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OVERVIEW

AGRICULTURAL LANDSCAPES: CAN THEY SUPPORT HEALTHY BIRD POPULATIONS AS WELL AS FARM PRODUCTS?

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AT THE BEGINNING of the twentieth century, prospects for bird populations occupying farmlands were promising. Agricultural expansion and the resulting deforestation produced wholesale changes to the landscape of eastern North America (Trautman 1977, Zeranski and Baptist 1990, Nicholson 1997). Regional avifaunas were transformed as Horned Larks (*Eremophila alpestris*), Dickcissels (*Spiza americana*), and other farmland birds undertook range expansions (Hurley and Franks 1976, Askins 1999). Those farmland birds became conspicuous, frequently in numbers that are hard to imagine today (Trautman 1940).

One hundred years later, many of those once plentiful species experienced dramatic population declines (Askins 1993, Peterjohn and Sauer 1999). Those trends were evident for many decades, although pre-1965 trends were largely based on anecdotal accounts and were frequently attributed to changing regional landscapes due to urban expansion, farm abandonment resulting in increased forest cover, and the more intensive use of remaining agricultural fields (Trautman 1940, Herkert 1991, Askins 2000). However, numerous specific factors were implicated in local declines of individual species (Kantrud 1981, Bollinger et al. 1990, Lymn and Temple 1991, Bowen and Kruse 1993, Herkert 1994, Houston and Schmutz 1999, Blackwell and Dolbeer 2001).

Understanding factors responsible for population changes can be approached at various geographic scales. Local studies identify specific factors influencing small populations, but the applicability of those results across broad geographic areas is often uncertain. Studies conducted at large geographic scales identify broad patterns of change, but those patterns frequently involve interrelated factors that may be only loosely related to the actual causes of population change. However, correlations between broad patterns of changes in bird populations and land-use characteristics provide a basis for directing future studies conducted at smaller geographic scales.

BROAD PATTERNS OF POPULATION CHANGES IN FARMLANDS

The North American Breeding Bird Survey (BBS) is the only source of continental scale, long-term data for breeding populations of farmland birds. Despite the survey's limitations (Robbins et al. 1986), farmland habitats are well represented along roadsides and most farmland birds are conspicuous and well sampled by point-count methodology. By examining correlations between broad patterns of population changes and agricultural land-use variables, Murphy (2003) attempts to improve our understanding of factors responsible for dramatic declines in farmland birds since 1966. The trick is to determine which correlations are meaningful.

Consistent positive associations between landscape variables and population trends are potentially the result of common responses to those variables and may provide better insight into patterns of population changes in agricultural areas than negative associations. When similar positive associations between landscape variables and populations are noted at various geographic scales, then those associations may suggest important clues toward identifying factors that are most strongly influencing population changes.

Murphy (2003) indicated grassland bird populations have strong positive relationships with the extent of rangelands, habitats that tend to be the structurally most diverse and that support the most diverse breeding avifaunas (Rotenberry and Weins 1980, Bollinger

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1995, Davis and Duncan 1999). However, those relationships can vary among species (Delisle and Savidge 1997). Some species also prefer native grasslands to non-native grasslands with similar structural diversity (Davis and Duncan 1999). Hence, some combination of factors including grassland species composition, structural diversity, patch size, habitat fragmentation, and management activities contributes towards the positive relationships reported between bird populations and rangelands. Each species may respond differently to this suite of factors, and additional studies at smaller geographic scales are needed to clarify the true relationship between bird populations and rangeland characteristics.

Murphy (2003) found few additional consistent associations between bird populations and landscape-level variables. The breeding ecology of each species is presumably interacting with the suite of landscape variables to produce the observed patterns of population changes, but the nature of those bird–landscape relationships are primarily species-specific. Whether or not those relationships remain constant across a species' range deserves additional study. The implications are that broad-scale conservation measures are likely to benefit only some species, perhaps to the detriment of others, and simple all-encompassing solutions will not reverse all significant declines of farmland birds.

Shrubland birds generally have more positive population trends than grassland birds. However, there are regional differences in the trends of shrubland species, with many experiencing significant declines in eastern North America (Askins 1993). Landscape-level factors are contributing to these regional differences in population trends. For example, fire suppression in the southern Great Plains is allowing eastern red cedars (*Juniperus virginiana*) to encroach on grassland habitats, favoring increases in shrubland birds at the expense of grassland species (Coppedge et al. 2001). Farm abandonment produced similar habitat changes in eastern North America during the first half of the twentieth century (Askins 1993), but as secondary succession progressed, the conversion of shrublands into woodlands contributed to recent declines of shrubland birds in the east (Hagan 1993). Although other factors including patch size, fragmentation, and structural diversity could also contribute to regional changes in shrubland bird populations, those relationships are less well understood than for grassland birds.

Some of Murphy's (2003) results appear to contradict long-standing beliefs on the factors affecting farmland bird populations. For example, his failure to find clear negative relationships between population trends of grassland birds and habitat loss seems to dispute the prevailing view that habitat loss is the major factor adversely affecting avifaunas in most grassland ecosystems (summarized in Vickery et al. 1999). But most grasslands in eastern and central North America were converted to other habitats before the mid-1960s (Noss et al. 1995). Recent declines in grassland birds probably reflect factors other than habitat loss, such as habitat fragmentation (Herkert 1994), increased mowing, and other detrimental management practices (Bollinger et al. 1990, Dale et al. 1997).

The negative relationship between population trends and Conservation Reserve Program (CRP) fields is also somewhat surprising. Whereas some CRP grasslands receive little use by breeding birds (King and Savidge 1995), the overall benefits of CRP for grassland birds have been documented at several geographic scales (Johnson and Igl 1995, Best et al. 1997, Igl and Johnson 1999, Koford 1999). The negative relationship reported by Murphy (2003) may reflect the fact that CRP fields constitute only 3.6% of the overall landscape, and the negative factors operating over the remaining 96.4% of the landscape have a considerably greater influence over regional population trends than the benefits produced by CRP.

Contributions of Breeding and Nonbreeding Season Factors to Farmland Bird Population Changes

Most ecological studies of farmland bird populations are conducted during the breeding season (Vickery and Herkert 1999). Not surprisingly, our understanding of farmland bird–habitat relationships is much better during the breeding season than at other times of the year. The few studies conducted during other seasons indicate potential limiting factors away from the breeding grounds. For a declining population of Loggerhead Shrikes (*Lanius ludovicianus)* in central North America, suitable breeding habitats appear to be unoccupied,

but loss of grassland habitats to cultivation and forestation, and competition with fire ants (*Solenopsis saevissima richteri*) may be limiting population levels in their winter range (Brooks and Temple 1990, Lymn and Temple 1991). Henslow's Sparrows (*Ammodramus henslowii*) occupy pitcher plant (*Sarracenia* spp.) bogs and similar moist grasslands in portions of their winter range (Plentovich et al. 1999), and maintaining those habitats is critical for the conservation of that species. Our understanding of the ecology and habitat requirements of many farmland birds during the nonbreeding seasons remains rudimentary, and our ability to develop effective conservation strategies may be limited until that understanding improves.

Given those limitations, existing data are unlikely to conclusively establish the relative contributions of the breeding and nonbreeding seasons towards the population changes of farmland birds. The winter distributions for the breeding populations of each species are poorly known, and until those distributions are established, understanding how population changes that occur during the nonbreeding season relate to breeding season changes is not possible.

Available range-wide population trends during nonbreeding seasons provide few insights. Christmas Bird Counts (CBCs) are the only landscape-level data for nonbreeding North American bird populations (Butcher 1990). Some shrubland birds are fairly conspicuous and well represented on CBCs, but nonbreeding grassland birds tend to be secretive, require considerable effort to locate, and only tiny portions of their populations are detected on CBCs. Those small numbers are probably insufficient to establish meaningful population trends. Additionally, nomadic behavior and other factors limiting winter site fidelity obscures interpretation of population trends for some farmland birds during those seasons.

Many farmland birds are short-distance migrants and are exposed to similar changes in the North American landscape during all seasons (Murphy 2003). Hence, those landscape factors should explain a greater amount of variance in population trends for short-distance migrants than for Neotropical migrants that are probably affected by a different set of factors in their winter range. Until appropriate landscape factors for Neotropical migrants are incorporated into an analysis, the relative importance of breeding and nonbreeding season factors on the trends of all farmland birds remains speculative.

Trends in Farmland Birds: A Broader Perspective

Similar relationships between bird population trends and agricultural land-use patterns have been noted in Great Britain. Large-scale monitoring programs there document sizable declines in many farmland birds since the early 1970s, during a period of agricultural intensification (Fuller et al. 1995, Siriwardena et al. 1998). Those declines raise concerns about their future prospects in the British agricultural landscape (summarized in Chamberlain and Vickery 2002). Similar trends are evident for farmland birds elsewhere in western Europe where agricultural activities have intensified in recent decades.

The British monitoring data are based on more than just trends in breeding populations. They also include nonbreeding surveys and information on some demographic factors such as reproductive success from nest-record schemes and survivorship from constant-effort mist-netting programs (Chamberlain and Vickery 2002). Those data identify the factors responsible for population declines of some species, such as a reduction in annual survival in Reed Buntings (*Emberiza schoeniclus*; Peach et al. 1999). A different approach is to conduct species-specific surveys designed to establish patterns of habitat use across the landscape and identify habitats favored by the species (Browne et al. 2000), taking advantage of a large corps of volunteer observers residing on a small land mass to conduct those surveys.

Those studies implicated a number of factors contributing to declines of farmland birds in Great Britain, encompassing a large range of agricultural management and land use activities during all seasons of the year. No single factor was common to every species, but the general intensification of agriculture affecting many aspects of farmland management appears to underlie most declines. Whereas conservation actions at local scales can reverse those trends locally (Chamberlain and Vickery 2002), how to implement measures that effectively change landscape-level patterns of population decline remains an unresolved problem.

Implications for North American Farmland Birds

The BBS was developed to monitor broad-scale changes in North American bird populations, but not to identify causes responsible for those changes (Robbins et al. 1986). Given the unpredictability of future events, the BBS serves a critical conservation function by documenting population changes that are outside of the normal variability for a species. Once a consistent pattern of population changes emerges across geographic regions or taxonomic groups, then broad-scale correlative studies begin the process of establishing factors responsible for those changes (e.g. Murphy 2003). However, correlative studies only demonstrate relationships between variables, not cause and effect, and additional correlative studies conducted at smaller geographic scales may not provide many additional insights into the potential factors affecting farmland bird population changes.

The biggest gaps in our knowledge concern the ecology of farmland birds during the nonbreeding seasons. Until we develop a good understanding of the entire annual cycles for most species, we risk implementing conservation activities that are inefficient or ineffective in the use of resources. Information on habitat preferences with regard to changing climatic conditions and management strategies, winter site fidelity, survivorship, and status of competitor and predator populations would provide a better basis for identifying limiting factors for those species and for developing effective conservation strategies.

Filling those information gaps will require decades, during which many farmland birds will continue to decline. Conservation actions will not cease while those studies are being conducted, but until critical limiting factors can be identified, where should those resources be directed to best benefit farmland birds? An emphasis on preserving and restoring habitats in the southern United States may be the best short-term strategy because both resident and short-distance migrant bird populations likely benefit from those actions.

Studies on North American and British farmland birds indicate that unique sets of factors are probably responsible for the population changes in each species. Hence, single-species management may not be an effective approach for the entire farmland bird community, but may be necessary for scarce and locally distributed species of immediate conservation concern such as Mountain Plover (*Charadrius montanus*), Henslow's Sparrow, and Baird's Sparrow (*Ammodramus bairdii*). Most factors responsible for declines in farmland bird populations likely fall under a general theme of agricultural intensification that incorporates both habitat changes and various farmland management strategies (Chamberlain and Vickery 2002). Reverting to less-intensive agricultural practices across North America is not realistic. Effective conservation of farmland birds will require innovative solutions based on current agricultural practices that benefit the greatest diversity of farmland birds.

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