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## WINTERING BIRD RESPONSE TO FALL MOWING OF HERBACEOUS BUFFERS

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**ABSTRACT.**—Herbaceous buffers are strips of herbaceous vegetation planted between working agricultural land and streams or wetlands. Mowing is a common maintenance practice to control woody plants and noxious weeds in herbaceous buffers. Buffers enrolled in Maryland's Conservation Reserve Enhancement Program (CREP) cannot be mowed during the primary bird nesting season between 15 April and 15 August. Most mowing of buffers in Maryland occurs in late summer or fall, leaving the vegetation short until the following spring. We studied the response of wintering birds to fall mowing of buffers. We mowed one section to 10–15 cm in 13 buffers and kept another section unmowed. Ninety-two percent of birds detected in buffers were grassland or scrub-shrub species, and 98% of all birds detected were in unmowed buffers. Total bird abundance, species richness, and total avian conservation value were significantly greater in unmowed buffers, and Savannah Sparrows (*Passerculus sandwichensis*), Song Sparrows (*Melospiza melodia*), and White-throated Sparrows (*Zonotrichia albicollis*) were significantly more abundant in unmowed buffers. Wintering bird use of mowed buffers was less than in unmowed buffers. Leaving herbaceous buffers unmowed through winter will likely provide better habitat for wintering birds. Received 21 December 2009. Accepted 23 August 2010.

Herbaceous buffers are strips of herbaceous vegetation planted between working agricultural land and streams or wetlands. They are designed to manage environmental concerns such as water quality and can provide habitat for a variety of wildlife species (Clark and Reeder 2005). The U.S. Department of Agriculture's (USDA) Conservation Reserve Program (CRP) offers several types of herbaceous buffer practices to agricultural producers, and Maryland's Conservation Reserve Enhancement Program (CREP) offers additional financial incentives for landowner enrollment. Over 15,000 ha of herbaceous buffers are established in Maryland through the CRP (USDA 2010), most of which are enrolled in Maryland's CREP. Herbaceous buffers in Maryland are usually planted either to native warm-season grasses or cool-season grasses with the addition of native wildflowers or introduced legumes (USDA 2009b).

Maintenance is required to keep CREP plantings in Maryland in good condition and functioning properly (USDA 2009b). Mowing is a common maintenance practice to control woody

plants and noxious weeds in herbaceous plantings. Mowing is generally not allowed on CRP or CREP land during the primary nesting and brood rearing seasons for wildlife (dates vary from state to state), but is allowed during the rest of the year. Maryland's CREP land may not be mowed between 15 April and 15 August (USDA 2009b). Most mowing of buffers in Maryland occurs in late summer or fall (hereafter, fall mowing) and often within a few days of 15 August (P. V. Barry, pers. comm.; J. E. Gerber, pers. comm.). Fall mowing is also a common practice in herbaceous CRP plantings in other states, including Virginia (G. I. Hall, pers. comm.), Ohio (M. D. DeBrock, pers. comm.), and Tennessee (M. E. Zeman, pers. comm.). Fall mowing leaves the vegetation short until growth begins the following spring. Farm managers often choose to mow in fall instead of late winter or spring because they believe shorter grass looks better, the ground may be too wet in spring for mowing, or fall is when they have the most time available (S. V. Strano, pers. comm.).

It is recommended that buffers be mowed no more than once every 2 to 3 years with no more than half of the area mowed in any 1 year (USDA 2009b). A common recommendation is to mow a third of each buffer every year on a 3-year rotation (USDA 2009b). However, some farm managers mow entire buffers each year (PJB, pers. obs.).

Buffers often represent the only uncultivated herbaceous areas on farmland in Maryland and may be important habitat for early-successional birds. Many studies have evaluated the response by breeding birds to mowing of early-successional

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habitats (e.g., Swanson et al. 1999, Warren and Anderson 2005, Zuckerberg and Vickery 2006), but few studies have evaluated the effects of mowing on wintering bird communities. We studied the response of wintering birds to fall mowing of herbaceous buffers. We hypothesized that wintering bird abundances, species richness, and total avian conservation value would be less in mowed than in unmowed buffers. We focus on the response of grassland and scrub-shrub birds because they are experiencing substantial population declines (Sauer et al. 2008) and are of high conservation concern (Hunter et al. 2001, Askins et al. 2007).

## METHODS

*Study Area.*—The Eastern Shore of Maryland (east of Chesapeake Bay) has ~46% of land-cover in farms (USDA 2009a) and 77% of the CREP buffers in the state (USDA 2007). Filter strips (USDA Practice CP21) are the most common type of herbaceous buffers in Maryland (USDA 2010). We conducted an experiment in 13 filter strips (hereafter, buffers) among two counties (Queen Anne's and Talbot) on Maryland's Eastern Shore.

All buffers selected were installed between 1997 and 2004, and were  $\geq 3$  years of age at the time of the study. Each buffer was between a rowcrop field and a forested wetland, which is a common location of buffers in Maryland. The adjacent rowcrops had been planted to either corn or soybeans in the previous growing season, and most were planted to winter wheat after fall harvest.

Nine buffers were planted with cool-season grasses and four were planted with warm-season grasses. Common warm-season grasses were big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), indiagrass (*Sorghastrum nutans*), and broomsedge bluestem (*A. virginicus*). The most common cool-season grass in buffers was orchardgrass (*Dactylis glomerata*), but other cool-season grasses including red (*Festuca rubra*) and sheep (*F. ovina*) fescue were also planted.

We established two treatments in each buffer: (1) a section (experimental treatment) mowed in late summer or fall (Aug–Dec) to 10–15 cm in height, and (2) an unmowed section. Mowed and unmowed treatments were randomly located along the length of the buffer and spanned the entire width of the buffer. We established one

study site in each treatment. Each study site spanned the width of the buffer, was  $\geq 50$  m from the ends of the buffer and from the interface with the other treatment, and  $\geq 100$  m from the other study site in the same buffer. Mowed and unmowed study sites among all buffers were similar ( $\bar{x} \pm SD$ ) in length (mowed:  $176.0 \pm 50.0$  m; unmowed:  $176.6 \pm 50.3$  m).

We defined the width of each buffer as the distance from the crop edge to the wooded edge and calculated width by averaging measurements taken every 50 m over the length of the buffer. Buffers ranged in width from 11 to 91 m, and average buffer width was  $40.9 \pm 35.7$  m. We measured the length of each study site in a Geographic Information System (GIS) and calculated the area of each site by multiplying site width by site length.

*Vegetation Surveys.*—We conducted vegetation surveys once at each study site in winter 2007. We established one transect line through the center of the site in buffers  $< 45$  m wide, and two transect lines spaced evenly across the width of the site in buffers  $> 45$  m wide. We measured vegetation structure characteristics within 1-m<sup>2</sup> sampling plots at random distances perpendicular to five points spaced evenly apart along each transect line. Thus, we surveyed vegetation at five plots in buffers  $< 45$  m wide and 10 plots in buffers  $> 45$  m wide. We visually estimated the percent cover (non-overlapping) of grasses, forbs, trees, bare ground, and litter in each plot. We also measured vertical vegetation density (Robel et al. 1970), litter depth, and maximum vegetation height.

*Bird Surveys.*—We conducted three bird surveys at each study site between 19 January and 10 March 2007. All surveys were between 1 hr after sunrise and 1 hr before sunset. We did not conduct surveys in precipitation, fog, or wind  $> 16$  km/hr. Bird surveys in the two study sites in the same buffer were subsequent to one another and in random order. Individual birds observed in one study site were not observed to move to any other study sites, and study sites were considered independent.

We surveyed birds across the entire area of each study site. All surveys were conducted simultaneously by P. J. Blank and J. R. Parks. We walked parallel to the wooded edge of the buffer  $\leq 20$  m apart. The distance between us varied depending on width of the buffer. Nine buffers were  $\leq 40$  m wide and required only one pass. Four buffers were  $> 80$  m wide and required

three passes. We communicated regularly and watched for birds moving within study sites so that individual birds were not counted twice. By using these methods, at least one observer walked within 10 m of all points in the study sites. Diefenbach et al. (2003) reported nearly 100% detection of breeding grassland birds within 25 m of observers, and Roberts and Schnell (2006) recommended that observers walk within 10 m of all points in fixed areas when calculating density of wintering grassland birds. Thus, we assumed 100% detection during our surveys. One observation of an American Kestrel (*Falco sparverius*) observed foraging above a study site during a survey was included in the counts.

**Statistical Analyses.**—We used three bird community metrics to compare bird use of mowed and unmowed buffers: total abundance, species richness, and total avian conservation value (TACV). The latter is an index used to assess the relative conservation value of different sites that incorporates the biological vulnerability and the regional importance of each species (Nuttall et al. 2003). We calculated TACV by multiplying each species' abundance by its Partners in Flight conservation priority rank (Carter et al. 2000, Nuttall et al. 2003) for the Mid-Atlantic Bird Conservation Region (Partners in Flight 2008), and then summing the species-specific TACV scores within a site (Conover et al. 2007, 2009). We categorized each bird species as either a grassland or scrub-shrub species based on literature of species assemblages (Askins 1993, Vickery et al. 1999, Hunter et al. 2001, Sauer et al. 2008, Schlossberg and King 2008, Poole 2010).

We calculated the mean of each bird community metric and species' abundance across the three rounds of bird surveys, and used the means as response variables in statistical analyses. Bird and vegetation metrics were not normally distributed within treatments, and we used generalized linear mixed models (GLMM) in Proc GLIMMIX (SAS Institute, Cary, NC, USA) to compare responses in mowed and unmowed treatments. We specified a Poisson distribution for models of bird metrics and either a log-normal or a Poisson distribution for models of vegetation metrics. We treated management type (mowed or unmowed) as a fixed factor, buffer as a random block (to account for the paired study sites), and grass type (cool- or warm-season) as a random factor. We included study site area as an offset in all bird models because study sites differed in area, and

TABLE 1. Vegetation characteristics (mean  $\pm$  SE) in mowed and unmowed buffers on the Eastern Shore of Maryland, winter 2007.

Vegetation characteristic	Management type		F	P
	Mowed	Unmowed		
Vertical density	5.5 $\pm$ 0.9	21.9 $\pm$ 2.7	115.4	<0.001
Maximum height, cm	3.2 $\pm$ 0.1	4.6 $\pm$ 0.1	158.3	<0.001
Litter depth, cm	4.7 $\pm$ 0.7	4.4 $\pm$ 0.7	0.1	0.72
Percent cover				
Grass	3.2 $\pm$ 0.2	3.6 $\pm$ 0.2	5.1	0.045
Forbs	4.1 $\pm$ 2.1	5.7 $\pm$ 3.0	8.2	0.016
Trees	0.1 $\pm$ 0.1	0.6 $\pm$ 0.3	4.0	0.070
Litter	3.9 $\pm$ 0.4	3.5 $\pm$ 0.4	3.7	0.078
Bare ground	5.1 $\pm$ 1.4	2.9 $\pm$ 2.6	3.5	0.086

included width as a covariate because buffer width influences bird communities (Best 2000, Clark and Reeder 2005, Blank et al. 2011). We only analyzed the species-specific responses of Savannah Sparrow (*Passerculus sandwichensis*), Song Sparrow (*Melospiza melodia*), and White-throated Sparrow (*Zonotrichia albicollis*) because we could not fit appropriate models to the distribution of other species due to a lack of detections in most study sites. We considered a test result statistically significant at  $P \leq 0.05$ .

## RESULTS

Vertical vegetation density, maximum height, percent cover of grass, and percent cover of forbs were significantly greater in unmowed than in mowed buffers (Table 1). We detected 412 birds in buffers, of which 98% were in unmowed buffers. We observed five species in mowed buffers and 14 species in unmowed buffers. Eight species were grassland or scrub-shrub birds (Table 2) and constituted 92% of all detections. The Song Sparrow was the most abundant species (45% of detections), followed by Field Sparrow (*Spizella pusilla*; 19%), and Savannah Sparrow (10%). Savannah Sparrow ( $F_{1,12} = 6.36$ ,  $P = 0.027$ ), Song Sparrow ( $F_{1,12} = 16.54$ ,  $P = 0.001$ ), and White-throated Sparrow ( $F_{1,12} = 5.68$ ,  $P = 0.035$ ) were all more abundant in unmowed than in mowed buffers. Total abundance, species richness, and TACV were all greater in unmowed than in mowed buffers (Table 3).

## DISCUSSION

Wintering bird use of mowed buffers was less than in unmowed buffers. All bird community

TABLE 2. Mean density (birds/10 ha  $\pm$  SD) of grassland and scrub-shrub bird species detected in mowed and unmowed buffers on the Eastern Shore of Maryland, winter 2007.

Common name	Scientific name	Management type	
		Mowed	Unmowed
American Kestrel	<i>Falco sparverius</i>	0.0 $\pm$ 0.0	0.1 $\pm$ 0.5
Eastern Bluebird	<i>Sialia sialis</i>	0.0 $\pm$ 0.0	0.1 $\pm$ 0.4
Field Sparrow	<i>Spizella pusilla</i>	0.0 $\pm$ 0.0	11.3 $\pm$ 34.7
Savannah Sparrow	<i>Passerculus sandwichensis</i>	0.6 $\pm$ 2.1	7.2 $\pm$ 16.2
Song Sparrow	<i>Melospiza melodia</i>	2.1 $\pm$ 5.3	70.1 $\pm$ 60.1
Swamp Sparrow	<i>M. georgiana</i>	0.0 $\pm$ 0.0	5.5 $\pm$ 13.3
White-throated Sparrow	<i>Zonotrichia albicollis</i>	1.6 $\pm$ 5.7	15.9 $\pm$ 51.0
Dark-eyed Junco	<i>Junco hyemalis</i>	0.7 $\pm$ 2.4	3.4 $\pm$ 12.2

metrics and species' abundances tested were significantly greater in unmowed than in mowed buffers, and 98% of all bird detections were in unmowed buffers. Wintering birds use herbaceous habitats for foraging, roosting, and escape cover (Watts 1990, Marcus et al. 2000, Smith et al. 2005, Conover et al. 2007) and fall mowing removes valuable habitat that wintering birds could otherwise exploit (Harper 2007).

These results are especially important because most birds detected in unmowed buffers were grassland or scrub-shrub species, two guilds experiencing substantial population declines (Hunter et al. 2001, Askins et al. 2007, Sauer et al. 2008). Three species detected in buffers (Field Sparrow, Savannah Sparrow, and Dark-eyed Junco [*Junco hyemalis*]) are listed as species of greatest conservation need in Maryland (Maryland Department of Natural Resources 2004). Thus, reducing the practice of fall mowing could provide additional habitat for several birds of conservation concern.

Our findings agree with other studies of wintering bird use in mowed and unmowed herbaceous habitats. Saab and Petit (1992) reported relative bird abundance and species richness were lower on grazed pastures maintained by mowing compared to abandoned pastures in Belize. Marcus et al. (2000) found

greater sparrow abundance in herbaceous field borders than in mowed field edges in North Carolina. However, compared to studies of breeding birds, there have been few studies on the response of wintering birds to mowing of herbaceous habitats.

This study focused on the response of wintering birds to fall mowing but did not examine bird response to mowing at other times of year. Late winter or early spring mowing instead of fall mowing could provide additional habitat for wintering birds (Harper 2007). For example, mowing a buffer on 15 March instead of 15 August could provide 7 months of additional unmowed habitat. There are practical reasons why fall mowing may be preferred, including wet weather or lack of time to mow in late winter or early spring, that should be considered prior to altering mowing schedules. Late winter or early spring mowing may also remove habitat for wintering birds that may have become dependent on unmowed buffers for food or cover. When mowing is necessary, leaving nearby herbaceous areas unmowed will provide habitat that may be a refuge for some bird species (Bryan and Best 1991). Following the recommended guideline of mowing one-third of the area per year will provide more habitat for wintering birds than completely mowing buffers.

TABLE 3. Bird community metrics (mean  $\pm$  SE) in mowed and unmowed buffers on the Eastern Shore of Maryland, winter 2007.

Bird community metric	Management type		F	P
	Mowed	Unmowed		
Total abundance	0.3 $\pm$ 0.2	11.0 $\pm$ 3.1	48.8	<0.001
Species richness	0.5 $\pm$ 0.3	3.3 $\pm$ 0.8	11.0	0.006
Total avian conservation value	0.4 $\pm$ 0.2	19.9 $\pm$ 5.8	94.4	<0.001

Mowing should not be the sole form of management in herbaceous plantings to maintain early successional habitat (McCoy et al. 2001, Harper 2007). Mowing can accelerate grass succession and litter accumulation which creates unfavorable conditions for wildlife (McCoy et al. 2001). Burning, discing, and targeted herbicide applications may be more effective than mowing for maintaining optimal early successional habitat for wildlife (Harper 2007).

### CONSERVATION IMPLICATIONS

Our results clearly indicate the negative impacts of fall mowing of herbaceous buffers on wintering bird communities in Maryland. This study has implications for the mowing schedules of many types of herbaceous habitats, including lawns, meadows, grasslands, and powerline rights-of-ways, and has particular relevance to management of herbaceous CRP or CREP plantings. When possible, leaving these herbaceous areas unmowed through winter will likely provide better habitat for wintering birds.

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