Bird habitat associations in the lower Missouri River floodplain

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Introduction

Floodplain forests provide some of the most dense and diverse assemblages of birds in North America; unfortunately, because of floodplain protection projects, the ecology of many rivers, including the lower Missouri River, have changed, potentially influencing avian floodplain abundance and diversity. We examined avian community composition associated with the floodplain of the lower Missouri River. Our specific objectives were:

(1)describe the breeding bird assemblage and environmental factors associated with three stages of forest succession represented in the lower Missouri River floodplain: open areas dominated by wet prairie/forbs (wet prairie), early successional floodplain forests (early forest), and mature floodplain forests (mature forest);
(2)describe the plant community associated with each habitat type and identify indicator bird species and species of conservation concern associated with each habitat type;
(3)compare the breeding bird community of the lower Missouri River floodplain to published reports of large floodplain bird communities elsewhere (upper and middle Mississippi River and lower Mississippi Alluvial Valley);
(4)describe the spring migrating bird assemblage associated with the three stages of forest succession represented in the lower Missouri River floodplain: mature forests, young forests, and wet prairie, comparing species assemblages between eastern and western Missouri study sites;
(5)examine environmental conditions associated with establishment of young forests vs. prairie in abandoned agricultural land subject to frequent floods; and
(6)suggest approaches to future monitoring of the bird community with respect to the appropriate sampling intensity needed to detect change in relative abundance over time, including incorporation of detection probabilities.

This work was the result of a multi-refuge FWS-USGS collaboration.

Study Area

Ten study sites were chosen within the lower Missouri River alluvial floodplain, stretching from northwestern Missouri (near St. Joseph) to east-central Missouri (near St. Louis)(Fig. 1 and Table 1). These ten sites were located in three Fish and Wildlife Service refuges (Big Muddy National Fish and Wildlife Refuge, Swan Lake National Wildlife Refuge, Squaw Creek National Wildlife Refuge), three Missouri Department of Conservation Areas (Overton South, Eagle Bluffs, Howell Island), and the Department of Defense's Fort Leavenworth. All sites were on public land and all except two (Swan Lake National Wildlife Refuge, Squaw Creek National Wildlife Refuge) were riverward of a levee.

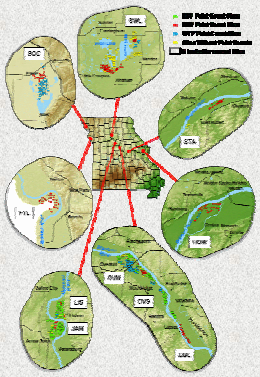

Figure 1. Study site locations along the lower Missouri River. See Table 1 for acronyms

Study Area	Acronym	Avian Survey Sites	No. of Point Counts Conducted	Vegetative Survey Sites	No. of Vegetative Surveys Conducted
Squaw Creek	SQC	66	770	66	175
Ft. Leavenworth-Weston	FTL	30	173	30	30
Swan Lake	SWL	52	169	49	66
Jameson Island	JAM	55	260	49	81
Lisbon Bottoms	LIS	41	190	40	77
Overton Bottoms North	OVN	36	200	41	88
Overton Bottoms South	OVS	63	310	62	111
Eagle Bluffs	EBL	18	109	17	31
St. Aubert's Island	STA	17	92	16	23
Howell Island	HOW	30	133	30	37

Table 1. Study area location and size and sample sizes of bird and vegetative surveys along the lower Missouri River, 2002-2004

Results

We found avian assemblages along the lower Missouri River to be among the most diverse in North America, comprising >15% of all species occurring on the continent. One-hundred-twenty-one species were identified in early successional forest, 131 species in wet prairie, and 140 species in mature floodplain forest, representing sampling during the breeding and migration seasons (Fig. 2-4). We examined environmental factors differentiating wet prairie and early successional forest site, important habitat for floodplain birds. We found early successional forest sites were closer to the river and on lower elevation, but occurred on drier soils than wet prairie. In a regulated river such as the lower Missouri River, wet prairie sites are relatively isolated from the main channel as compared to early successional forest, despite occurring on relatively moister soils (Fig. 5). We found the power to detect trends in bird abundance was a function of the trend magnitude, sample size, and species-specific sampling variance. We found for nine representative species that most individual management sites were too poorly sampled to allow for site-level estimation of trends in abundance. In general, to detect trends of 3% per annum or greater at 80% power required an annual sample size of ≥50 (Fig. 6). Confounding our ability to calculate power to estimate trends was the imperfect detectability of species (Fig. 7). This ability to detect species varied among species by habitat, time, and observer. In general, approximately half of the individuals were estimated to have been observed (i.e., half the individuals of a species were not observed during surveys). Species accumulation curves provided information on the number of samples in each habitat necessary to adequately characterize the avian communities during migration and breeding (Fig. 8).

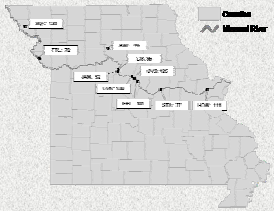

Figure 2. Geography of species richness for avian assemblages along the lower Missouri River, 2002-2004

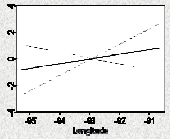

Figure 3. Plot of avian species richness as a partial function of longitude from 10 locations along the lower Missouri River, 2002-2004. Note: west is on the left, east on the right

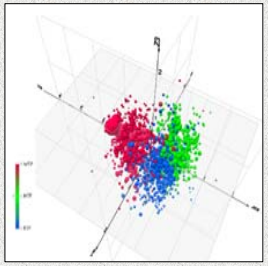

Figure 4. Avian community compositional differences between cover classes, lower Missouri River, 2002-2004. Bubble size corresponds to the number of species observed at the site

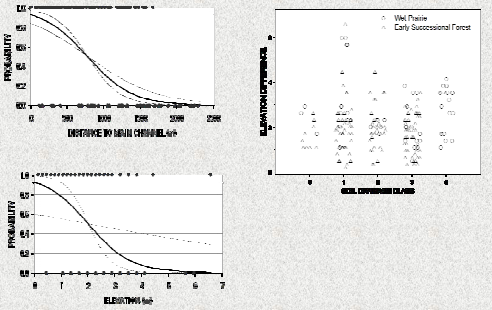

Figure 5. The probability of a lower Missouri River site being forest rather than wet prairie declined with distance from the main channel and an increase in the difference between the site elevation and that of the river. The interaction of the difference in elevation and soil drainage class (ordered from driest [0] to wettest [4]) had a marginal influence on discriminating between wet prairie and early successional forest. The symbols are jittered on the abcissa to aid discrimination between responses

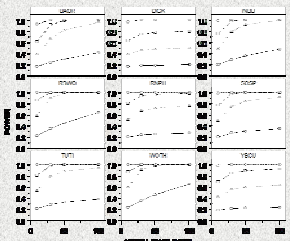

Figure 6. Power to detect a decline in avian abundance along the lower Missouri River as a function of sample size (along the ordinate), species (by panel), and trend. The trends assessed were declines of 1% (○), 3% (△), 5% (□), and 10% (◇) per annum. Species detectability was not incorporated in this calculation of power

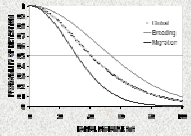

Figure 7. Example of estimating detection probability: the estimated detection probability of Bell's Vireo occurring in habitat of the lower Missouri River, 2002-2004 (n = 24 detections) was a function of distance (meters) observed from survey point and season.

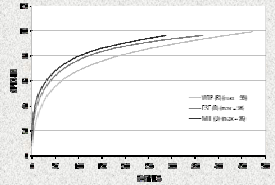

Figure 8. Species accumulation curves used to determine the number of samples needed to estimate bird species richness during the breeding season in mature floodplain forest (MTF), early successional forest (ESF), and wet prairie (WTP). Maximum values indicate total species richness during the breeding season by habitat type in our study

Acknowledgments

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