Project Title: Toward Restoration Recovery: Avian community assemblages as an indicator of biological condition of Wetland Reserve Program along a cover-density gradient of eastern baccharis.

Project Summary: Invasion of eastern baccharis (*Baccharis halimifolia*) throughout restored wetlands in the southeastern U.S. is likely inhibiting the Wetland Reserve Program (WRP) from effectively achieving its restoration potential in terms of hydrologic and biogeomorphic function, and wildlife habitat value. In the absence of baccharis, restored WRP sites are capable of providing 5-7 years of early successional grassland habitat that can benefit many breeding songbird species (e.g., Henslow's sparrow, grasshopper sparrow, sedge wren) and winter migrants (e.g., LeConte's sparrow, Smith's longspur, short-eared owl). However, once baccharis invades a wetland, it can quickly out-compete most annual and perennial grasses and forbs, resulting in a woody-dominated wetland with little or no herbaceous understory. The purpose of this work is to model the avian community assemblage and nesting demographics of successional grassland bird species across a cover-density gradient of eastern baccharis. This evaluating will include 5 cover-density gradients or treatment levels (i.e., none [0-4% baccharis cover], low [5-25%], moderate [26-50%], high [51-75%], and extensive [76-100%]). Multi-species, multi-year occupancy models will be used to evaluate the effects of increasing cover-densities of baccharis, and other micro-habitat (vegetation) and macro-habitat (patch-level) characteristics on site occupancy, colonization, and local extinction probabilities of grassland bird species of conservation concern during both the breeding and winter seasons. Higher occupancy rates of breeding and wintering grassland bird species are expected in fields with lower cover-densities of baccharis. Also, local extinction rates of grassland birds are expected to increase with increased cover-density, and colonization is expected to increase with decreasing cover-densities. If in fact occupancy of target grassland species of conservation concern are compromised by increasing baccharis cover-densities, than this work may be the pivot point for future restoration recovery efforts of WRP and a potential eastern baccharis removal initiative on WRP sites throughout the southern U.S.

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Project Budget:

| Item	Requested	Match 35%	Match 50%	Total (35%)
Salary and Fringe	$50,924	$1,685	$11,797	$52,609
Travel	$6,500	$0	$0	$6,500
Equipment/Supplies	$1,250	$0	$0	$1,250
Publication	$1000	$0	$0	$1000
Indirect non-recovered	$0	$21,483	$21,483	$21,483
Sub-total	$59,674	$23,168	$33,280	$82,842
Indirect	$5,967	$0	$0	$5,967
Total	$65,641	$23,168	$33,280	$88,809

Need: The potential adverse impacts of invasive plant species to alter ecosystem processes and functions have been broadly recognized (Vitousek et al. 1997). In fact, biological invasion is second only to land-use change as a cause of endangerment to many species and ecosystems. In the southeastern US, eastern baccharis (*Baccharis halimifolia*) is an invasive species found commonly in reconstructed wetlands such as those created through the WRP. Consequently, the WRP, in part, may not be effectively achieving its program objectives of restoring wildlife habitat value due to the invasion of baccharis. Baccharis is a facultative wetland plant that exhibits a high efficacy for water-usage (Ewe and Sternberg 2002) that, in turn, impedes hydrologic function and habitat potential for many migratory bird species. In the absence of baccharis, herbaceous plants (annual and perennial grasses and forbs) may dominate a restored WRP site for the first 5–7 years post-establishment (Battaglia et al. 2002, Twedt and Best 2004). Grassland ecosystems and thus,

many grassland dependent bird species, are among the most threaten in Arkansas. These species are dependent on herbaceous understory vegetation densities that range from sparse (eastern meadowlark) to moderately-dense (grasshopper and Henslow's sparrow) for concealment during the breeding season (Osborne and Sparling 2013) and winter. The intent of this work is to document the avian community assemblage along a cover-density gradient of baccharis to demonstrate the benefits of WRP with low baccharis cover on grassland bird species of conservation concern in an attempt to initiate a baccharis removal initiative in the southeastern US.

Purpose and Objectives: The purpose of this work is to determine occupancy rates of grassland-dependent bird species of greatest conservation concern across a cover-density gradient of baccharis to identify the threshold value in which baccharis cover-density compromises the biological integrity of a WRP site for resident-breeding and wintering bird species in southeast Arkansas. The objectives of this study are to:
1) Determine occupancy, colonization, and local extinction probabilities for a) breeding and b) wintering birds in WRP across a cover-density gradient of eastern baccharis;
2) Investigate micro-habitat and macro-habitat (i.e., patch-level) factors that influence occupancy, colonization, and local extinction probabilities;
3) Determine nest density and nest survival rates of breeding birds across a cover-density gradient of eastern baccharis;
4) Model micro-habitat and macro-habitat (e.g., baccharis cover-density) factors that influence nest survival in WRP;

Location: This study will be conducted in southeast Arkansas, primarily in the counties of Ashley, Chicot, Desha, and Drew counties. Collectively, this 4-county region contain nearly 27,000 acres of WRP easements (Figure 1), most of which are restored bottomland hardwood sites that exhibit intermittent hydrologic function, primarily during the winter months.
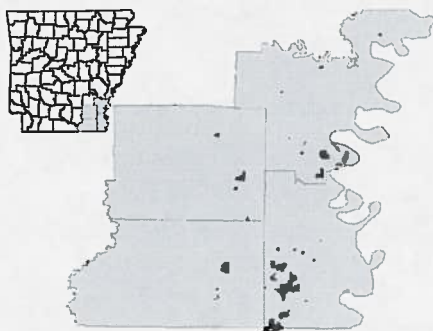
Figure 1. Arkansas counties and Wetland Reserve Program restoration sites which may serve as potential sites for evaluating avian community assemblage across a cover-density gradient of eastern baccharis, during 2014-2016.

Approach: We will use a stratified random sampling design to select 30 total WRP sites (6 sites representing each of 5 treatment levels). Treatment levels will span a range of cover-densities of eastern baccharis that fall into the following categories; none (0-4% cover), low (5-25%), moderate (26-50%), high (51-75%), and extensive (76-100%).

To determine site occupancy, colonization, and local extinction probabilities of breeding birds, observers will conduct point-transect surveys (survey points on a 500 m² sampling grid throughout the field) ≥3 times per year per site during May – July, 2015 and 2016. Observers will be trained and tested in identification of target species prior to the start of field sampling. Observers will record all birds detected by species during each survey. All surveys will be conducted within 4 hours of sunrise. Surveys will not be conducted in inclement weather conditions or during high wind events. Observers will search for nests of breeding birds 2 times per site per year by walking a series of systematic transects, covering ≥75% of the fields area. All nests will be identified to species (Baicich and Harrison 1997), and geo-referenced. All active nests of target species (Table 1) will be re-visited every 3 days to determine nest fate.

To determine occupancy, colonization, and local extinction probabilities of wintering birds, observers will conduct line transect surveys ≥2 times per during January – March, 2015–2016. Observers will record all individual birds and groups of birds detected during each survey. For each group of birds detected, observers

will record the cluster size by species. Observers will not conduct surveys in inclement weather conditions or during high wind events.

Vegetation structure and composition will be estimated during the growing season at 2 spatial scales. We will establish a permanent sampling grid that included macro-plots (5 acre blocks) and micro-plots (16 sampling cells within each 5 acre block) using ArcGIS. Vegetation composition and structure will be measured at 35% of the sampling cells per year for 2 consecutive years. Vegetation composition will be measured at random sampling cells by estimating the percent canopy cover by species within a 1-m² sampling frame. Vegetation structure will be estimated by measuring visual obstruction density and the percentage of bare ground.

Univariate logistic regression will be used to evaluate simple associations between patch occupancy, colonization, and local extinction probabilities across the cover-density gradient. Multiple regression procedures will be used to provide a best-fit model to test the hypothesis that baccharis cover-density, percent herbaceous understory, percent bare ground, patch size, and patch isolation explain patch occupancy, colonization, and local extinction probabilities. Nest survival models (Dinsmore et al. 2002) in Program MARK will be used to model nest survival as a function of micro-habitat and macro-habitat factors influence nesting ecology of songbirds in restored WRP. All a priori models will be generated prior to modeling occupancy and nest survival estimates. We will select the most parsimonious model by evaluating AICc and model weight estimates. Model averaging will be conducted to determine effects size of those factors included in the best preforming models (i.e., those within 2.0 ΔAICc of the top model). Odds ratio estimates will be generated to indicate the change in the odds of the dependent variables (e.g., occupancy, colonization, location extinction probabilities) for a one-unit increase in the independent variable (cover-density of baccharis).

Expected Results and Benefits: Avian community structure and estimates of nest survival can be effective parameters for evaluating biological integrity of an ecosystem and for comparing among treatment levels. The results of this work will demonstrate the level of biological integrity that exists in WRP sties, in terms of wildlife habitat use, across a cover-density gradient of eastern baccharis across southeast Arkansas. These data will be used to generate recommendations regarding cover-density classes of baccharis that compromise the integrity of a site and for which removal of baccharis should be considered. If baccharis is found to influence avian community assemblage and a threshold value for cover-density is identified, then recommendations for the establishment of a baccharis removal initiative may be present to USDA-NRCS.

Table 1. Target species for determine rates of occupancy across a cover-density gradient of eastern baccharis in Wetland Reserve Program sites in southeast Arkansas during 2015-2016.

Common name	Scientific name	Arkansas Status**	Residence	Nest placement
American woodcock*	*Scolopax monor*	Imperiled breeding	Permanent	Ground
Barn owl*	*Tyto alba*	Vulnerable breeding	Permanent	--
Eastern meadowlark	*Sturnella magna*	--	Permanent	Ground
Grasshopper sparrow*	*Ammodramus savannarum*	Vulnerable breeding	Breeding	Ground
Henslows sparrow*	*Ammodramus henslowii*	Critically imperiled breeding	Permanent	Ground
Lark sparrow*	*Chondestes grammacus*	Vulnerable breeding	Permanent	Ground
Le Conte's sparrow*	*Ammodramus leconteii*	Vulnerable nonbreeding	Winter	--
Loggerhead shrike	*Lanius ludovicianus*	Vulnerable breeding/nonbreeding	Permanent	Above ground
Northern bobwhite	*Colinus virginianus*	Secure	Permanent	Ground
Northern harrier*	*Circus cyaneus*	Critically imperiled breeding	Winter	--
Prairie warbler*	*Dendroica discolor*	Secure breeding	Breeding	Above ground
Sedge wren*	*Cistothorus platensis*	Critically imperiled breeding	Permanent	Ground
Short-eared owl*	*Asio flammeus*	Vulnerable nonbreeding	Winter	--
Smith's longspur	*Calcarius pictus*	Vulnerable nonbreeding	Winter	--
Sprague's Pipit	*Anthus spragueii*	Candidate species**	Winter	--

*Arkansas species of conservation concern (SWAP)

**Federally listed candidate species

BUDGET

Budget Period: 1 Oct 2014 – 30 Sept 2016

	Year 1 1 Oct 2014 - 30 Sept 2015			Year 2 1 Oct 2015 - 30 Sept 2016			Project Totals		
	AGFC	AAES (35.4%)	AAES (51.4%)	AGFC	AAES (35.2%)	AAES (50.0%)	AGFC	AAES (35.3%)	AAES (50.7%)
Personnel									
Douglas Osborne, Principal investigator (@35% match =1% salary+fringe; @50% match = 7%)	$0	$843	$5,899	$0	$843	$5,899	$0	$1,685	$11,797
Temporary Extra Help ($1600/month @ 4 months + 8.0% fringe)	$6,912	$0	$0	$6,912	$0	$0	$13,824	$0	$0
Graduate Research Assistant ($15,000/yr. + 1% fringe + $3400 tuition/yr.)	$18,550	$0	$0	$18,550	$0	$0	$37,100	$0	$0
Subtotal	$25,462	$843	$5,899	$25,462	$843	$5,899	$50,924	$1,685	$11,797
Travel									
Vehicle use, oil, and fuel (summer/winter)	$2,500	$0	$0	$2,500	$0	$0	$5,000	$0	$0
Regional or National meeting - student travel	$0	$0	$0	$1,500	$0	$0	$1,500	$0	$0
Subtotal	$2,500	$0	$0	$4,000	$0	$0	$6,500	$0	$0
Materials/Supplies									
General field supplies	$750	$0	$0	$500	$0	$0	$1,250	$0	$0
Subtotal	$750	$0	$0	$500	$0	$0	$1,250	$0	$0
Commodities									
Publication (e.g., Wetland Ecology & Management)	$0	$0	$0	$1,000	$0	$0	$1,000	$0	$0
Subtotal	$0	$0	$0	$1,000	$0	$0	$1,000	$0	$0
Total Direct Costs	$28,712	$843	$5,899	$30,962	$843	$5,899	$59,674	$1,685	$11,797
Indirect Costs (10.0% agreement AGFC)	$2,871	$0	$0	$3,096	$0	$0	$5,967	$0	$0
Unrecovered Indirect (46% vs. 10%)	$0	$10,336	$10,336	$0	$11,146	$11,146	$0	$21,483	$21,483
Project Costs	$31,583	$11,179	$16,235	$34,058	$11,989	$17,045	$65,641	$23,168	$33,280
Total Project Expense									$88,809

Douglas C. Osborne, Ph.D. is an Assistant Professor of Wildlife for the University of Arkansas, Division of Agriculture and the Arkansas Forest Resources Center. He is Associate Wildlife Biologist certified through the Wildlife Society. Dr. Osborne has extensive experience with USDA-NRCS private land conservation working land and easement programs. During 2012, Dr. Osborne and co-authors completed a comprehensive review of national and regional inventory and monitoring programs to develop strategies for monitoring biological condition of USDA-NRCS easements programs and to determine if national easement program objectives are being met (http://neap.tennessee.edu/pdf/NEAP_October2012Report-Final10-8-12.pdf). Dr. Osborne has a proven track record of publishing his research findings in leading scientific journals and for presenting at national and regional conference, and landowner workshops. Dr. Osborne has published 3 peer-reviewed journal articles and a book chapter related to grassland bird species and their associated habitat use and response to management applications in Conservation Reserve Program fields.

Selected Publications

Osborne, D. C., and D. W. Sparling. 2013. Multi-scale associations of grassland birds in response to cost-share management of Conservation Reserve Program fields in Illinois. Journal of Wildlife Management 77: 920-930.

Osborne, D. C., D. W. Sparling, and T. V. Dailey. 2012. Arthropod consumption by northern bobwhite chicks in managed tall fescue monocultures. Proceedings of the National Quail VII Symposium 7: 113–121 .

Osborne, D. C., D. W. Sparling, and R. L. Hopkins II. 2012. Influence of Conservation Reserve Program mid-contract management and landscape composition on northern bobwhite in tall fescue monocultures. Journal of Wildlife Management 76: 566–574.

Osborne, D. C., J. J. Shew, and D. W. Sparling. *In review.* Effects of mid-rotation management on dickcissel nest survival and density in Conservation Reserve Program fields. Journal of Field Ornithology.

Sutton, W. B., G. D. Upchurch, **D. C. Osborne**, H. M. Hagy, K. E. Edwards, Z. Guo, and M. J. Gray. *In preparation.* Effective Strategies for Conducting a Habitat Inventory on Restored Wetlands and Uplands. Remote Sensing of Environment.

Gray, M. J., K. E. Edwards, W. B. Sutton, H. M. Hagy, **D. C. Osborne**, G. D. Upchurch, and Z. Guo. 2012. USDA NRCS National Easement Assessment Project, Final Report (October 2012). U. S. Department of Agriculture, Natural Resources Conservation Service, National Easement Assessment Project. Washington, DC.

Book Chapter

Sparling, D. W. and **D. C. Osborne**. 2009. Response of bobwhite, vegetation, and invertebrates to three methods of renovating monotypic Conservation Reserve Program grasslands in south-central Illinois. Pages 117 – 127 *in* Burger and Evans, editors. U. S. Department of Agriculture, Natural Resources Conservation Service. Managing working lands for northern bobwhite: The USDA-NRCS Bobwhite Restoration Project.