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Giving-up Density of Moist-soil Seeds By Dabbling Ducks in the Mississippi Alluvial Valley

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Extended Abstract: Moist-soil wetlands are important habitats for migrating and wintering waterbirds and have been increasingly incorporated into waterfowl management complexes in the Mississippi Alluvial Valley (MAV) and elsewhere in the United States. As expanding human development, potential climate change, and increasing agricultural intensification threaten to reduce wetland areas for wildlife, managers should improve quality of wetlands and ensure adequate habitat exists to meet goals of the North American Waterfowl Management Plan and other conservation initiatives.

Managing moist-soil wetlands for early succession vegetation (e.g., annual grasses, sedges, and smartweeds) can increase natural plant and invertebrate foods. Farmers and wildlife managers in the MAV often use disking and mowing to maintain early succession plant communities; and, in fall, create openings in robust emergent vegetation which may otherwise deter late fall-early winter waterfowl use. Fall manipulation of moist-soil vegetation (e.g., mowing, disking, or rolling) and sequential flooding can increase winter waterfowl use and maintain early succession plant communities the following year in moist-soil wetlands (Gray et al. 1999, this study).

Previous research indicates waterfowl intensively use food resources in moist-soil wetlands, although estimates of carrying capacity for these wetlands do not include an experimentally evaluated estimate of "giving-up" density (GUD) – a lower threshold of food availability at which waterfowl may cease foraging or abandon habitats because nutrient acquisition does not meet physiological needs given costs of additional foraging (Stephens and Krebs 1986). Previous studies have estimated GUD for rice grain in flooded rice fields at 50 kg/ha in the MAV (Greer et al. 2009); however, no previously published study has reported a GUD for seeds, tubers, and aquatic macroinvertebrates in moist-soil habitats. Estimates of GUD in moist-soil wetlands would enable wildlife managers to determine waterfowl carrying capacity accurately and enhance efficiency of habitat conservation planning.

We evaluated waterfowl use and food resource dynamics in managed moist-soil wetlands in winters 2006 – 2009 in the MAV to estimate food density at which waterfowl abandoned, stopped foraging in, or greatly reduced depletion of food resources per unit effort (% ducks foraging/survey). We found that combined late-winter moist-soil seed, tuber, and invertebrate abundances in mowed, disked and non-manipulated moist-soil wetlands were ~50% lower than in late fall, but remained ~7 times greater than the GUD estimate for harvested rice fields. Additionally, seeds, tubers, and invertebrates did not decline markedly from December 2006-2007 – February 2007-2008, in spite of continued waterfowl foraging activity in these wetlands during winter. Therefore, we designed a field

experiment to estimate GUD for seeds in moist-soil wetlands.

We conducted a pilot experiment to estimate GUD in February – March 2008. In early February after the waterfowl hunting season, we added a surrogate moist-soil seed, Japanese millet (*Echinochloa esculenta;* hereafter millet), to 2 moist-soil wetlands which had been heavily used by waterfowl on private land throughout winter 2007 – 2008. We added millet in 3 densities (50 kg/ha [GUD in harvested rice fields; Greer et al. 2009], 250 kg/ha [a preliminary GUD estimate for moist-soil wetlands; this study], and 550 kg/ha [late fall MAV moist-soil seed and tuber abundance; Kross et al. 2008]). We collected waterfowl abundance and foraging data 4 – 5 times per week and soil cores alternate weeks until early March 2008.

During our pilot experiment, waterfowl abandoned experimental wetlands when 202 kg/ha (SE = 24.1) of moist-soil seeds and millet remained. Because it was ~4 times greater than GUD in harvested rice fields (50 kg/ha), we designed a larger scale experiment for winter 2008 – 2009.

During summer and fall 2008, we used herbicide applications (Glyphosate) to deter seed production but preserve vegetative structure in 7 moist-soil wetlands in Mississippi and Tennessee. We collected 10 soil cores to determine the density of seeds and tubers present in the seed bank before addition of millet in each experimental area and again at monthly intervals from 15 December 2008 – 5 March 2009. We collected waterfowl abundance and foraging data 3 – 5 times per week during the same interval.

Core samples from 3 sites with partial sample processing at this time indicated that natural moist-soil seed abundance was 213 kg/ha (SE = 72.1) and millet was 38 kg/ha (SE = 24.2) after waterfowl stopped foraging or ceased significant depletion of seeds and tubers. Natural seeds were depleted by 40% (SE = 6.3) while millet declined by 86% (SE = 4.9).

In a separate experiment, we estimated decomposition of millet to be 34% (SE = 4.1) in experimental wetlands during the same period.

We will process remaining core samples and provide GUD estimates that integrate our complete data set.

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