

INTRODUCTION

The National Audubon Society's *Waterbirds on Working Lands (WWL)* project aims, primarily, to identify and promote agricultural practices that improve the extent to which humans and birds can coexist. By bringing together members of the farming industry, the grower community, and conservation scientists, Audubon aspires to create a workable blueprint for advancing the conservation of wetland birds within working agricultural landscapes. An initial step in this process is to identify what we currently do and do not know about the ways in which different species use farmland, and the ways that farming practices affect wetland birds. Consequently, we conducted a detailed systematic review of the research literature in order to provide a baseline body of information from which conservation planning and future research can proceed.

The review focuses on nine row crops: corn, soybean, spring and winter wheat (treated in a joint chapter in this document), cotton, sorghum, rice, peanuts, and tobacco. This list includes the most important crops planted in North America both in terms of the area of land under cultivation and their use by wetland-associated birds. Corn, soybean, wheat, cotton and sorghum were the five most widely planted crops in the United States in 2005 when they collectively occupied more than half of all U.S. farmland (Table 1-1). Rice, although planted in only a few areas of North America, is also one of the ten most commonly grown row crops in the United States and is widely considered to provide considerable value to waterbirds (Eadie et al. 2007).

We focused our review geographically on the bird conservation regions in which agriculture is most dominant. For the WWL project, Audubon identified seven focal BCRs in which more than 10% of the total land area is used for the production of the focal row crops (Butcher et al. 2007). Because there are likely to be ecological similarities in the ways in which crops are used across regions, we did not limit our review to only these regions. Instead, we compiled all of the information we could find about wetland bird use of the nine crops in North America, supplemented by additional information from elsewhere in the world when a topic had not been investigated in North America. We did, however, summarize the results of our survey with the focal BCRs in mind, and provide separate lists of species using each crop for each BCR.

The primary set of 216 bird species considered during our survey was determined through a review process conducted by the National Audubon Society, designed to identify all North American species that are importantly associated with aquatic habitats and that occur within the focal regions. Many of these species are generally considered to be "waterbirds", and the inclusion of members of the following groups was straightforward: Anseriformes (waterfowl), Gaviiformes (loons), Podicipediformes (grebes), Pelecaniformes (e.g., pelicans, cormorants), Ciconiiformes (e.g., herons, ibis, storks), Gruiformes (e.g., rails, cranes), and Charadriiformes (shorebirds, gulls, terns). In addition to species from these groups, however, a range of other species that are regularly associated with wetlands were included in the focal bird list. These additional species included raptors, such as Osprey and Bald Eagle, Belted Kingfisher, and a variety of wetland passerines including various flycatchers, swallows, wrens, sparrows, blackbirds, etc. For more details on the creation of this list please see Butcher et al. (2007).

In addition to the overall species list, Audubon produced regional lists of species that are at least

moderately abundant in each focal BCR. These regional lists were created to screen out - in a systematically manner - those species on the primary list that only occur occasionally in a given BCR because it is at the periphery of their normal range (see Butcher et al. 2007). Briefly, species were included on regional lists if they exceeded a minimum standard of regional importance for any given season, based on what Partners in Flight (PIF) calls “Relative Density” (RD) scores (Panjabi et al. 2005). Relative density estimates were obtained by first dividing a standardized index of abundance for a species in a BCR by the index of abundance for the same species in the BCR where it is most abundant, then multiplying this figure by 100 to place the relative abundance of all species on a scale of 0 – 100. RD scores were then derived by assigning relative density estimates in each BCR (in a particular season) to a 5-rank ordinal scale as follows: score 1: $0 < RD < 1$; score 2: $1 \leq RD < 10$; score 3: $10 \leq RD < 25$; score 4: $25 \leq RD < 50$; score 5: $50 \leq RD \leq 100$. Any species with a RD score of 2 or more in a focal BCR in any given season was included on the regional list for that BCR.

In addition to the primary and regional lists of focal species, a subset of high conservation priority species was also identified by Audubon and were given special consideration during our review. Species were included on this priority list if they are listed under the U.S. Endangered Species Act, on the Audubon WatchList, USFWS Birds of Conservation Concern, or exhibit significant population declines according to Christmas Bird Count or Breeding Bird Survey data.

The overall WWL project is designed, ultimately, to identify methods by which farming practices can be adapted in order to increase benefits to bird conservation, while maintaining productive economic use of the land. We have, therefore, organized this report in a manner designed to maximize the efficiency with which information can be extracted for use in the development of crop management practices that increase the value of farmland for birds. For each crop, we have summarized the information into three main sections describing (i) basic patterns of field use by waterbirds, (ii) crop resources that are available to birds and how they are used, and (iii) ways in which crop management activities are known to affect wetland birds. Patterns of crop use are described separately for each major group of wetland-associated birds, subdivided into waterfowl, shorebirds, wading birds, “other waterbirds”, and “landbirds”. Resources are subdivided into foraging resources (spilled grain, weed seeds, green vegetation, invertebrate and vertebrate prey) and breeding resources (nesting habitat, brood-rearing habitat). Effects of crop management are described relative to crop phenology (soil preparation, sowing, pesticide/herbicide applications, crop depredation, harvest, post-harvest field management), with additional sections on associated topics (crop rotation, management of field margins, field size and landscape-level issues, hunting, etc.) where appropriate.

We close the chapter for each crop with a synthesis section, in which we draw out the major issues described in detail earlier in the chapter and identify areas where additional research is warranted. To supplement the written accounts for each crop we have also compiled a series of tables summarizing the key information. These tables identify (i) the wetland bird species that have been recorded using the crop in each season and for different purposes, both for the U.S. and Canada combined, and for each of the focal BCRs; (ii) the resources available to different types of bird at different stages of the growing cycle; and (iii) the documented effects of different agricultural practices and landscape features on the birds that use the crop.

Finally, at the end of this document we provide an overall synthesis chapter, which provides an overview of our findings, makes comparisons among crops, and makes general suggestions for improving the state of knowledge about wetland bird use of agricultural habitats in North America.

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Table 1-1. Top ten crops in terms of area of land planted in the United States in 2005, with comparable data from Canada when available.

Crop	US		US Planted (ha) ¹	Canada (acres) ²	Canada (ha) ²
	US Planted (acres) ¹	Harvested (acres) ¹			
Corn: grain	81,759,000	75,107,000	33,112,000	2,778,000	1,124,200
silage	> 5,920,000	5,920,000	> 2,398,000	?	?
Soybeans	72,030,000	71,251,000	29,172,000	2,907,000	1,176,400
Wheat	57,229,000	50,119,000	23,178,000	25,020,000	10,125,300
Cotton	14,245,000	13,802,000	5,769,000	N/A	N/A
Sorghum: grain	6,454,000	5,736,000	2,614,000	?	?
silage	> 311,000	311,000	> 126,000	?	?
Oats	4,246,000	1,823,000	1,720,000	4,580,000	1,853,300
Rice	3,384,000	3,364,000	1,371,000	N/A	N/A
Sunflower	2,709,000	2,610,000	1,097,000	230,000	93,000
Dry Edible Beans	1,665,000	1,569,000	674,000	?	?
Peanuts	1,657,000	1,629,000	671,000	N/A	N/A

¹ Data from: National Agriculture Statistical Service 2006
<http://usda.mannlib.cornell.edu/usda/nass/CropProd//2000s/2006/CropProd-12-11-2006.pdf>
 (original units: acres; estimates rounded to nearest 1000).

² Data from: <http://www40.statcan.ca/l01/cst01/prim11a.htm> (original units: hectares; estimates rounded to nearest 1000).