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Benefits and Risks of Agro-Ecosystem Management to Grassland Birds in Nova Scotia

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BACKGROUND

Agricultural systems can serve as habitat for wildlife, which are often defined as "agro-ecosystems". Several ecologically and economically important bird species make use of agro-ecosystems, especially agricultural hayfields in eastern North America, such as Bobolink (*Dolichonyx oryzivorus*), Savannah Sparrow (*Passerculus sandwichensis)*, Ring-necked Pheasant (*Phasianus colchicus*) and the eastern allopatric subspecies of Nelson's Sharp-tailed Sparrow (*Ammodramus nelsoni subvirgatus*). Therefore, the value of managing agro-ecosystems for wildlife is considerable, when only a small portion of land can ever be protected through reserves. Formally managed large-scale agro-ecosystems that deliver a benefit to wildlife have developed only recently, examples of which are the Conservation Reserve Program in the United States, and the Permanent Cover Program in Canada. Even under these programs, severe declines in many populations of North American grassland birds have continued over the last few decades. The North American Breeding Bird Survey has detected precipitous declines, with up to 43% decreases in some eastern populations of Bobolinks. Many authors attribute these declines to a large net loss of hayfields and changes in timing and frequency of hay cutting. In some areas, approximately 95% of hayfields that were extant 50 years ago are no longer active. Concurrently, the median date of cutting the first hay crop is now 14-21 days earlier than 50 years ago, and overlaps directly with peak nesting of grassland birds in most regions. Delaying the timing and changing the frequency of hay harvest can significantly increase reproduction in grassland birds.

In Maritime Canada, grasslands / hayfields are often associated with rich coastal dykeland agricultural soils and fresh- and salt-marshes. The eastern subspecies of Nelson's Sharp-tailed Sparrow typically breeds in coastal salt marshes, however, they often also nest in the wet meadows and drainages provided by these dykelands, and other wetland landscapes (grassland-associated breeding). The Maritimes and coastal Maine comprise almost the entire population of the *subvirgatus* subspecies of Nelson's Sharp-tailed Sparrow. Partners-in-Flight has declared the *subvirgatus* subspecies as one of their top regional conservation priorities.

For species of such conservation concern, we know surprisingly little about what agricultural management practices best support populations of grassland birds (in our region

and abroad). Likewise, little is known of the habitat selection processes that dictate distributional patterns. Study of habitat selection in these species is also important to those charged with management of wildlife in grasslands and agro-ecosystems. Determining the process behind habitat selection for these species is indispensable to identifying what constitutes high quality habitat to them in managed agro-ecosystems.

To better understand these processes (and the resultant population-level patterns of concern to managers), I began research in 2002 to move towards determining the habitat quality parameters that guide these selection processes. Therein, data is being obtained that will serve to support stewardship activities in agricultural grassland and wet meadow habitats, by addressing the direct demographic and behavioral responses of birds to agro-ecosystem management.

OBJECTIVES

- Model habitat selection for breeding grassland birds in small - medium scale managed and non-managed agricultural landscapes with such parameters as habitat type (composition and context) and connectivity.

- Model factors that contribute to the area requirements of grassland birds in eastern Canada, especially for the relatively unknown *subvirgatus* subspecies of Nelson's Sharp-tailed Sparrow.

- Determine habitat use of certain grass types and habitat patches that proximally underlie habitat selection parameters (e.g. prey abundance and climate).

- Examine agricultural techniques that may most benefit breeding grassland birds in the region (e.g. grass types and adjusted hay harvest dates).

- Evaluate wildlife habitat in managed agro-ecosystems in Atlantic Canada to influence the delivery of successful habitat stewardship initiatives. This will move towards resolving the conflict between losses of forage quality in hay from provision of bird habitat through delayed harvest.

Results from 2003 Field Season

Study Sites. All surveys were conducted in hayfields of the Annapolis Valley, across four study sites: Belleisle and Upper Belleisle (crown-managed), Queen Anne, and Pea Round. These sites are marshes that were dyked and drained to a state suitable for agriculture.

Bird Surveys & Banding. Peak fledging for all species occurred after the allowable hay harvest date (1 July) in Belleisle, but before harvest actually began in Upper Belleisle and Queen Anne. It is notable that both Bobolinks and Savannah Sparrows showed a later phenology of breeding events in 2003 over that of 2002, by almost a week in most cases.

Over 56% of 179 individuals colour banded in 2002, and a further 83 individuals in 2003, were re-observed or recaptured. Territories were delineated for 50 Savannah Sparrows, 17 Sharp-tailed Sparrows, and 23 Bobolinks.

Vegetation sampling. Grass height at the end of May was 33 cm, almost doubling in mean height by the end of June. Litter depth in 2002 maintained an average depth of 3.7 cm, but was reduced by almost half in 2003 to 2.4 cm. The percentage of cover types remained the same across years at a ratio of 4:1 grass to forbs.

Insect sampling. A total of 49,489 (in 2002) and 62,119 (in 2003) insects were captured of which most were identified to Order. 90% (99,833) were from pitfalls and 10% (11,855) from sweeps. In pitfalls, half of all insects collected were accounted for by 41,109 Araneae (spiders) (37%) and 14,788 (13%) Isopoda (sowbugs). In sweeps, 3,991 of insects captured (34%) were the grass pest meadow plant-bug (Hemiptera; Mirinae; *Leptopterna dolabrata* Linn.).

Between the two years of sampling, a marked increase in the abundance of individuals from most orders was observed. Most notably, a five-fold increase was seen in spiders (Araneae) and Hymenoptera (primarily ants) by pitfall sampling. The reverse trend (a five-fold decrease) was seen in Isopods. Fewer obvious changes were seen in sweepnet sampling, where the largest difference was a site-specific 3x increase in Hemipterans detected at Upper Belleisle. No data were collected on insects at Pea Round in 2002, so no inter-year comparisons can be made. However, site comparisons show that Pea Round has less diversity in insect orders, and fewer individuals of most of those orders. Especially notable are the greatly reduced numbers of spiders and ants detected in pitfalls, and the ten-fold decrease in the numbers of Hemipterans (true bugs) compared to other sites. It is also worth noting the complete absence of Odonates (damsel- and dragonflies), Orthopterans (grasshoppers and crickets), and Acarinids (ticks).

Habitat Correlates. The top best-fit models (using logistic regression with an AIC model selection procedure) for each species are as follows (*using preliminary data only*):

- *Bobolink*: Litter + Field Area + Grass Density / Height + Grass:Forb ratio + Lepidoptera
- *Savannahs:* Grass Density / Height + Litter + Lepidoptera
- Nelson's: Grass Density / Height + Litter + Soil Moisture + *Spartina* spp.

It is important to note that litter depth and grass density / height appear as important terms in all three models. This provides indication that these variables are *likely* of overarching importance to habitat selection in these species.

Future Work - 2004

In 2004, work needs to continue as in the past two summers. An increased emphasis will be placed on trying to validate and refine habitat models. The residency patterns of birds in 2004 will be invaluable to assess to double sample size and validate the models. In point form the main goals of the 2004 season will be:

- Refine and validate habitat selection models built thus far.
- Further assess variability in phenology and reproductive activity.

- Experimentally determine the relative importance of best-fit model variables.
- Derive estimates of fidelity and survivability.
- Further assess variability in prey abundance and habitat measures.

COMMUNICATIONS

- Nocera, J.J., G.J. Forbes, and G.R. Milton. 2003. Developing models of grassland bird habitat selection: The importance of considering behavioural mechanisms. Poster presentation to The Wildlife Society -10th Annual Conference, Burlington, VT, USA. 6-10 Sept.
- Nocera, J.J. 2003. "Behavioural mechanisms of habitat selection in birds: information use past and prescient". Invited seminar to the Department of Biology, Univ. of New Brunswick, Fredericton, NB, Canada. 5 Dec.

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