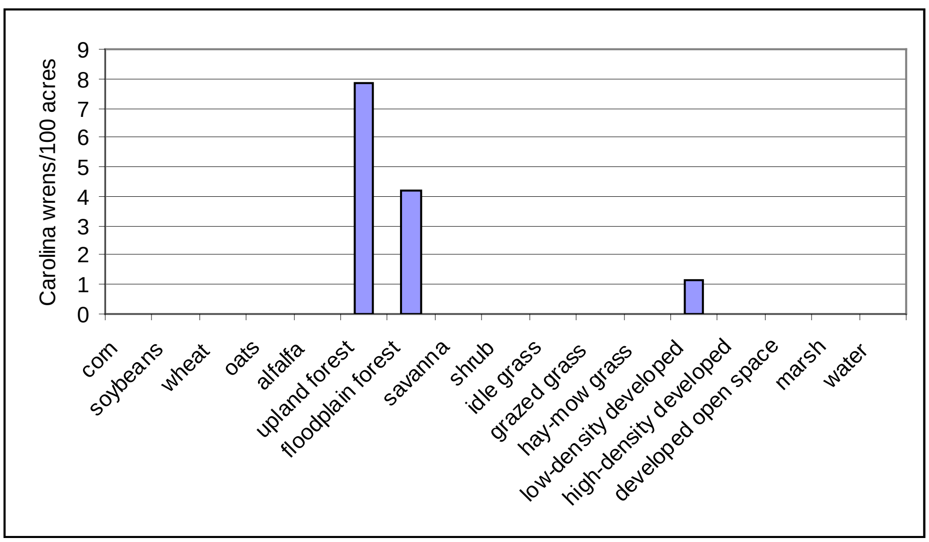


Fig. 5.45. Average density (birds per 100 acres) of Carolina wrens in various habitat types from transect surveys in Illinois, 2006-2008.

House Wren – While most species of wrens have a reputation as feisty birds, house wrens might be the most aggressive of the bunch. House wrens regularly take over nest boxes occupied by much larger eastern bluebirds, destroying the bluebirds' eggs and killing their nestlings. True to their name, house wrens readily nest in wren houses put out by people, and the house wren's song is common in residential areas throughout Illinois. Overall, house wrens are far more abundant in floodplain forests than other habitats, but they also occur in upland forests and savanna-open woodlands (Fig. 5.48). Some of the highest densities of house wrens in northern Illinois are in coniferous forests.

Our occupancy analyses suggest that house wrens occurred throughout Illinois during the past century, although in all three periods they were much less common in the southern region of the state (Fig. 5.47). Ridgway (late 1800s) reported house wrens were absent in Richland and Wabash counties in southeastern Illinois in the late 1800s. The species did not nest in Kentucky and Arkansas until the 1910s or 1920s. What historically limited their distribution to the northern states is unknown, but one potential factor may have been competition for nesting cavities in the south. For example, in the 1900s there were at least 13 species of cavity nesting birds in southern Illinois, compared to only 6 in northern Illinois. Developed areas seem to be enabling this bird's southward range expansion, including the greater availability of nest sites in the form of wren houses. Densities from our point count data suggest a fundamental difference in the habitat association of house wrens in southern Illinois with those in the central and northern regions today (Fig.5.49). In southern Illinois, house wrens were found almost exclusively in developed areas and rarely in more natural habitats. Similarly, the Grabers found house wrens were about equally abundant in residential areas statewide, but absent from forests in southern

Illinois. Overall, the North American Bird Banding Survey has demonstrated positive trends for house wrens in the state of Illinois (Fig.5.46)

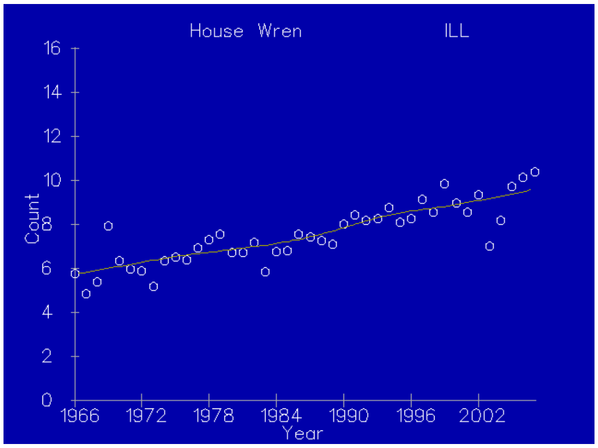


Fig. 5.46. Abundance of house wrens on North American Breeding Bird Survey routes in Illinois, 1966-2006.

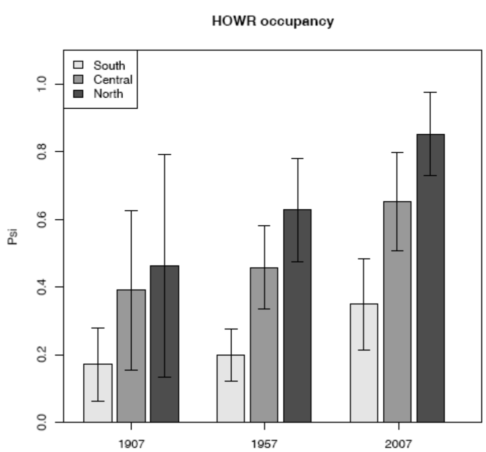


Fig. 5.47. Occupancy rates of house wrens at North, Central, and South locations in the 1900s, 1950s, and 2000s.

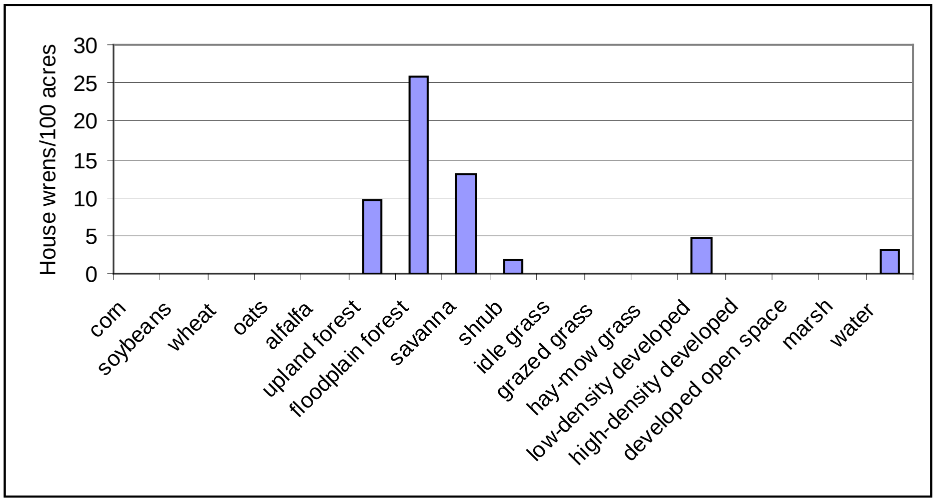


Fig. 5.48. Average density (birds per 100 acres) of house wrens in various habitat types from transect surveys in Illinois, 2006-2008.

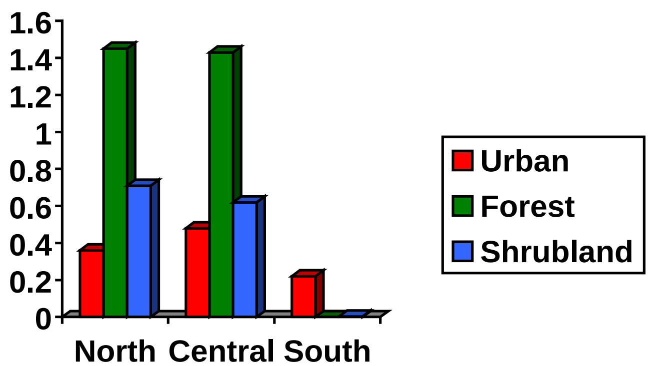


Fig. 5.49. Densities of house wrens (birds/ha) detected on point counts in urban, forest and shrubland habitats in North, Central and Southern Illinois, 2006-2008.

<u>Loggerhead Shrike</u> – If shrikes were much larger, they would pose a hazard to pets and small children. Also known as the "butcher bird," shrikes are the only songbirds that regularly kill other vertebrates. Shrikes impale their prey, usually large insects, frogs, snakes, mice and small birds, on thorns and barbed wire. This behavior seems to be a combination of a mating display (males showing females they are good providers), prey storage, and anchoring their prey so they

can tear it apart and eat it. Historically, 'hedge rows' of Osage orange trees and pastures with scattered shrubs and trees were prime shrike habitat, and both are much reduced compared to 50 or 100 years ago. Over time, the shrike's range in Illinois has contracted southward and the state population as a whole has declined (Figs. 5.50 and 5.51). A few outpost populations and scattered pairs persist in northern and central Illinois, and the population in southern Illinois is also shrinking, similar to shrike populations throughout most of the Midwest and southeastern United States. Recent studies in southern Illinois found the lowest nest success rates ever reported for loggerhead shrikes (Collins 1996, Walk et al. 2006). In 2009, the status of the loggerhead shrike in Illinois was changed from threatened to endangered.

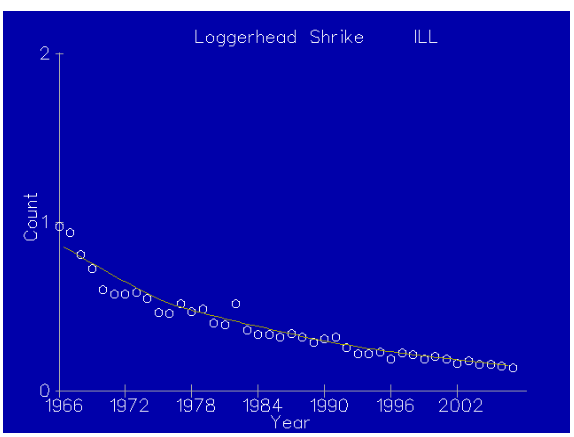


Fig. 5.50. Abundance of loggerhead shrikes on North American Breeding Bird Survey routes in Illinois, 1966-2006.

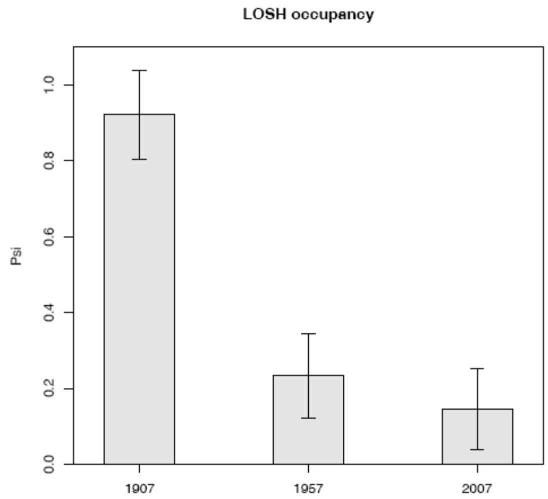


Fig. 5.51. Occupancy rates of loggerhead shrikes in the 1900s, 1950s, and 2000s.

Red-eyed Vireo – Like other forest birds that spend most of their time in the leafy forest canopy, red-eyed vireos were difficult to see during transect surveys. Our point counts estimated densities of red-eyed vireos to be about five times greater than those estimated from transect surveys. Red-eyed vireos occurred at about twice the density in northern Illinois as in the southern region.

The North American Breeding Bird Survey trend for red-eyed vireos has been stable since the 1960s (Fig.5.52), but our occupancy models show reduced occurrences of red-eyed vireos throughout the state over the three survey periods (Fig.5.53). This pattern could result if the number of red-eyed vireos in the state has remained fairly constant, but birds have become clustered into fewer areas. Given that forested areas have increased over time, particularly in the northern region where we found highest densities of red-eyed vireos in forests, this does not seem like a plausible explanation. The consistently declining occupancy rate of this species is surprising given the stability of Acadian flycatchers, eastern wood-pewees and other birds that also prefer closed-canopy forests. Like many forest-nesting birds, red-eyed vireos are a common victim of nest parasitism by brown-headed cowbirds. Understanding whether occupancy rates of red-eyed vireos are declining and why is important given that other sources of data show vireo abundance to be stable or increasing. If increasing forest area is masking a larger problem, red-eyed vireos may be poised for a dramatic decline when the amount of forest in Illinois stabilizes or if forest quality declines.

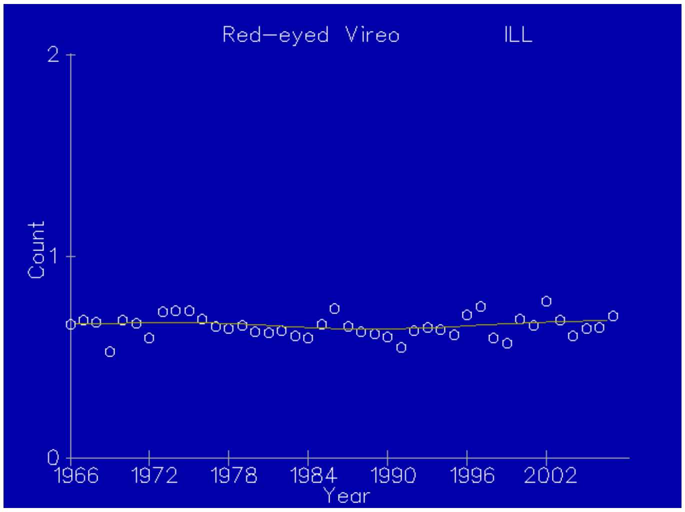


Fig. 5.52. Abundance of red-eyed vireos on North American Breeding Bird Survey routes in Illinois, 1966-2006.

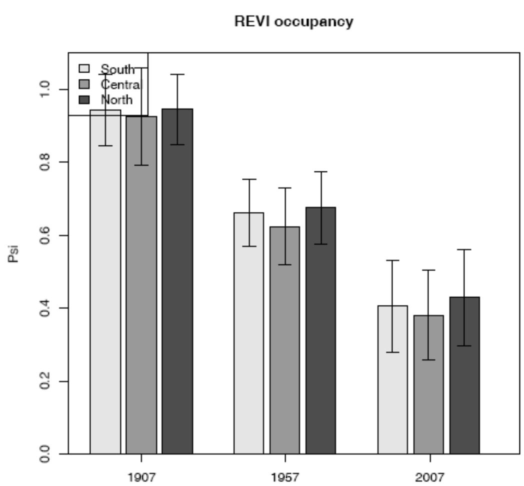


Fig. 5.53. Occupancy rates of red-eyed vireos at North, Central, and South locations in the 1900s, 1950s, and 2000s.

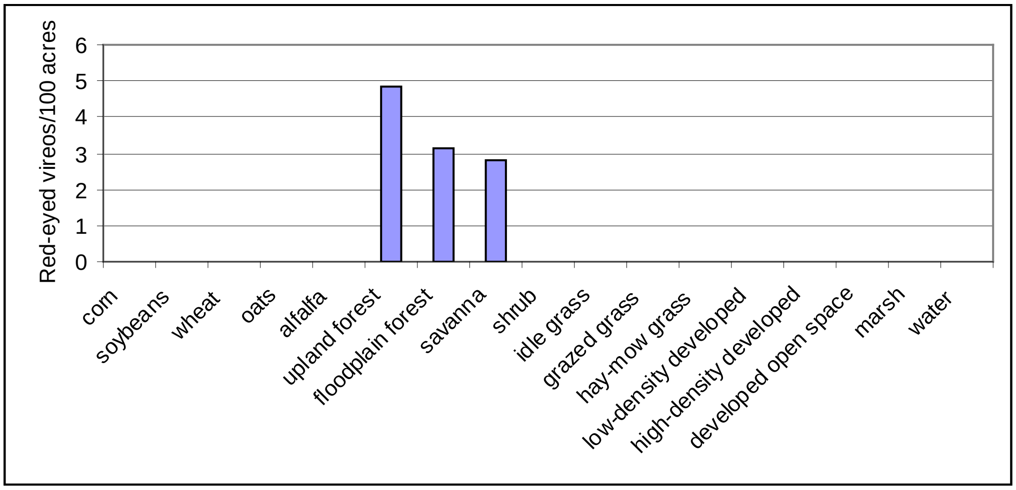


Fig. 5.54. Average density (birds per 100 acres) of red-eyed vireos in various habitat types from transect surveys in Illinois, 2006-2008.

Cedar Waxwing – Cedar waxwings are beautiful, interesting birds with a nomadic lifestyle well-suited for finding fruits and berries, their preferred food resources. Waxwings can be abundant at a site one day and gone the next. Large flocks will quickly strip a tree of fruit. Waxwings have significantly expanded their range southward in recent decades, from Canada and the northern states throughout the Midwest and across Appalachia. Waxwings were not recorded in the 1900s or 1950s summer surveys, but we regularly encountered them in shrublands, savanna-open woodlands, and developed areas during our 2000s surveys (Figs. 5.56 and 5.57). The North American Breeding Bird Survey shows dramatic growth of the waxwing population in Illinois (Fig.5.55).

Fruiting trees and shrubs and evergreens, which are preferred nesting substrates for cedar waxwings, are typical landscaping plants in developed areas and may be contributing to their range expansion. Waxwings could be 'stopped short' on their northward spring migration and prompted to nest where they encounter an abundant supply of food and good nesting sites. Waxwings are probably contributing to the spread of invasive fruiting shrubs by dispersing the seeds of bush honeysuckle and other plants.

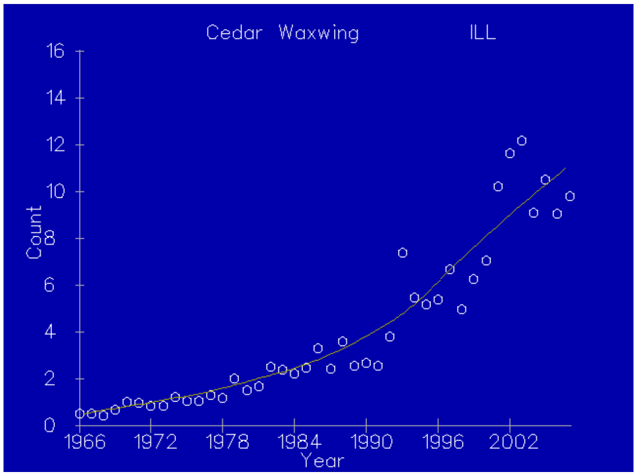


Fig. 5.55. Abundance of cedar waxwings on North American Breeding Bird Survey routes in Illinois, 1966-2006.

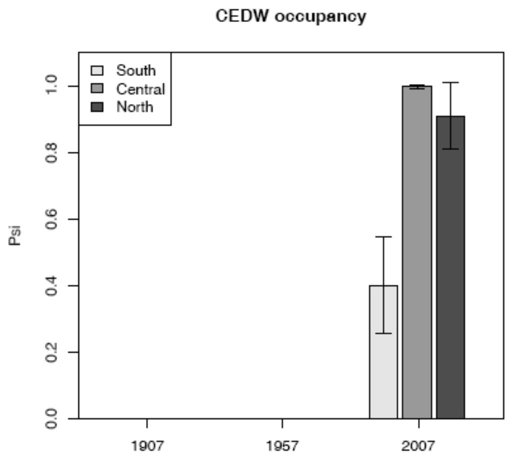


Fig. 5.56. Occupancy rates of cedar waxwings at North, Central, and South locations in the 1900s, 1950s, and 2000s.

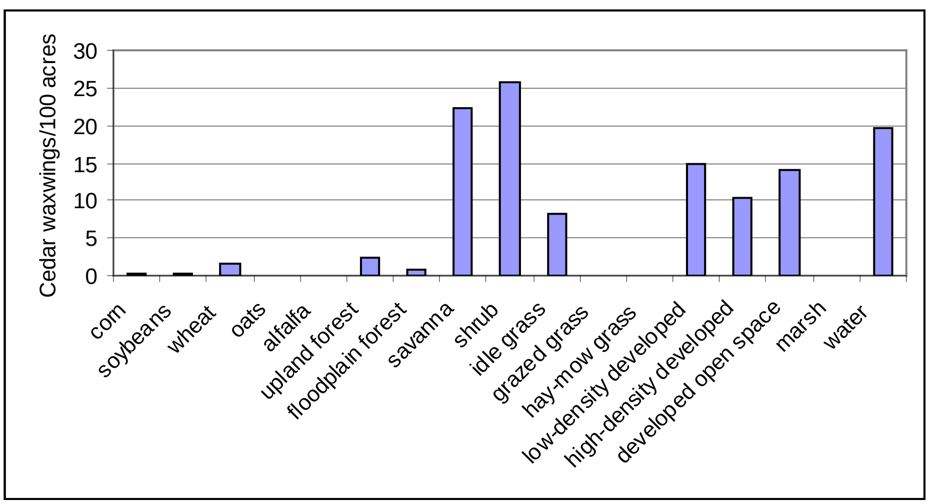


Fig. 5.57. Average density (birds per 100 acres) of cedar waxwings in various habitat types from transect surveys in Illinois, 2006-2008.

European Starling – European starlings were intentionally released in 1890 in New York as an ill-fated attempt to introduce all the birds mentioned in the works of Shakespeare. Those 60 released starlings have grown to a population now estimated around 200 million in North America. The first starlings in Illinois were reported from the University of Illinois campus in Urbana-Champaign in 1922. By the 1950s starlings occurred throughout the state, although occupancy rates were lower in the south than in central and north Illinois (Fig.5.59). In the 2000s occupancy rates were similar in all three regions. Like the house sparrow which arrived in Illinois 40 years earlier, starlings nest in natural cavities, buildings, and nest boxes at the expense of native species like bluebirds, purple martins, and red-headed woodpeckers. At the time of the Grabers' surveys in the 1950s, the starling population was still increasing. Today, the state may be effectively saturated with starlings; Breeding Bird Survey data show the abundance of starlings has leveled off in recent decades (Fig.5.58). Starlings are a serious agricultural pest, reported to cost more than $1.6 billion annually for damage to crops and disease transmission among livestock (Linz et al. 2007). Though it seems bizarre for a bird that is so abundant here, starlings are now endangered in many parts of their native Europe.

We found starlings in all habitat types, but they are most abundant in developed areas (Fig.5.60). In southern Illinois, starlings were almost exclusively found in developed areas, where their average density (373 birds/100 acres) was greater than in developed areas in central or northern Illinois (276 and 187 birds/100 acres, respectively).

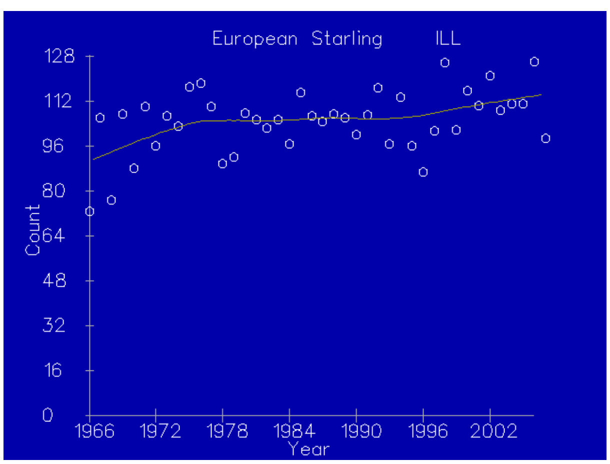


Fig. 5.58. Abundance of European starlings on North American Breeding Bird Survey routes in Illinois, 1966-2006.

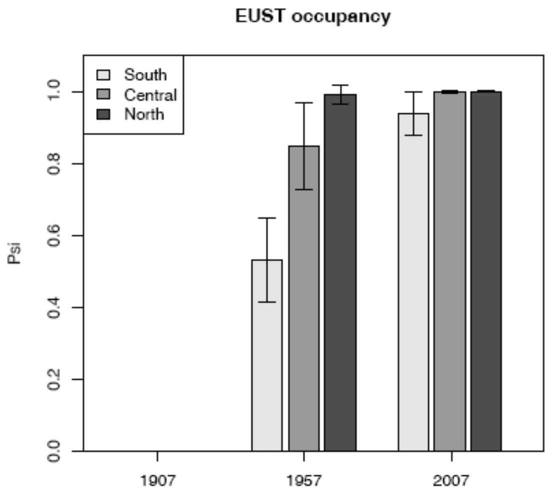


Fig. 5.59. Occupancy rates of European starlings at North, Central, and South locations in the 1900s, 1950s, and 2000s.

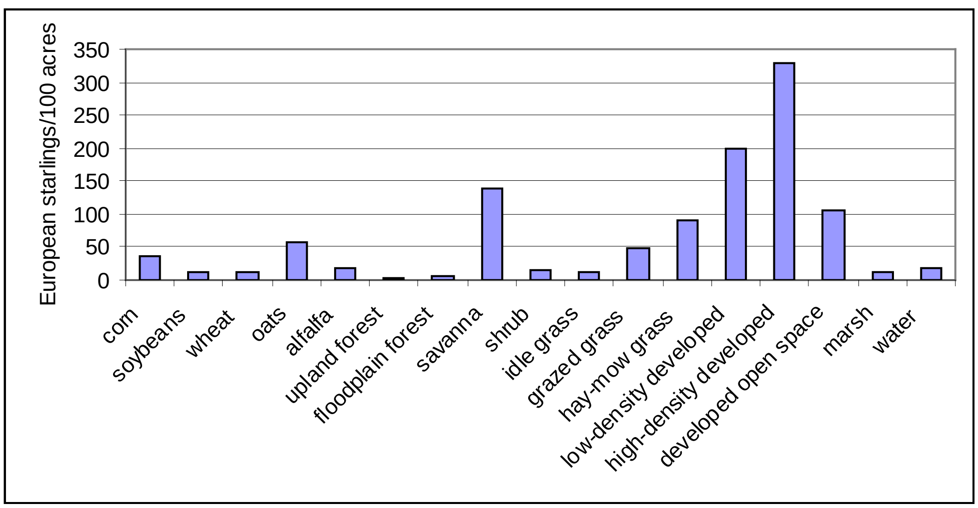


Fig. 5.60. Average density (birds per 100 acres) of European starlings in various habitat types from transect surveys in Illinois, 2006-2008.

Horned lark – "No Illinois species increased more dramatically between 1909 and 1957 than the horned lark," wrote the Grabers (pg. 477). Much of the population growth during the first half of the 20th century can be attributed to a shift in preferred habitat. Found mostly in grazed and hayed grasslands in the 1900s, horned larks had become abundant in fields of corn, soybeans and alfalfa by the 1950s surveys. Much like killdeer, horned larks survive in landscapes dominated by corn and soybeans by nesting early in the season in the sparse cover of the previous year's stubble. Unlike killdeer, however, changes in agricultural practices, such as earlier planting, may be contributing to the long-term decline in abundance of horned larks shown by the North American Breeding Bird Survey (Fig. 5.61).

In spite of reduced abundance, occupancy estimates suggest horned larks may be more widespread than in the 1950s or 1900s, particularly in southern Illinois. The increase in occupancy of the southern region by horned larks since the 1950s probably reflects the expansion of its two favorite habitats (corn and soybeans) by about 2.1 million acres between 1957 and 2007 (Fig.5.62). Despite increases in occupancy rates, average densities of horned larks within corn and soybeans in southern Illinois remain about half of the average densities in central and northern Illinois.

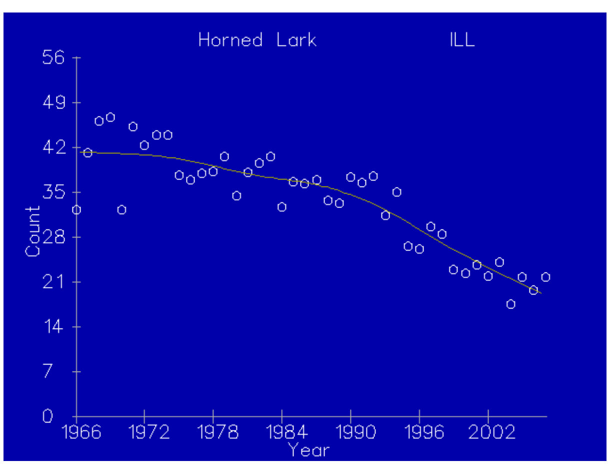


Fig. 5.61. Abundance of horned larks on North American Breeding Bird Survey routes in Illinois, 1966-2006.

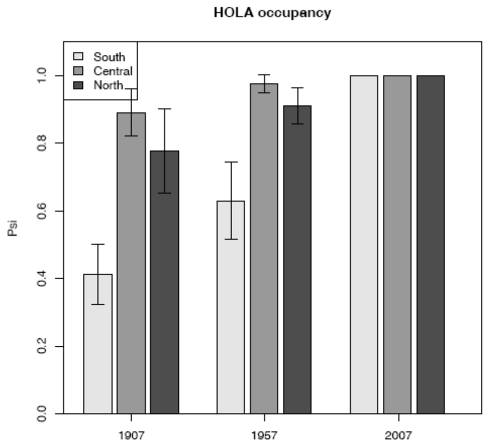


Fig. 5.62. Occupancy rates of horned larks at North, Central, and South locations in the 1900s, 1950s, and 2000s.

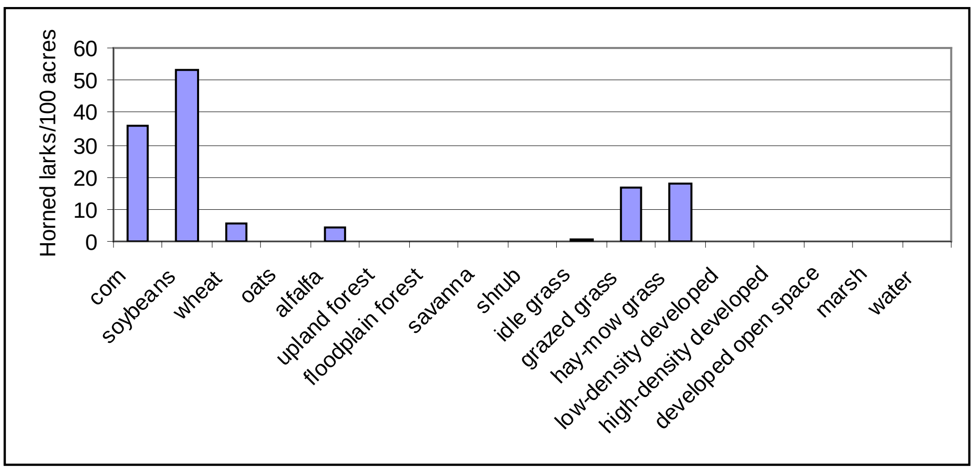


Fig. 5.63. Average density (birds per 100 acres) of horned larks in various habitat types from transect surveys in Illinois, 2006-2008.

Swallows

With the exception of purple martins, which have had stable or slightly declining population over the past century, the five other species of swallows in Illinois (barn, bank, northern rough-winged, cliff, and tree)currently have increasing populations (Fig. 5.64). Two of these species, barn and tree swallow, have also expanded their distributions south (Fig. 5.65).

The range expansion of the barn swallow was one of our most surprising results. In the 1900s surveys, Gross and Ray encountered barn swallows only once in southern Illinois. At that time, barn swallows did not nest in Arkansas, Tennessee or other southern states. By the 1950s, the Graber's reported that barn swallows had "increased greatly," particularly in southern Illinois. Our recent results showed the density of barn swallows was slightly greater in southern Illinois than elsewhere in the state. Historically, it is possible that the extensive forest cover of southern Illinois restricted barn swallows to the more open landscapes of the northern and central regions. By the 1900s, however, much of the forest had been removed from southern Illinois and barns for nesting were abundant, so the delay in the barn swallow's southward range expansion remains unexplained. Tree swallows have also increased in overall abundance and moved southward, a trend that had been noted in other parts of their range (Winkler).

The continued increase in barn swallow abundance in Illinois is somewhat surprising given there are fewer open barns for nesting and their preferred foraging habitat (grazed grasslands, Fig. 5.66) are less common. It appears that barn swallows, and more recently cliff swallows, have begun nesting under bridges and in large culverts. These nesting sites are abundant and typically very safe from predators.

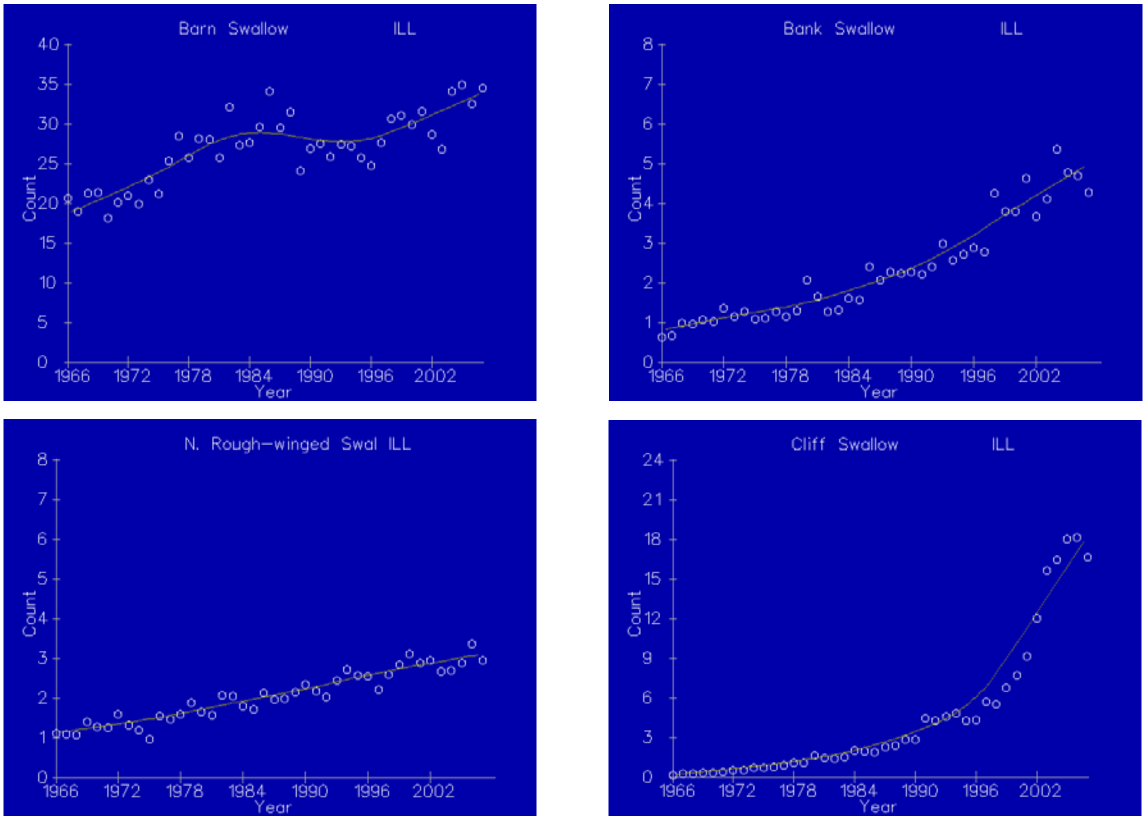


Fig. 5.64. Abundance of (A) barn swallows, (B) bank swallows, (C) northern rough-winged swallows, and (D) cliff swallows on North American Breeding Bird Survey routes in Illinois, 1966-2006.

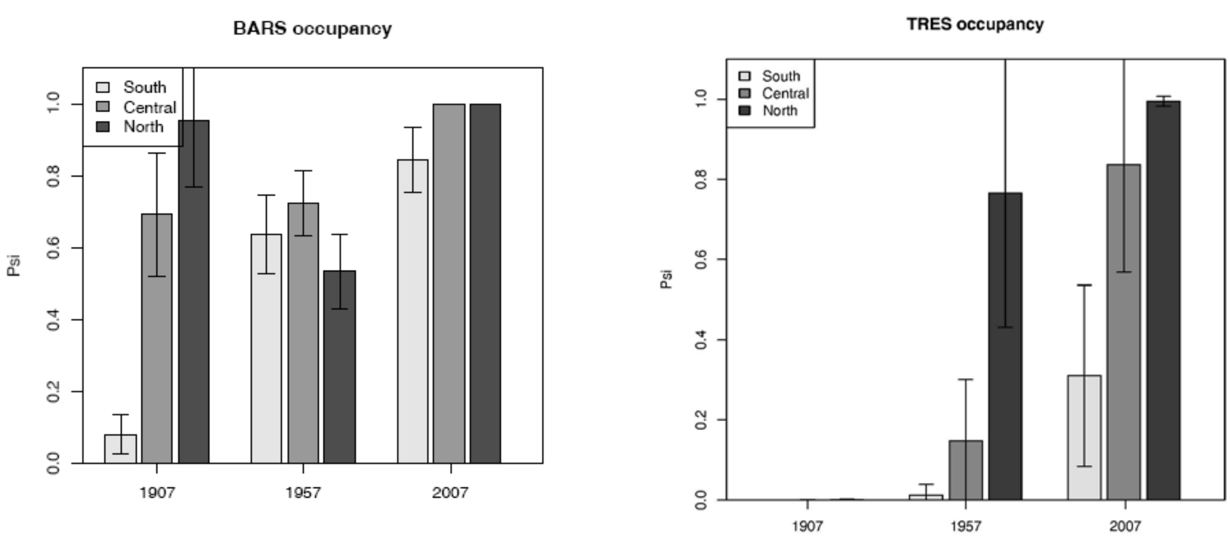


Fig. 5.65. Occupancy rates of barn swallows (left) and tree swallows (right) at North, Central, and South locations in the 1900s, 1950s, and 2000s.

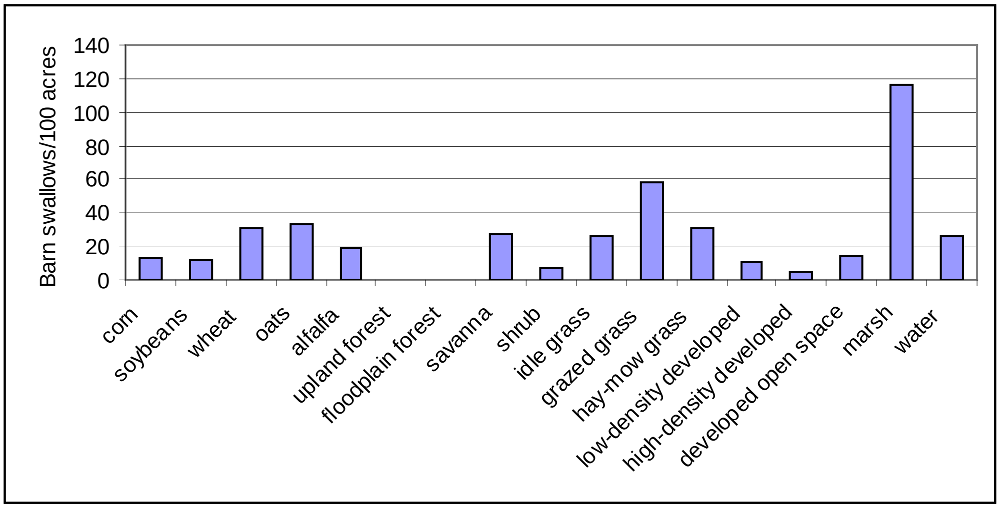
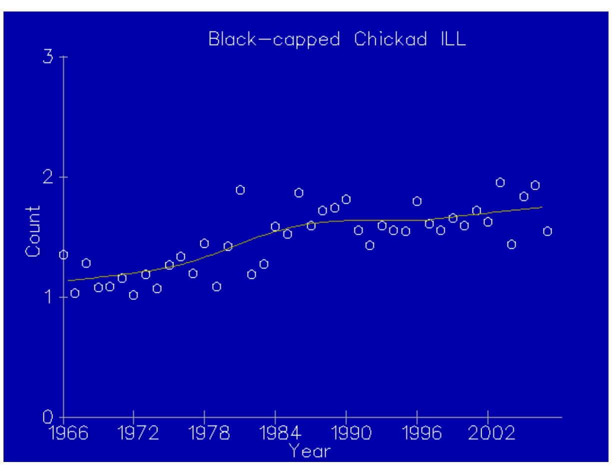


Fig. 5.66. Average density (birds per 100 acres) of barn swallows in various habitat types, from transect surveys in Illinois, 2006-2008.

Chickadees – Illinois is home to both the northerly black-capped chickadee and southerly Carolina chickadee. A contact zone between the two species occurs across central Illinois, from roughly St. Louis to Danville, , where birders might encounter birds that sing hybrid songs of black-capped and Carolina chickadees or 'bilingual' birds that sing both songs. This contact zone appears to have been stable since the 1960s (Enstrom and Bollinger 2009).

The average density of black-capped chickadees in northern Illinois forests is about twice the density of Carolina chickadees in southern Illinois forests. This difference may be due to competition with tufted titmice, which are common in southern Illinois and decrease in abundance farther north. North American Breeding Bird Survey trends also differ for the two species, with black-capped chickadees increasing, and Carolina chickadees stable (Fig. 5.67). The occupancy data from transects also suggests that Black-capped Chickadees are increasing while Carolina Chickadees are stable (Fig. 5.68). Forested land cover has increased rapidly in the black-capped chickadee's range in northern Illinois, whereas forest cover has increased only slightly in the Carolina chickadee's range in southern Illinois (Fig. 5.69).



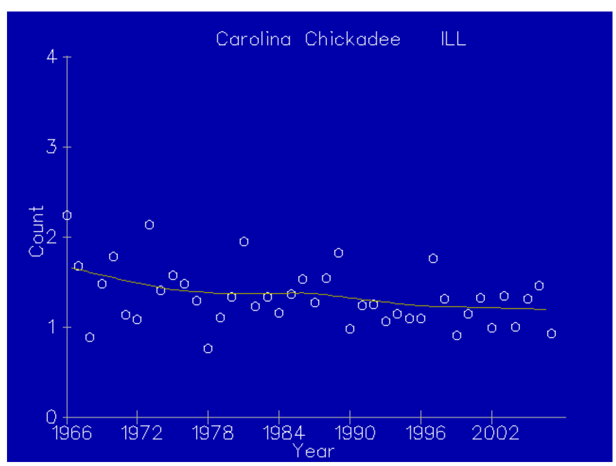


Fig. 5.67. Abundance of black-capped chickadees (left) and Carolina chickadees (right) on North American Breeding Bird Survey routes in Illinois, 1966-2006.

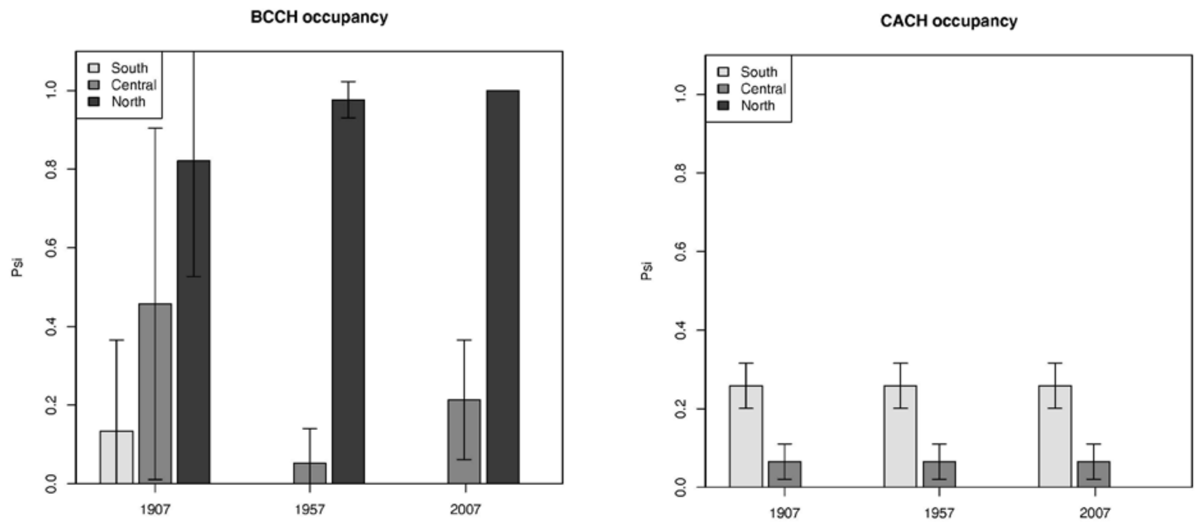


Fig. 5.68. Occupancy rates of black-capped chickadees (left) and Carolina chickadees (right) at North, Central, and South locations in the 1900s, 1950s, and 2000s.

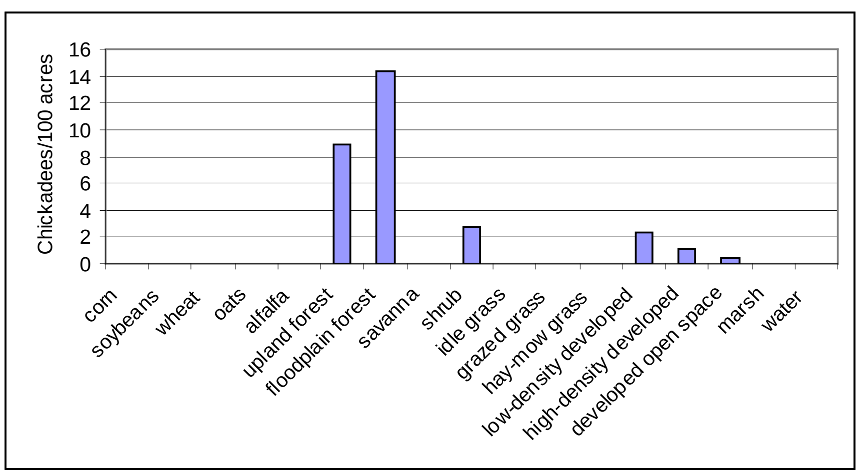


Fig. 5.69. Average density (birds per 100 acres) of chickadees (both species combined) in various habitat types, from transect surveys in Illinois, 2006-2008.

Tufted Titmouse – Like Carolina wrens, tufted titmice are ubiquitous in southern Illinois, and scarcer and locally distributed in the central and northern regions (Fig. 5.71). Like chickadees, titmice nest in tree cavities, inhabit a variety of forest types, and are regular visitors to sunflower feeders in low-density developed areas (Fig. 5.72). In northern Illinois, we found tufted titmice only in developed areas. The North American Breeding Bird Survey shows that the abundance of titmice has remained fairly stable since the 1960s (Fig. 5.70). Competition with black-capped chickadees might be a factor limiting the distribution of the tufted titmice. Black-capped chickadees are found at twice the density in northern forests than Carolina chickadees are in southern forests, potentially preventing tufted titmice from expanding their distribution in the north. Nonetheless, with increasing forest habitat and climate change, titmice are likely to move northward in the future.

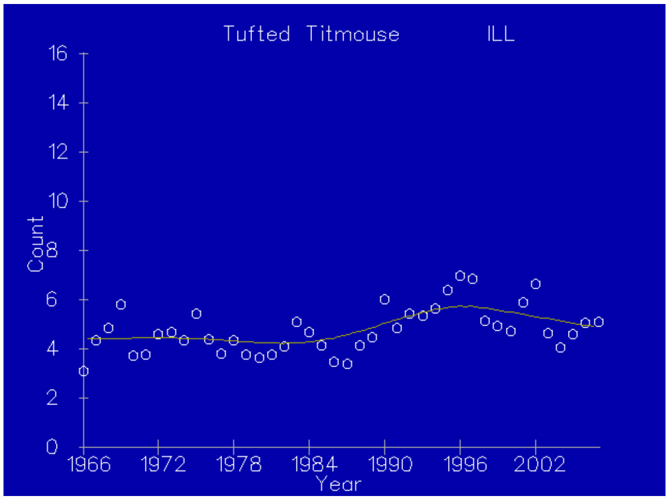


Fig. 5.70. Abundance of tufted titmice on North American Breeding Bird Survey routes in Illinois, 1966-2006.

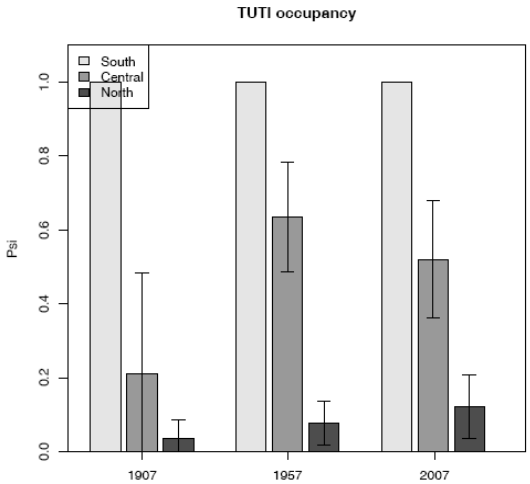


Fig. 5.71. Occupancy rates of tufted titmice at North, Central, and South locations in the 1900s, 1950s, and 2000s.

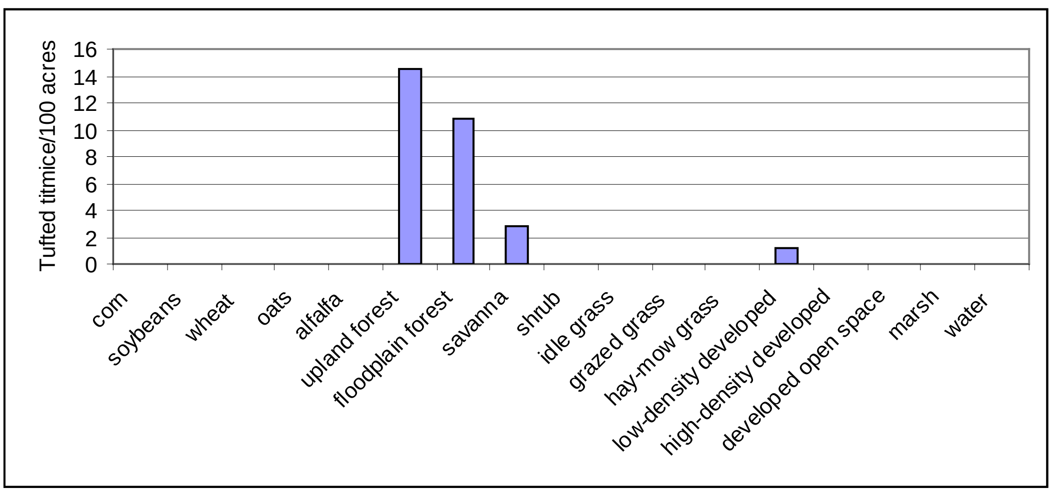


Fig. 5.72. Average density (birds per 100 acres) of tufted titmice in various habitat types from transect surveys in Illinois, 2006-2008.

Brown Thrasher – In the 1900s surveys, when shrubby hedge rows and fences bound nearly every small field, brown thrashers were among the most important species in cropland, grassland and shrubland habitats. Removal of woody field borders and increases in field size have left far less habitat for thrashers in the state. We only encountered thrashers regularly in linear wooded habitats, shrublands and the understory of savanna-open woodlands (Fig. 5.75). The decline of brown thrashers was first detected between 1900s and 1950s in southern Illinois (Fig. 5.74). This decline has continued in the south, but over the recent time span also occurred in the northern and central regions. The alarming population trends of brown thrashers and many other shrubland birds highlight the need to create and manage shrubland habitat (Fig. 5.73).

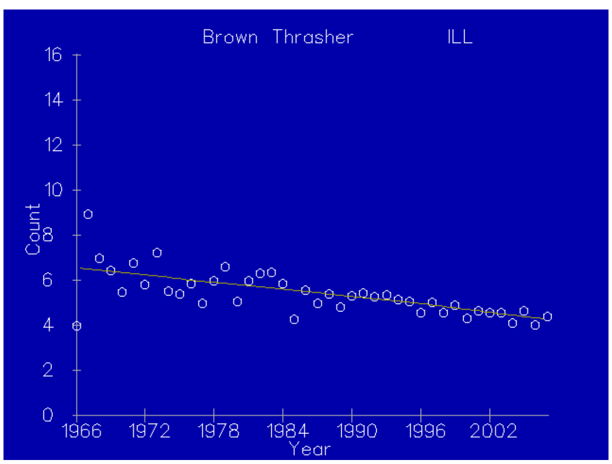


Fig. 5.73. Abundance of brown thrashers on North American Breeding Bird Survey routes in Illinois, 1966-2006.

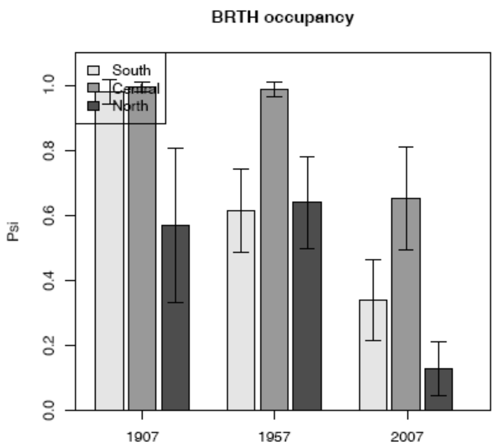


Fig. 5.74. Occupancy rates of brown thrashers at North, Central, and South locations in the 1900s, 1950s, and 2000s.

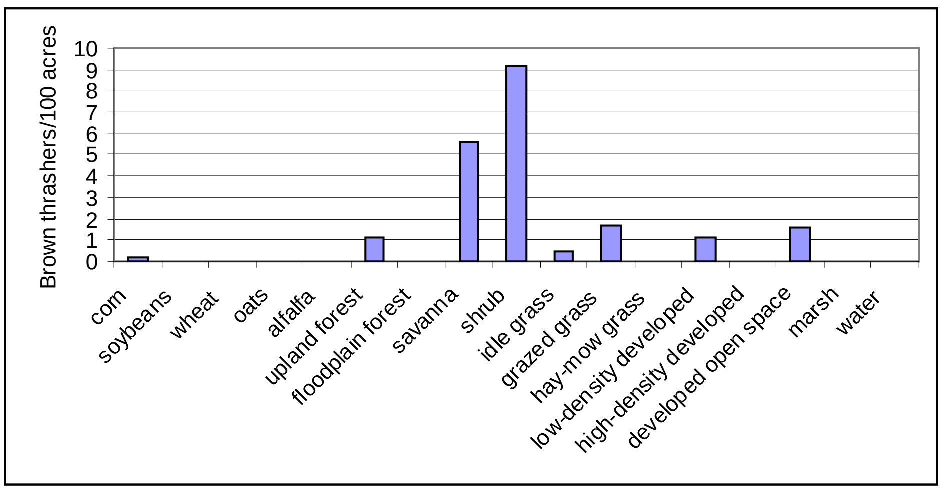


Fig. 5.75. Average density (birds per 100 acres) of brown thrashers in various habitat types from transect surveys in Illinois, 2006-2008.

American Robin – The American robin has benefitted from the suburbanization of Illinois, and the species seems likely to do extremely well into the foreseeable future. In the 1900s, Gross and Ray found only about 6% of the state's robins in developed areas, increasing to about 28% during the Grabers' 1950s surveys. We found 61% of all robins in developed areas. Robins reach their highest density in developed areas (Fig. 5.78), and the density of robins in developed areas does not vary much among northern, central, and southern Illinois. The overall regional abundance of robins has also changed over time: density was greatest in the southern region in the 1900s but greatest in northern Illinois in the 1950s and 2000s.

The most significant change in the bird community of forests from the 1950s to 2000s was the robin's rise from about 20th place to the most commonly encountered bird. Most of this change happened in northern Illinois, where robins are three times more abundant in forests as compared to southern Illinois forests. Since robins, like waxwings, are proficient at spreading the seeds of fruits they eat, the abundance of robins is probably an important factor in the rapid spread of invasive fruiting shrubs like bush honeysuckle.

The Breeding Bird Survey trend for American robins shows impressive population increases in recent years (Fig. 5.76). Models show occupancy rates dropped in the 1950s in southern and central Illinois, perhaps related to organochlorine chemicals that were being used at the time and were highly toxic to robins (Fig. 5.77, see also next chapter). Robins are wintering hundreds of miles further north today than they did 40 years ago (Niven and Butcher 2009), which could be related to climate change and milder winters or to increased food availability and secure habitat in developed areas.

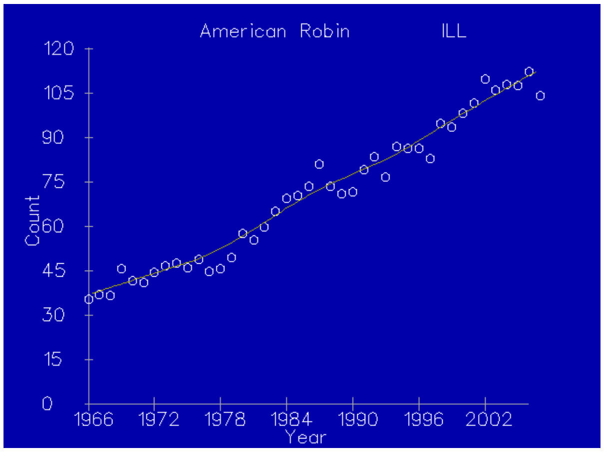


Fig. 5.76. Abundance of American robins on North American Breeding Bird Survey routes in Illinois, 1966-2006.

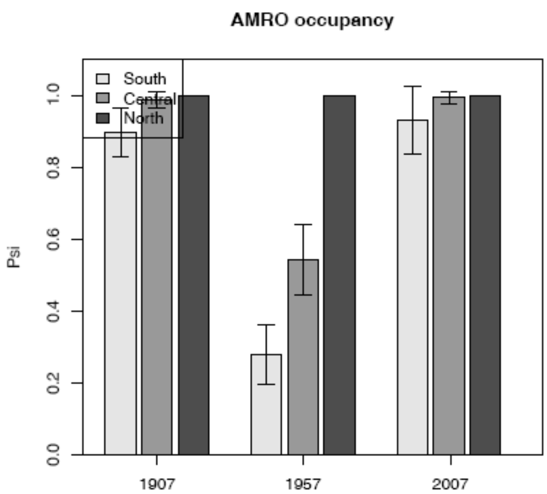


Fig. 5.77. Occupancy rates of American robins at North, Central, and South locations in the 1900s, 1950s, and 2000s.

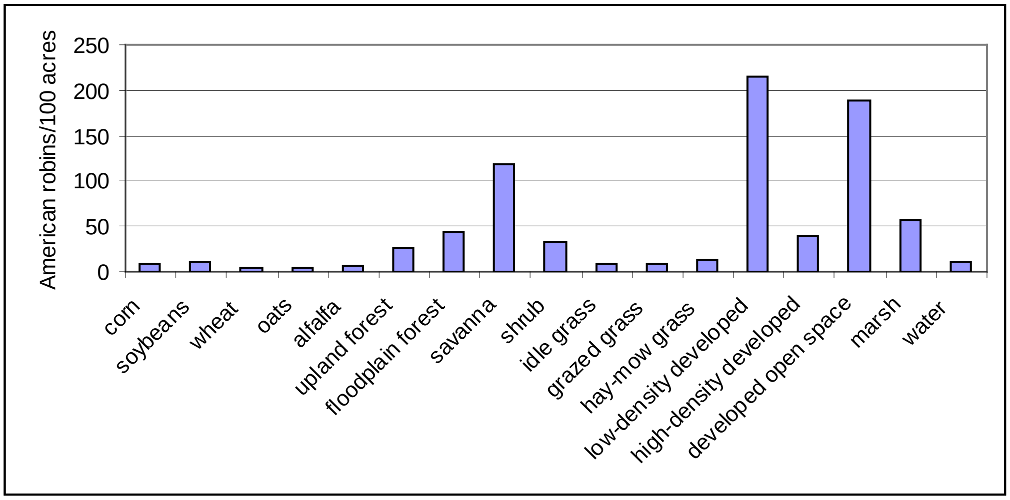


Fig. 5.78. Average density (birds per 100 acres) of American robins in various habitat types from transect surveys in Illinois, 2006-2008.

Red-winged Blackbird – During the late-spring and early-summer months, red-winged blackbirds are exceptionally abundant throughout Illinois. The red-winged blackbirds has probably been the most common bird in Illinois throughout the last century, and it is among the ten most common birds in North America. Red-winged blackbirds are generalists because they are abundant, and not abundant because they are generalists: their densities are highest in their original preferred habitat (marshes) and in fields planted to small grains like wheat, where they can probably nest successfully before the grain is harvested (Fig. 5.81). However, because of frequent mowing of alfalfa and hayed grasslands and high predation rates in linear grassland habitats, the red-winged blackbirds dominating these areas are probably not contributing much recruitment to the overall population.

Although red-winged blackbirds have always been an abundant bird in Illinois, we found evidence that their occupancy was lowest in the 1950s, possibly related to the use of some pesticides (Fig. 5.80). Looking ahead, the state's red-winged blackbird population is likely to drop. The two most rapidly expanding habitats, development and forest, are the two habitat classes with the lowest densities of red-winged blackbirds. While it seems unlikely that red-winged blackbirds will be uncommon in 50 years, it is possible that its status as the most abundant bird in the state will be overtaken by common grackles, mourning doves, American robins or European starlings.

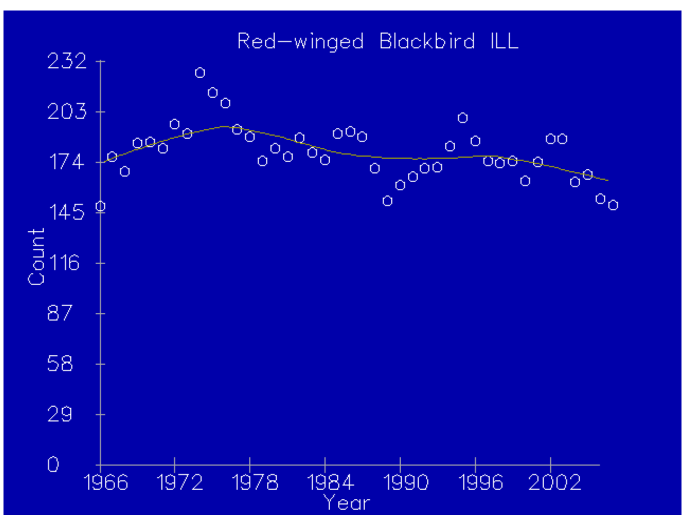


Fig. 5.79. Abundance of red-winged blackbirds on North American Breeding Bird Survey routes in Illinois, 1966-2006.

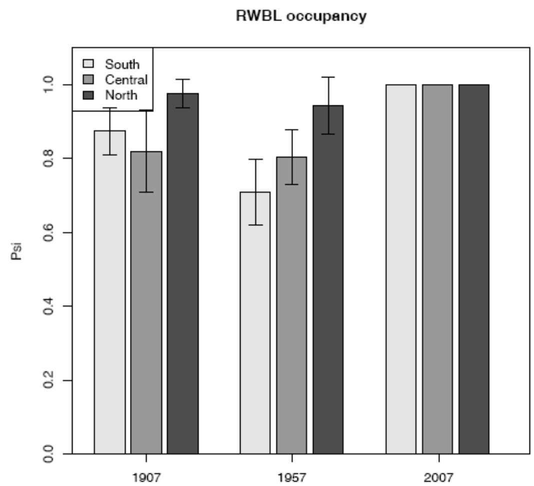


Fig. 5.80. Occupancy rates of red-winged blackbirds at North, Central, and South locations in the 1900s, 1950s, and 2000s.

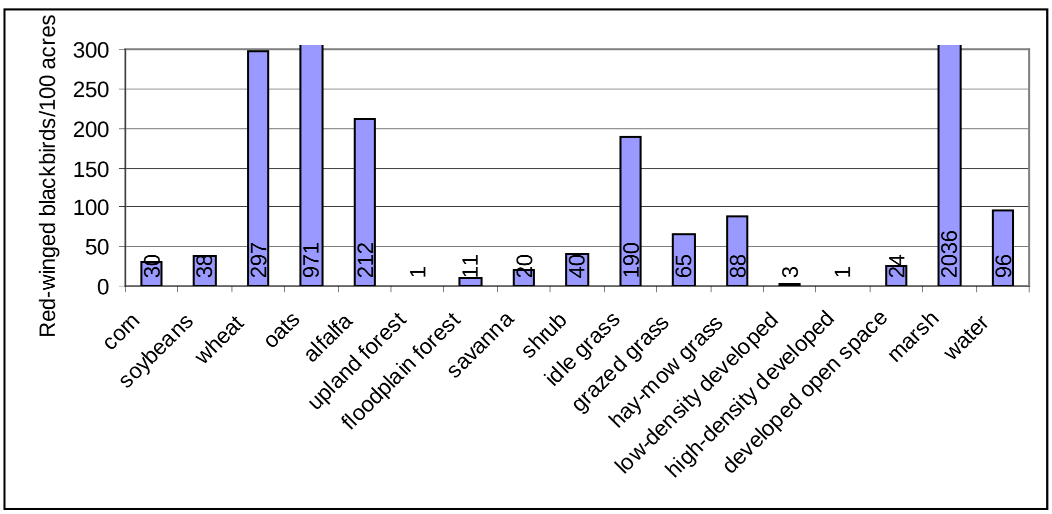


Fig. 5.81. Average density (birds per 100 acres) of red-winged blackbirds in various habitat types from transect surveys in Illinois, 2006-2008. Note: densities in marshes and oat fields greatly exceeded the scale of this chart.

Brown-headed Cowbird – Brown-headed cowbirds are obligate brood parasites – they lay their eggs in the nests of other birds, and they never build their own nests, incubate their own eggs, or feed their own nestlings. This behavior probably evolved when cowbirds followed nomadic herds of bison across the Great Plains and could not remain in one place long enough to raise their own young. Cowbird parasitism can be problematic for the host birds, because fast-growing cowbird hatchlings are aggressive and crowd out or kill their nest mates. Adult female cowbirds often destroy hosts' nests by removing eggs during incubation or killing nestlings, probably to force the host birds to re-nest and give the cowbirds another opportunity to lay their eggs. Cowbirds also engage in mafia-like behavior; female cowbirds re-visit nests they have parasitized, and if the cowbird eggs have been removed from the nest, the cowbird will destroy the host's eggs (Hoover and Robinson 2007).

Cowbird parasitism has been a regular occurrence in Illinois for well over a century. Ridgway (1889) described the cowbird as common throughout the state, adding the female cowbird

> "…hunts stealthily though the woods, usually in the undergrowth, and when a nest is discovered, patiently awaits from a convenient hiding place the temporary absence of the parent, when the nest is steathly and hastily inspected, and if found suitable she takes possession and deposits her egg, when she departs as quietly as she came."

Research by Scott Robinson at the Illinois Natural History Survey showed that exceptionally high rates of cowbird parasitism essentially eliminate recruitment by wood thrushes, vireos, and warblers in the most fragmented forests of the Midwest (Robinson et al. 1997). Elsewhere, excessive parasitism by cowbirds is a threat to several endangered species, including Kirtland's warbler in Michigan and the golden-cheeked warbler in central Texas.

Statewide, we found the highest density of cowbirds in shrubland habitats (Fig. 5.84). Not surprisingly, common shrub-nesting birds like field sparrows, indigo buntings and northern cardinals are among the most frequent victims of cowbird parasitism. In southern Illinois, cowbirds are found more often in forests than in grasslands, whereas they are about equally common in forests and grasslands in central and northern Illinois. Like many other birds, cowbirds show a ‘dip’ in their occupancy rates in the 1950s, particularly in northern and central Illinois (Fig. 5.83). The 2000s surveys found high occupancy rates of brown-headed cowbirds throughout the state and the North American Breeding Bird Survey shows an increasing trend since the mid-1960s (Fig. 5.82).

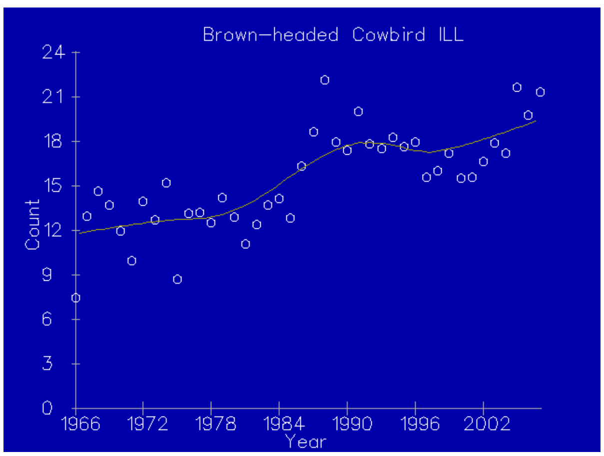


Fig. 5.82. Abundance of brown-headed cowbirds on North American Breeding Bird Survey routes in Illinois, 1966-2006.

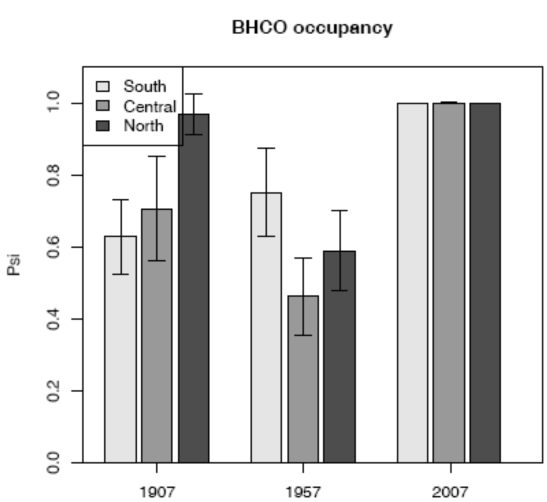


Fig. 5.83. Occupancy rates of brown-headed cowbirds at North, Central, and South locations in the 1900s, 1950s, and 2000s.

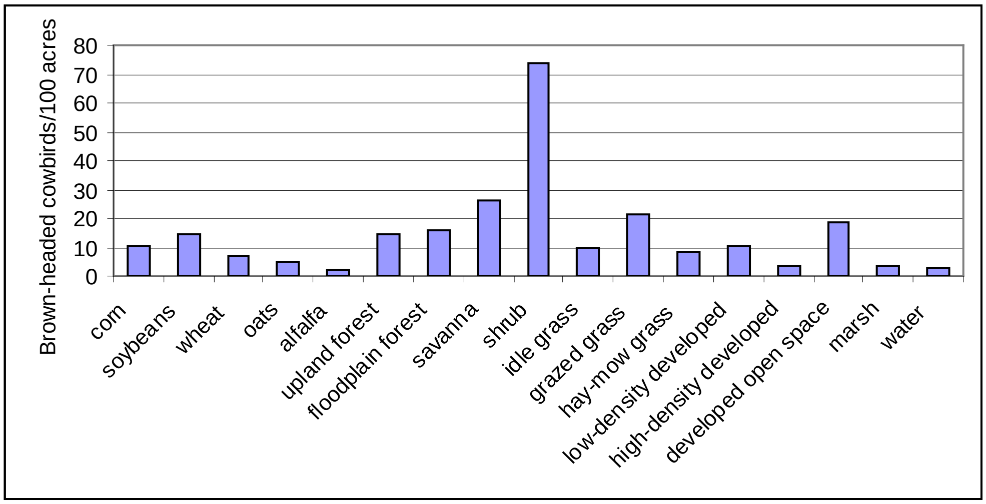


Fig. 5.84. Average density (birds per 100 acres) of brown-headed cowbirds in various habitat types from transect surveys in Illinois, 2006-2008.

Bobolink – The Grabers reported bobolinks that had increased in abundance between the 1900s and 1950s in the central region, and our occupancy models also suggest a slight southward range expansion over the last 50 years (Fig. 5.86). We suspect that the few birds encountered in the southern region were actually late migrants en route to more northerly nesting areas. Bobolink density averaged three times greater in northern Illinois grasslands than in central Illinois habitats. In central Illinois, we regularly found bobolinks in grasslands at sites west of the Illinois River but rarely to the east. Even though bobolinks remain relatively wide spread over the northern half of the state, their abundance and occupancy rates have dropped considerably. The North American Breeding Bird Survey estimates a rate of decline of 8.5% per year over the past 40 years – a cumulative decline of well over 90% (Fig. 5.85). Many of the locations where we detected large numbers of bobolinks were grasslands managed by county forest preserve districts in northeastern Illinois.

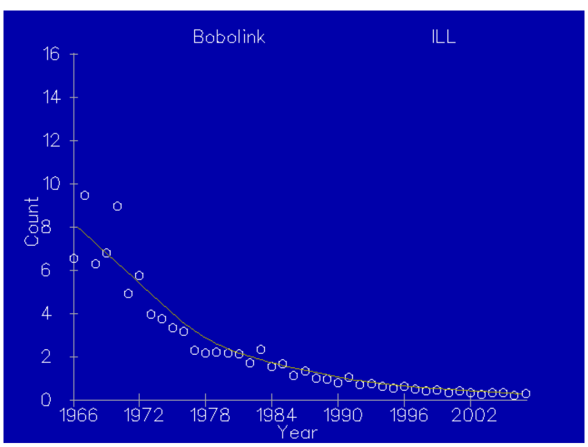


Fig. 5.85. Abundance of bobolinks on North American Breeding Bird Survey routes in Illinois, 1966-2006.

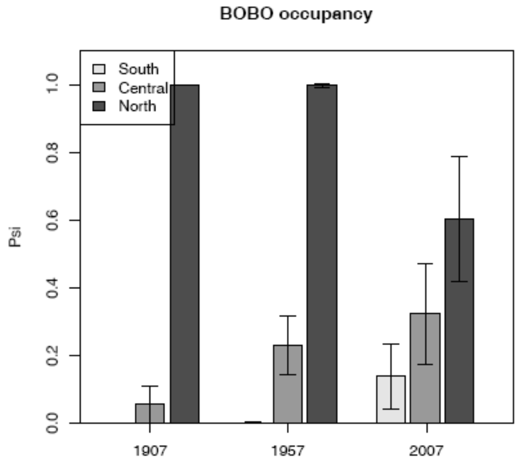


Fig. 5.86. Occupancy rates of bobolinks at North, Central, and South locations in the 1900s, 1950s, and 2000s.

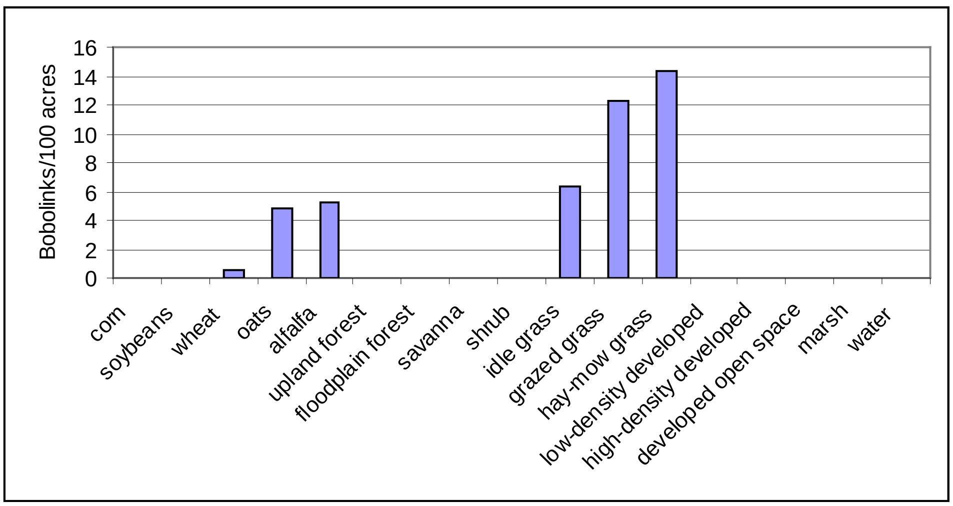


Fig. 5.87. Average density (birds per 100 acres) of bobolinks in various habitat types from transect surveys in Illinois, 2006-2008.

Meadowlarks – Meadowlarks may have been the most familiar birds to Illinois residents during the surveys of Gross and Ray in the early 1900s. Throughout most of the state, only the eastern meadowlark is present. Western meadowlarks are common in the northwestern counties but can be found locally in northeastern and central Illinois. Although they have become less common in Illinois over time, meadowlarks remain widespread and can still be found in most grasslands, including rural roadsides (Fig. 5.90). Eastern meadowlark densities in grasslands are greater in southern Illinois than in the northern or central regions. The North American Breeding Bird Survey offers the hope that the eastern meadowlark population 'bottomed out' around 1980 and has been stable or only slightly declining since (Fig. 5.88).

Our occupancy models show that meadowlarks were present statewide in the 1900s and 1950s, and were only missing from a few northern Illinois areas in the 2000s (Fig. 5.89). However, including information on density paints a much more concerning picture for meadowlarks. We divided all counts of meadowlarks over the three survey periods into 'high-density' and 'low-density' categories. Nearly all of the 1900s and 1950s surveys found high-densities of meadowlarks, but about half of the places where we found meadowlarks in the 2000s in central and northern Illinois were low-density counts. Recently, meadowlarks were still at high-densities in the southern region, where grasslands remain more common (Fig. 5.89). If loss of grassland habitat continues, meadowlarks are likely to be absent from many areas of central and northern Illinois in the near future. The meadowlark's pattern of remaining widespread at a low-density rather than becoming localized has probably prevented people from perceiving how severely the population has declined.

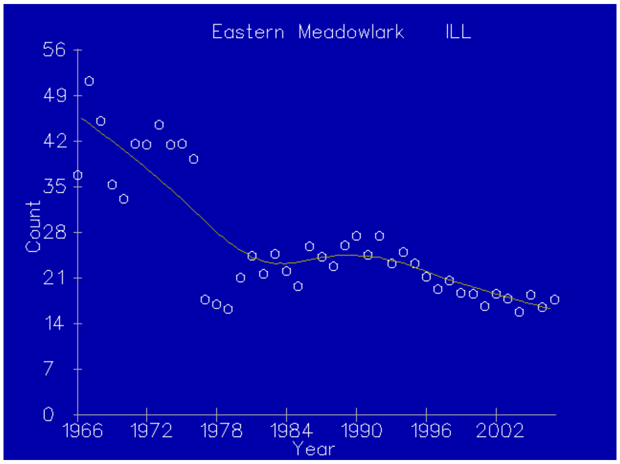


Fig. 5.88. Abundance of eastern meadowlarks on North American Breeding Bird Survey routes in Illinois, 1966-2006.

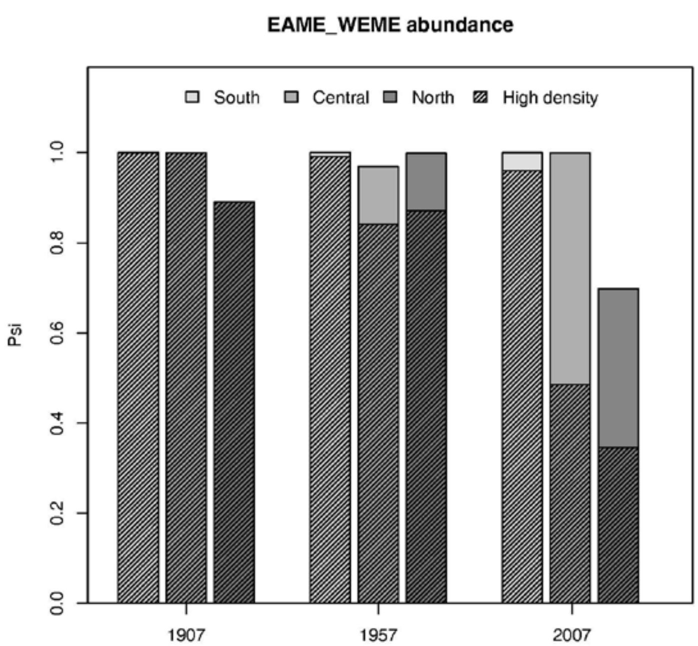


Fig. 5.89. High-density and low-density occupancy rates of meadowlarks at North, Central, and South locations in the 1900s, 1950s, and 2000s.

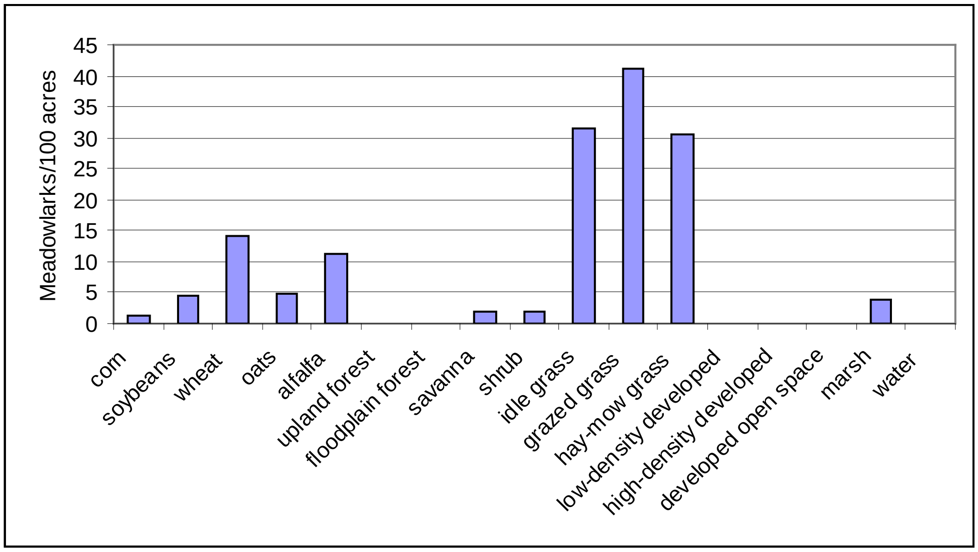


Fig. 5.90. Average density (birds per 100 acres) of meadowlarks (both species combined) in various habitat types, from transect surveys in Illinois, 2006-2008.

Chipping Sparrow – Chipping sparrows have adapted well to suburban living – nearly every yard in the state with a blue spruce also hosts a pair of chipping sparrows. In the 1900s surveys, 19 of the 29 chipping sparrows recorded were in grasslands or small grain fields. Only eight birds (5 in residential areas) were recorded in the 1950s surveys. By our 2000s surveys chipping sparrows recovered throughout the state, and occupancy rates were at or above those estimated in the 1950s, especially in central Illinois (Fig. 5.92). Nearly two-thirds of the 227 chipping sparrows observed in the 2000s surveys were in developed areas (Fig. 5.93). Aside from low-density developed areas and developed open space, we found chipping sparrows were common in savanna-type habitats. A few were also encountered in crop fields and

grasslands, probably foraging. Average density of chipping sparrows is greatest in the central region, about twice the density recorded in northern Illinois, and four times the density recorded in southern Illinois.

It is unclear why chipping sparrows were so uncommon during the 1950s surveys, perhaps their low numbers were due to pesticide use (addressed in the next chapter) or the same factors causing mid-century ‘dips,’ or decreases in the occupancy rates of American robins, brown-headed cowbirds, and common grackles. Others besides the Grabers noticed the absence of chipping sparrows during the mid-part of the 20th century. Ford et al. (1934) in their “Birds of the Chicago Region” stated that the chipping sparrow was a “fairly common summer resident….. However it has become rare in the immediate vicinity of Chicago where formerly it was exceedingly common.” The Breeding Bird Survey confirms they have increased rapidly since the mid-1960s (Fig. 5.91).

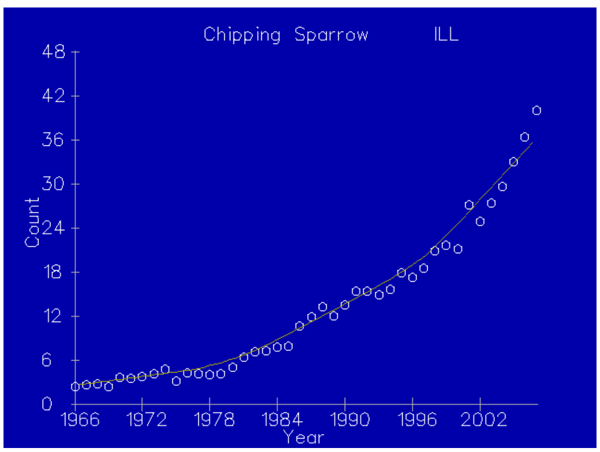


Fig. 5.91. Abundance of chipping sparrows on North American Breeding Bird Survey routes in Illinois, 1966-2006.

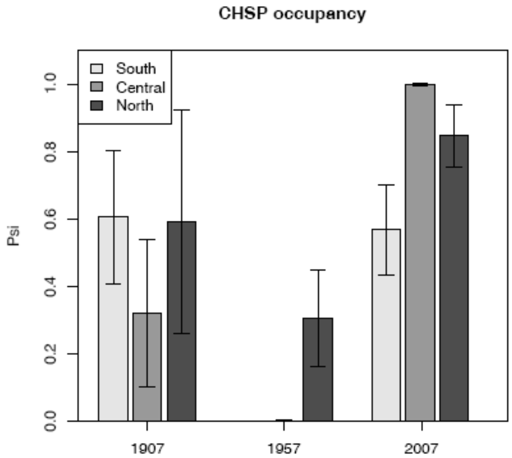


Fig. 5.92. Occupancy rates of chipping sparrows at North, Central, and South locations in the 1900s, 1950s, and 2000s.

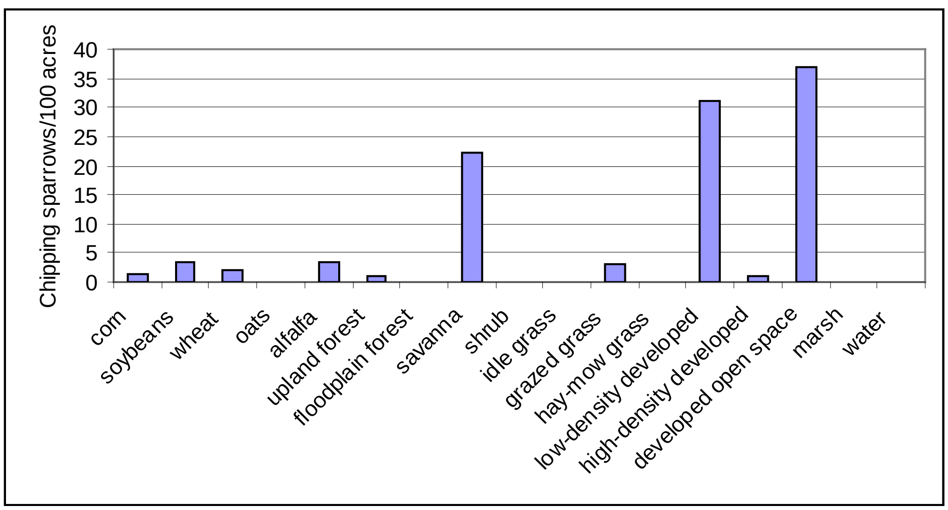


Fig.5.93 Average density (birds per 100 acres) of chipping sparrows in various habitat types from transects surveys in Illinois, 2006-2008.

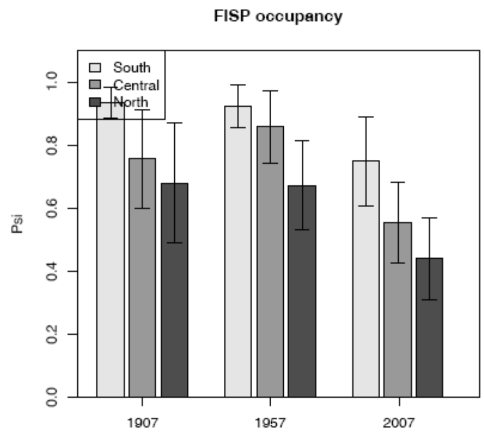


Fig. 5.95. Occupancy rates of chipping sparrows at North, Central, and South locations in the 1900s, 1950s, and 2000s.

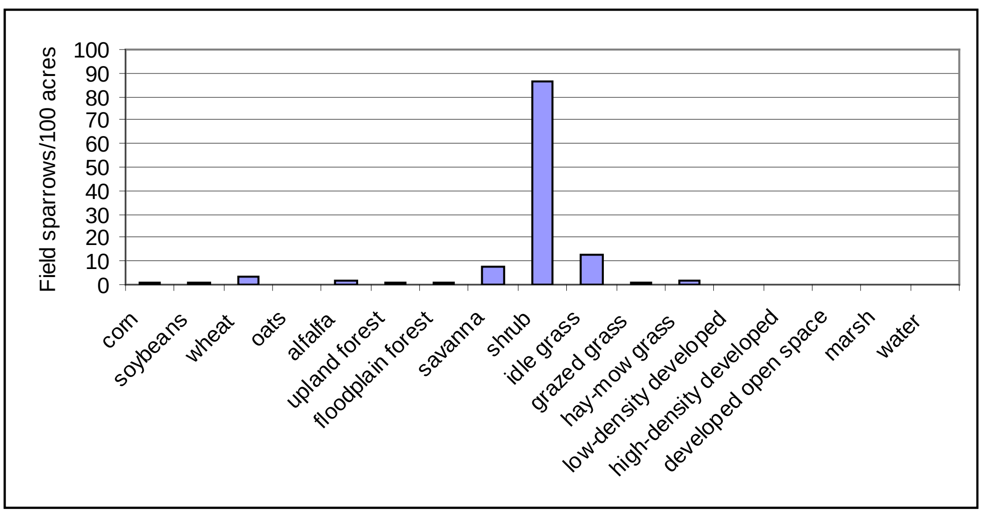


Fig. 5.96. Average density (birds per 100 acres) of field sparrows in various habitat types from transects surveys in Illinois, 2006-2008.

Grasshopper Sparrow – Just as its close relative, the Henslow's sparrow, is rebounding, the grasshopper sparrow abundance is plummeting. The North American Breeding Bird Survey trend for grasshopper sparrows is −6.6% per year, a cumulative decline of about 95% over the past 40 years (Fig. 5.97). While Henslow's sparrows prefer the dense cover typical of conservation areas and Conservation Reserve Program grasslands, grasshopper sparrows favor the shorter, more open vegetation typical of grazed or hayed grasslands, which have become less common. Like meadowlarks, grasshopper sparrows remain broadly distributed across the state, albeit at much lower abundances (Fig. 5.98).

Grasshopper sparrows were found in several types of cropland as well as grasslands (Fig. 5.99). The highest average density of grasshopper sparrows was in unplanted crop fields (not shown in Fig. 5.99 below because of its small sample size) with annual weeds in southern Illinois. Because most of these fields are eventually planted within a season, the grasshopper sparrow nests initiated in unplanted fields probably produce few young birds. If grasshopper sparrows re-nest or initiate nesting after the fields are planted to no-till soybeans, they may experience much better success. Fields of no-till soybeans with grassy residual vegetation held good numbers of grasshopper sparrows, but grasshopper sparrows were absent from conventionally-tilled fields.

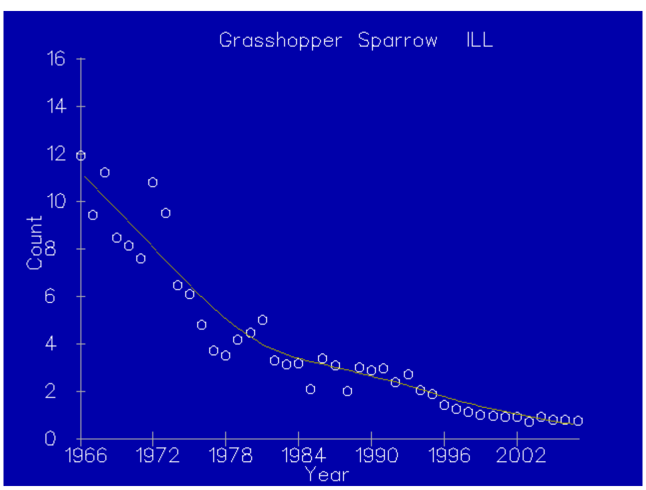


Fig. 5.97. Abundance of grasshopper sparrows on North American Breeding Bird Survey routes in Illinois, 1966-2006.

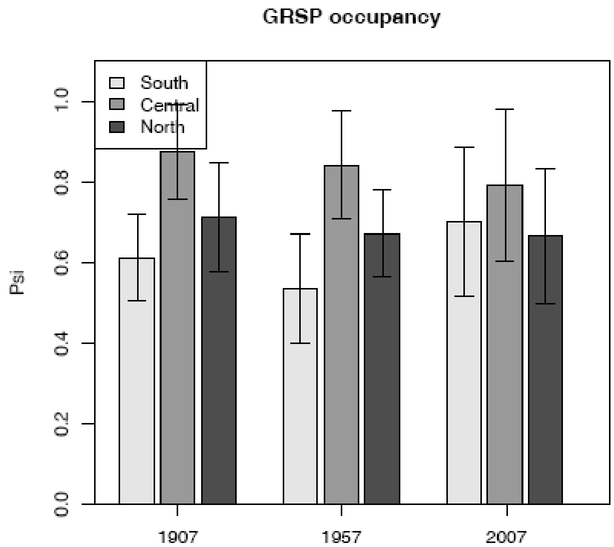


Fig. 5.98. Occupancy rates of grasshopper sparrows at North, Central, and South locations in the 1900s, 1950s, and 2000s.

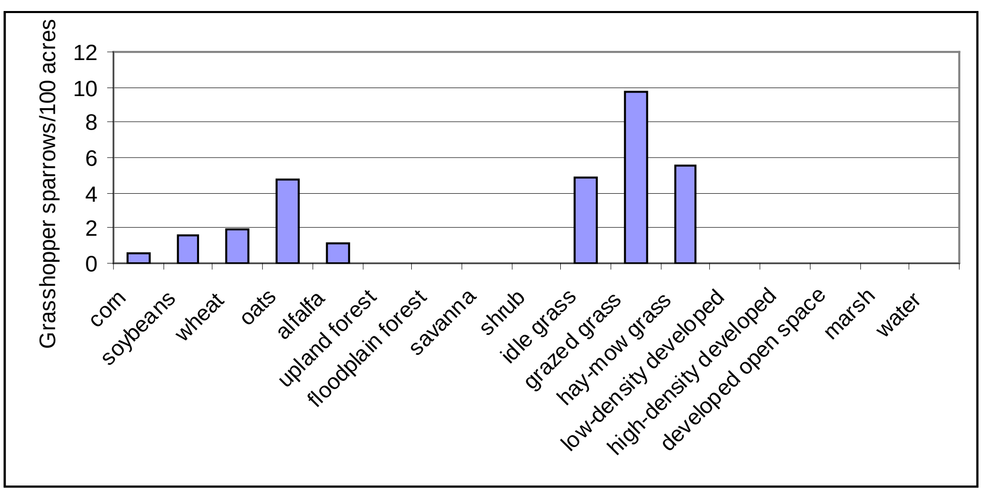


Fig. 5.99. Average density (birds per 100 acres) of grasshopper sparrows in various habitat types from transects surveys in Illinois, 2006-2008.

Indigo Bunting – When seen with good lighting, the electric blue of a male indigo bunting seems to glow. In fact, bunting feathers do not contain any blue pigments at all, and the color is created by the refraction of light through the structure of the feathers.

While clearly favoring shrubland areas, the indigo bunting is adaptable to several habitats, including forest edges and canopy opening created by tree falls in forests (Fig. 5.102). Indigo buntings have notoriously high rates of brood-parasitism by brown-headed cowbirds, but they persistently renest into the late summer and early fall, well after cowbirds have stopped laying eggs for the season. In the 1900s and 1950s, indigo buntings were less widespread in northern and central Illinois than they were in the southern region. Today, buntings are ubiquitous throughout the state (Fig. 5.101). Unlike most other shubland birds, indigo buntings are thriving and have a stable population trend according to the Breeding Bird Survey (Fig. 5.100). There is evidence that indigo buntings are expanding their range in Illinois and elsewhere as their population continues to grow in all directions. Given the species' ability to deal with the loss of shrubland habitat and cowbird parasitism, it is likely indigo buntings will continue to flourish into the future.

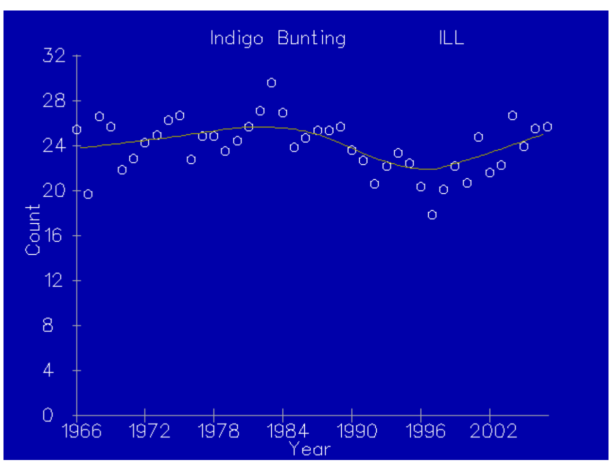


Fig. 5.100. Abundance of indigo buntings on North American Breeding Bird Survey routes in Illinois, 1966-2006.

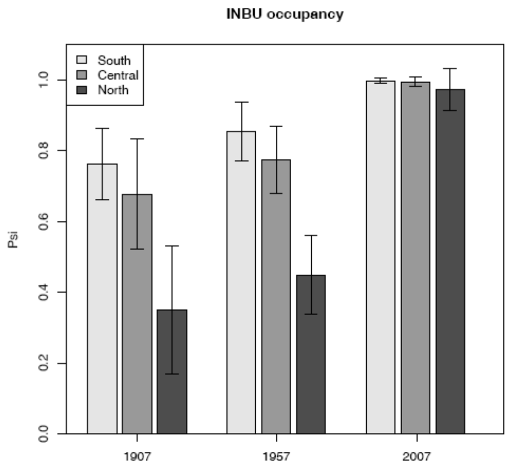


Fig. 5.101. Occupancy rates of indigo buntings at North, Central, and South locations in the 1900s, 1950s, and 2000s.

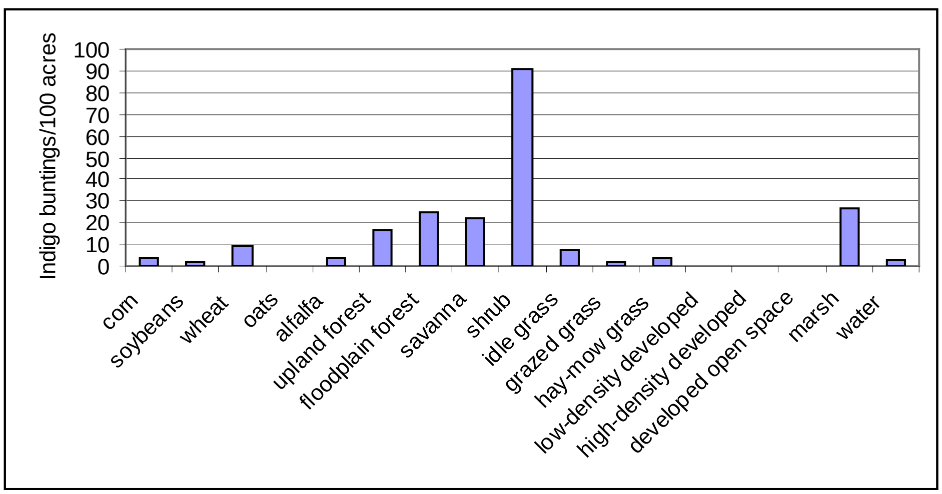


Fig. 5.102. Average density (birds per 100 acres) of indigo buntings in various habitat types from transects surveys in Illinois, 2006-2008.

Dickcissel – Alfred Gross was fond of dickcissels, and after moving to Bowdoin College in Maine, he wrote a thorough treatise based on his observations of dickcissels in Illinois, including during the 1907-1909 surveys (Gross 1921). Dr. Gross compiled several interesting statistics and anecdotes. He estimated that a male dickcissel sings 5,000 times a day, but also condemned him as "a lazy husband and as a father utterly lacking resourcefulness when responsibilities are thrust upon him," because only females incubate eggs and feed nestlings. Based on watching a female dickcissel bringing grasshopper nymphs to nestlings, he estimated that a million dickcissels might be saving Illinois farmers $4,680 per day by avoiding the destruction of clover fields. "These figures have a meaning which no one can fail to understand," he wrote. "With such a strong popular sentiment already in their favor the Dickcissels are destined to continue their great increase in numbers."

Indeed, the Grabers estimated that the number of dickcissels nesting in the state had increased between the 1900s and 1950s surveys. Since then, they have declined substantially in Illinois (Fig. 5.103). Like other grassland birds, dickcissels are faced with a shrinking amount of habitat on the nesting grounds in Illinois. Unlike other grassland birds though, dickcissels are persecuted as an agricultural pest on their wintering grounds in Venezuela where the 'rice bird' is shot, trapped, and sprayed with harmful chemicals. Because winter flocks may number millions of birds, they can be a serious local economic problem for farmers. However, each flock may represent a sizable portion of the global population. Dickcissels are well-known for being somewhat nomadic, with significant range shifts from year to year. Nonetheless, since the 1950s dickcissels have consistently been least common in northern Illinois compared to the central and southern regions (Fig. 5.104).

[Gross, A. 1921. The Dickcissel of the Illinois prairies. Auk 38: 163–184.]

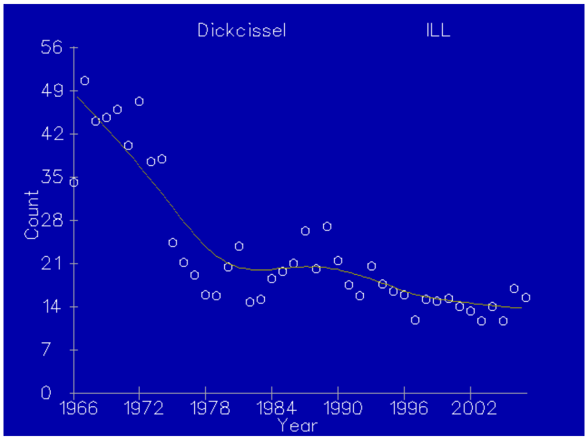


Fig. 5.103. Abundance of dickcissels on North American Breeding Bird Survey routes in Illinois, 1966-2006.

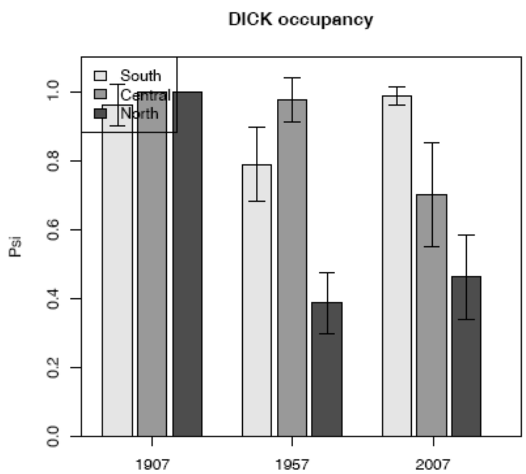


Fig. 5.104. Occupancy rates of dickcissels at North, Central, and South locations in the 1900s, 1950s, and 2000s.

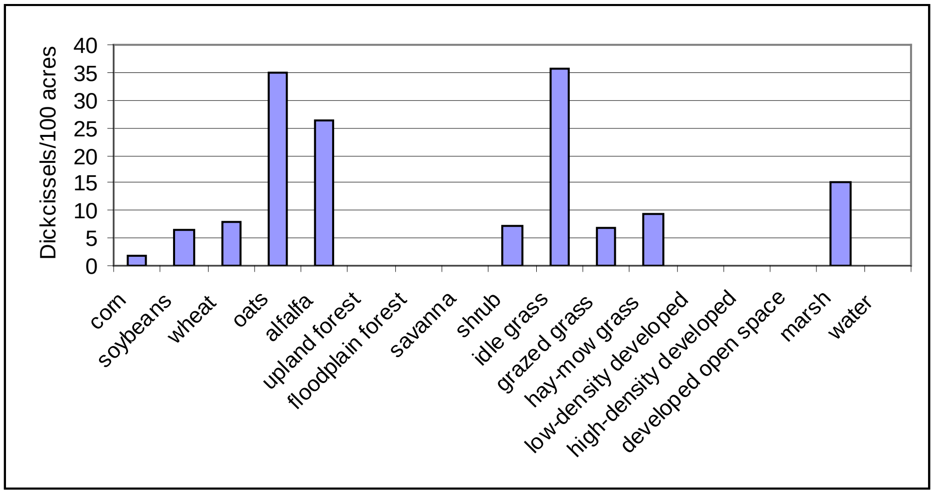


Fig. 5.105. Average density (birds per 100 acres) of dickcissels in various habitat types from transects surveys in Illinois, 2006-2008.

Northern Cardinal – The northern cardinal is the most frequent designee as a 'state bird,' including Illinois and six other states to the south and east. Ridgway (1889) declared the cardinal "truly a glorious bird." Only in recent decades have cardinals become common statewide, however (Fig. 5.107). In a pattern similar to red-bellied woodpeckers, cardinals were common throughout southern Illinois but were not recorded in northern Illinois during the 1900s surveys. By the 1950s, cardinals had saturated much of the central region, and we found them in virtually all suitable habitats statewide in the 2000s. Northern cardinals are about equally abundant in forests, shrublands, savanna-open woodlands and low-density developed areas, and about equally common in each of the three regions of Illinois (Figs. 5.107 and 5.108). Because they spend most of their time in the shrub layer nearer the ground, cardinals were easier to see on transects through forests than other species that live higher in the canopy.

Today cardinals are a familiar sight at bird feeders, using their large bills to crush sunflowers. That does not seem to have been the case in the 1950s. The Grabers wrote "residential habitat is not so good for cardinals as the natural types, but urbanization, as long as it encroaches on cultivated lands and not on forest, will benefit the cardinal." We found that farther north in Illinois, cardinal populations were more dense in developed habitats and less dense in forests. In winter these resident birds may need the resources provided by developed habitats in northern Illinois, while the milder climate in the south allows the birds to reside in forests. Breeding Bird Survey data demonstrate a slight increase in cardinal populations in the state since 1966 (Fig. 5.106). Because cardinals seem to thrive in all kinds of forest and in developed areas, we expect cardinals will maintain or increase their population into the future.

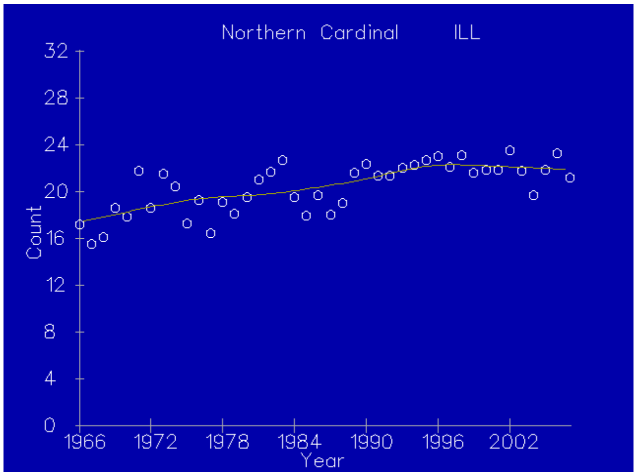


Fig. 5.106. Abundance of northern cardinals on North American Breeding Bird Survey routes in Illinois, 1966-2006.

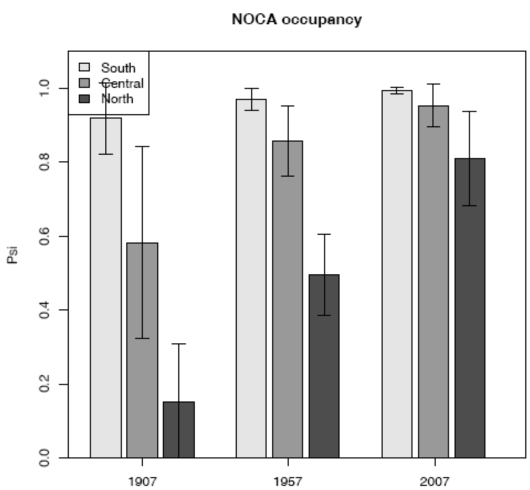


Fig. 5.107. Occupancy rates of northern cardinals at North, Central, and South locations in the 1900s, 1950s, and 2000s.

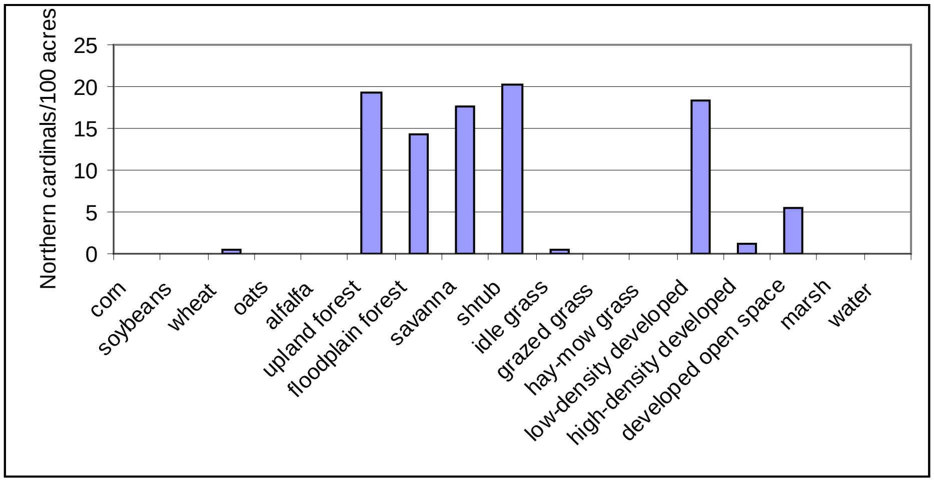


Fig. 5.108. Average density (birds per 100 acres) of northern cardinals in various habitat types from transects surveys in Illinois, 2006-2008.

House Sparrow – Though their first successful introduction to North America was in New York in 1851, house sparrows were subsequently released in many cities including Cincinnati, Minneapolis-St. Paul, Salt Lake City, and San Francisco for the purpose of insect control. House sparrows arrived in Illinois before 1870 (Fig. 5.109). By the 1880s, house sparrows were recognized as a pest for consuming livestock feed, competing with native species such as the bluebird, and simply being messy and annoying through their abundance. In 1891, Illinois started a bounty program to aid in their eradication but the program achieved little. At the time of the Gross and Ray surveys, house sparrows were the most abundant bird in the state.

The shift from horses to motorized transportation in the early 20th century is seen as a turning point to the detriment of house sparrows and the benefit of the new invader, European starlings. Stables, hay, and grain provided perfect nest sites, nesting material and food for house sparrows. The Breeding Bird Survey confirms the gradual decline in house sparrow abundance across North America and in Illinois since the 1960s (Fig. 5.110). The house sparrow is experiencing dramatic declines around the world, including in India and the Netherlands where it is considered an endangered species. While the decline of any species is concerning, the drop-off of a species that has adapted to living on every continent except Antarctica and numbering in the hundreds of millions worldwide is particularly alarming and may be a bellwether of future problems.

At least for now, house sparrows remain a common sight throughout Illinois (Fig. 5.111). House sparrows were the 5th most frequently counted bird, following common grackles, in our 2000s surveys. House sparrows were about eight times more abundant in developed areas than other habitats (Fig. 5.112), and roughly twice as common in central Illinois as either northern or southern Illinois based on our point count data.

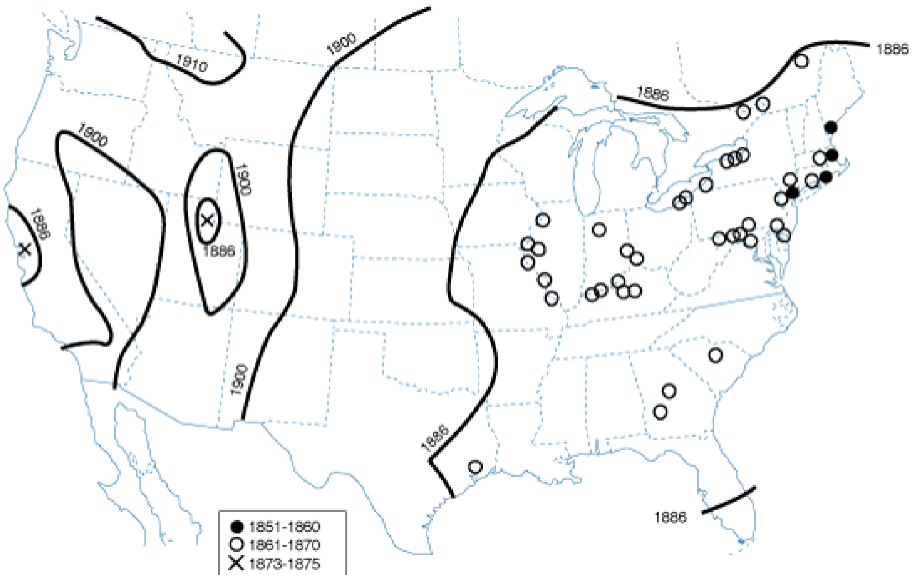


Fig. 5.109. Colonization of the United States by house sparros in the 19th century.

From BNA (Lowther, Peter E. and Calvin L. Cink. 2006. House Sparrow (Passer domesticus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/012
doi:10.2173/bna.12)

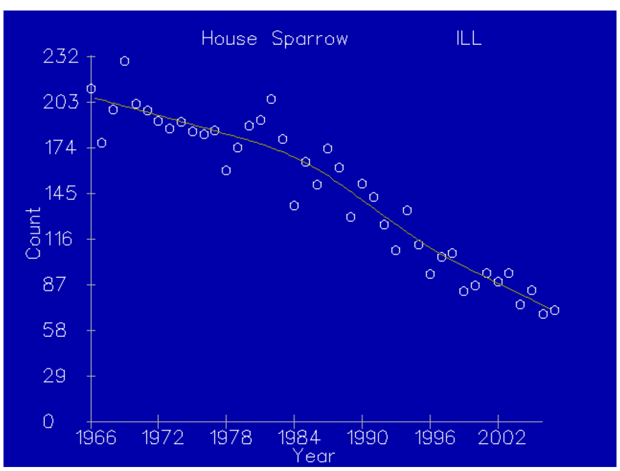


Fig. 5.110. Abundance of house sparrows on North American Breeding Bird Survey routes in Illinois, 1966-2006.

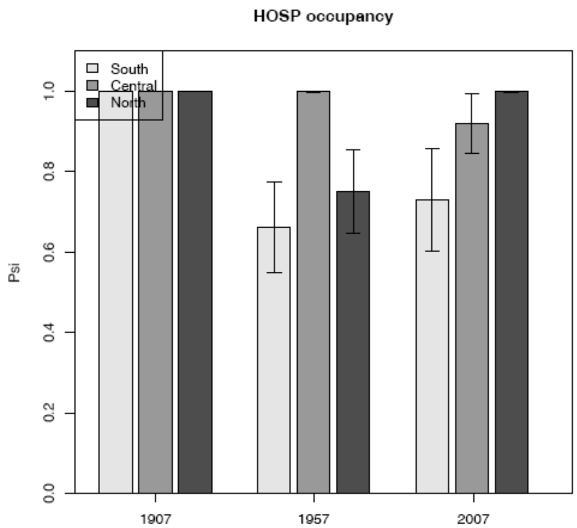


Fig. 5.111. Occupancy rates of house sparrows at North, Central, and South locations in the 1900s, 1950s, and 2000s.

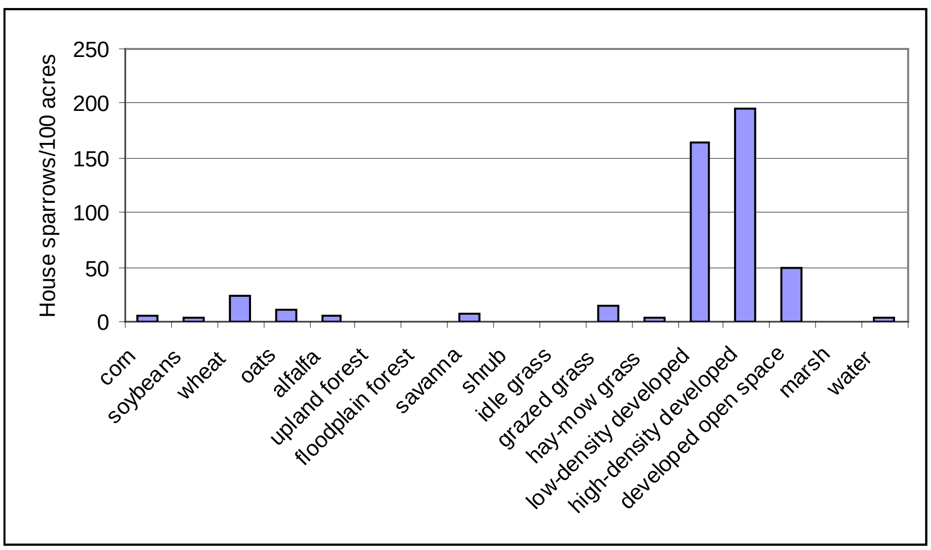


Fig. 5.112. Average density (birds per 100 acres) of house sparrows in various habitat types from transects surveys in Illinois, 2006-2008.

Common Trends Among Birds Using Similar Habitats

Grasslands - For the past few decades, conservationists have been well aware that the North American Breeding Bird Survey data showed that grasslands birds were experiencing the steepest and most widespread declines in abundance of any group of birds. Over the 40-year interval from 1966 to 2006, most grassland birds showed a cumulative loss of 40 to 90% of their population in Illinois (for example, bobolinks, Fig. 5.113A). The upland sandpiper has been virtually extirpated from the Illinois landscape (Fig. 5.113B) and is now rarely found outside of a few conservation areas in the state. However, most grassland birds, such as meadowlarks, are still widespread though at much lower densities than in the past (Fig. 5.113C).

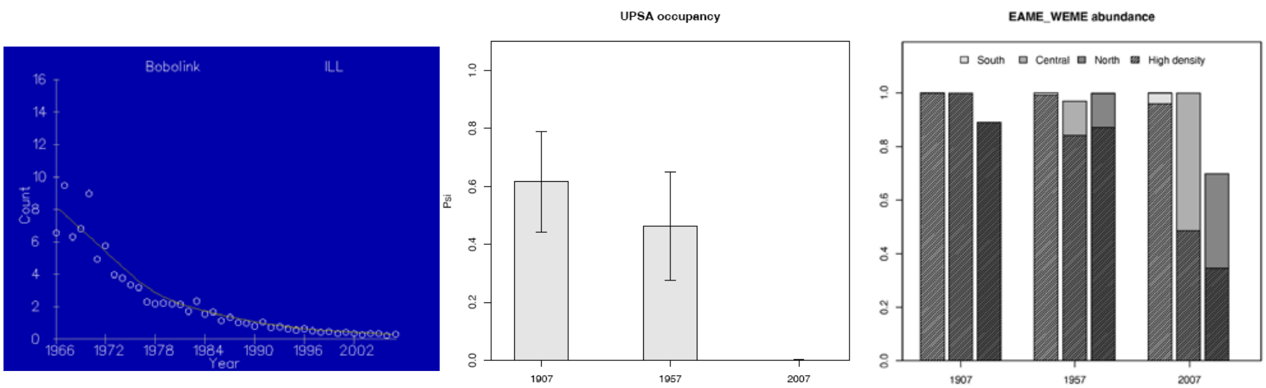


Fig. 5.113. Downward population trends of grasslands birds in Illinois are typified by (A) the declining abundance of bobolinks, (B) reduced occupancy rates of upland sandpipers, and (C) widespread occurrence but lower density of meadowlarks.

Recently, populations of many grassland birds have stabilized due to a number of factors. Conservation actions, including the Conservation Reserve Program, have helped and the most compellingly evidence is the case of the Henslow's sparrow in Illinois. Much of the hay and pasture that could be converted to cropland has been converted, so the rate of habitat loss for grassland birds has slowed. Finally, several grassland birds persist at low densities in cropland (Fig. 5.114), but whether the populations of these birds in cropland are self-sustaining is unclear.

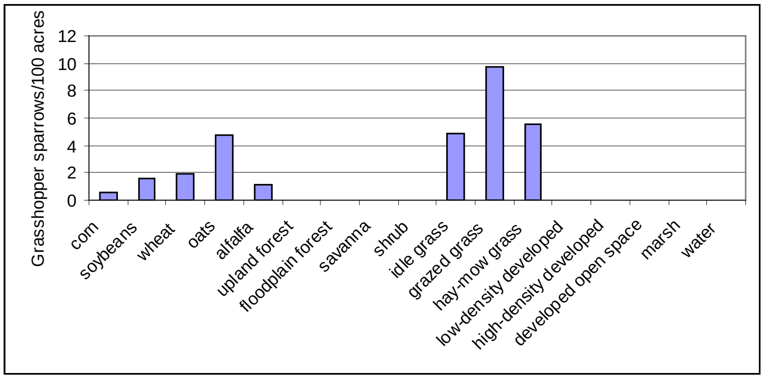


Fig. 5.114. Many species of grassland birds such as grasshopper sparrows occur at low densities in croplands.

Shrublands and Savannas – Unlike grassland birds, which weathered changes to the Illinois landscape fairly well for the first half of the 20th century, several shrubland and savanna birds appear to have been declining for a century (e.g., northern bobwhites, brown thrashers, and field sparrows, Fig. 5.115). At the time of the 1900s surveys by Gross and Ray, much of the state's forest was probably regenerating shrubland or open woodland because of timber harvesting in the late 1800s. Shrubland and open woodland habitats subsequently declined over the landscape as they recovered into forests over the following decades. The elimination of wooded fence rows and other shrubby habitats to accommodate larger agricultural fields and development accelerated in the 1950s. Today, shrublands, savannas, and their characteristic birds are scarce over much of Illinois.

While some shrubland birds have sharply declining Breeding Bird Survey trends, they have not received the same conservation attention as grassland birds. Unfortunately for these birds, there has been comparatively little research into managing shrublands, designing reserves for shrubland birds, or developing programs to establish and maintain shrubland habitat as there has been for grasslands, forests, and wetlands.

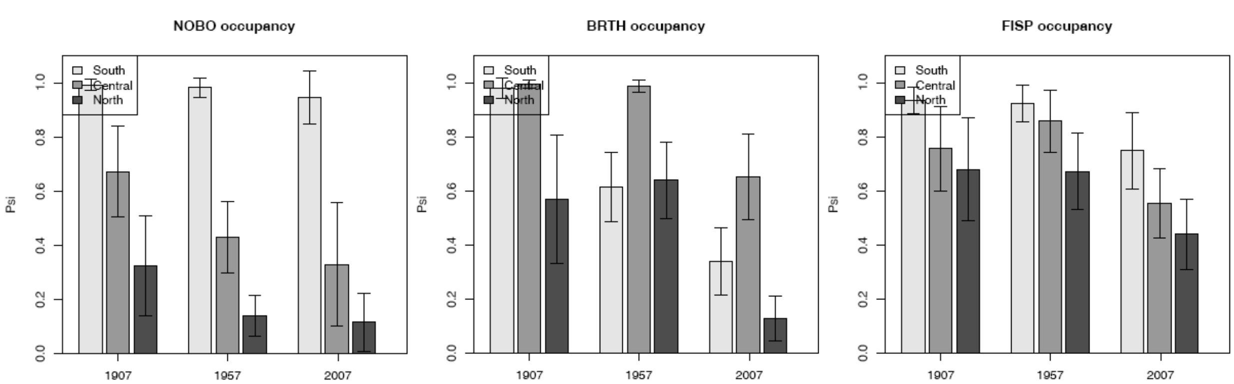
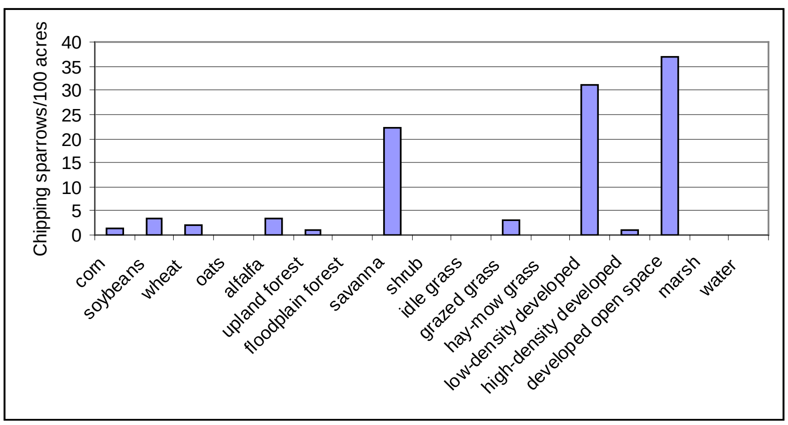


Fig. 5.115. Occupancy rates of shrubland birds have generally declined over all regions of Illinois across the three survey periods, as shown by (A) northern bobwhites, (B) brown thrashers, and (C) field sparrows.

On the other hand, some shrubland and savanna birds are thriving. Indigo buntings, northern cardinals, and brown-headed cowbirds are commonly found in forests and other habitats and not narrowly restricted to shrublands or savannas. Chipping sparrows and field sparrows, two closely related and ecologically similar birds, have slightly different habitat preferences and very different population trends. Chipping sparrows thrive in low-density developed areas and park-like settings, and have a rapidly increasing population (Fig. 5.116), whereas field sparrows, which are closely tied to shrublands, have a negative population trend (Fig. 5.117). The ability of some birds to use other habitats has enabled them to maintain or increase their populations in spite of reductions in shrublands and savannas.



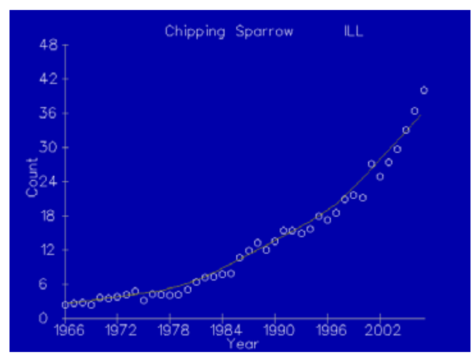


Fig. 5.116. Some shrubland birds readily use other habitats (such as chipping sparrow's use of developed areas, left), and have increasing populations (as shown by the chipping sparrow's Breeding Bird Survey trend, right).

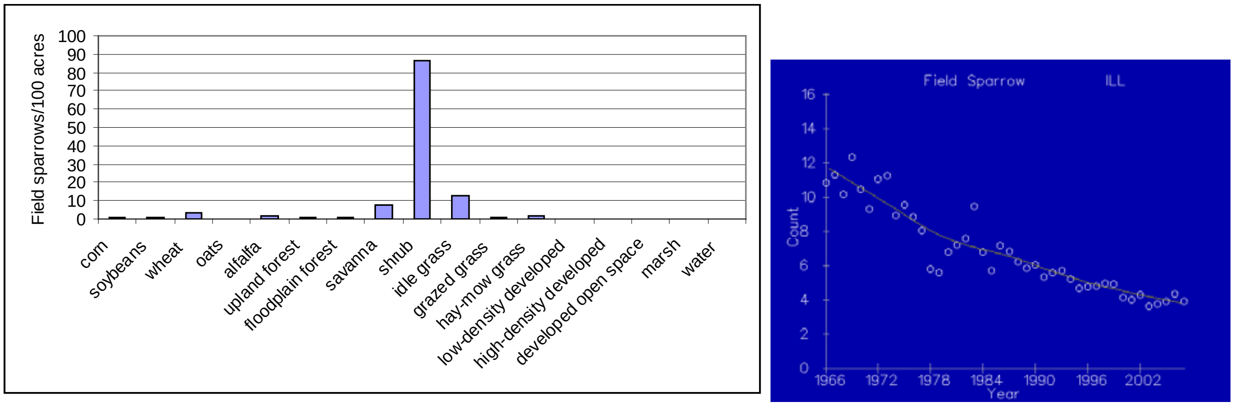


Fig. 5.117. Birds that are narrowly restricted to shrublands (such as field sparrows, left) have declining population trends (right).

Forests – To some extent, the bad news for birds of savannas and shrublands has been good news for forest birds. Over the past 90 years, the amount of forest in Illinois has been steadily increasing, owing to the gradual maturation of younger shrubby stages with open canopies. These changes in the landscape and forest birds were particularly evident between the 1900s and 1950s surveys, as shrub-favoring birds like field sparrows and brown thrashers gave way to chickadees, vireos, flycatchers and woodpeckers. Between the Graber's 1950s surveys and the 2000s, the forest bird community was the least changed of any major habitat type in Illinois. The occupancy patterns and Breeding Bird Survey trend of the eastern wood-pewee epitomize the stability of many forest species (Fig. 5.118). On the other hand, red-bellied woodpeckers and several other forest birds have increased in abundance and expanded their ranges northward (Fig. 5.119). Most of these birds are residents or short-distance migrants, and are tolerant of smaller, fragmented forests. By contrast, wood thrushes, cerulean warblers, and some other Neotropical migratory forest birds are clearly less common now than they were 50 or 100 years ago.

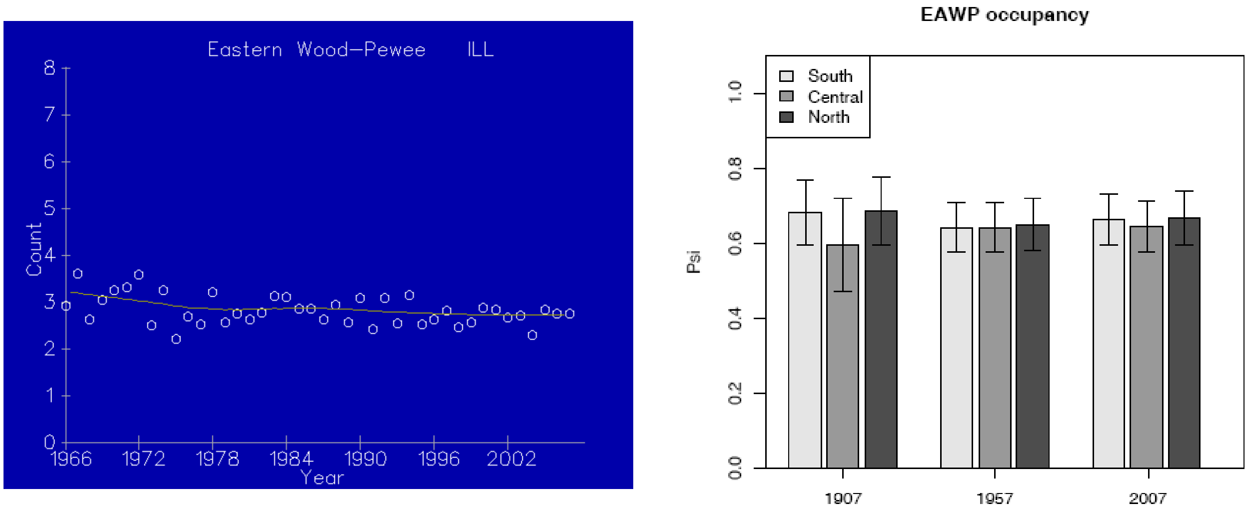


Fig. 5.118. Many forest birds, like the eastern wood-pewee, have had stable populations in Illinois.

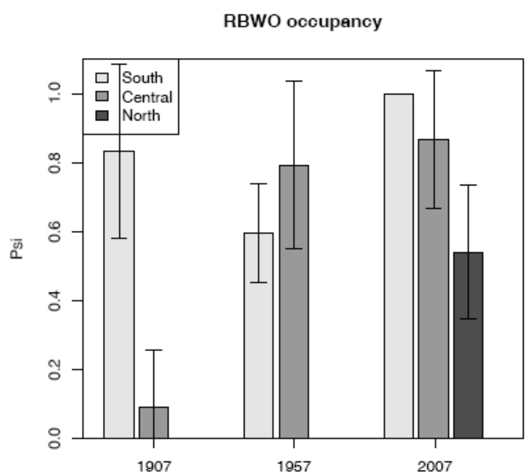


Fig. 5.119. A group of resident and short-distance migratory forest birds have expanded their ranges northward over the past century, such as the red-bellied woodpecker.

Wetlands – Several birds of wetlands and open water habitats have increased dramatically in abundance since the 1950s surveys. We encountered herons, egrets, cormorants, and waterfowl far more often while surveying wetland habitats in the 2000s than the Grabers did in the 1950s (Fig. 5.120). Improvement in water quality attributable to the Clean Water Act was one factor in these recoveries, though Canada geese, bald eagles, great blue herons and sandhill cranes have also proven to be much more adaptable to living near people than imagined a half-century ago. Although stressed by invasive plants, sedimentation, and altered water levels, Illinois has a fairly extensive reserve network of wetlands, particularly along the Illinois and Mississippi rivers. Wetland restoration has partially offset the loss of natural wetlands to development and agriculture, though restored wetlands often do not match the diversity and quality of habitats found in natural wetlands.

Marshes – shallow wetlands with herbaceous vegetation – are rare in Illinois, and the birds found only in marshes appear to have become permanently "conservation reliant." Black terns, king rails, American bitterns, and yellow-headed blackbirds, all endangered in Illinois, only persist in Illinois through the continued management of a small number of marshes.

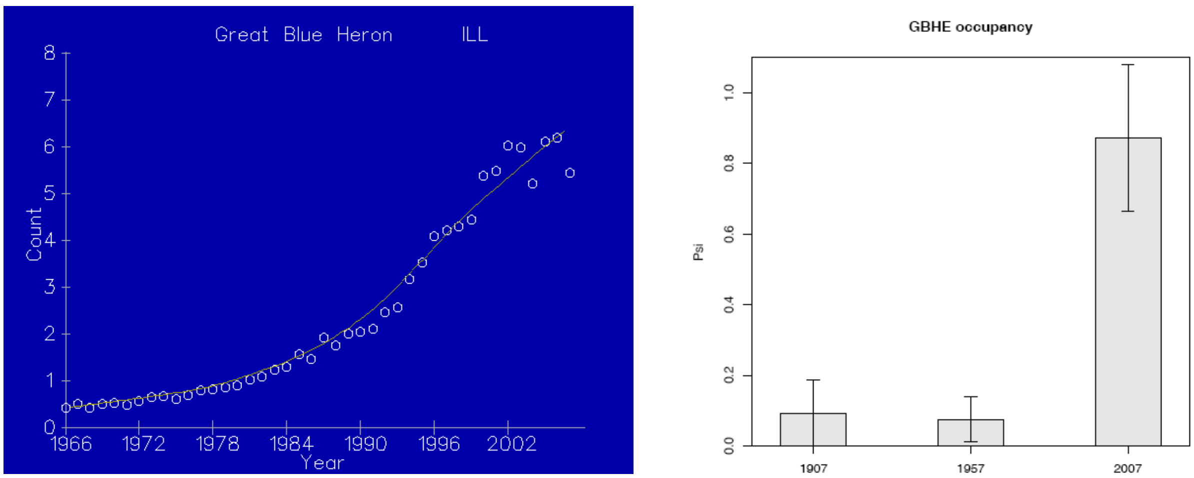


Fig. 5.120. The abundance and occupancy rates of great blue herons has increased since the 1950s, thanks largely to improvements in water quality.

Developed Areas – Birds that have adapted to living near people are thriving, with a few exceptions; common nighthawks, chimney swifts and house sparrows are declining, though it is not clear whether changes in their urban habitats are to blame. During this study, we repeatedly found a pattern whereby use of developed habitats by a bird species was associated with its northward or southward range expansion or overall increase in abundance. House wrens, found almost exclusively in developed areas in southern Illinois, are expanding their range southward (Fig. 5.121). Northern cardinals show the same pattern, but in reverse. In the 1900s, cardinals were mostly found in southern Illinois forests. Today they occur statewide, but in northern Illinois their abundance is higher in developed areas than in forests (Fig. 5.122). The dramatic increase in abundance of American robins since the 1950s coincides with a shift of the highest densities to developed areas (Fig. 5.123). Developed areas also may play the same role in the establishment and range expansion of introduced birds. Rock pigeons, Eurasian collared-doves, European starlings, house finches, Eurasian tree sparrows, and house sparrows are all most common in developed areas in Illinois (Fig. 5.124). Developed areas have lower bird species diversity than other habitats, though the total number of individual birds in a given area tends to be quite high. Less competition with other species of birds, less severe climate conditions, or the novel resources available in developed areas (e.g., ornamental fruiting trees, bird houses/structures, bird feeders) may be to the advantage of some birds, allowing them to expand their ranges or become established via developed areas.

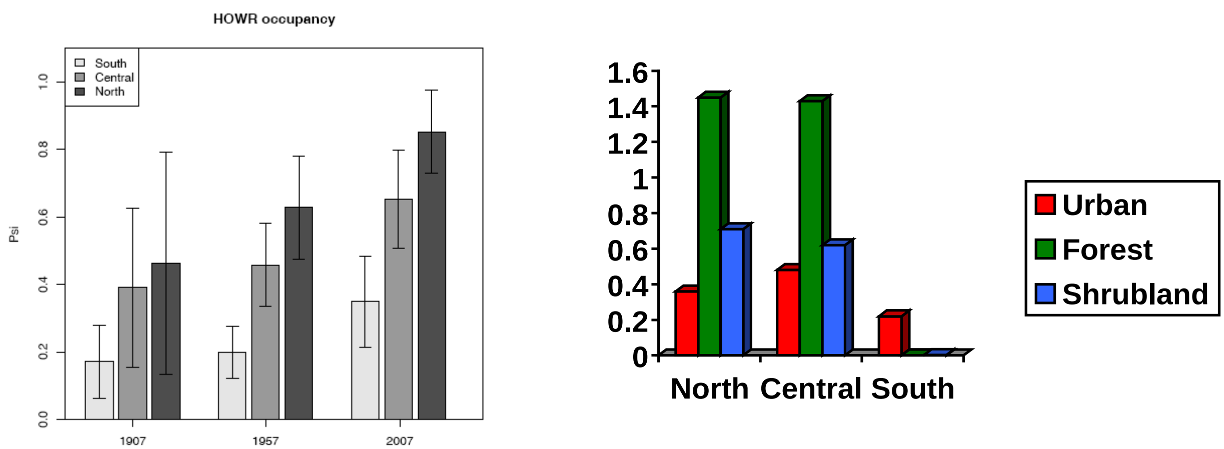


Fig. 5.121. House wren occupancy over time (left) and regional abundance by habitat type (right).

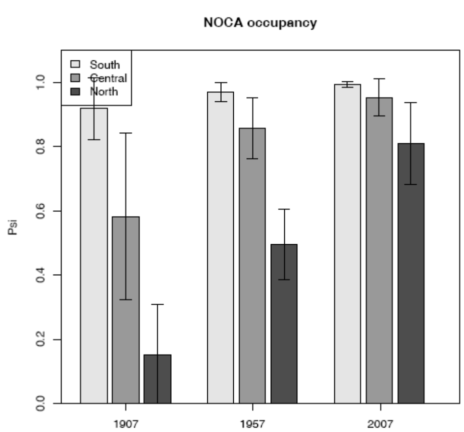


Fig. 5.122. Northern cardinal occupancy.

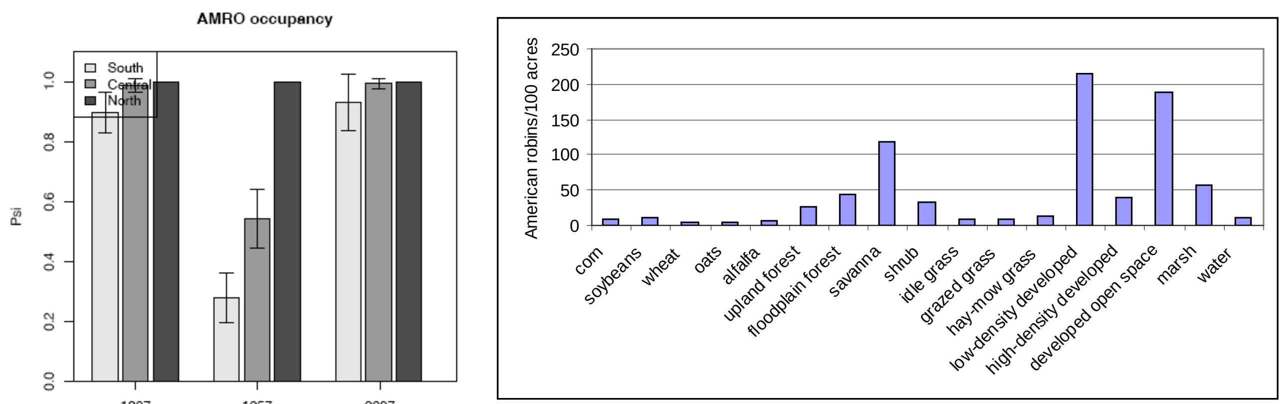


Fig. 5.123. Today, American robins occur nearly everywhere in Illinois, but reach their greatest density in developed areas.

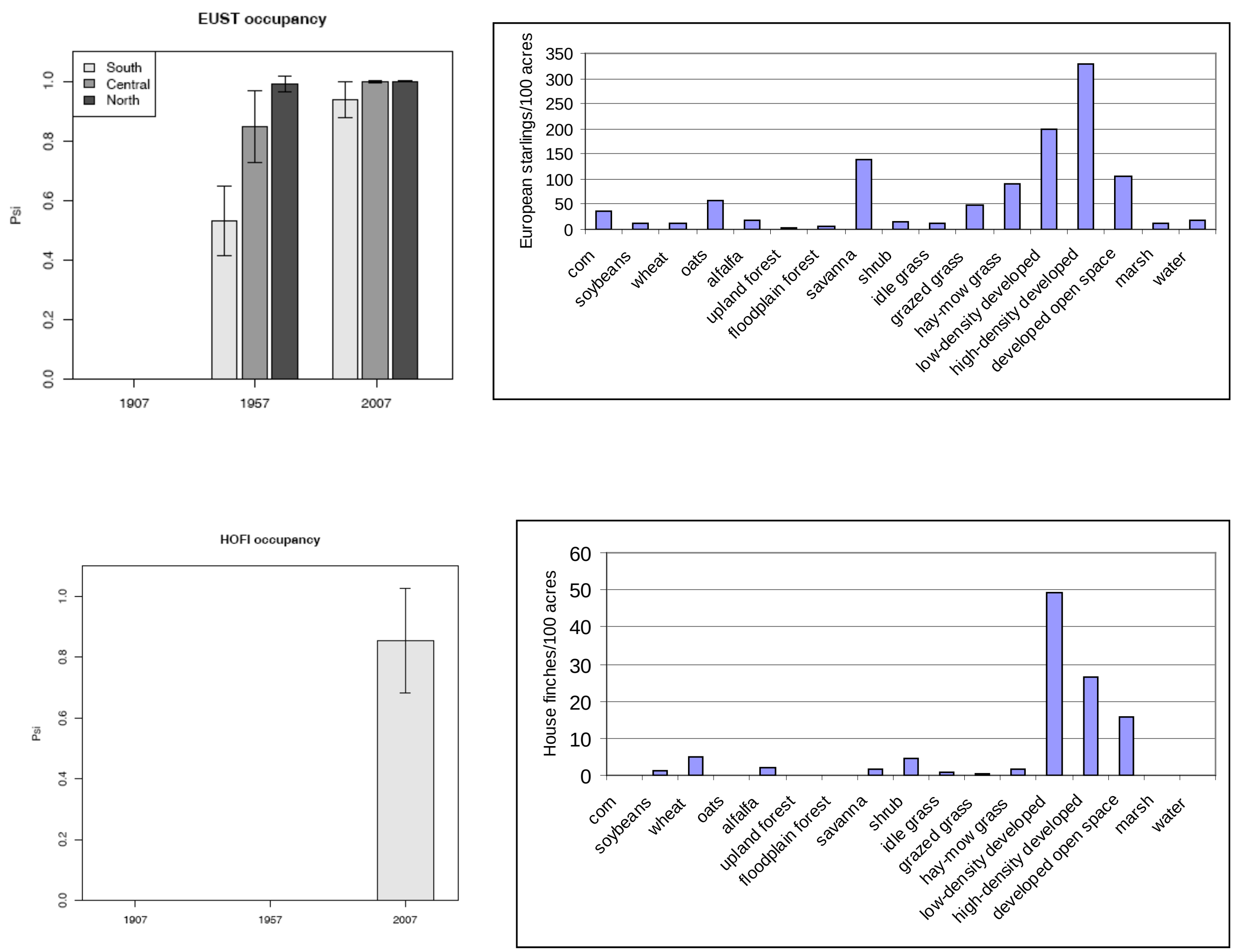


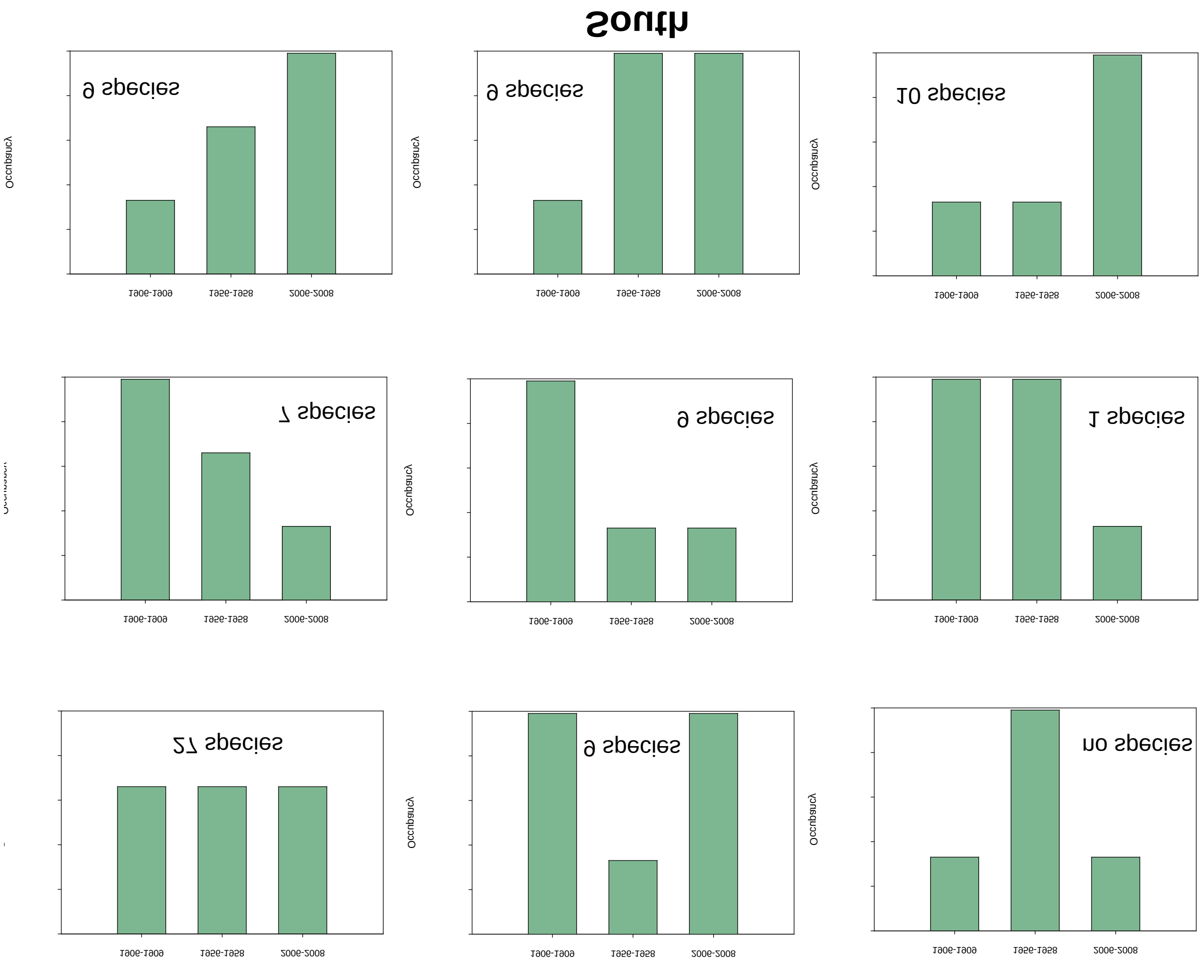
Fig. 5.124. Like most introduced birds that successfully colonize Illinois, European starlings (top) and house finches (bottom) are most abundant in developed areas.

Looking Back, Moving Forward: Bird Populations and Conservation in the 21st Century

During the years Gross and Ray were traversing Illinois, many important events in conservation were occurring. Gifford Pinchot, the first Chief of the U.S. Forest Service, was the first to use the term "conservation" as we do today, meaning the management of natural resources. President Theodore Roosevelt set forth sweeping policies to create the National Wildlife Refuge System and National Forests. The interest in conservation was largely in response to great abuses to the land and wildlife. In Illinois, birds such as Eskimo Curlew, Passenger Pigeon, and Carolina Parakeet had recently been extirpated by market hunting and unrestricted persecution. In 1900 the Lacey Act made it illegal to transport animals across state lines, essentially ending market hunting. The Migratory Bird Treaty Act of 1918 made it illegal to pursue, hunt, take, capture, kill, or sell 'migratory' birds. Shortly after the Grabers repeated this survey in the 1950s, Rachel Carson's 1962 book, *Silent Spring,* brought attention to the plight of many birds caused by DDT and other chemicals. The federal Endangered Species Act of 1973 provided addition protection to critically imperiled birds including the bald eagle. Given all of these protections we might expect that bird abundance and diversity in Illinois should have steadily increased since Gross and Ray's surveys.

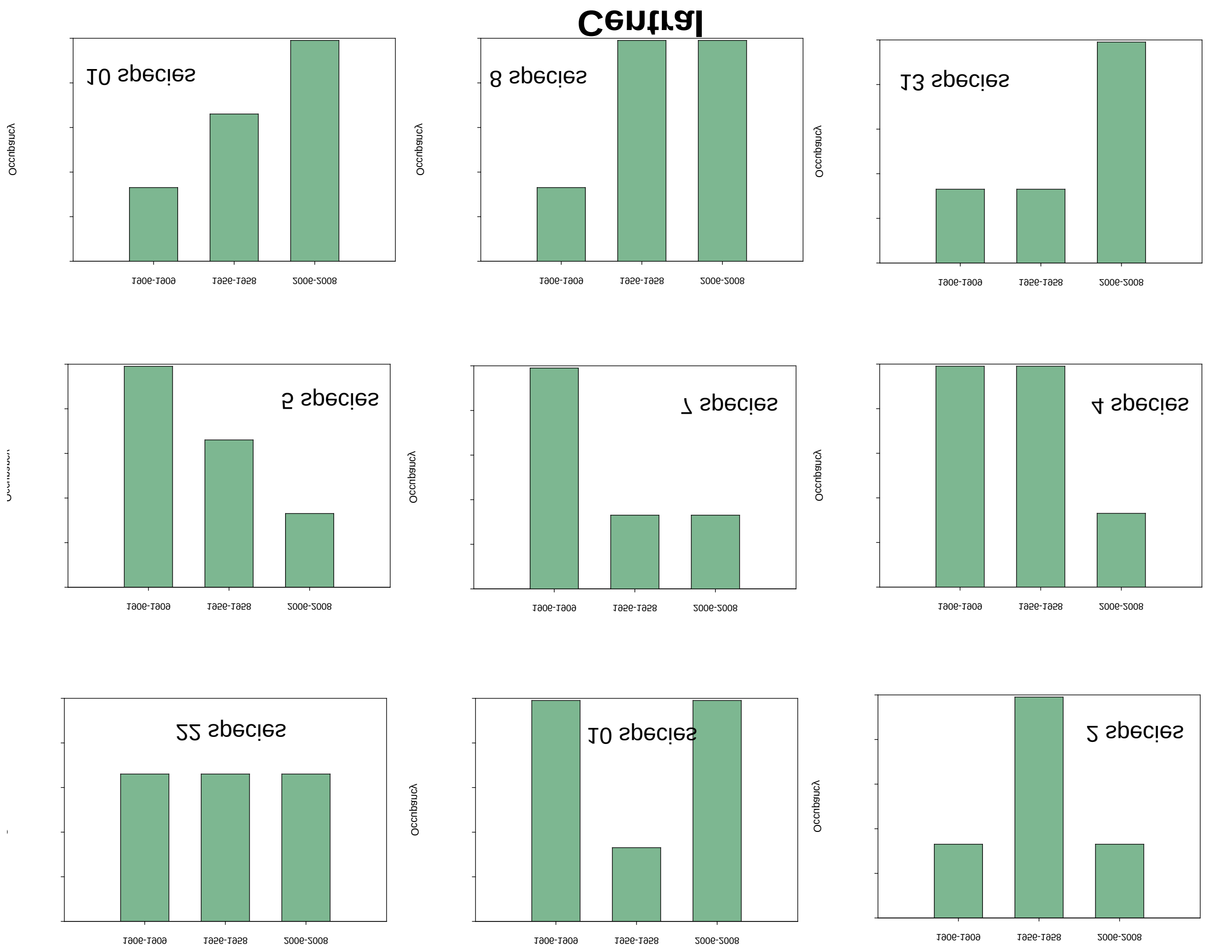
Without question there have been conservation successes. Only one bird, the Bachman's Sparrow, has been completely extirpated from the state over the last century. One reason why so few species have been lost is the remarkable efforts that have been directed to conserve certain birds. Over the last century, conservation organizations such as the Illinois Department of Natural Resources, US Fish and Wildlife Service, The Nature Conservancy, Illinois Audubon Society, and many other organizations have successfully preserved over a million acres of bird habitat in Illinois. This habitat acquisition has been effective in conserving many birds, such as greater prairie-chickens that now only remain in Illinois on land purchased and managed for them. Several wetlands species (e.g. yellow-headed blackbirds, common moorhens, black terns) are also located almost exclusively on public lands. Although it is encouraging that public resources are used to conserve many species, over 90% of the land area in Illinois is privately owned. Policies and incentives for managing wildlife habitat on private lands are needed to maintain and enhance bird populations in Illinois.

There are many ways to evaluate how Illinois' bird community has changed over the last century, and one of the simplest approaches is to plot their occupancy (probably of finding the species at a site) in the southern, central, and northern portions of the state and categorize them as increasing, decreasing or stable. Although a species' occupancy may change, it is interesting to know if these changes occurred early (between 1900s and 1950s), late (between 1950s and 2000s), or were consistent among time periods. With three possibly population trajectories (increase, decrease, stable) over three time periods there are a total of nine possible patterns of occupancy over time.



[label rows as Increasing, Decreasing, and Stable or Mixed Trends]

In southern Illinois, 18 birds showed increasing trends, 17 birds decreased, and 27 were stable.


Central
10 species
8 species
13 species
5 species
7 species
4 species
22 species
10 species
2 species
Occupancy
1906-1909
1956-1958
2006-2008

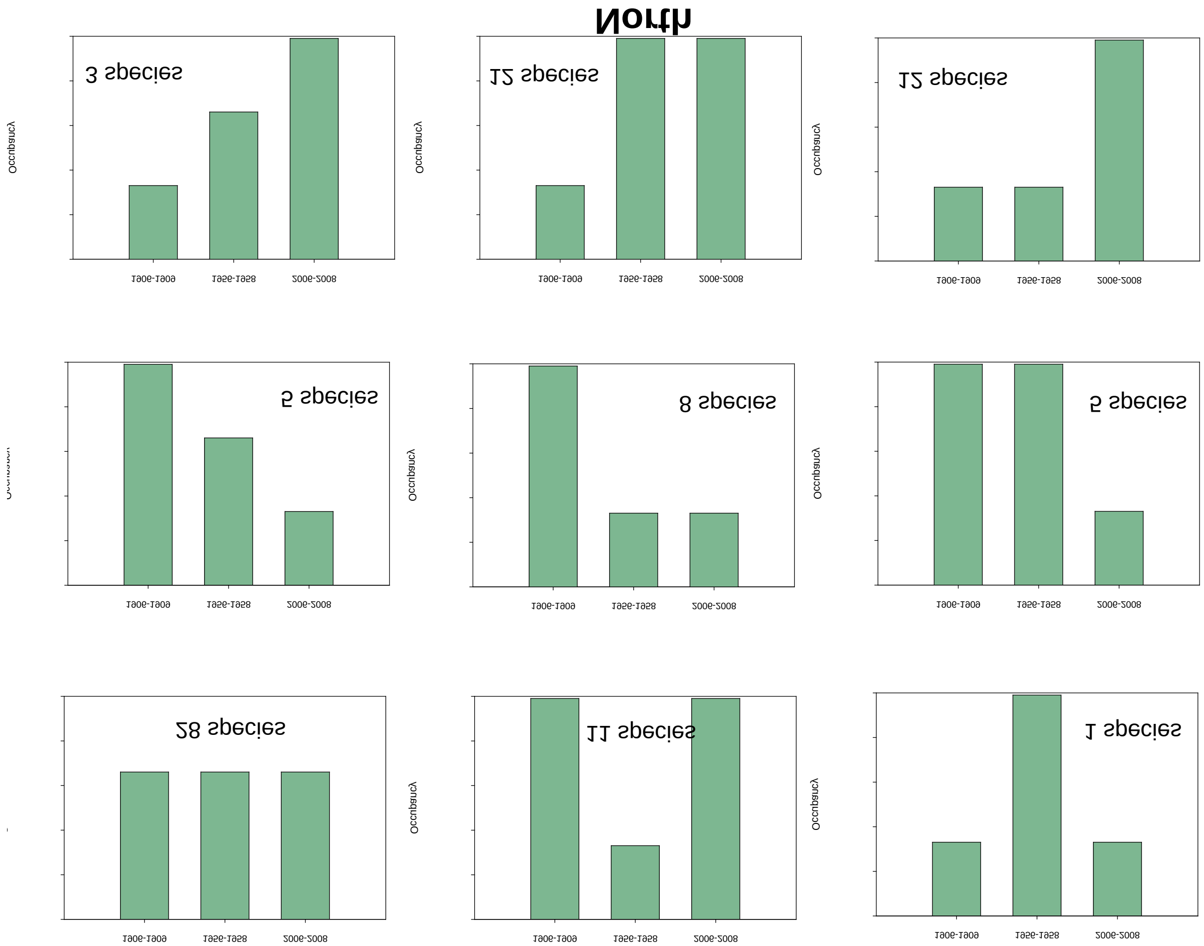


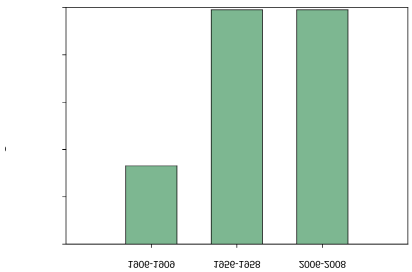
Figure x. General patterns of change in regional occupancy trends for 81 species in southern, central, and northern Illinois among 1906-1909, 1956-1958, and 2006-2008 sample periods.

Overall Changes in Occupancy

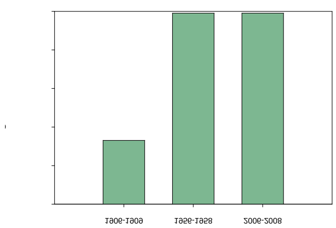
Over the last 100 years, increasing birds (34%) have outnumbered decreasing species (21%). Nearly one third (32%) of birds' regional occupancy trends were stable. Several species experienced both declines and increases over the last 100 years, with 12% of regional occupancy trends suggesting initial declines followed by increases ("dips"). Only 1% of birds experienced increases followed by declines ("bumps"). In many cases, birds that showed similar occupancy patterns shared characteristics such as habitat preference.

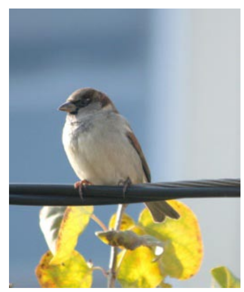
Which Birds Increased?

- Most species that increased from the 1900s to 1950s were forest species

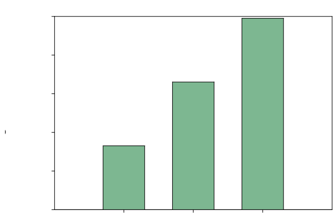


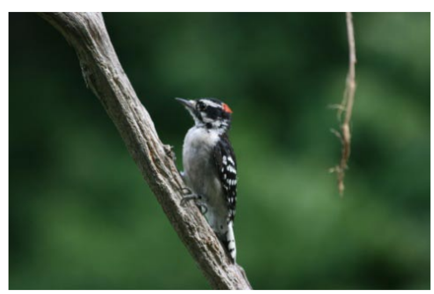
- Most species that increased from the 1950s to 2000s were species that use urban habitats





- The species that increased throughout the 100 years are birds that live in close association with humans, are not dependent on a specific habitat, can thrive in small patches of habitat, and are non-migratory.





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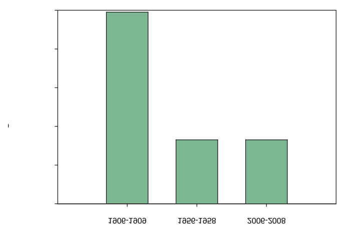
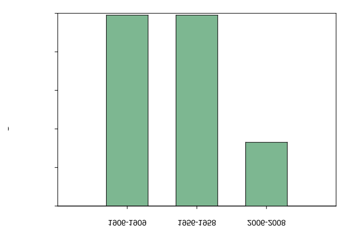
Which Birds Decreased?

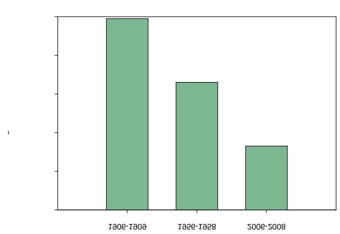
- Some of the most dramatic declines happened between the 1900s and 1950s, but these species do not easily fit into a habitat-based category. These birds include American kestrel, Bewick's wren, loggerhead shrike, northern flicker, and red-headed woodpecker.



- The species that declined between the 1950s and 2000s were mostly grassland birds



- Most of the species that declined throughout the last century are shrubland birds. All of these birds are migratory, expect the northern bobwhite.



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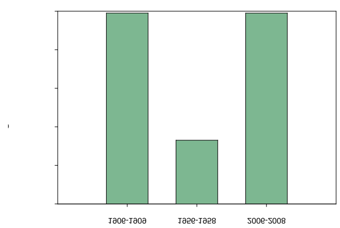
Which Birds Experienced a 'Dip'?

- Eighteen species exhibited large declines (in at least one region) between the 1900s and 1950s, and then recovered between the 1950s and 2000s. These were birds of agricultural landscapes and developed area that often nest in farms or yards. One dramatic example is that of chipping sparrows. Their statewide occupancy rate went from 62% to 18% to 81% in the three surveys. Chipping sparrows were completely absent in central Illinois in the 1950s, while 50 years later they had an occupancy of 85%, and a density of more than three birds per acre in developed areas. The frequency of 'dips' suggests the 1950s were a difficult period for many bird populations.



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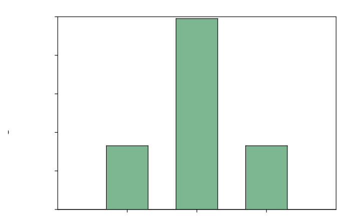
Which Birds Experienced a 'Bump'?

- Few species had populations that initially increased only to decrease in the recent surveys. One example is the ring-necked pheasant, which became establishing in Illinois after Gross and Ray's 1900s surveys and was abundant during the Graber's surveys. Since the 1950s, pheasant abundance has declined with the loss of grassland nesting areas and shrubby winter cover.



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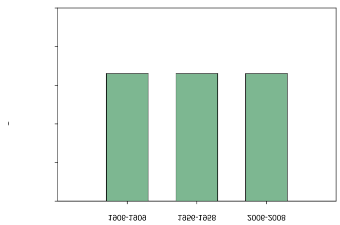
Which Birds Were Stable?

- Fourteen species had stable populations in all three regions of the state over the last century. Twenty five birds were stable in one or two portions of the state. Nearly all of the species with stable occupancy patterns were forest birds.



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Why Do We See These Occupancy Patterns for These Groups of Birds?

Although looking at increasing or decreasing occupancy provides some guidance for conservation priorities, it is much more important to understand why there have been changes in populations over time. This study does not resolve what has been driving the changes in bird populations over the last century, but there are several contributing factors. We explore how changes in land use, environmental contaminants (e.g., DDT), invasive species, and how changes in a species' behavior or distribution may have affected occupancy patterns.

Land Use Changes

As outlined in Chapter 3, the Illinois landscape has changed substantially over time. Using aerial photographs, we were able to quantify changes such as the increase in development or the decline in grasslands. Changes in habitat quality, however, are much more difficult to evaluate over large areas. For instance, we noticed changes in the forest canopy over a 50 year period in Cora, but it would be a substantial effort to try to describe similar changes in quality for forests across Illinois.

Another way we see the landscape changing is in the bird populations. Because so much data have been collected on birds, we have a good idea of which birds are habitat specialists. For example, Acadian flycatchers only breed and forage in forests, while yellow-breasted chats are shrubland specialists, and dickcissels nest primarily in grasslands. Given these species-habitat relationships, we identified habitats with a large proportion of birds experiencing population changes.

The most logical explanation for most bird-population changes over the past 100 years is the amount or quality of available habitat. Trends for many birds reflect the trends in their preferred habitat. Like shrublands, shrubland birds have been declining over the course of the last century. Grassland bird populations declined substantially over the last 50 years, when the conversion of grasslands to row crops and developed areas was most dramatic. Forest bird populations increased from the 1900s to 1950s and have been stable since, whereas the state's forests were heavily cut-over in the early 1900s, and have generally matured and increased in area ever since. Because of the fundamental importance of habitat, it's essential that conservation efforts are focused on protecting existing habitat, maintaining or improving habitat quality, and restoring lost habitats whenever possible.

Environmental Contaminants

Although habitat changes are the primary driver of most changes in Illinois' bird community, the population dips in the 1950s were an interesting and unexpected result of our study. From a conservation perceptive, the dips can be viewed as a positive because whatever factors were associated with the initial declines appear to have been remedied in recent decades. However, understanding what caused these dips is important for avoiding similar declines in the future. The timing of these declines was linked with the advent and widespread use of synthetic pesticides. The 18 species that displayed these mid-century declines cannot be easily classified into a single habitat-based category, but they share other characteristics. First, they are all insectivorous, and secondly these species are commonly associated with agricultural or developed areas. House sparrows, eastern phoebes, and barn swallows commonly nest within barns and sheds on farmsteads. American robins, common grackles, red-winged blackbirds, and brown-headed cowbirds are often observed feeding in lawns, crop fields, or pastures. All of these human -associated species were positioned to be affected when DDT became a prevalent insecticide in the 1940s. Similarly, sudden declines of chipping sparrows in Chicago in the mid 1930s coincided with the use of a new chemical (pyrethrum) to control mosquitoes (NSMAD 1933). The book *Silent Spring* recounted the effects of DDT and other chemicals on birds, including mass die-offs of robins. Although pesticides were an important factor in the mid-century declines of many birds, the rebound of many species a testament to the resiliency of bird populations and the efficacy of environmental regulations.

While 18 species recovered following declines in the 1950s, 12 species experiencing regional population declines between the 1900s and 1950s have yet to recover. Six birds (American kestrel, red-headed woodpecker, northern flicker, loggerhead shrike, blue jay, and Bewick's wren) exhibited statewide declines. While the decline of blue jays was relatively small, the remaining five birds experienced dramatic declines. Pesticides, in particularly DDT, have been implicated in the decline of loggerhead shrike (Pruitt 2000) and American kestrels (BNA). In Illinois, Herkert (2004) found that 90% of the shrike egg samples in 1971-72 had DDT (or it derivatives), while in 1995 only 11% of eggs contained DDT. Pesticides have also been implicated in the decline of Bewick's wren, red-headed woodpecker, and northern flicker. Because populations of these birds did not recover after DDT was banned, other factors such as habitat changes or competition with other birds appear to be inhibiting their recovery.

Introduced Species

In the 1950s, the Grabers suggested that several species had declined due to competition with introduced birds. They thought that competition with house sparrows had caused the decline of eastern bluebirds, while competition with European starlings led to northern flicker declines. There are several studies supporting the idea that competition with introduced species leads to population declines. While it is likely that house sparrows and European starlings impacted some populations, the declines associated with the rapid increase of starlings in Illinois from the 1930s to the 1950s coincided with the use of new pesticides. Competition with these introduced species along with environmental contaminants may have jointly contributed to these declines. Eurasian collared-doves and house finches have invaded Illinois in recent decades, and to date there is little evidence these birds are having a significant effect on populations of native birds.. While we should prevent the establishment of new exotic birds in Illinois, the conservation impact of established introduced bird species is probably best mitigated by creating high-quality habitat. Except for pheasants, all of the widely-established introduced birds in Illinois thrive in highly altered, and often urban, environments (house sparrow, Eurasian tree sparrow, house finch, European starling, rock pigeon, Eurasian-collared dove) and are usually present at low density in natural habitats. Invasive plants and insects that fundamentally change the composition and structure of natural habitats are a greater concern. Invasive plants may be particularly problematic in forests where understories are being invaded and dominated by honeysuckle (*Lonicera spp.)* and buckthorn (*Rhamnus cathartica*). While some birds may prefer these exotic shrubs, many species of conservation concern are negatively impacted by these invaders (McCusker et al. 2010).

Behavioral Changes

When attempting to predict the future, one approach is to investigate the “winners” (birds that increased the most) and think about whether their strategies could work for other birds. One of the most abundant birds in the state – and perhaps in North America (Yasukawa et al. 1995) -- is the red-winged blackbird. 150 years ago the red-winged blackbird was a marsh specialist, taking advantage of the large expanses of marshes and wet prairies throughout Illinois. Over 90% of Illinois’s wetlands and prairies have been lost and if the red-winged blackbird had remained a marsh specialist, it would probably be rare and perhaps endangered today. Instead, the red-winged blackbird invaded upland habitats, and now nests in roadsides, grasslands, small

Figure x. The town of Grand Tower in southern Illinois. Many urban areas in Illinois have large trees with extensive canopies creating appropriate habitat for many forest species.

grains, soybeans, and shrublands. Unfortunately, the ability of red-winged blackbirds to adapt to increasingly available habitats is not universal among birds and those species have suffered more because of habitat loss.

Many external factors, like land use, pesticides, and introduced species, have impacted Illinois's bird community over the last 100 years. In the future, intrinsic factors may be a critical determinant of the fate of several birds. How well species can adapt to human-modified landscapes has affected past population trends and will undoubtedly affect the future conservation status of many species. Associated with the increase in developed landscapes since the 1950s has been an improvement in the quality of these habitats for many bird species. Many towns and cities have a forest canopy; if forest birds are "willing" to use this habitat, then a large source of habitat becomes available. Developed habitats tend to harbor fewer types competitors, and food may be more available. American robins, northern cardinals, and mourning doves, were not "urban" birds 100 years ago, but now developed landscapes are their stronghold. Residential landscaping provides many possible nest sites for forest birds, and flowering landscape plants attract insects and/or produce fruit. As if shelter and fruit-producing plants was not enough, people consistently provide supplemental food at bird feeders, grain elevators, and garbage dumps. This combination of food and shelter may have provided the ideal situation for population growth and range expansion of several birds. For example, as northern cardinals expanded northward, winter food availability could be less of a limiting factor in developed landscapes . Now, on the coldest and snowiest days, cardinals can remain in neighborhoods visiting one or more bird feeders, increasing winter survival and allowing for population increases and the ability to winter and nest farther north.

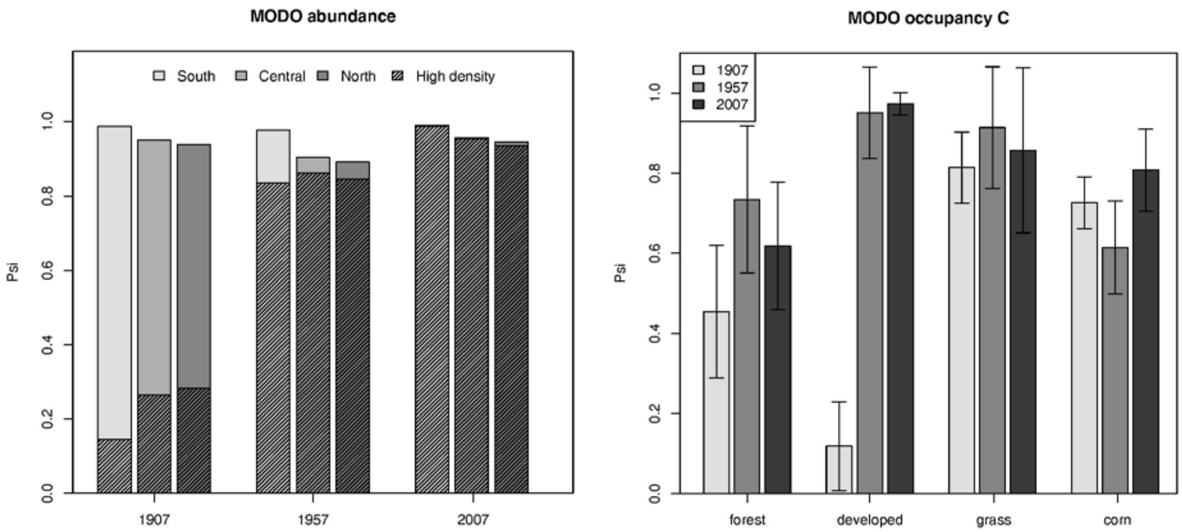


Figure x. The left figure represents the density of mourning doves in the three regions over the last century. The right figure is the occupancy of mourning doves in forests, developed areas, grasslands, and corn fields over the last century.

Many birds have shifted towards greater use of developed landscapes (figure x), and this behavioral change has likely resulted in many of the observed range expansions and population increases over the past century. Although more research is needed, developed areas may facilitate range expansion. This increased use of developed areas also applies to birds that have expanded southward. The expansion of the house wren's range into southern Illinois is best explained by use of residential habitats.. In the historic range in central and northern Illinois, house wrens reach their greatest density in forests, but in southern Illinois they are found nearly exclusively in residential areas (Chapter 5, Figure x.)

Changes in Bird Distributions

Our surveys in the northern, central, and southern portions of the state provided the opportunity to investigate range expansion. Eight birds expanded their range south, and eight species had expanded northward (Table X). The birds with ranges extending farther south are open habitat birds, and the birds with northward expansions were forest species. The simplest explanation for these changes is that clearing of forests for agriculture in the 1800s created suitable habitats for open habitat birds in southern Illinois, and recovery of forests across Illinois during the 1900s has enabled birds confined to southern Illinois a century ago to expand northward. -

Table x: Birds with range expansions:

Northward	Southward
Turkey vulture	Red-tailed hawk
Downy woodpecker	Cedar waxwing
Hairy woodpecker	Barn swallow
Red-bellied woodpecker	Tree Swallow
Blue-gray gnatcatcher	Horned lark
Indigo bunting	House wren
Summer tanager	Song sparrow
Northern cardinal	American goldfinch

Not all forest birds have expanded their ranges. Resident forest species were much more likely than migratory birds to have expanded their range north over the last century. We had sufficient data to examine regional occupancy patterns for 24 forest species (10 residents and 14 migrants). Of the 10 residents, two were found statewide in the 1900s (blue jay, white-breasted nuthatch) and four expanded northward (downy woodpecker, hairy woodpecker, red-bellied woodpecker, northern cardinal). Black-capped and Carolina chickadees appear to have formed a relatively stable hybrid zone across the central portion of the state that may restrict range expansion. The only remaining year-round forest residents that were possible candidates for northward expansion are the Carolina wren and tufted titmouse. While our occupancy data do not suggest any expansion, we did encounter both species in northern Illinois. Other sources, including the North American Breeding Bird Survey and Christmas Bird Counts, suggest that the Carolina wren is expanding north (Figure below).

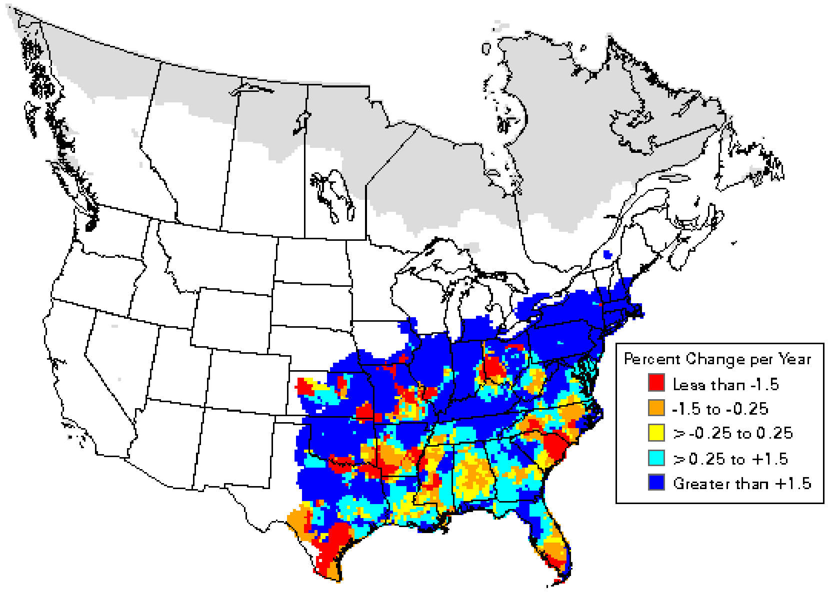


Figure x. Breeding Bird Survey map of the distribution of Carolina wrens.

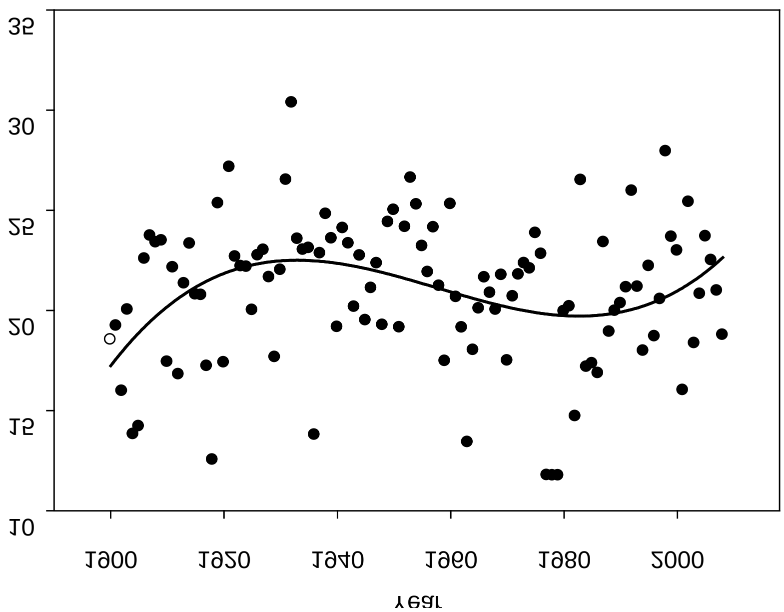
Although migratory birds are obviously capable of expanding to new locations outside their current range, only two (blue-gray gnatcatcher and summer tanager) of the 14 migrants appear to have are expanded north. Kentucky warbler may be expanding north, but our small sample size makes it difficult to determine. Three migratory forest birds (Acadian flycatcher, eastern wood-pewee, and American redstart) have had consistent occupancy patterns. Several of these forest-dwelling migrants have experienced population declines (red-headed woodpecker, northern flicker, red-eyed vireo, wood thrush).

Why are resident forest birds stable or increasing while several migratory birds are declining? There are several potential reasons for this disparity. First, migrants are impacted by changes in habitat availability and quality not only in Illinois, but also along their migratory path and on their wintering grounds. The Grabers suggested that range expansion of some migratory species was caused by increased densities, and increased competition, in their core range. For example, they suggested that density of Red-bellied Woodpeckers “level off at 5 birds per 100 acres…a figure (that) represents a saturation level for the breeding population in this species.” By this logic, only when densities exceed the “saturation level” are birds forced to move elsewhere to seek out nesting territories and expand the species’ range. Another possible driver of range expansion for forest residents is that they may select habitats differently. While residents have sufficient time in fall, winter, and spring to explore and assess new potential breeding areas, migratory birds have a tight timeline in which they must establish a territory, build a nest, raise young, and migrate back to the wintering grounds. Therefore, the time and costs associated with dispersing beyond the current breeding range may be greater for migrants than for residents. However, many questions need to be addressed, including what specific factors influence species range limits. Some of the most interesting of these questions include not just which species have expanded their ranges, but why others have not expanded.

Climate Change

The climate of Illinois, because of its temperate, mid-continental location, is variable. It is normal for temperatures to vary by more than 100ºF over a year. Periodic cycles of drought and abundant precipitation are normal. However, over the last half century the average annual temperature has increased, there have been more "heat waves", fewer "cold snaps", snow is melting sooner in the spring and arriving later in the fall, and heavy rains are occurring about twice as frequently (De Gaetano 2002, Kunkel et al. 1999). These changes are expected to continue into the future (UCS July 2009).

The northward range expansions we've documented for several species fit with a warming trend. It seems logical that permanent residents or short-distance migrants, like mourning doves and American robins, would benefit more from milder winters (with improved overwinter survival) and longer growing seasons than long-distance migrants. However, five of the eight birds were expanding north early in the century before there were noticeable changes in winter temperatures or growing season length. The only species that expanded their range only during the last 50 years are hairy woodpecker, indigo bunting, and summer tanager. Additionally, climate change is an unlikely explanation for southward range expansions. While climate certainly affects changes in bird distribution over time, changes in land use appeared to have a much more dramatic effect. In particular, birds that thrive in developed habitats have had some of the most noteworthy range shifts over the past 50 years. The 500-km range expansion of red-bellied woodpeckers from southern to northern Illinois likely resulted from habitat changes and possibly an increased reliance on forests associated with developed areas.



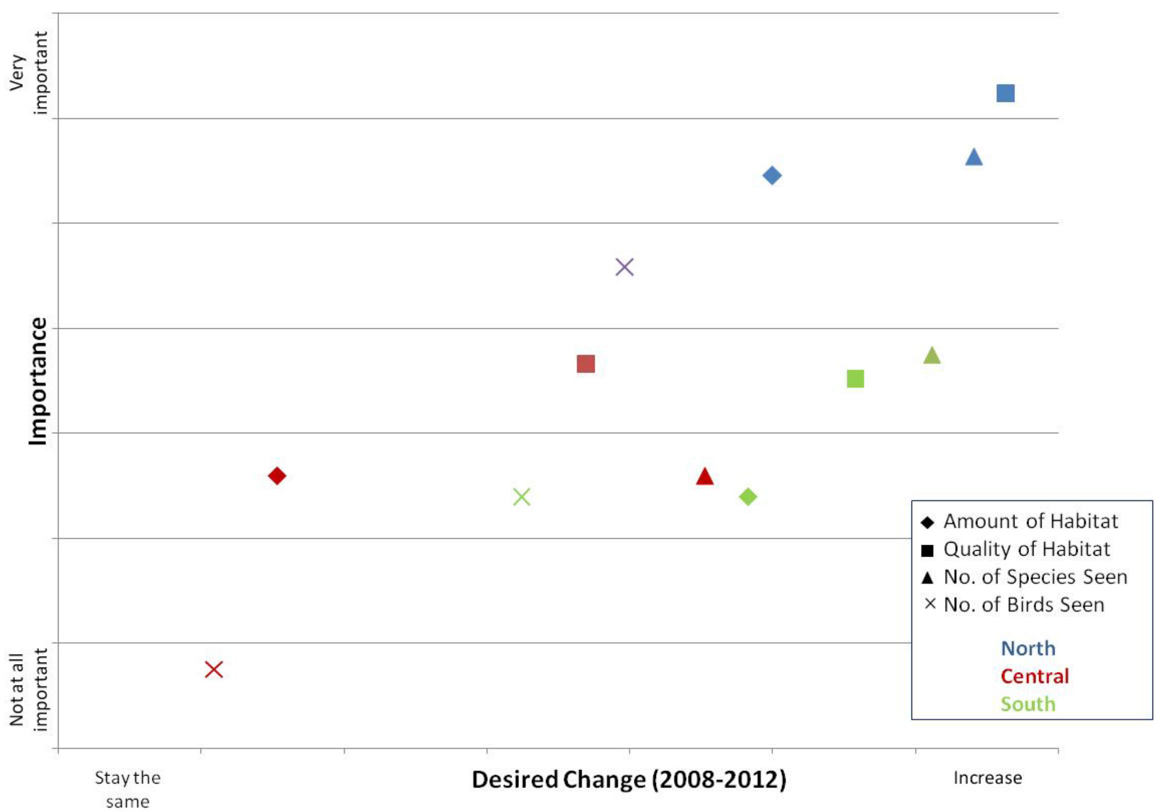
Mean monthly minimum temperature during winter months (December, January, and February)

Attitudes Towards Birds & Bird Habitat

Ultimately, understanding which birds and why birds are declining is only important if the public appreciates nature. It is likely that the birds present in Illinois in 2057 will reflect what Illinoisans want the state to look like. Unlike previous surveys in the1900s and 1950s we conducted a study to determine the attitudes of the general public toward birds and bird habitat.

A complex mix of factors determine an individual's support for any land use action, which makes predicting support for conservation actions challenging; however, we do have some indications of how Illinoisans would like to see bird communities in Illinois change in the next five years. (Previous research shows that memories beyond 5 years in the past, or aspirations beyond 5 years into the future are not reliable for surveys of people.)   Survey respondents clearly have noticed changes in the birds they see around their home and the habitats which support those birds. It is also clear that they would like to see changes in the bird populations around their homes.   To determine which birds and land characteristics ought to be prioritized for conservation, we asked respondents how much of a change they would like to see in bird populations and habitat characteristics, and how important those changes were to them. In general, respondents from the north region felt that improvements in habitat and populations were more important than respondents in other regions. Respondents in the central region of the state were most satisfied with the number and types of birds they saw, as well as the amount and quality of bird habitat in their area, and felt that improvements in these items was least important. However, respondents from all regions felt that improvements in the number of species seen (diversity) and quality of bird habitat in the area were more important than the amount of habitat and number of birds seen (Fig.). Respondents are likely expressing a desire for conservation actions which lead to improved quality over just quantity of habitat or birds. It's unlikely that Illinoisans would be satisfied with actions that lead to large flocks of starlings being seen around the state, but rather would prefer fewer birds seen, but a greater diversity of species.

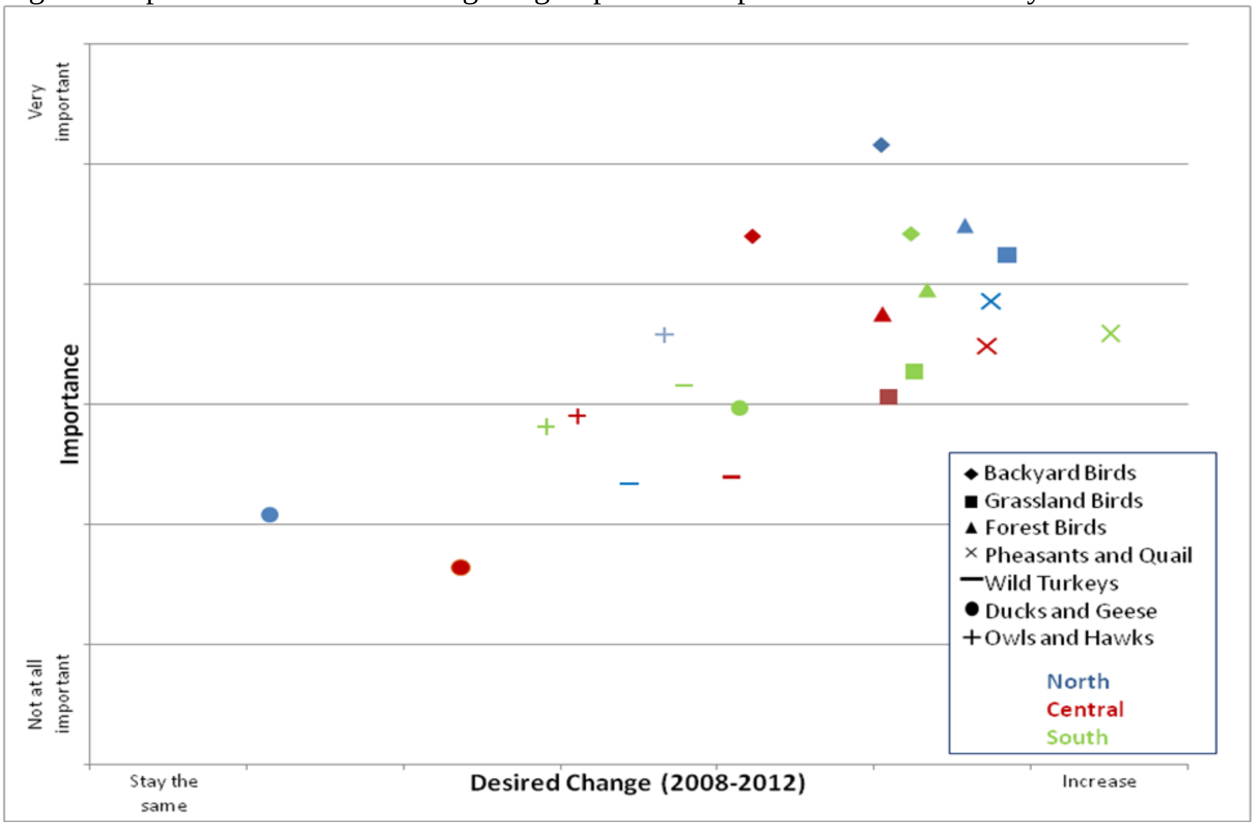
Figure. Importance of desired change in bird numbers and habitat over the next 5 years in Illinois.



When we asked respondents what kind of change they desired in specific groups of birds and how important those changes were to them, several interesting patterns emerged. First, respondents desired the largest increase in the populations of pheasants and quail, but thought it was more important for the populations of backyard birds (such as cardinals and robins) to increase.. Pheasants and quail are popular, recognizable birds, and residents are well-aware of their ongoing population declines. Hunters in particular are motivated to reverse these trends. Respondents who do not hunt likely desire increases in backyard birds because they are so commonly seen around homes. Conservation efforts targeted at these two groups of birds are likely to be noticed and valued by Illinoisans, and may have positive effects on their perceptions of bird conservation in the state.

Second, respondents desired the least increase, and thought it was least important to change, the populations of ducks and geese in Illinois. Whereas these are important and popular game birds, Canada geese are perceived by some Illinoisans as a nuisance and this likely influenced responses to this question. Populations of resident, non-migratory Canada geese have increased, particularly in suburban and urban areas, to such an extent that localities have begun taking actions to reduce their numbers. Negative interactions with geese and perceptions of overpopulation of these resident geese may have led to the perception that all ducks and geese populations are large enough and have access to enough quality habitat to sustain them. A challenge for biologists will be convincing the public that wetland conservation remains important for other waterfowl and will not further increase the abundance of geese.

Figure. Importance of desired change in groups of bird species over the next 5 years in Illinois.



To ensure these changes occur, however, conservationists must engage individual landowners, policy makers and conservation organizations effectively. This remains the largest challenge to bird conservation on a regional and state-wide scale. One of the most important topics on which to engage Illinoisans is how the changes in land use we have measured affect bird populations. When individuals make decisions on how to use their land, they commonly consider only effects they can directly notice. It is difficult to consider the effects of building a house or cutting trees on birds over 10 or 15 years. It is the role of scientists and researchers to provide information to landowners about how their actions may affect bird populations now and into the future. In addition, landowners will require information about how to mitigate the effects of their land use actions on bird populations. Studies like this one that show the long-term effects of land use on birds and their habitat can help to clarify which actions are most effective and which species will benefit most from our actions.

THE FUTURE

What the future holds for Illinois bird communities is difficult to predict. It is likely that some species commonly encountered today may be endangered in 50 years. Conversely, some rare birds may become common. Although predicting these trends is challenging, our knowledge of changes in land use, conservation, and environmental policies over the past 100 years can help us make educated predictions of what is needed to provide stable or increasing bird populations in Illinois.

Which Birds Deserve the Most Urgent Attention?

Two suites of birds are in immediate need of management attention on public and private lands in Illinois: grassland birds and shrubland birds. Conservationists have been aware of declining grassland bird populations for more than 20 years and have developed strategies to manage these birds. The plight of shrubland birds has received less attention, and research is critically needed to learn how to effectively manage shrublands.

Although Illinois is known as the "Prairie State," prairie habitats in Illinois have been so limited over the past 150 years that they no longer function as meaningful habitats for grassland bird species. Following conversion of native prairies to agriculture, grassland birds readily adopted hayfields and pastures of introduced grasses as surrogate homes. The limited data on grassland bird populations from soon after this conversion suggests that grassland bird populations remained healthy by using pastures and structurally diverse agricultural fields throughout the first half of the 20th century. When the diverse farms of the 1900s to 1950s were further converted to large row crop monocultures, grassland bird populations began to decline. Over 50% of grassland birds with sufficient data for modeling trends exhibited downward trends over the last 50 years. Although it is difficult to pinpoint, the 1980s appear to be when grassland bird populations decreased to their lowest point. The Conservation Reserve Program (CRP), a federal government program which pays farmers and landowners to leave agricultural lands fallow, has increased the amount of grassland in Illinois, allowing some grassland birds to rebound. Today, Henslow's sparrows breed in old fields, primarily those in the CRP, in southern Illinois. Henslow's sparrows are able to use these habitats despite their dominance by an invasive grass, tall fescue. The case of the Henslow's sparrow shows us that, although relic grasslands can maintain bird communities on public lands, programs such as CRP are needed to recover populations on a large spatial scale and create viable ecosystems in which species can be sustained.

The loss of grasslands and agricultural practices that benefits grassland birds has resulted in alarming declines, however there is another suite of birds that are also experiencing dramatic declines. Birds that are not easily classified into a specific habitat but rather use grasslands, shrublands, hedgerows, and other early successional habitats such as northern bobwhite, loggerhead shrike, field sparrows, and brown thrasher, now persist mainly in agricultural areas with low-quality soils. Crop yields on these areas are too poor for them to be profitably farmed and, therefore, they are commonly covered with hedgerows, early successional forest, or other unmowed or unmanicured habtiats. One of the birds exhibiting the greatest declines is the eastern towhee. Towhees do not require large expanses of habitats but rather patches of messy, successional habitats, like old fields, shrubby areas and young forests. Although many of these shrubland birds (e.g. brown thrashers, field sparrows) can still be readily observed in Illinois it serves Illinoisans' best interest to engage in conservation of species while they are still relatively common and before they decline to a point where they must be listed as endangered and restoring their populations is more difficult

Figure . This rural road near Easton, Mason County, was the only location in which loggerhead shrike was encountered during the 2000 censuses. The road is not particuallry unique other than it is not excessively manicured. Weedy vegetation was allowed to grow along the road possibly provided the nesting habitat for the shrike.

Our data suggest that, in general, forest bird communities have remained robust over the last century. Nonetheless, many birds within these habitats do require conservation action. Species, such as the cerulean warbler and ovenbird, should be prioritized for conservation to prevent their decline in the next 50 years. Many wetland birds had experienced large decline prior to the 1900s surveys, and their restoration will require a significant increase in wetland habitats.

Changes in the Future

In 50 years, cropland will still be the dominant land use of the state, although covering a smaller total acreage than today. Future croplands may not be more intensively cultivated, but are likely to generate higher yields because of improved genetics and new farming methods. We expect cultivation, fertilizer, and pesticides will be used more strategically in fields – both to reduce expenses and to minimize off-field environmental problems like nutrient leaching. No new major crop has emerged in the state since 1920, but as the yield of corn increases there may be "room" on the landscape for other crops, possibly perennial or crops used in biofuels.

The 'suburbanization' of Illinois is certain to continue, especially in northeastern Illinois and around other large cities across the state. Whereas suburban developments radiating from urban areas have increased steadily over the past 50 years, exurban development, building one or a few isolated homes in rural areas, is a relatively new phenomenon. Forested areas are especially attractive for this type of development, creating a matrix of mixed residential and forested land cover in many areas of the state. Accompanying these low-density developments will be an increase in 'green space' such as parks and recreation areas embedded within developed landscapes. These low-density developments in suburban and forested areas are likely to provide food and shelter for birds tolerant of human activity, but the disturbance of contiguous forests may have negative effects on forest-dependent species.

Forested areas of the state are likely to cover similar or slightly larger areas than today, but they will be in flux. Some forest will inevitably be lost to development, but other areas will become forested over time, such as abandoned cropland, shrublands, and grasslands. Most of the 130,000 acres of former cropland on floodplain and highly-erodible portions of the Illinois River watershed, which was enrolled in the Conservation Reserve Enhancement Program, will eventually become forested, even if it was initially established to grasslands or shallow-water wetlands. Today, oaks and hickories are the dominant mature trees in the state's forests, but young oak or hickory trees are scarce. Scientists are documenting a 'maple take-over' in many forests. As the mature canopy-level trees die, they are being replaced by sugar maples. Since 1960, the estimated basal area of maples in Illinois forests has increased 40 times. By 2057, high-quality oak-hickory forests will likely be rare on the Illinois landscape – the way high-quality wetlands and prairies are now.

In the future, more engineered wetlands will probably be constructed to mitigate losses, or abate water flow for flood-water storage, nutrient/pollutant filtering, and sediment trapping. The track record of constructed wetlands in providing quality habitat for birds is mixed. Some of these wetlands are created to perform specific functions, such as removing nitrogen or storing flood water, and designing wetlands to maximize these functions may limit their value as wildlife habitat. We will need to build upon the many recent successful wetland restorations

(Spunky Bottoms, Pecatonica Wetlands, Emiquon, Hennipen-Hopper Wetlands, Cache River) in order to recover populations of many wetland-dependent birds.

Another area of future concern that has received a great deal of attention in recent years is the potential impact of climate change. Looking forward, climate may be a major driver of bird distribution and abundance. By 2050, climate models predict that winters in northern Illinois will average about 5ºF warmer, with greater changes in northern and less extreme changes in southern Illinois. An increase of about 6ºF in average summer temperature is expected over most of the state. Projecting out another 50 years to 2100, winters could average 5ºF warmer in the south, and nearly 10ºF warmer in northern Illinois. Summer averages could be about 10ºF warmer over most of the state. Climate scientists also expect increased variability – more frequent and more extreme heat waves, cold snaps, droughts, and floods.

We should not only consider gradual, predictable northward range "shifts" as the usual response of birds to climate change. It is as likely that habitats and bird populations will explode, crash, and jump as much as they "shift." Some analyses of anticipated changes in the distribution of tree species and other habitats project massive changes in the ranges of several species. Bobolinks and sedge wren breeding ranges may be pushed northward out of Illinois; Bachman's sparrow and brown-headed nuthatch may colonize from the south (Matthews et al. 2004). These types of projections do not fully capture the complexity of the Illinois landscape. How will the fragmented nature of habitats, topography, soils, and human interventions affect the habitats found in an area and the birds that are able to live there? No one knows, but opportunistic and "weedy" kinds of plants and animals are likely to do best in a rapidly changing environment. Climate change, the character of the surrounding landscape, and invasive species will all make it harder for conservationists to maintain "time capsules" of forests, savannas, prairies and wetlands that resemble those habitats of the 19th century.

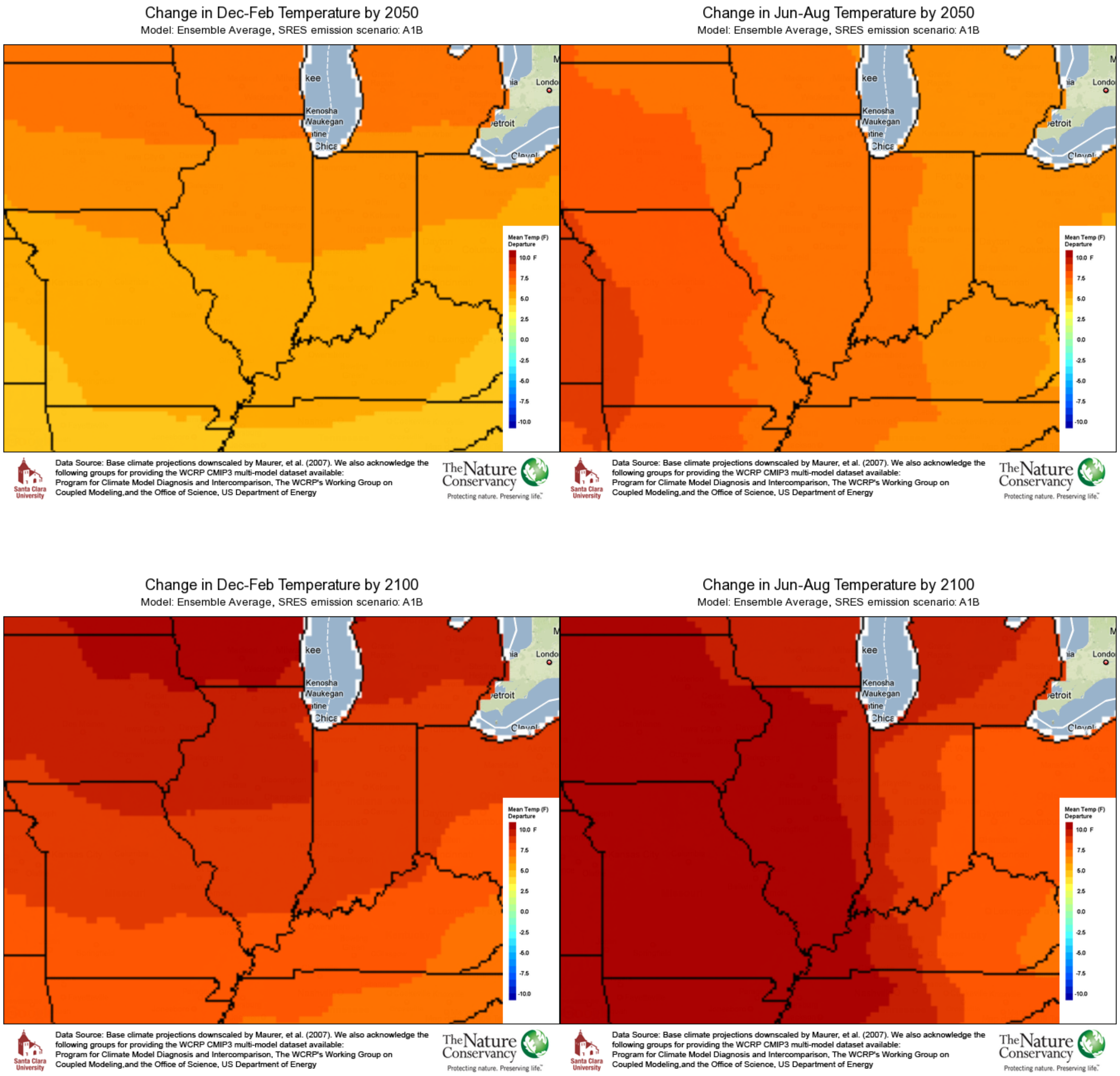


Fig. Projected climate of Illinois in 2050 and 2100, based on ensemble average of 3 global climate models for moderately-reduced emissions (A1B medium scenario; http://www.climatewizard.org/).

Conservation Lessons

Over the last century, we have learned much about the life history of the birds that breed in Illinois. One of the most sobering lessons for conservationists has been that local conservation efforts may set a ceiling for local bird populations, but not a floor. We may do things to make it possible for more birds, and more types of birds, to live and reproduce in an area, but it is not certain that birds will use it. For example, if bobolinks don't survive the winter in Argentina, no amount of restored prairie in Illinois will bring them back to breed here. Identifying limiting factors for each bird species is challenging, but critical for effectively conserving species of concern. Comprehensive plans for conservation should focus on all parts of the annual cycle for birds, not only management of breeding habitat, but also stopover and wintering habitat. Without these widespread efforts, resources used in one area may not result in increases of species across their range. It is possible that in 50 years state organizations will be weighing the costs and benefits of purchasing habitat for wood thrushes in Pope County, Illinois or Quintana Roo, Mexico. It is likely that in the future, more species and habitats will be dependent on conservation intervention to persist in the state. This is the major short-coming of conservation to date – we are fairly good at preventing extinction, but perform poorly at preventing rarity. Scientists have been warning about grassland bird trends for 20 years, and our results show that concern is certainly warranted, but whether we have prevented future declines remains to be seen. The last century has witnessed several successes (e.g. recovery of wood ducks, wild turkeys) and failures (e.g., decline of grassland bird). Although we need to continue to develop information and tools to aid in the conservation and restoration of bird populations, the most important component will be the will of the people of Illinois to conserve their natural history.

Which species will increase and decrease of the next 50 years.

The classic example of an Illinois bird that changed its ecological strategy is the red-winged blackbird, moving from marshes to uplands, and grassland birds shifted readily from prairies to pastures and hay fields. Sandhill cranes and Canada geese, now commonly nest in/near developed areas…but not 50 years ago. Adaptation can be based on genetics, social cues, and learned behaviors passed among generations. Recovery of the sandhill crane was unexpected after it was extirpated from Illinois. It did not recover because of wetland conservation efforts in northeastern Illinois…but would recovery have been possible if wetlands had not been conserved and they had been further destroyed or degraded? There will be strong selection pressure on species to use human-modified or human-dominated habitats. While some species that we currently view as species only found in high-quality "pristine" habitats will likely start to use human-modified habitats, not all will. It is likely that in the next 50 years a species or two will "fall between the cracks" and be extirpated from Illinois. Below is a list of the species the authors feel will be most likely to be extirpated and increase as a breeding species in the state. The factors that conspire to result in large increases or decreases are varied and difficult to predict. We currently do not have the information to accurately predict the population trajectories of species over the course of several decades, so we (the authors) used our experiences and knowledge to make an educated guess as to which species may be the next “winners” and “losers”.

	Extirpated	Increases
Dr. Walk	Bobolink	Swallow-tailed Kite
Dr. Ward	Whip-poor-will	Black-bellied Whistling Duck
Dr. Benson	Upland Sandpiper	Eurasian Collared-Dove
Dr. Deppe	Bewick’s Wren	Whooping Crane
Dr. Brawn	Red-headed Woodpecker	Trumpter Swan

To the future scientist that repeat this survey. All data and information are archived at the Illinois Natural History Survey at the University of Illinois, Urbana-Champaign. Good Luck!

FINAL REPORT

An Assessment of Grassland Bird Populations on Reclaimed Mine Lands in Illinois

State Wildlife Grant Program Project T-16-P-1, Job 2

Jeffery W. Walk, Michael P. Ward, and Thomas J. Benson

Abstract. *Areas reclaimed after surface mining often provide large patches of grassland that are scarce in Midwestern landscapes. We sampled reclaimed mine grasslands in west-central Illinois, and found at least 6 grassland bird Species in Greatest Need of Conservation at each site; 13 Species in Greatest Need were documented overall. Bobolinks, dickcissels, eastern meadowlarks, and northern bobwhite were present at all sites. Bobolinks, and to a lesser extent grasshopper sparrows, were more abundant on agricultural-use grasslands (activity managed with haying or grazing) than conservation or recreational use grasslands (typically idle >1 year). Bobolinks and dickcissels were both more abundant on publicly-owned reclaimed mine grasslands than privately-owned lands. Large populations of upland sandpipers, willow flycatchers, Henslow's sparrows, and bobolinks were documented at some sites. A site known as the Municipal Sanitation District, Fulton County, was nominated as an Important Bird Area based on these surveys. We recommend conservation actions to maintain and enhance grasslands habitats on publicly and privately owned reclaimed mine grasslands.*

INTRODUCTION

Areas reclaimed after surface mining often provide large patches of grassland, shrubland and wetland vegetation that are scarce in Midwestern landscapes. Previous studies have documented significant populations of wetland, shrubland, and grassland birds (Horstman et al. 1998, Bajema et al. 2001, Devault et al. 2002, Scott et al. 2002), and found nest success rates in mined habitats are similar to those observed in unmined areas (Monroe et al. 2005, Galligan et al. 2006). Mined grasslands may be particularly important to the regional population of Henslow's sparrows, *Ammodramus henslowii* (Bajema et al. 2001).

Within Illinois, the significant avian resources that have been associated with reclaimed surface mines include migratory and wintering waterfowl, wintering grassland raptor (especially short-eared owls, *Asio flammeus*, and northern harriers, *Circus cyaneus*), migratory shore birds, marsh-nesting birds, shrubland-nesting birds, and grassland-nesting birds. Several sites with a history of surface mining have now been designated as Illinois Important Bird Areas, including Double T State Fish & Wildlife Area, Pyramid State Recreation Area, and Banner Marsh State Fish & Wildlife Area (The Habitat Project 2009).

Although several southern Illinois sites have been surveyed (Smout 1997, Horstman et al. 1998, Hoover 2003, May 2007), most reclaimed mine lands in west-central Illinois have not been sampled. Grassland wildlife may be jeopardized as succession changes reclaimed mine grasslands to shrubland and forest. Conversely, imperiled species may be more secure if reclaimed mine habitats are maintained. Regardless, baseline data are lacking to assess the relative value of reclaimed mine habitats across Illinois.

To better understand the conservation opportunities and needs for nesting grassland birds on reclaimed mine lands in Illinois, we undertook this study to survey birds on reclaimed mine habitats under public and private ownership, and managed for a variety of purposes (including conservation, recreation, and forage production), with special emphasis on documenting presence and/or concentrations of Species in Greatest Need of Conservation (Illinois Department of Natural Resources 2005). Based on previous studies and the geographic distribution of grassland birds species relative to the location of most reclaimed mine grasslands in Illinois, we focused on documenting the abundance of grassland birds on reclaimed mine grasslands in west-central Illinois during the nesting season.

METHODS

We selected potential survey areas with assistance from the Illinois Department of Natural Resources. The Office of Mines & Minerals is a source of site reclamation plans, maps and corporate landowner contact information (D. Spindler, pers. comm.), and their web-based "Illinois Coal Mine Viewer" tool was useful for locating reclaimed surface mines (Fig. 1) and approximating land cover (*http://dnrgis.state.il.us/website/Mpermit/viewer.htm).* Additionally, biologists in the Office of Resource Conservation were asked to identify Department properties with a history of surface mining, with a specific need for information on non-game birds.

Breeding season surveys consisted of 5-minute point-counts, with the distance estimated to each bird detected, conducted under acceptable conditions (from dawn to no later than 4.5 hours after sunrise, wind $\leq$3 Beaufort scale, and no precipitation), between late May and early July. Points were located >300 m apart, and >50 m from public roadways. Additionally, area searches were conducted on sampling areas to determine the presence/absence of rare and other species unlikely to be detected on point-count surveys. Density estimates were calculated with the program DISTANCE (Thomas et al. 2005), and values with non-overlapping 95% confidence intervals were considered significantly different.

RESULTS

From 2006-2008, we conducted 55 point-counts at nine sites in west-central Illinois (Table 1, Fig. 2, Appendix I). Agriculture (haying and grazing) was the dominant land use at 21 of the point count locations. The remaining point locations were in areas managed for conservation and/or recreational purposes and mostly provided undisturbed grassland habitat, with a few points in areas of recent prescribed fire (2) or soil disturbance for invasive species control and re-seeding (4).

Of the 13 grassland or shrub-grassland Species in Greatest Need of Conservation observed, 6 to 11 species were detected at a given site (Table 2). Bobolinks, dickcissels, eastern meadowlarks, *Sturnella magna*, and northern bobwhite, *Colinus virginianus*, were present at all sites, whereas western meadowlarks, *Sturnella neglecta*, were found at a single site. Among Illinois-Endangered or -Threatened species, the Henslow's sparrow was present on at least 7 of the 9 sites surveyed. There was sufficient evidence of nesting at 5 sites to warrant an Element Occurrence Report to the Illinois Department of Natural Resources (Victoria PHA, Knox County; Snakeden Hollow SFWA, Knox County; private lands near Victoria, Knox County; Mautino SFWA, Bureau County; Municipal Sanitation District, Fulton County). Because Henslow's sparrows had become reported from most Illinois counties and several large populations occurred on protected areas, the species was removed from the Illinois-Threatened list in 2009 (Illinois Endangered Species Protection Board 2009)

Five grassland species had sufficient detections to generate density estimates. Bobolinks, *Dolichonyx oryzivorus*, were significantly more abundant on agricultural-use grasslands compared to conservation/recreational grasslands (mean values of 3.0 birds/ha and 0.76 birds/ha, respectively; Table 3). Though not significant, grasshopper sparrows, *Ammodramus savannarum*, tended to be considerably more abundant in agricultural-use grasslands as well (mean of 1.21 birds/ha, compared to 0.67 birds/ha in conservation/recreational grasslands). Bobolinks and dickcissels, *Spiza americana*, were more abundant on public lands than on private property (Table 4).

Upland sandpipers, *Bartamia longicauda*, were detected at two sites. A single individual was found once on private land near Victoria, Knox County. A minimum of 6 and as many as 9 individuals (including territorial behavior of at least 4 males, and at least 2 apparent mated pairs) were present on the Double T SFWA, Fulton County, warranting a report to the Illinois Department of Natural Resources' Biotics 4 Database. Northern harriers, short-eared owls, or loggerhead shrikes, *Lanius ludovicianus*, were not seen on any breeding season surveys of these reclaimed mine grassland sites.

Double T SFWA had previously been recognized as an Important Bird Area for upland sandpipers, and our surveys confirmed that distinction. We documented significant numbers of three Species in Greatest Need of Conservation at the Municipal Sanitation District, Fulton County. The number of singing males found for each species was 18 willow flycatchers, *Empidonax trallii*, 34 Henslow's sparrows, and 94 bobolinks. Bobolinks were the second-most abundant bird located on the site (following red-winged blackbird, *Agelaius phoeniceus*). Based on these results, the site has been nominated as an Important Bird Area.

DISCUSSION

Reclaimed mine grasslands in west-central Illinois varied considerably in their vegetation composition, management, and size, but all sites we sampled hosted at least 6 Species in Greatest Need of Conservation. Interestingly, bobolinks were located at all sites. In Illinois, bobolink populations have been declining at the rate of 8.5% per year from 1966-2007 (Sauer et al. 2008). Reclaimed mine grasslands in west-central Illinois could be important in conserving this bird within Illinois. The reclaimed mine grasslands in southern Illinois are outside this species' usual nesting range. Our data show Henslow's sparrows were widespread on reclaimed mine grasslands in west-central Illinois and supports Bajema et al.'s (2001) contention that reclaimed mine grasslands are regionally important for the conservation of this priority bird.

The threats to grassland birds on reclaimed mines are similar to threats on other grasslands, namely disturbance during the nesting season and woody encroachment. Conversion to cropland is a lesser risk for reclaimed mine grasslands. Though many areas are capable of being cultivated, soil conditions are less favorable to crop production than unmined areas. Haying operations were underway at the Municipal Sanitation District site in Fulton County on the same day as our surveys. This was particularly unfortunate because the site hosted the largest population of bobolinks we located, and haying is known to destroy virtually all bobolink nests (Bollinger et al. 1990). Woody encroachment on grassland habitat was especially severe at Mautino SFWA, Snakeden Hollow SFWA, and on private lands near Wyoming. Black locust, *Robinia pseudoacacia*, which is commonly planted on reclaimed mine areas, and autumn olive, *Elaeagnus umbellata*, were the most noteworthy invading woody plants. Overgrazing contributing to soil erosion was noted on portions of all private lands surveyed.

Bobolinks and grasshopper sparrows were more common on recently hayed or grazed grasslands than in undisturbed grasslands on conservation/recreational areas. Bobolinks respond favorably to properly timed burning, mowing, and grazing. Peak abundance generally occurs 1-3 years following fire or haying or during light grazing (Herkert 1991, 1994, Dechant et al. 2003). Similarly, grasshopper sparrows prefer relatively short, sparse vegetation in Illinois (Herkert et al. 1993), including grazed areas (Walk and Warner 2000). Bobolinks and dickcissels were more abundant on public lands than on private lands. Considering most private grasslands were used for agriculture, this is a surprising result. The Municipal Sanitation District site in Fulton County was the only publically-owned site that was predominantly used for agriculture of the sites we surveyed, and dickcissels and bobolinks were far more abundant at this site than any other site we surveyed.

Based on our surveys, we nominated the Municipal Sanitation District as an Illinois Important Bird Area for large nesting populations of willow flycatchers, bobolinks, dickcissels, and Henslow’s sparrows. In this respect, the Municipal Sanitation District is similar to Pyramid State Recreation Area, Perry County, as reclaimed mine grasslands of statewide importance for grassland bird Species in Greatest Need of Conservation. Both of these large sites are have additional nearby reclaimed mine grasslands, improving their landscape context for grassland wildlife. Haying and grazing at this site created habitat conditions attractive to grassland birds, but the timing of haying operations may be creating an ecological trap. Modifying haying practices at this site would likely improve the recruitment of bobolinks, dickcissels, Henslow’s sparrows, eastern meadowlarks and other grassland birds nesting in hayed areas on the site.

Reclaimed mine grasslands in west-central Illinois are hosting several grassland Species in Greatest Need of Conservation, including populations of statewide significance for upland sandpipers, bobolinks, and Henslow’s sparrows. These habitats provide a significant opportunity for the conservation of grassland birds because of the grasslands’ large average size, large total extent, and low-risk of conversion to cropland. However, grassland birds on these areas are also being adversely affected by encroachment of woody vegetation, nesting season haying operations, and improper management. Public land managers should develop strategies to maintain and enhance grassland habitat on those sites, consistent with the primary site objectives. Outreach to private landowners should emphasize haying operations that avoid the nesting season to the extent possible, managed grazing, control of invasive woody plants, and a regular regime of prescribed fire.

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Table 1. Locations of reclaimed mine grassland surveyed for grassland and shrub-grassland birds, 2006-2008.

County	**Site Name**	**Management**	**Ownership**
Bureau	Mautino SFWA	Conservation/recreation	Public - Illinois Dept. Natural Resources
Fulton	Double T SWFA	Conservation/recreation	Public - Illinois Dept. Natural Resources
Fulton	Lakeland Park	Recreation	Public - Canton Park District
Fulton	Municipal Sanitation District	Agriculture	Public - Metropolitan Water Reclamation District of Greater Chicago
Fulton	(near Table Grove)	Agriculture	Private (multiple)
Knox	Snakeden Hollow SFWA	Conservation/recreation	Public - Illinois Dept. Natural Resources
Knox	Victoria PHA	Conservation, Conserevation/recreation	Public - Illinois Dept. Natural Resources
Knox	(near Victoria)	Agriculture, Conservation/recreation	Private (multiple)
Stark	(near Wyoming)	Agriculture, Conservation/recreation	Private (multiple)

Table 2. Densities (birds/ha) of five grassland birds among agricultural-use and conservation/recreational-use reclaimed mine grasslands in Illinois, 2006-2008. An “*” indicates non-overlapping 95% confidence intervals among the two grassland types by species.

	Agricultural-Use Grasslands				**Conservation & Recreational Grasslands**			
	mean	**95% Confidence Interval**			**mean**	**95% Confidence Interval**		
Bobolink	3.00	1.64	5.48		0.76	0.55	1.05	*
Dickcissel	0.93	0.62	1.41		0.85	0.60	1.19	
Eastern meadowlark	1.31	0.96	1.78		1.25	0.93	1.70	
Grasshopper sparrow	1.21	0.78	1.87		0.67	0.49	0.92	
Red-winged blackbird	5.65	3.04	10.48		7.67	5.68	10.37	

Table 3. Densities (birds/ha) of five grassland birds among public and privately-owned reclaimed mine grasslands in Illinois, 2006-2008. An “*” indicates non-overlapping 95% confidence intervals among the two grassland types by species.

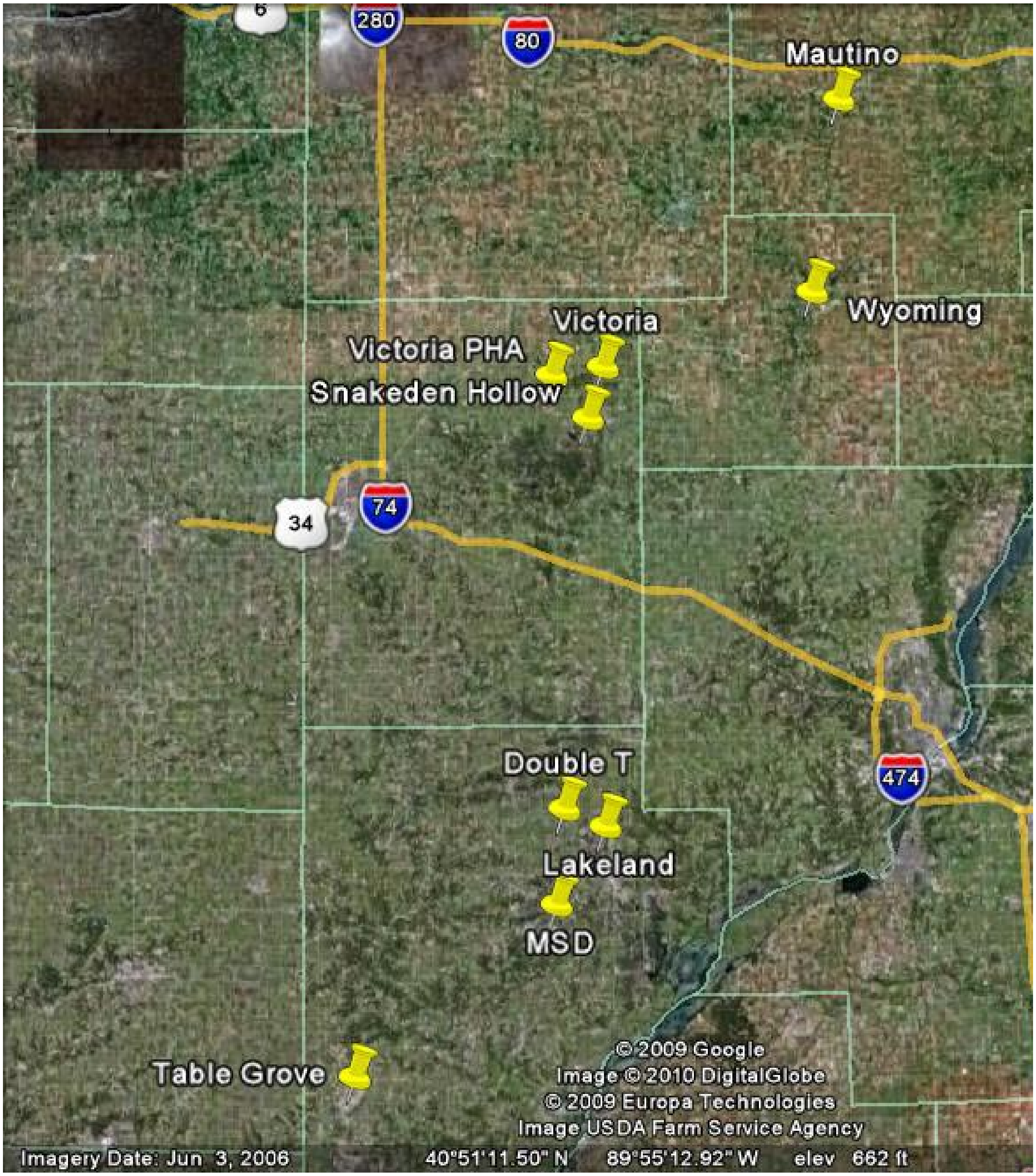
	Private Ownership				**Public Ownership**			
	mean	**95% Confidence Interval**			**mean**	**95% Confidence Interval**		
Bobolink	0.27	0.19	0.38		2.03	1.38	2.99	*
Dickcissel	0.31	0.19	0.49		1.07	0.76	1.48	*
Eastern meadowlark	1.24	0.90	1.70		1.29	0.95	1.74	
Grasshopper sparrow	1.18	0.55	2.55		0.78	0.57	1.06	
Red-winged blackbird	4.55	3.00	6.90		7.60	5.75	10.17	

Table 4. Grassland and Shrub-grassland birds of conservation concern detected at reclaimed mine grasslands in Illinois, 2006-2008. Includes birds detected by point counts or area searches.

Site	**County**	**Grassland and Shrub-Grassland Birds of Conservation Concern**												
		Bell's Vireo	Bobolink	Dickcissel	Eastern Meadowlark	Field Sparrow	Grasshopper Sparrow	Henslow's Sparrow	Northern Bobwhite	Savannah Sparrow	Sedge Wren	Upland Sandpiper	Western Meadowlark	Willow Flycatcher
Double T SFWA	Fulton		X	X	X		X		X	X		X		X
Lakeland Park	Fulton	X	X	X	X	X		X	X		X			
Mautino SFWA	Bureau		X	X	X	X		X	X	X				X
Municipal Sanitation District	Fulton		X	X	X	X	X	X	X	X	X			X
near Victoria	Knox		X	X	X	X	X	X	X	X	X	X	X	
Snakeden Hollow SFWA	Knox	X	X	X	X	X	X	X	X					X
near Table Grove	Fulton		X	X	X		X		X	X				
Victoria PHA	Knox		X	X	X		X	X	X	X	X			
near Wyoming	Stark	X	X	X	X	X	X	X	X	X				X

Fig. 1. (Following page) Distribution of surface mined lands in Illinois, as captured by the Illinois Department of Natural Resources' ArcIMS Illinois Coal Mine Permit Viewer tool.

This figure would not covert to a PDF but is available on IDNR website.



6
280
80
Mautino
Wyoming
Victoria
Victoria PHA
Snakeden Hollow
34
74
474
Double T
Lakeland
MSD
Table Grove
© 2009 Google
Image © 2010 DigitalGlobe
© 2009 Europa Technologies
Image USDA Farm Service Agency
Imagery Date: Jun 3, 2006
40°51'11.50" N
89°55'12.92" W
elev 662 ft

Fig. 2. Locations of reclaimed mine grasslands surveyed for birds in west-central Illinois, 2006-2008.

Appendix I. Locations of point-counts for grassland birds on reclaimed mine grasslands. Points were marked on maps in the field and approximated in these figures.

Double T State Fish & Wildlife Area, Canton, Fulton County

Lakeland Park, Canton, Fulton County

Mautino State Fish & Wildlife Area, Sheffield, Bureau County

Municipal Sanitation District (MSD), Canton, Fulton County

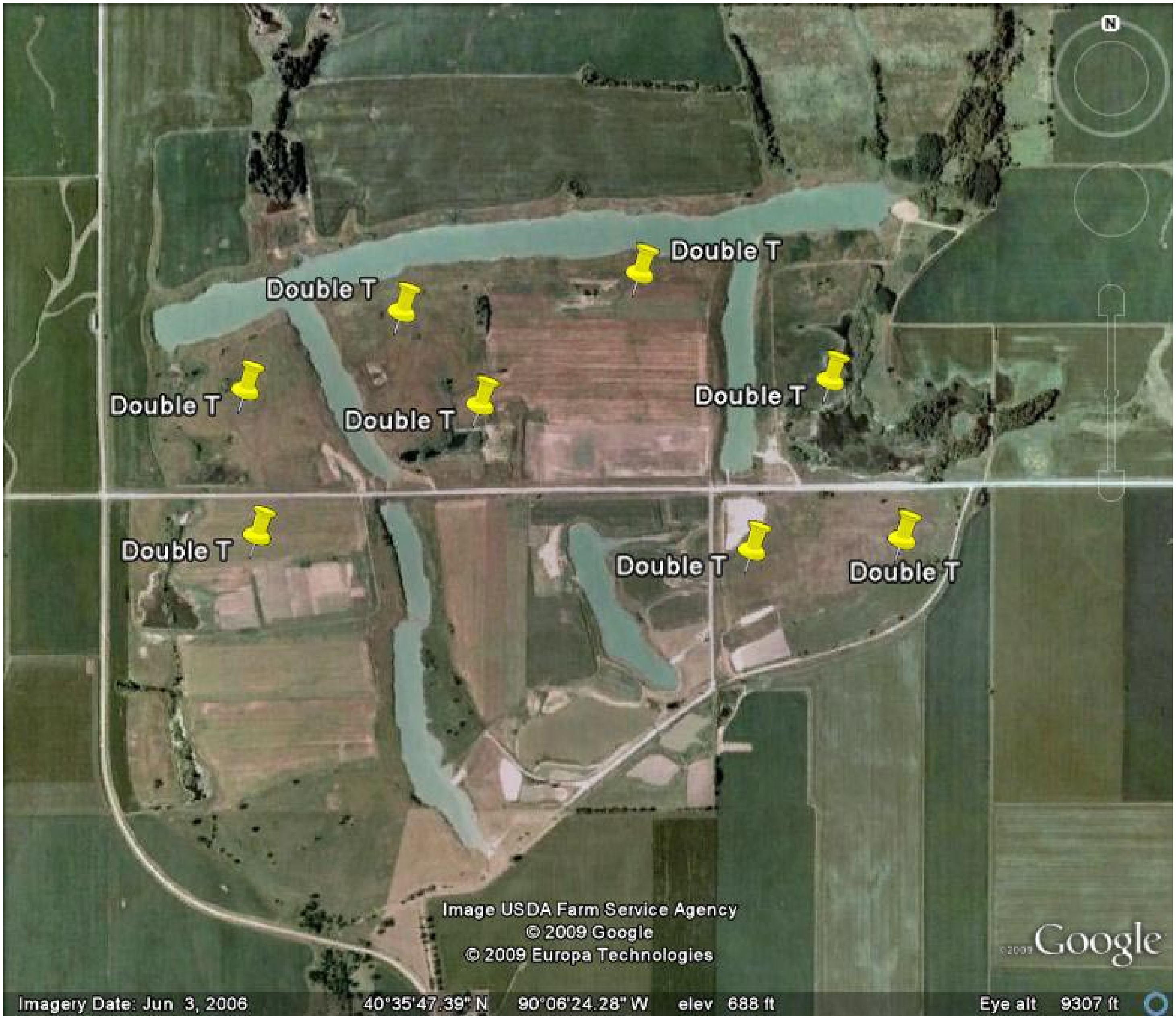
Snakeden Hollow State Fish & Wildlife Area, Victoria, Knox County

private lands near Table Grove, Fulton County

Victoria Pheasant Habitat Area, Victoria, Knox County

private lands near Victoria, Knox County

private lands near Wyoming, Stark County


Double T
Double T
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Double T
Double T
Double T
Image USDA Farm Service Agency
© 2009 Google
© 2009 Europa Technologies
Google
Imagery Date: Jun 3, 2006
40°35'47.39" N
90°06'24.28" W
elev 688 ft
Eye alt 9307 ft

Lakeland
Lakeland
Lakeland
Lakeland
Van Dyke Dr
N Park Dr
Middle Park Dr
Park Plaza Dr
N Main St
Co Rd 21
Image USDA Farm Service Agency
© 2009 Google
© 2009 Europa Technologies
Google
Imagery Date: Jun 3, 2006
40°34'40.54" N
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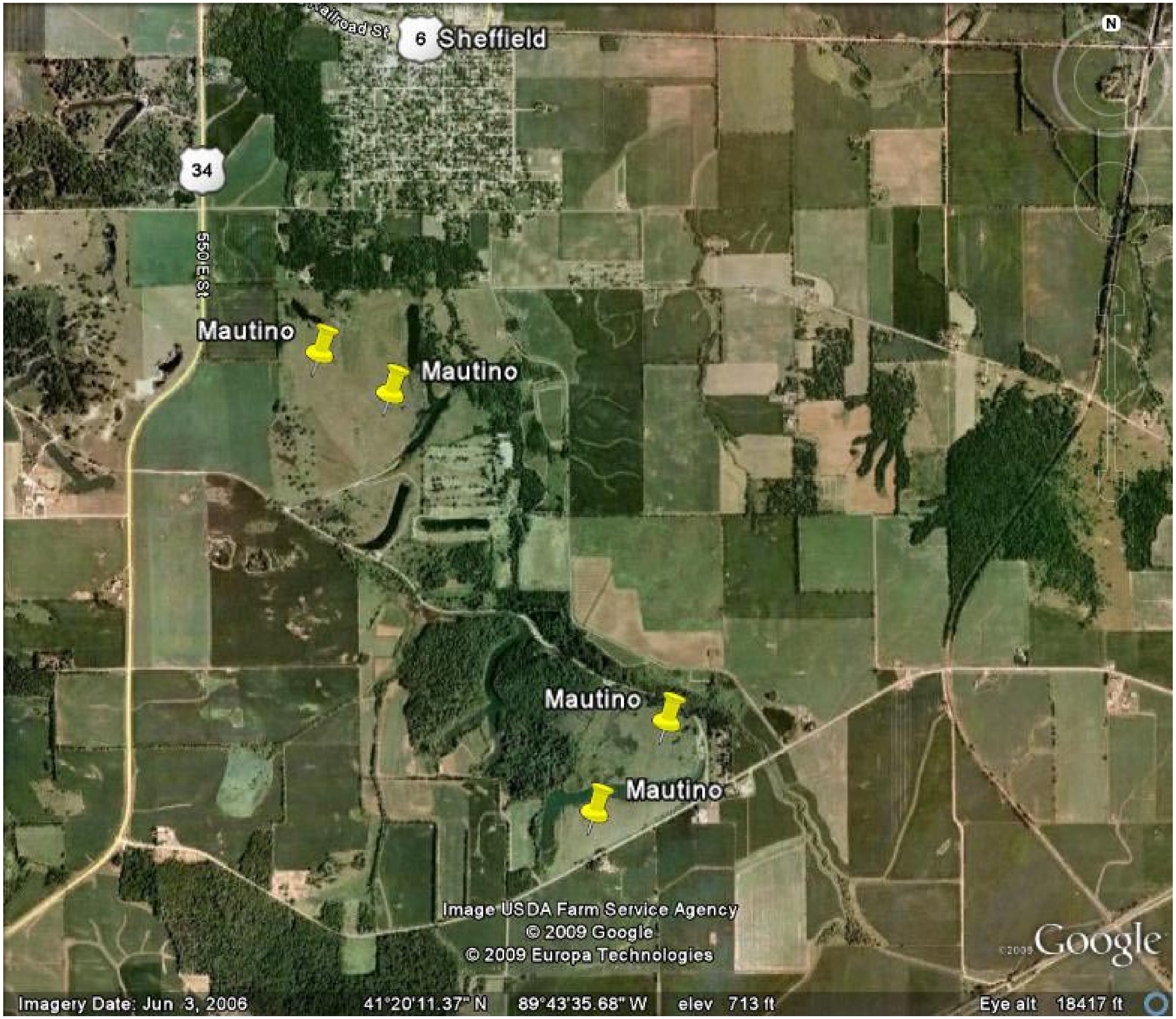
elev 676 ft
Eye alt 7942 ft



Railroad St
6
Sheffield
34
550 E St
Mautino
Mautino
Mautino
Mautino
Image USDA Farm Service Agency
© 2009 Google
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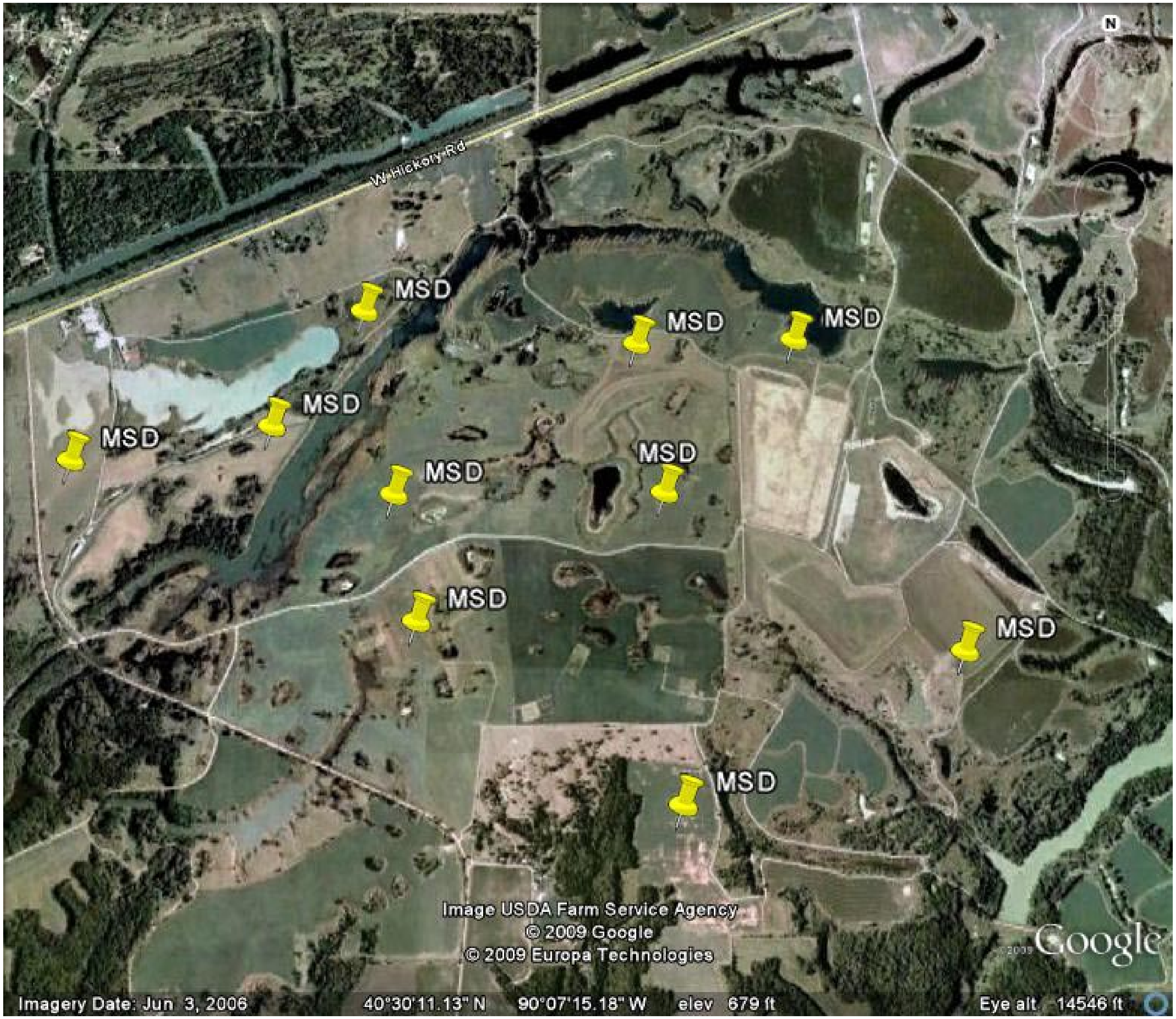
Google
Imagery Date: Jun 3, 2006
41°20'11.37" N
89°43'35.68" W
elev 713 ft
Eye alt 18417 ft



W Hickory Rd
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MSD
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MSD
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MSD
MSD
MSD
Image USDA Farm Service Agency
© 2009 Google
© 2009 Europa Technologies
Google
Imagery Date: Jun 3, 2006
40°30'11.13" N
90°07'15.18" W
elev 679 ft
Eye alt 14546 ft


Knox Hwy
N
Snakeden Hollow
Snakeden Hollow
Snakeden Hollow
Snakeden Hollow
Snakeden Hollow
Snakeden Hollow
Image USDA Farm Service Agency
© 2009 Google
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Eye alt 13435 ft

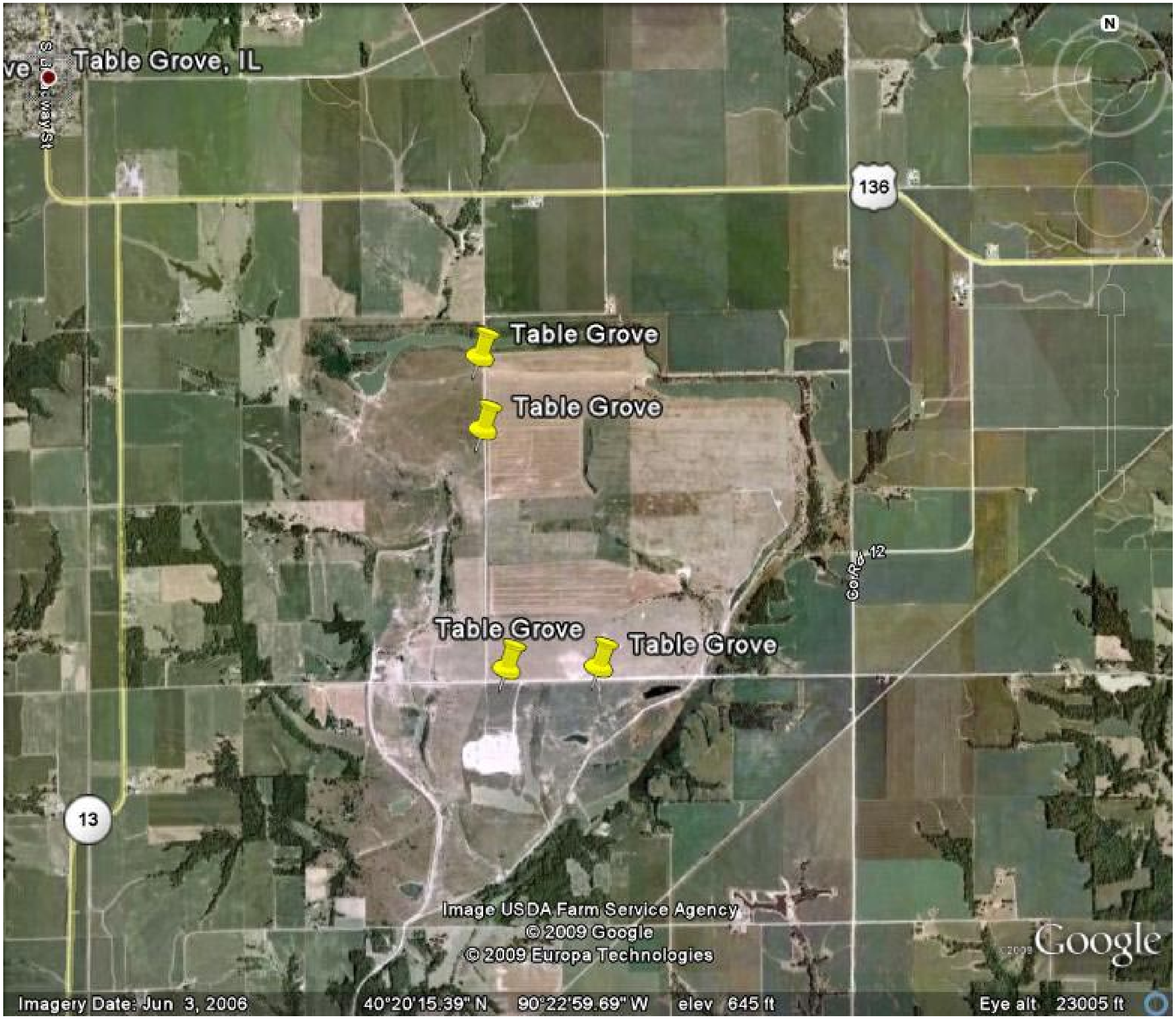

Table Grove, IL
136
13
Table Grove
Table Grove
Table Grove
Table Grove
Co Rd 12
Image USDA Farm Service Agency
© 2009 Google
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Google
Imagery Date: Jun 3, 2006
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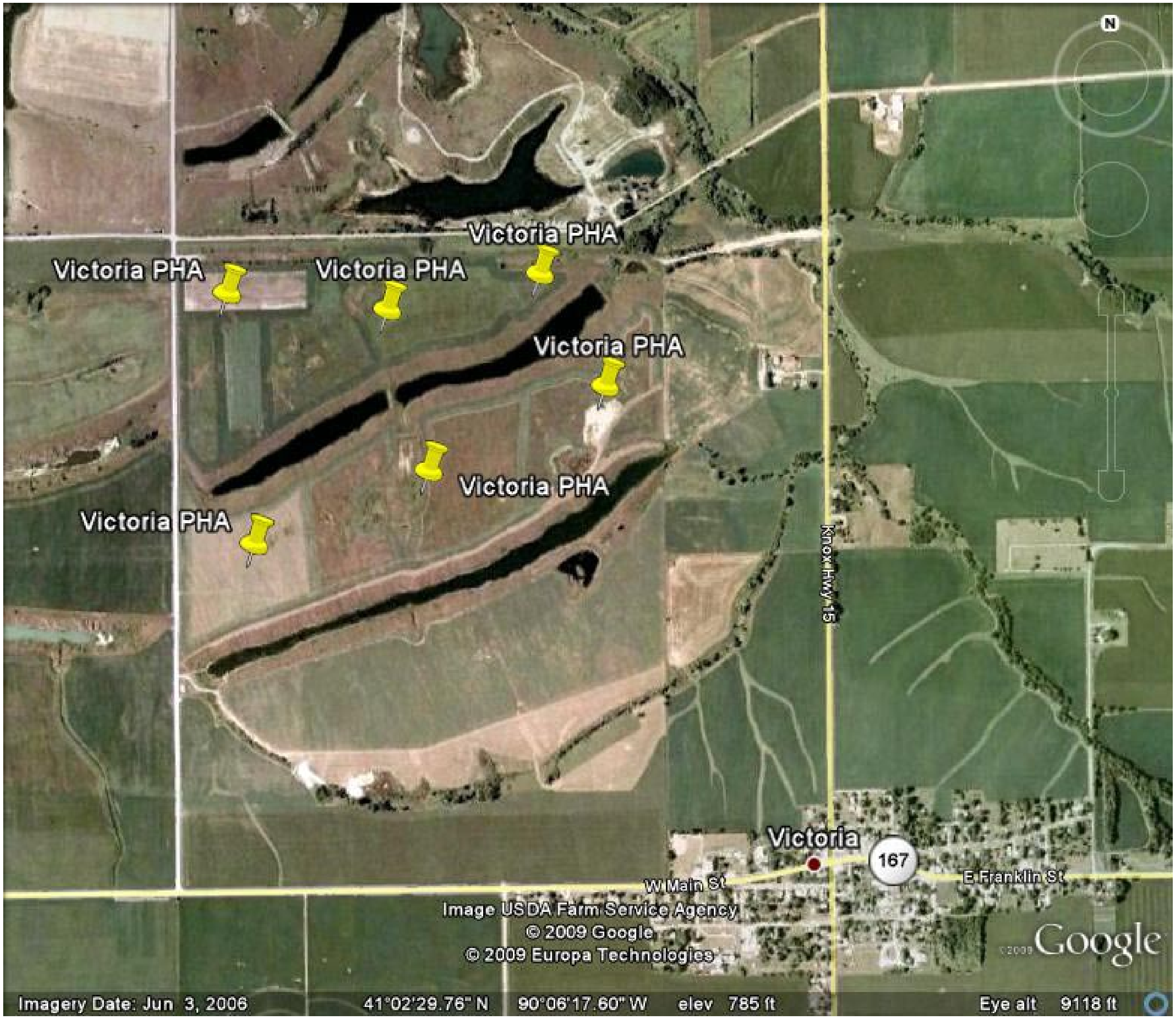
elev 645 ft
Eye alt 23005 ft


Victoria PHA
Victoria PHA
Victoria PHA
Victoria PHA
Victoria PHA
Victoria PHA
Knox Hwy 15
Victoria
167
W Main St
E Franklin St
Image USDA Farm Service Agency
© 2009 Google
© 2009 Europa Technologies
Google
Imagery Date: Jun 3, 2006
41°02'29.76" N
90°06'17.60" W
elev 785 ft
Eye alt 9118 ft

N
Victoria
Victoria
Victoria
Victoria
Victoria
Victoria
Victoria
167
180
Image USDA Farm Service Agency
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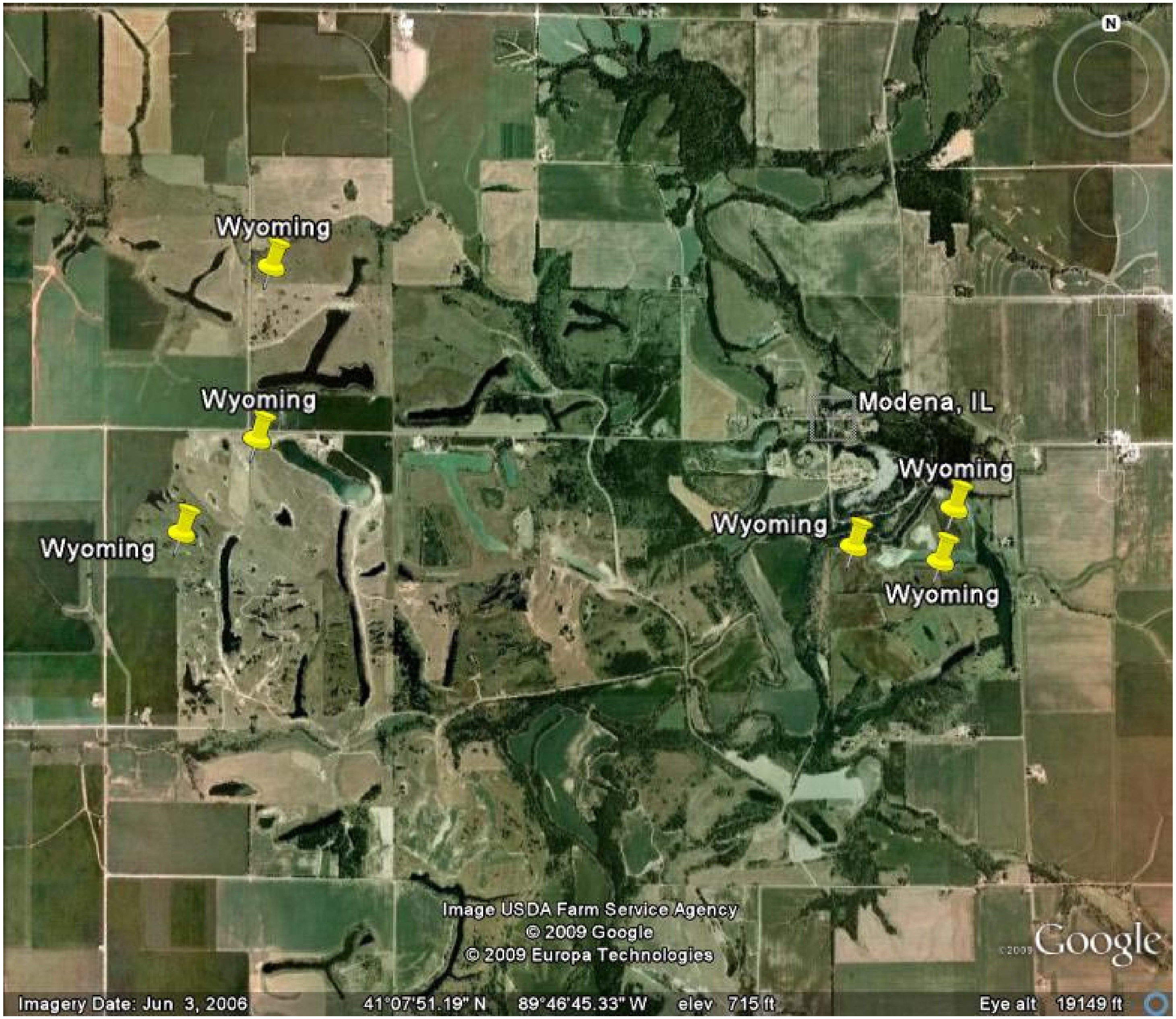
Wyoming
Wyoming
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Modena, IL
Wyoming
Wyoming
Wyoming
Image USDA Farm Service Agency
© 2009 Google
© 2009 Europa Technologies
Google
Imagery Date: Jun 3, 2006
41°07'51.19" N
89°46'45.33" W
elev 715 ft
Eye alt 19149 ft

FINAL REPORT

Coordinating Wildlife Conservation with Wind Farm Development

State Wildlife Grant Program Project T-16-P-1, Job 3

Jeffery W. Walk, Tara Beveroth, and Michael P. Ward

INTRODUCTION

No energy source is entirely without environmental or ecological risks. Wind energy is a widely-available, renewable, ‘no emissions’ energy source. For these reasons, as well as pollution, supply and cost issues related to other energy sources, government incentives are encouraging wind energy development as part of the state’s and nation’s energy portfolio. Our objective is to minimize possible adverse effects of the construction and operation of wind energy facilities on wildlife, specifically due to direct mortality, avoidance behaviors, habitat destruction/alteration, and habitat fragmentation. To this end, we offer a spatially-explicit representation of the areas in Illinois where we would have elevated concerns about the potential adverse effects of wind energy development on wildlife and wildlife habitat.

The scientific evidence of interactions between wind energy developments and wildlife is sparse and based on short-term research, and thus siting guidance will likely change as new information emerges. Wind energy developments outside of the areas identified on this map may nonetheless cause adverse effects on wildlife or wildlife habitat. We encourage long-term research into direct mortality and behavioral/avoidance effects on wind energy facilities and wildlife. We also encourage development of siting and operational guidance from regional, flyway, or continental perspectives that considers the cumulative effects of wind energy development on populations.

Because so much remains to be determined both about the direct mortality and the behavioral responses to birds to wind farms we took a simple approach to investigating what areas should receive additional attention when planning to install a wind farm

Methods

We used the Wind Resources and Potential Project Area map from the National Renewable Energy Laboratory (NREL) 2001 and overlaid a number of GIS layers associated with Illinois' natural resources. Below is a list of the layers we used:

<u>Illinois Department of Natural Resources Properties</u> - Randall Collins (Creator), 10/10/07

<u>Illinois Natural Areas Inventory</u> and <u>Nature Preserves</u> – Tara Kieninger (ed.), Illinois Natural Heritage Database Program Publisher and Place: Illinois Dept. of Natural Resources, Springfield, IL 9/29/09

<u>Illinois Threatened and Endangered Species</u> - Illinois Natural Heritage Database Program Publisher and Place: Illinois Dept. of Natural Resources, Springfield, IL 9/29/09

<u>Important Bird Areas</u> – these are areas that host large concentrations of birds (during migration, winter, or nesting seasons), or important nesting populations of conservation concern species. Many Important Bird Areas overlap in part or in total with dedicated conservation areas. For more information on the Important Bird Areas program in Illinois, visit: http://www.habitatproject.org/birds/iba.html

The Nature Conservancy's Conservation Portfolio – this collection of geographic areas is designed to capture viable representatives of all natural communities and other targets (such as globally-rare species) within as compact geographic area as possible. Many portfolio sites overlap in part or in total with dedicated conservation areas. For more information on how The Nature Conservancy's *Conservation By Design* process, visit: http://www.nature.org/aboutus/howwework/cbd/

Results

A quick glance at the map (figure 1) illustrates that Illinois's natural resources are not randomly spread across the landscape. Given the patchiness of Illinois' natural resources there are certain areas that should receive greater attention when siting wind farms. This greater attention is not only due to the possibility of direct mortality of species of concern, but also indirect effects. These indirect effects could be avoiding an area due to the wind farms, or in the case of forested areas, the footprint of turbines resulting in the fragmentation of a forest promoting nest predators and parasites. We suggest that the concentration of natural resources in the southern tip of Illinois and along the Illinois River should result in a greater attention to these areas. However, the wind resource map suggests that these areas do have great potential for wind therefore, siting issues may not arise.

There are two other areas that contain significant natural resources and have great potential for wind farms; western Illinois forests and Prairie Ridge State Natural Area. The greatest threat at these locations may be disturbance to breeding birds. In western Illinois forest, particularly, Calhoun, Pike, Adams, and Brown Counties, the addition of wind farms may fragment already highly fragmented areas. We would be particularly concerned about Siloam Springs State Park and other large forest tracts in this area. Wind farms in and around Prairie Ridge State Natural Area may impact the behavior of birds. Many grassland birds prefer open treeless areas, currently it is unknown how they will react to wind farms. Given the sensitive nature of Greater Prairie-Chickens in Illinois would suggest caution when siting wind farms in this area.

Discussion

Rural/agricultural wind farms are thought to pose low risk to breeding bird populations, however, such farms may be located in or near major migration corridors/flyways and may pose a risk to all groups of migrating birds due to their height (nearly 400 feet) and white strobe lights. Monitoring of avian fatalities should be conducted in a scientifically rigorous fashion to evaluate this risk.

Given limited resources, the investigators should concentrate effort to bear on this question, which remains one of the least studied and understood. Although characteristics of weather and migratory behavior may differ between fall and spring, spring is a more feasible time to conduct mortality searches due to the absence of standing crops. Searching periods spread throughout the year would be likely to underestimate the true risk of the wind plant.

More research is needed on avoidance of wind farms by breeding birds. Research to date suggests that direct mortality is not common however how wind farms impact where birds decide to breed is unknown. Given these unknowns we are concerned about the potential impacts in western Illinois and Prairie Ridge State Natural Area. While it is possible wind farms are completely benign more research is needed.

Acknowledgements

We thank the GIS group at the Illinois Department of Natural Resources and the Illinois Natural History Survey will assistance in acquiring GIS layers.

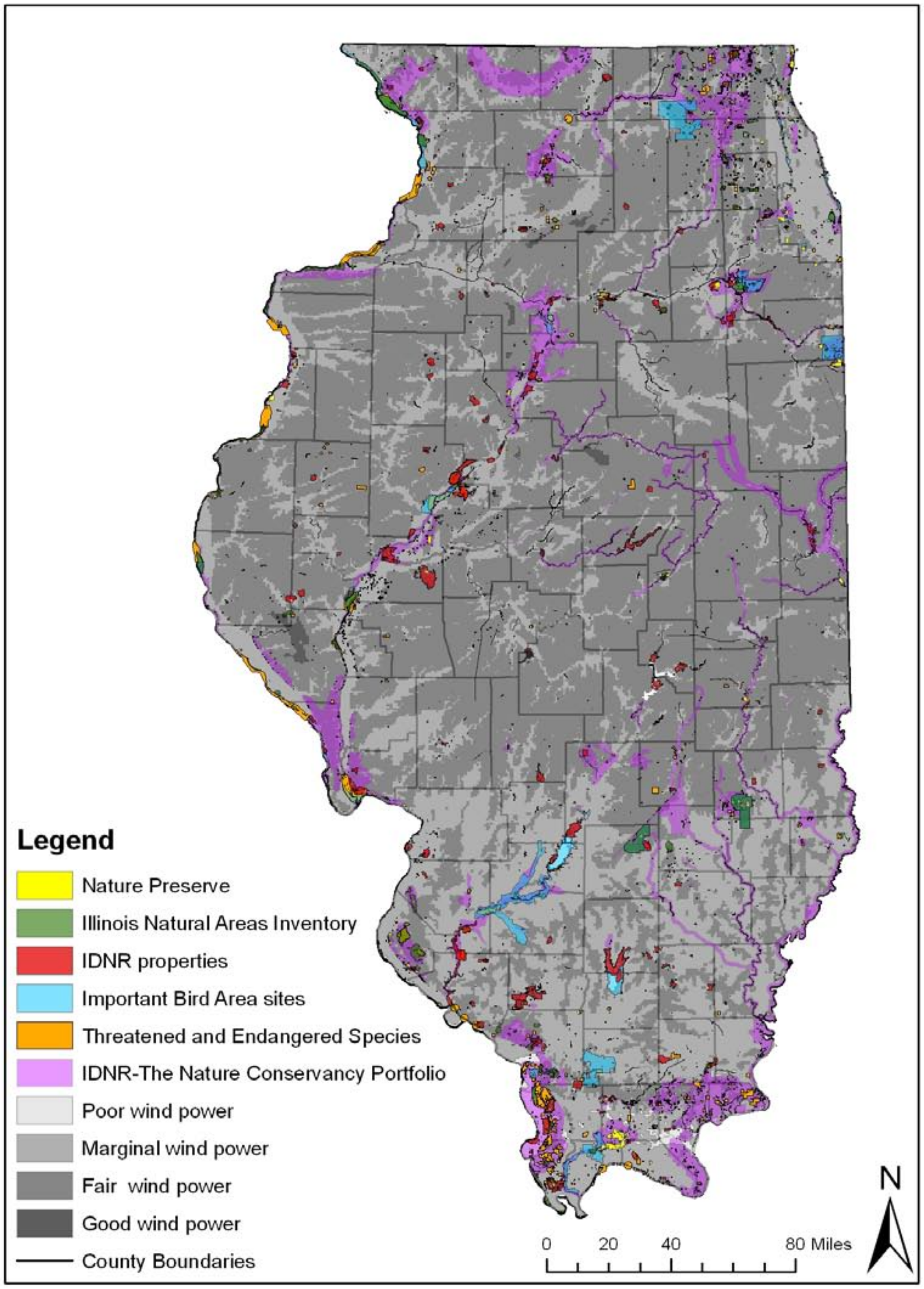
Legend
Nature Preserve
Illinois Natural Areas Inventory
IDNR properties
Important Bird Area sites
Threatened and Endangered Species
IDNR-The Nature Conservancy Portfolio
Poor wind power
Marginal wind power
Fair wind power
Good wind power
County Boundaries
0
20
40
80 Miles
N

Figure 1.

FINAL REPORT

ARE PHEASANT HABITAT AREAS CONSERVING GRASSLAND BIRDS?

State Wildlife Grant Program Project T-16-P-1

"Evaluation of Non-Game Bird Conservation in Illinois"

Job 4 – Evaluation of Pheasant Habitat Areas

Jeffery W. Walk and Michael P. Ward

INTRODUCTION

An explicit goal in the Illinois Wildlife Action Plan (IDNR 2005) is to establish five additional grassland bird conservation areas; however the locations for these restorations were left to be determined. Grassland bird conservation areas are described as landscapes with >3,000 acres of grassland habitat (more than 50% in patches wider than 0.5 mile), less than 10% wooded and urban land covers, and area based on recommendations from several sources (Walk 2004, Sample and Mossman 1997, Simpson and Esker 1997, Herkert et al. 1993). The Illinois Department of Natural Resources' Pheasant Habitat Areas (PHAs) may be suitable foundations for these larger grassland bird conservation areas. Indeed, since the beginning of this study, an extension of the Conservation Reserve Program, known as State Acres For Wildlife Enhancement (SAFE or CP38), has emerged, with private lands near several of the PHAs selected as eligible areas. Through this new program, a mechanism exists for establishing up to 10,300 acres of grassland and wetland habitat among the eligible areas.

Since 1991, more than twenty Pheasant Habitat Areas have been established in central and northern Illinois. Ranging from 80 to 640 acres (median: 100 acres), these sites are often the largest grassland patches in intensive agriculture landscapes. PHAs are have been acquired primarily with funding from the State Pheasant Fund (derived from sales of Pheasant Stamps initially, later Habitat Stamps), are managed to provide nesting, brood-rearing and winter cover for pheasants, and support limited hunting for pheasants and other upland game through a no-cost, lottery-type permit process. A secondary objective of the PHAs is to provide habitat for other grassland wildlife.

David et al. (2003) scored habitat quality for pheasants at 14 PHAs, but the value of habitat on PHAs for nongame birds has not been evaluated. Near these sites, surrounding landscape features further affect the ability of PHAs to function as anchors for grassland bird conservation areas due to land cover (i.e., favorable uses such as agricultural grasslands and small grains and unfavorable land uses such as woodland and developed areas) and soil types (i.e., highly erodible soils lend themselves to complimentary farm programs such as SAFE on private lands, and less productive soils are less expensively acquired and/or leased).

Our objectives with this study were to:

(1) Determine the presence and quantify abundance of grassland birds on Pheasant Habitat Areas;

(2) Identify site-specific issues or management strategies that might improve the capacity of each PHA to provide habitat for grassland birds while maintaining or improving on the primary function of providing high-quality pheasant hunting opportunities;

(3) Consider landscape features (adjacent land use, soil types, exurban and infrastructure development) to identify PHAs with greater potential for expansion into grassland bird conservation areas;

(4) Analyze the physical site characteristics, landscape context, pheasant harvest rates, and diversity/abundance of grassland birds associated with each PHA (a) to characterize the most successful and least successful PHAs and (b) to recommend any changes to the site evaluation process for potential PHA acquisitions to improve future PHAs' pheasant hunting and grassland bird conservation results.

METHODS

We collected maps and basic information (location, size, management/vegetation composition) for each Pheasant Habitat Area from the Illinois Department of Natural Resources' hunter fact sheets. Information on pheasant harvest and hunter effort at each PHA for the 5-year period from 2002-2006 was provided courtesy of John Cole, Upland Wildlife Program Manager, Illinois Department of Natural Resources. From IDNR maps, we plotted approximate locations for conducting point-count surveys during site visits. Points were situated at least 200 m apart and at least 50 m from an IDNR property boundary; the number of points to be sampled varied with the size of the PHA. Since our objectives were specific to grassland birds, points were not placed in wooded areas or crop fields/food plots. Walking searches of portions of PHAs not included in the point counts, such as wetlands, riparian areas, woodlands, and cropland/food plots, were to be used to generate a list of species present on a site and/or to seek out rare/cryptic species not detected on point counts. Immediately following bird surveys, the vicinity surrounding the PHA was driven to assess the landscape context of the PHA.

Field Protocol – Surveys were conducted seasonally during the peak of nesting season for grassland birds (20 May to 10 July). Field work began daily no earlier than 0.5 hr before sunrise and was completed no later than 4.5 hr after sunrise. Acceptable weather conditions for field work were typical of bird surveys, including periods free of rain or when wind conditions were less than Beaufort scale 3 (<13 km/hr).

In the field, observers marked the precise locations of point-counts on aerial photos. We made other notes on the maps, including habitat features, management activities, and locations where threatened/endangered species were observed for reporting to the Illinois Department of Natural Resources' Biotics 4 database. At each point, observers paused for a few minutes then began a 5-minute, unlimited-radius point-count. Birds were recorded as within or beyond 100 m from the observer. Before and after point-counts, we slowly walked all portions of PHAs and stopped frequently so as to identify as many species 'present' as possible.

Landscape Assessment Tool – A rapid assessment tool was developed, with input from grassland biologists with the Illinois Natural History Survey, Illinois Department of Natural Resources, and The Nature Conservancy, to rank sites on 5 parameters that could influence the feasibility and likelihood of biological response from expended grassland conservation effort within 5 km of each PHA (Table 1). The tool was not an evaluation of the PHA itself, but rather the surrounding landscape. The importance of each parameter likely is not equal, and we made no attempt to rank their relative importance. Each parameter was subjectively scored by us on the same date of bird surveys.

Data Analysis – Data across all point-counts at a PHA were pooled to yield a mean number of individuals of each grassland species detected per point, at all distances and within 100m of the observer.   The data reported here are not corrected for detection probabilities based on distance, and these data should not be used to estimate density (birds per unit area). With a single observer (JW) conducting >70% of all the point-counts, these data are a reasonable index of relative abundance of species among sites. With relatively few points per site, and a single visit to each site, we caution against over-interpreting these data at the site level. Robust trends among variables (with correlation coefficients $\geq |0.50|$) are discussed, below.

An overall measure of “grassland bird abundance” was obtained by summing the mean abundance per point for all the grassland species detected at a site. “Richness” was the total number of grassland bird species recorded at a PHA (considering both point-counts and area searches). Because richness is expected to be partially a sampling artifact of the size of a PHA (larger areas included more point-counts, increasing the likelihood of detecting additional species), we also considered “point diversity,” the mean number of grassland bird species detected at all distances on point-counts at a PHA.

RESULTS

From 21 May 2006 through 11 June 2008, we sampled 97 point-counts across 19 sites (17 Pheasant Habitat Areas, and one Habitat Area and one Natural Area within high pheasant response counties; Table 2). Considering all birds, 94 species were observed, ranging from 13 to 41 species per PHA. Twelve species were observed on 16 or more sites (about 85% or greater occurrence; Table 3) – ring-necked pheasants were, in fact, found at all Pheasant Habitat Areas.

Across all sites, only 9 grassland-dependent species were recorded, ranging from 3 to 8 grassland species per PHA (Table 4). None of the native grassland-dependent non-passerines (greater prairie-chicken, upland sandpiper, northern harrier, short-eared owl) were encountered on any Pheasant Habitat Area, though past records exist for some species on some sites. Western meadowlarks (2 sites) and Henslow’s sparrows (4 sites) were among the most narrowly distributed. Dickcissels and eastern meadowlarks (18 sites each) were the most widely distributed grassland songbirds. Abundance of grassland birds fluctuated a great deal across species and sites (Table 4), which undoubtedly includes variability among observers, years, time-of-year, time of day, and weather conditions during surveys, as well as site-specific qualities such as vegetation diversity and structure.

As expected due to greater sampling effort, more grassland species tended to be recorded on larger PHAs (richness and ln-transformed area, correlation coefficient = 0.676; Fig. 1). However, larger PHAs also tended to have great point diversity of grassland birds (correlation coefficient = 0.56), supporting area-sensitivity, whereby some species selectively avoid habitat patches smaller than some threshold level (e.g., Herkert et al. 1993, Walk and Warner 2000). Correlated with great point diversity was higher grassland bird abundance (i.e., more bird territories overlap at a point when more species occur at a point; coefficient = 0.847).

One other factor, the proportion of wooded area on a site, was strongly and negatively correlated with grassland bird diversity and abundance (Fig. 2). As woody vegetation on a site increased, the number of grassland species detected per point decreased (correlation coefficient = -0.687) as did the number of individual grassland birds within the 100m radius point-count (correlation coefficient = -0.714). Woody vegetation was also correlated with poorer pheasant hunting; as woody cover increased, the 5-year average number of pheasants harvested per hunter, per day dropped (correlation coefficient = -0.737).

Considering the landscapes surrounding PHAs, none were rated as >25% wooded or developed. However, the five PHAs in more than 10% wooded landscapes also had the five poorest pheasant hunting success rates. Favorable adjacent land use was not strongly correlated with pheasant hunting success or grassland bird diversity/abundance on PHAs.

DISCUSSION

Size Matters (it's the ceiling, but not the floor) – small sites do not host large populations and do not tend to attract any individuals of rare or area-sensitive species; large sites can be poorly managed or fragmented by woody vegetation so that they also do not host large populations or attract any individuals of rare or area-sensitive species.

Grassland Birds Don't Live in Trees (and pheasants are grassland birds) – Pheasant Habitat Areas with roughly 5% or less woody cover consistently provided more successful pheasant hunting, higher grassland bird diversity, and higher grassland bird abundance. In their review of habitat management at PHAs, David et al. (2003) rated the problem of woody succession as moderate to severe for 10 of 16 units evaluated, and in their narrative of each PHA, indicated a need or benefit of reducing or eliminating "excessive" tall trees on 10 of 14 PHAs.

Landscapes Matter – Even modest amounts of woody cover within 5 km of PHAs was associated with lowered diversity and abundance of grassland birds, and reduced pheasant harvest rates.

Grassland Birds Are a Possible "Co-Benefit" of PHAs (but the rules for selecting PHAs need to be changed…and those changes will likely improve pheasant abundance as well) – The most successful PHAs can be generally described as the largest, least wooded PHAs in open landscapes. The State Pheasant Fund Committee (1996) established a scoring system for evaluating potential PHA acquisitions. In light of our results, and the management issues described by David et al. (2003), we propose a number of changes to the scoring criteria for PHA acquisitions.

The “Absolute Requirement” that parcels contain less than 10% woody cover must be **strictly enforced**. If grassland wildlife conservation is truly a priority co-benefit of PHAs, parcels should be no more than 5% wooded.

Parcels larger than 120 acres host more grassland species, and provide managers with more opportunities to provide a diversity of vegetation structures. In the past, 80-acre parcels with some woody vegetation were considered the ‘ideal’ PHA, with pheasants hatched on adjacent private lands aggregating in the superior winter cover of PHAs and providing excellent pheasant hunting experiences (J. Cole, pers. comm.). With increasingly intensive agriculture in the pheasant range and declining pheasant populations across these landscapes (Cole 2008), the role of on-site pheasant recruitment is increasingly important to the quality of pheasant hunting. Considering these factors, 160-acre parcels are a much more appropriate size to consider for grassland birds.

Parcel size 120-320 acres = 10 points

Parcel size >75 acres = 5 points

Proportion of Prime Farmland [**STRIKE AS A SCORING CRITERION**]

[NEW CRITERION] Proportion HEL:

>40% HEL = 10 points

15% to 40% HEL = 6 points

<15% HEL = 3 points

Proportion wooded land [**SPECIFY “ON PARCEL”**]

0-5% wooded = 10 points

5-10% wooded = 3 points

[NEW CRITERION] Proportion wooded/developed lands within 3-mile radius of parcel

Less than 10% = 10 points

10-20% = 4 points

>20% = 0 points

<u>Bonus Points</u>

[NEW CRITERION] >15% idle grassland/CRP, pasture and hay within 3-mile radius of parcel = 5 points

Only PHA in County (+5) [**STRIKE AS A BONUS CRITERION**]

PHA within 2 miles (-5) [**STRIKE AS A DEDUCTION**]

The following are brief summaries of our findings and assessment of potential for grassland bird conservation at each of the sites we surveyed. Areas are considered in alphabetical order.

Bradford (Stark)
Site Statistics: 103 acres – 85 acres open (estimate) and 18 acres wooded (estimate)

Abundance and Richness of Grassland Birds
Three grassland bird species were observed at Bradford PHA (sedge wren, dickcissel, ring-necked pheasant), with a mean abundance of 2.25 birds within 100 m per point-count. Both abundance and species richness of grassland birds at Bradford PHA were among the poorest recorded. A total of 45 species were recorded on the site.

Site Condition and Potential for Conserving Grassland Birds
The north unit is bordered by forest on the east, south and west sides, but is adjoined by a fairly large CRP grassland on the north. The dominant feature of the south unit is the floodplain of Cooper's Defeat, and is wooded on the north border, with woody vegetation on the east and west sides as well. Due to wooded borders, low topography, and small size, the site has low potential for grassland birds.

Landscape Condition and Potential for Conserving Grassland Birds
The vicinity of the Bradford PHA is characterized by rolling topography, woodlots and riparian corridors. Though much of the land appears to be HEL, much is in crop production, and little is in pasture, hay, or idle grassland. The site is not an appropriate anchor for a large grassland bird conservation area.

Clifton (Iroquois)
Site Statistics: 80 acres – all open

Abundance and Richness of Grassland Birds
Only four species of grassland birds were recorded at Clifton PHA (bobolink, eastern meadowlark, dickcissel and ring-necked pheasant), with dickcissels dominating the relatively high abundance of grassland birds (10.5 birds per 100 m point-count). Overall, only 13 species were recorded on the site.

Site Condition and Potential for Conserving Grassland Birds

Clifton is a relatively small PHA, contains very little woody vegetation or topographic relief, and is entirely surrounded by cropland. The primary limitation to managing grassland birds at the site is size and isolation from other grassland habitat.

Landscape Condition and Potential for Conserving Grassland Birds
The openness of the surrounding area is excellent for grassland birds, but is almost exclusively rowcrop agriculture, with little HEL. Large-scale habitat restoration in the vicinity is likely to be cost-prohibitive.

Dublin-Highlands (Stephenson)
Site Statistics: 122 acres – 110 acres open (estimate) and 12 acre wooded (estimate)

Abundance and Richness of Grassland Birds
Richness of grassland birds (four species – bobolink, sedge wren, eastern meadowlark, dickcissel) and abundance (7.5 individuals within 100 m per point-count) were modest at modest at Dublin-Highlands PHA. The site hosted fairly good numbers of sedge wrens and dickcissels. A total of 40 species were recorded on the site.

Site Condition and Potential for Conserving Grassland Birds
While topographically in an elevated location (i.e., highly suitable for grassland birds), it is largely bordered by woody vegetation. Shrub plantings on the western edge will increase this effect. Large CRP grasslands occur to the east and southeast of the site. Much of the grassland had been recently mowed, apparently to control noxious weeds. One hen pheasant and nest were found destroyed by mowing. Species that require large open expanses (e.g., upland sandpiper, northern harrier) should not be expected at the site. Henlsow's sparrows are expected, when habitat conditions improve.

Landscape Condition and Potential for Conserving Grassland Birds
Broad open slopes with good potential for attracting grassland birds occur in this area, but there is nonetheless 10-20% forest land cover, several tree plantings on private lands, and indications of exurban development. Due to the many steep slopes, the landscape contains large amounts of hay and some idle grassland.

Gifford (Champaign)
Site Statistics: 101 acres – 96 acres open and 5 acres wooded

Abundance and Richness of Grassland Birds
Gifford PHA hosted an intermediate abundance (6.29 birds per 100 m point-count) and richness (6 species – grasshopper sparrow, sedge wren, eastern meadowlark, dickcissel, and ring-necked pheasant) of grassland birds. During the site visit, 25 species were recorded.

Site Condition and Potential for Conserving Grassland Birds
Most of the woody vegetation in the vicinity is on the southwest portion of the parcel, likely inhibiting some species from settling on the site. The higher elevation and more open exposure on the east side are better suited to grassland birds.

Landscape Condition and Potential for Conserving Grassland Birds

While the landscape is open, there is little agricultural grassland or small grains nearby. Except for the ridgeline, extending east of the site and in irrigated agriculture, there is little HEL in the area to encourage grassland restoration.

<u>Hallsville (DeWitt)</u>
Site Statistics: 83 acres – 78 acres open (estimate) 5 acres wooded (estimate)

Abundance and Richness of Grassland Birds
Only two grassland bird species were detected on point-counts at Hallsville PHA, dickcissel and eastern meadowlark, with a mean of 5 individuals within 100 m per point-count. Ring-necked pheasants were also present, but not recorded during point-counts. A total of 27 species was recorded on the site.

Site Condition and Potential for Conserving Grassland Birds
The grassland at Hallsville PHA was in need of disturbance to increase plant vigor and diversity. Even if optimally managed, this small site, split by a wooded riparian corridor, is unlikely to support high diversity or abundance of the more area-sensitive grassland birds.

Landscape Condition and Potential for Conserving Grassland Birds
The landscape surrounding Hallsville PHA is intensive row crop agriculture, and little of the area appears to be HEL soils. However, it is open and elevated. The cost of establishing additional grassland in the area would be high, but the expected response by grassland birds is very good.

<u>Hershel Workman (Vermilion)</u>
Site Statistics: 141 acres – 135 acres open and 6 acres wooded

Abundance and Richness of Grassland Birds
Abundance of grassland birds was intermediate (7.11 birds per 100 m point-count) at Workman PHA, and richness was fairly good, notably several Henslow's sparrows as well as grasshopper sparrow, savannah sparrow, eastern meadowlark, dickcissel, and ring-necked pheasant. A total of 38 bird species was recorded on the survey date, including a late-migrant, rare Nelson's sharp-tailed sparrow.

Site Condition and Potential for Conserving Grassland Birds
The main PHA includes a wooded stream corridor separating the southeastern third and woody vegetation and houses along the northern border. At the northwestern corner is a remnant cemetery prairie. It is unlikely additional species could be attracted to the site without expansion (with areas to the west and south better-suited). The satellite facility is entirely open; the primary limitation to managing grassland birds is size.

Landscape Condition and Potential for Conserving Grassland Birds
The surrounding landscape is favorably open, but lacking agricultural grasslands to augment the site's function, or HEL to encourage further habitat development.

<u>Hindsboro (Douglas)</u>
Site Statistics: 90 acres – 75 acres open and 15 acres wooded

Abundance and Richness of Grassland Birds
Just four grassland species were recorded on Hindsboro PHA (grasshopper sparrow, eastern meadowlark, dickcissel, ring-necked pheasant), at very low abundance (1.8 birds per 100 m point-count). Overall, 37 species were observed.

Site Condition and Potential for Conserving Grassland Birds
Hindsboro PHA was among the poorest PHAs for grassland birds. The site includes and is surrounded by woody vegetation to an extent that leaves little potential for changing that fact. Strips of crops (food plots) were planted through the marsh area, degrading any wetland habitat benefits.

Landscape Condition and Potential for Conserving Grassland Birds
Upland areas with appropriate openness occur to the southwest of the site, with the floodplain and riparian forests of the Embarrass River ‘blocking’ to the north and east. Also considering low amount of hay, pasture, small grains and HEL, the Hindsboro PHA area is not appropriate as an anchor for large-scale grassland habitat restoration.

<u>Loda (Iroquois)</u>
Site Statistics: 160 acres – 157 acres open and 3 acres wooded

Abundance and Richness of Grassland Birds
Of the four species of grassland birds observed at Loda PHA (grasshopper sparrow, eastern meadowlark, dickcissel, ring-necked pheasant), a mean of 6.88 were recorded per 100 m point-count. Forty (40) species were observed during the surveys.

Site Condition and Potential for Conserving Grassland Birds
Loda PHA is situated with interior and bordering woody vegetation blocking vistas and subdividing the grassy areas. Much of this is shrub habitat, and relatively little is mature trees. The adjacent areas to the west, south and east would potentially provide better grassland bird habitat than the PHA itself. The dilapidated silo near the hunter parking area on the north side would be a good location for a barn owl nest box.

Landscape Condition and Potential for Conserving Grassland Birds
Low to moderate amounts of wooded areas are in the surrounding landscape, and there is little favorable land use or HEL. The immediate area is not a high priority as an anchor for landscape-scale grassland restoration.

<u>Manito (Tazewell)</u>
Site Statistics: 78 acres – all 78 acres open

Abundance and Richness of Grassland Birds
Considering Manito is the smallest PHA, it hosted a respectable number of grassland species (bobolink, grasshopper sparrow, eastern meadowlark, dickcissel, ring-necked pheasant). Densities of grasshopper sparrows were exceptionally high in the sand prairie vegetation, contributing to the overall high

abundance of grassland birds (13.75) recorded per 100 m point-count. Twenty-four (24) species were observed on the site.

Site Condition and Potential for Conserving Grassland Birds
This is an open site, and the sand ridge along the eastern side helps to reduce the influence of woody vegetation and exurban development to the west and east. Because of the site's small size, the grassland bird community on the site is about as good as can be reasonably expected.

Landscape Condition and Potential for Conserving Grassland Birds
The Illinois River Sand Areas of Mason and Tazewell counties are generally a high priority area for grassland conservation. Manito PHA fit into this framework, but is perhaps not a "core" area. Nearby land use is quite favorable, and much of it likely is HEL. A modest amount of woody vegetation is in the vicinity, and it appears the blacktop along the eastern border of Manito PHA is a corridor for exurban residential development.

Maytown (Lee)
Site Statistics: 160 acres – 130 acres open (estimate) and 30 acres wooded (estimate)

Abundance and Richness of Grassland Birds
Three grassland bird species were recorded on point-counts (sedge wren, dickcissel, and eastern meadowlark). Mean number of individual grassland birds within 100m per point-count was 1.75. A brood of ring-necked pheasants (3 young) was observed on the site, but none were recorded during point-counts. A total of 38 species were recorded on the site.

Site Condition and Potential for Conserving Grassland Birds
While Maytown PHA is large enough to attract many area-sensitive birds, the site is far too wooded. Removal of tree lines, especially along the eastern border would greatly improve the site for grassland birds. However, the riparian corridor on the property will always affect openness, and a wind energy development is proposed to the east.

Landscape Condition and Potential for Conserving Grassland Birds
The region surrounding Maytown PHA has a moderate amount of woody land cover, and low proportions of hay, pasture, and idle grassland. A ridge to the east and northeast of the PHA offers the best suitability and potential for grassland restoration, but is also the area where wind energy development is expected.

Perdueville (Ford)
Site Statistics: 120 acres – 118 acres open, 1 acre wooded

Abundance and Richness of Grassland Birds
Six species of grassland birds were detected, including Henslow's sparrows, grasshopper sparrows, savannah sparrows and sedge wrens. The surveys at this PHA were conducted later in the morning, probably accounting for the lower than expected abundance of grassland birds (5.3 individuals within 100 m per point-count) given the high diversity. A total of 23 species were recorded on the site.

Site Condition and Potential for Conserving Grassland Birds

Perdueville PHA is situated on a broad open slope, contains little woody vegetation, and is bordered on the west by additional idle grassland on private land. Additional surveys may very well discover additional area-sensitive grassland birds (e.g., northern harrier, upland sandpiper) on or near the property. Grassland bird abundance on the PHA was lowest in the southeast corner where the site is bordered by a mature tree line, which should be removed or renovated into shrub habitat.

Landscape Condition and Potential for Conserving Grassland Birds

While there are several examples of idle grasslands in the area, including a large tract immediately to the Perdueville PHA's west, there is very little hay/pasture and few grazing animals in the landscape. The rolling topography of the area makes it more conducive to the Conservation Reserve Program. There is little to no development nearby and the landscape is wide open. Grassland birds are expected to respond very strongly to additional habitat nearby.

Sand Prairie (Lee)

Site Statistics: 316 acres – 300 acres open (estimate) and 15 acres wooded (estimate)

Abundance and Richness of Grassland Birds

Sand Prairie PHA supports excellent grassland bird richness (7 species recorded on point-counts, and 2 others located on area searches), and exceptional abundance (11.7 individual grassland birds within 100 m per point-count). Henslow's sparrows, grasshopper sparrows, sedge wrens, and meadowlarks were abundant on the PHA. Additional surveys at Sand Prairie PHA are likely to discover upland sandpipers, northern harriers, and short-eared owls using the large site in at least some years. A total of 41 species were recorded on the site.

Site Condition and Potential for Conserving Grassland Birds

Much of Sand Prairie PHA is on a sandy ridge with little woody vegetation and open vistas. The native and restored habitat provides an excellent diversity of structure for grassland birds, and the site is large enough to attract area-sensitive species. In the summer of 2006, there was very little water on the site in one pond. In normal or wet years, there apparently are many acres of water, marsh and sedge meadow on the PHA, and a new suite of birds, including sandhill cranes and king rails, would be expected. The flat portions of the PHA are in cropland and food plots. A soybean field was the dominant feature of the eastern third of the PHA, and large utility transmission line bisects the property

Landscape Condition and Potential for Conserving Grassland Birds

The opportunity for grassland conservation in the area is very well defined. A steep ridge is oriented from southwest to northeast, crosses the PHA, and sports a high proportion of small grains and hay, some prairie remnants, as well as small woodlots that appear most extensive immediately to the south of the PHA. A large utility transmission line parallels this ridge, which may adversely affect grassland birds. Away from this ridge, the landscape is flat and intensively agricultural. Green River SFWA is relatively close – about 7 km to the east.

Saybrook (McLean)

Site Statistics: 86 acres – 79 acres open and 7 acres wooded

Abundance and Richness of Grassland Birds

Grassland birds were relatively scarce at Saybrook PHA (mean of 2.6 per 100 m point-count), and represented only 3 species (dickcissel, eastern meadowlark, ring-necked pheasant). Overall, 31 species were noted.

Site Condition and Potential for Conserving Grassland Birds

When surveyed (June 2008), little residual vegetation was noted anywhere on the parcel, and the dense brome-alfalfa stands had fallen over from their own mass, providing a structure that appeared attractive to few species. Mature treelines bordered all of the east and most of the western lengths of the parcel. Shrubs were planted along the rest of the borders, which will make a bad situation worse as they mature and serve as a nursery for tree species. Any adjacent parcel is likely to provide superior grassland bird habitat than Saybrook PHA. Wind turbines shadow the site from the east, north, and west (though it is not clear that this feature is adversely affecting wildlife on the site).

Landscape Condition and Potential for Conserving Grassland Birds

In spite of existing and planned expansion of wind energy development in the area, the Saybrook PHA area has feature very attractive for expanding grassland conservation. There are several linear woody features in the area, but it is predominantly open. Much of the morainal topography is HEL. Other private grasslands and pastures, about 1 mile to the northwest and 2 miles to the southwest specifically, hosted bobolinks, Henslow's sparrows, grasshopper sparrows, and savannah sparrows that were absent from Saybrook PHA. About 1.5 miles northwest (3550N and 1300E), a pair of upland sandpipers was observed along a roadway between a fallow/unplanted field and a not-till soybean field. Their behaviors suggested a nearby brood or nest, though none was found. The location is surrounded by wind turbines. Significantly, the Illinois Department of Natural Resources has acquired about 500 acres to the north and northeast of Saybrook PHA along Illinois Route 9. These parcels have all the hallmarks of being an excellent PHA, and anchor for larger-scale grassland habitat restoration and management.

<u>Sibley (Ford)</u>

Site Statistics: 635 acres – entirely open

Abundance and Richness of Grassland Birds

Richness (7 species) and abundance (10.5 individual birds within 100 m per point-count) of grassland birds was excellent at Sibley. Dickcissels and eastern meadowlarks drove abundance numbers, with other species being fairly scarce. Three pheasant broods were recorded during a morning of surveys at Sibley PHA. A total of 26 species were recorded on the site.

Site Condition and Potential for Conserving Grassland Birds

Sibley PHA has almost no woody vegetation on site or nearby, and combined with its large size, is ideally suited to conserving grassland birds. However, a relatively small proportion of the site is in permanent grassland cover, with a large area in a corn-oat-alfalfa rotation. The unharvested oats and alfalfa provided grassland bird habitat (dickcissels and red-winged blackbirds were very abundant in the alfalfa), but corn held very few birds. Two hen pheasants and nests were found destroyed in mowed grass waterways on the site.

Landscape Condition and Potential for Conserving Grassland Birds
Sibley PHA is in an open, unobstructed landscape where grassland bird response to additional habitat is expected to be high. However, the landscape is in intensive rowcrop production, with little hay, small grains, pasture or idle grassland. High soil rental rates and limited potential for USDA Farm Programs to retire large acreages very likely will make long-term grassland establishment costly in the area.

Steward (Lee)
Site Statistics: 80 acres – entirely open

Abundance and Richness of Grassland Birds
Five species of grassland birds were present on Steward PHA, with sedge wrens exceptionally abundant. Overall grassland bird abundance was 13 individual birds within 100 m per point-count. A total of 31 species were recorded on the site.

Site Condition and Potential for Conserving Grassland Birds
While of marginal size to attract area-sensitive species, Steward PHA is situated in an open area with a similarly-sized patch of idle grassland on the ridge top to the southwest. At present, woody vegetation is not problematic on Steward PHA, though shrubs have been planted to ring the entire site. As these plants grow, they will begin to adversely affect grassland bird abundance.

Landscape Condition and Potential for Conserving Grassland Birds
The landscape surrounding Steward PHA is largely open, especially in the higher areas that have the greatest potential to attract grassland birds. A few tree lines in the area could be renovated to good benefit. Grassland birds would be expected to respond strongly to additional grassland habitat at the higher elevations. Most of the areas that might be HEL are in lower-lying areas with lesser potential for attracting grassland birds. The region appears well-suited for wind-energy development (especially immediately to west and southwest of the PHA), though none are known to be planned for the immediate area at this time.

Victoria (Knox)
Site Statistics: 241 acres – 215 acres open (estimate), none wooded (balance is water)

Abundance and Richness of Grassland Birds
Richness of grassland birds is excellent at Victoria PHA (8 species), including Henslow's sparrows and bobolinks. Upland sandpipers were reported from the area in 2004 (Kleen 2005) but not observed during these surveys. Abundance of grassland birds was good, at 9.3 individuals within 100m per point-count. A total of 38 species were recorded on the site.

Site Condition and Potential for Conserving Grassland Birds
This reclaimed strip mine area is open, large enough to attract area-sensitive species, and has diverse vegetation structure – all excellent features for conserving grassland birds.

Landscape Condition and Potential for Conserving Grassland Birds

Additional reclaimed strip mine lands in the area provide thousands of additional acres of grassland habitat, particularly to the east-northeast of the PHA. Not all of these lands provide good grassland bird habitat currently - some are overgrazed, others are essentially unmanaged and heavily invaded by woody vegetation. Composition of these grasslands (smooth brome or tall fescue monocultures, or autumn olive shrubland) could be greatly improved. In un-mined locations, most of the HEL soils are near riparian corridors, where additional grassland habitat is expected to be less attractive to grassland birds.

Whitefield (Marshall)

Site Statistics: 80 acres – 78 acres open (estimate) and 2 acres wooded (estimate)

Abundance and Richness of Grassland Birds

Only three species of grassland birds were recorded at Whitefield on point-counts (grasshopper sparrow, dickcissel, eastern meadowlark), though ring-necked pheasants are also present. Grasshopper sparrows and dickcissels were fairly abundant at the site, dominating the 7.0 individual birds recorded within 100 m per point count. Whitefield PHA is a relatively recent acquisition for the Illinois Department of Natural Resources, and habitat establishment is ongoing at the site. Other species may colonize the site in coming years, whereas grasshopper sparrows may be lost as bare soil and sparse vegetation declines. A total of 22 species were recorded on the site.

Site Condition and Potential for Conserving Grassland Birds

Whitefield PHA is small to be expected to attract many area-sensitive grassland birds, though it could be a very open site with renovation or removal of the tree line along the southern border.

Landscape Condition and Potential for Conserving Grassland Birds

The parcels immediately adjacent to Whitefield PHA on the north, west and south are each open, higher elevation, and combined with Whitefield PHA would form an excellent core for a grassland bird conservation area. The area is used intensively for rowcrop production with very little hay, pasture or idle grassland. Rolling slopes and ‘farmable wetlands’ may provide an opportunity for using USDA programs to establish additional grassland habitat. Wind energy developments are established near Camp Grove (about 8 km to the southwest and west) and at Tiskilwa (about 12 km north-northwest).

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TABLE 1. Rapid assessment tool for evaluating the suitability of landscapes near Pheasant Habitat Areas for grassland restoration.

Feature	Guideline	Score
Open Space (5 km radius of PHA)		
	<10% wooded or developed	2
	<25% wooded or developed	1
	>25% wooded or developed	0
Adjacent Favorable Land Use		
	>30% idle grassland, pasture, hay, and small grains	2
	>15% idle grassland, pasture, hay, and small grains	1
	<15% idle grassland, pasture, hay, and small grains	0
Agricultural Conservation Program Potential		
	>30% Highly Erodible Land (HEL), lower local soil rental rate	2
	>15% HEL, average local soil rental rate	1
	<15% HEL, higher local soil rental rate	0
Conversion Probability (5 km radius)		
	Little recent or anticipated development or negative land use changes	2
	Modest recent or anticipated development or negative land use changes	1
	Extensive recent or anticipated development or negative land use changes	0
Obstructions & Collision Risks (5 km radius)		
	Low density of existing or anticipated towers, utility lines, wind turbines, or other collision hazards	2
	Moderate density of existing or anticipated towers, utility lines, wind turbines, or other collision hazards	1
	High density of existing or anticipated towers, utility lines, wind turbines, or other collision hazards	0

TABLE 2. Pheasant Habitat Areas and other sites surveyed for grassland birds during the 2006-2008 nesting seasons.

Site	County	Size (acres)	Open area (acres)	Wooded area (acres)	Date Surveyed	Observer(s)
Bradford	Stark	103	est 85	est 18	2-Jun-06	J Walk
Clifton	Iroquois	80	80	0	30-May-07	J Walk, S Bailey
Dublin Highlands	Stephenson	122	est 100	est 22	6-Jul-06	J Walk, S Bailey
Gifford	Champaign	101	96	4	18-Jun-07	J Walk, S Bailey
Hallsville	Dewitt	83	78	5	29-Jun-06	J Walk, S Bailey
Hershel Workman	Vermilion	141	135	6	30-May-07	J Walk, S Bailey
Hindsboro	Douglas	90	75	15	11-Jun-08	M Ward
Ilo Dillin (Habitat Area)	Tazewell	80	est 60	est 20	30-May-06	J Walk
Loda	Iroquois	160	157	1	30-May-07	J Walk, S Bailey
Manito	Tazewell	78	78	0	27-May-07	J Walk
Maytown	Lee	160	est 130	est 30	5-Jul-06	J Walk
Nachusa Prairie (Natural Area)	Ogle	72			26-Jun-07	J Herkert
Perdueville	Ford	120	118	1	27-Jun-06	J Walk
Sand Prairie	Lee	316	est 300	est 16	5-Jul-06	J Walk
Saybrook	McLean	86	79	7	10-Jun-08	J Walk
Sibley	Ford	635	635	0	27-Jun-06	J Walk, S Bailey
Steward	Lee	80	80	0	7-Jul-06	J Walk, S Bailey
Victoria	Knox	241	est 215	est 0	21-May-06	J Walk
Whitefield	Marshall	80	est 78	est 2	2-Jun-06	J Walk

TABLE 3. Species recorded on at least 16 of 19 Pheasant Habitat Areas and other sites surveyed during the 2006-2008 nesting seasons.

Ring-necked Pheasant	Dickcissel
Mourning Dove	Red-winged Blackbird
Barn Swallow	Eastern Meadowlark
American Robin	Common Grackle
Common Yellowthroat	Brown-headed Cowbird
Song Sparrow	American Goldfinch

TABLE 4. Richness and abundance of grassland birds at Pheasant Habitat Areas, 2006-2008. Abundances for each species, and all species combined, are reported as the mean number of individuals recorded per point, within 100 m of observers (<100m) and at all distances from observers (Total).

	Richness (# Species Present)	Point-Diversity (Species/Point)	Ring-necked pheasant		Dickcissel		Eastern meadowlark		Grasshopper sparrow		Bobolink		Sedge wren		Savannah sparrow		Henslow's sparrow		Western meadowlark		Total Grassland Bird Abundance		**Points Counts (N)**
Pheasant Habitat Area			<100m	Total	<100m	Total	<100m	Total	<100m	Total	<100m	Total	<100m	Total	<100m	Total	<100m	Total	<100m	Total	<100m	**Total**	
Sand Prairie	8	5	0.67	2.3	4.5	6.5	2.33	4	1.33	1.33	0	**P**	1.5	2.5	0	0	1.33	1.33	0	**P**	11.7	18	6
Victoria	8	4.22	0.33	3	1.89	2.89	4.44	7.78	0.78	0.78	1.22	1.78	0.22	0.22	0.33	0.33	0.11	0.11	0	0	9.32	16.9	9
Sibley	7	4.5	0	2.33	6.83	8.5	1.83	2.83	0.83	0.83	0	0.17	0	0	0.5	0.5	0	0	0.5	0.67	10.5	15.8	6
Perdueville	7	3.67	0.33	1	2.33	5	0.66	2.33	0.33	0.33	0	**P**	0.66	0.66	0	0	1	1	0	0	5.31	10.3	3
Hershel Workman	6	3	0.22	1.44	3.56	6.11	3.11	6.22	0	0	0	0	0	0	0	**P**	0.22	0.22	0	0	7.11	14	9
Dublin-Highlands	6	2.25	0	**P**	3.5	4.25	1	2.5	0	0	1.5	1.5	2.25	2.25	0	0	0	0	0	0	7.5	8.25	4
Manito	5	4	0	0.25	5.75	9.5	2.5	5.75	4.75	5	0.75	1.75	0	0	0	0	0	0	0	0	13.8	22.3	4
Steward	5	3.5	0.5	0.5	4.5	5.5	1.5	1.5	0	0	0.5	1	6	7.5	0	0	0	0	0	0	12	16	4
Gifford	5	2.29	0	0.71	5	5.14	0.86	1	0.14	0.14	0	0	0.29	0.29	0	0	0	0	0	0	6.29	7.28	7
Loda	4	3.25	0.25	2.25	2.75	3.88	3.5	5	0.38	0.63	0	0	0	0	0	0	0	0	0	0	6.88	11.8	8
Clifton	4	3.25	0.5	3.5	6	10	4	5.75	0	0	0	0.25	0	0	0	0	0	0	0	0	10.5	19.5	4
Whitefield	4	2.25	0	**P**	4.2	6	1	2.5	1.75	1.75	0	0	0	0	0	0	0	0	0	0	6.95	10.3	4
Nachusa Prairie	4	2	0	0.25	1.5	2.5	0.25	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0	0	2.25	3.75	4
Hindsboro	4	1.6	0.2	0.4	1.4	2.2	0	**P**	0.2	0.2	0	0	0	0	0	0	0	0	0	0	1.8	2.8	5
Maytown	4	1.5	0	**P**	0.25	0.75	0.25	0.5	0	0	0	0	1.25	1.25	0	0	0	0	0	0	1.75	2.5	4
Saybrook	3	2.8	0	1	1.8	4.4	0.8	2.6	0	0	0	0	0	0	0	0	0	0	0	0	2.6	8	5
Hallsville	3	2	0	**P**	3	5.5	2	3.5	0	0	0	0	0	0	0	0	0	0	0	0	5	9	4
Bradford	3	2	0.5	1.75	0.5	1	0	0	0	0	0	0	1.25	1.5	0	0	0	0	0	0	2.25	4.25	4

Ilo Dillin	2	2	0	1	0	0	0.67	2.67	0	0	0	0	0	0	0	0	0	0	0	0	0.67	3.67	3

P = Present on site, but not detected on point-counts

Table 5. Overall ranking of Pheasant Habitat Areas based on pheasant harvest rates and abundance, richness and point diversity of grassland birds. Greatest values (green) and poorest values (red) for each variable were based on natural breaks in observed distributions.

Site	Acres	% Wooded	5-Year Pheasant Harvest Rate	Abundance (100 m)	Richness	Point Diversity
Hallsville	83	6	0.99	5	3	2
Steward	80	0	0.89	13	5	3.5
Loda	160	2	0.77	6.88	4	3.25
Perdueville	120	1	0.75	5.31	7	3.67
Sand Prairie	316	5	0.73	11.66	8	5
Sibley	635	0	0.68	10.49	7	4.5
Saybrook	86	8	0.64	2.6	3	2.8
Hershel Workman	141	4	0.63	7.11	6	3
Victoria	241	0	0.56	9.3	8	4.22
Gifford	101	4	0.49	6.29	5	2.29
Clifton	80	0	0.44	10.5	4	3.25
Manito	78	0	0.27	13.75	5	4
Dublin Highlands	122	18	0.25	7.5	6	2.25
Bradford	103	17	0.2	2.25	3	2
Hindsboro	90	17	0.17	1.8	4	1.6
Maytown	160	19	0.16	1.75	4	1.5

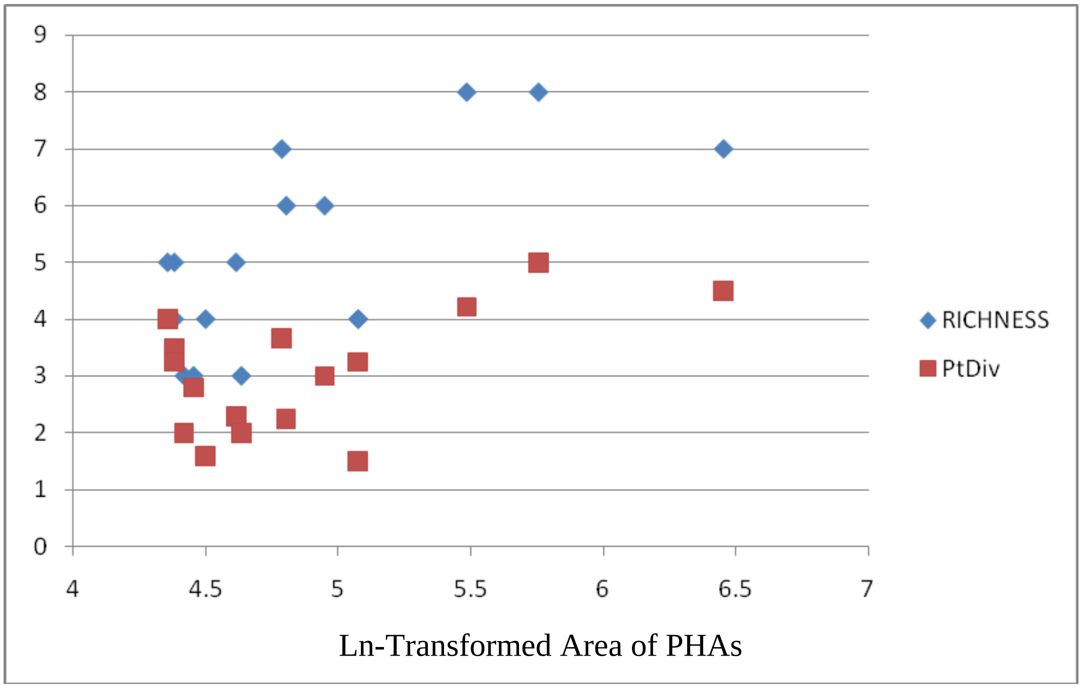

Figure 1. Correlations of richness of grassland birds at each PHA (0.676) and diversity of grassland birds at each sampled point (0.56), relative to the size of Pheasant Habitat Areas.

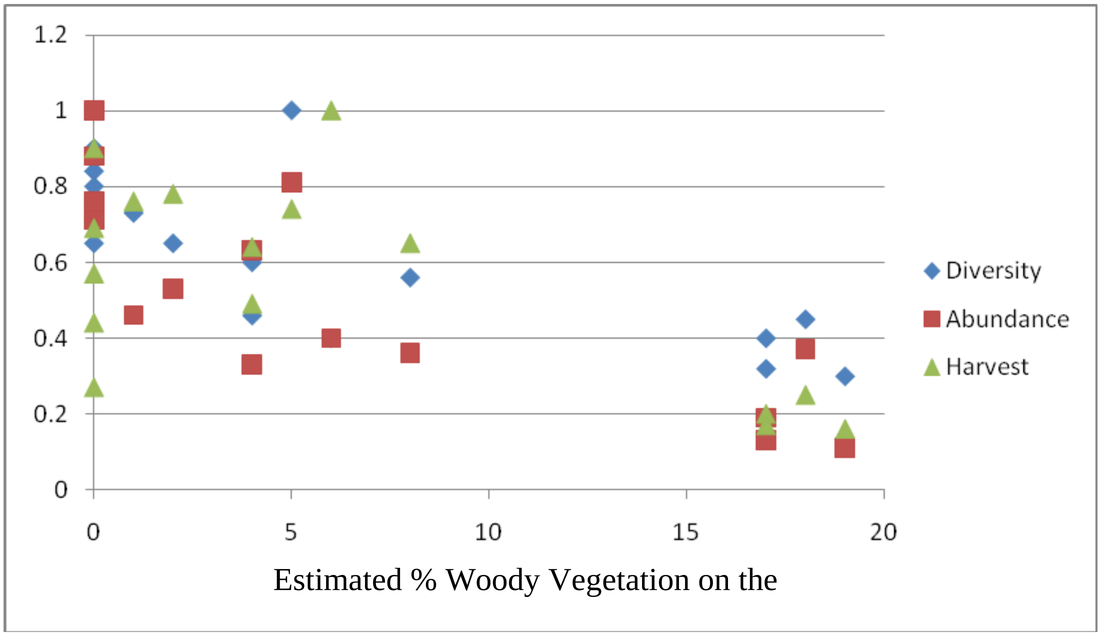

Figure 2. Correlations of grassland bird diversity (-0.687) and abundance (-0.714) and pheasant harvest (-0.737), relative to the amount of woody vegetation on Pheasant Habitat Areas. (Diversity, Abundance, and Harvest are displayed as proportions of the highest observed value of each variable.

FINAL REPORT

Developing Recovery Plans for Illinois Birds

State Wildlife Grant Program Project T-16-P-1, Job 5

Michael P. Ward, Jeffery W. Walk, and Tara Beveroth

INTRODUCTION

Over the last couple decades state Endangered and Threatened (E & T) species have experienced both population recoveries and setbacks. Many of the species on the E & T list share similar habitat affinities or life history characteristics that have resulted in the need to be listed. Over the last few years we have gathered data for a suite of E & T species in order to develop recovery plans, status triggers, and to essentially provide an established framework by which to determine which species may need to receive additional attention in order to determine their status. The recovery plans in this report are not binding reports dictating when a species status in Illinois should be changed. For example if Black Terns populations increase, but do not reached the threshold of 40 sites with breeding colonies as we suggest in the report should be the level at which the species is removed from the E & T list, there is no reason why the board should or should not take action on this species. However, if Black Terns become more common (breeding at 30+ sties) then the recovery plan provides information to facilitate the Endangered Species Protection Boards investigation into whether or not the species needs to remain on the list.

METHODS

We produced recovery plans for 12 species. These species were selected from a variety of habitats and also represent species with adequate information with which to develop a recovery plan. Many species require additional research in order to have the minimum amount of data to begin to develop a recovery plan. However, it should be noted that the species with limited data, have limited data because of their rarity (e.g. Bewick's Wren). Given their rarity it is unlikely they will be a candidate for status change, however additional information is needed to possibly improve our ability to conservation these species.

All recovery plans were developed using all available information that was pertinent to the Illinois population. All plans provide information on different status changes such as status change from threatened to endangered and threatened to delisted.

Results

As of Jan 1, 2010 there are 25 endangered and 5 threatened birds in Illinois of these we have prepared recovery plans for 12 species (one species Sandhill Crane was recently removed from the list). These recovery plans should be considered drafts as they will be submitted to the Endangered Species Protection Boards Technical Committee for Birds for comment and approval.

List of species for which recovery reports were created.

Grassland raptors (northern harrier & short-eared owl)
Osprey
Mississippi Kite
Black-crowned Night-heron
American Bittern
Black Rail
Black Tern
Common Tern
Sandhill Crane
Yellow-headed Blackbird
Henslow's Sparrow

Discussion

While further consultation with the Endangered Species Protection Boards Technical Committee for Birds is needed these recovery plans provide a framework and thresholds that will facilitate the status review of these species. Given the research we conducted to create the recovery plans, the only species whose current status may need to be reviewed is Black-crowned Night-heron. This species may be approaching the threshold to consider a change in status from endangered to threatened.

The long term plans are to produce plans for all species. After the current recovery plans are reviewed we will discuss with the board how to proceed to with the development of new recovery plans.