Poster; Travel Scholarship; Presentation Award

Red Oak Acorn Production and Abundance in the Mississippi Alluvial Valley

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Extended Abstract: Seasonally flooded bottomland hardwood (BLHW) forests in the Mississippi Alluvial Valley (MAV) are critically important wintering habitat for a variety of waterfowl, especially mallards (*Anas platyrynchos*) and wood ducks (*Aix sponsa*). Ducks exploit red oak acorns (*Quercus spp*; Subgenus *Erythrobalanus*) and aquatic invertebrates in these lowland forests. Information documenting red oak acorn production in the MAV is from studies at Mingo National Wildlife Refuge (NWR) in southeast Missouri, Noxubee NWR in east-central Mississippi, and Monsanto Farm and Wildlife Management Area near Stuttgart, Arkansas. These studies reported cumulative acorn production through winter, which does not accurately represent potential availability of acorns for ducks and other wildlife. In addition, these studies lacked replication; therefore; inferences may not apply to the MAV. Thus, our objectives are to estimate (1) red oak acorn production and abundance and (2) potential duck-existence days (DED) from red oak acorns in the MAV.

We conducted a pilot study during winter 2008-2009 and sampled BLHW forests for production and on-the-ground abundance of red oak acorns at Noxubee NWR and Delta National Forest in Mississippi, USA (Fig. 1). Acorn production is defined as sound mast (i.e., solid acorns that sink in water) produced by red oak trees and subsequently dried to constant mass, whereas abundance is dry mass of acorns on the ground and potentially available as wildlife forage under flooded or non-flooded conditions. Both study sites included a green-tree reservoir (GTR; i.e., BLHW area impounded by a levee and artificially flooded November-January) and naturally flooded (NFF) tract of BLHW forest.

Figure 1. *Study sites where acorns were collected during winter 2008-2009 (stars) and future study sites for 2009-2012 (circles) within the Mississippi Alluvial Valley (shaded region).*

We established 20, 0.2-ha circular plots using a generalized random tessellation stratified spatial design in each of 2 GTRs and 2 NFFs ($n = 80$). We only included plots that contained ≥ 1 red oak tree ≥ 25 cm DBH. We measured acorn production by installing a 1-m^2 trap in each plot beneath the canopy of a randomly selected red oak tree (≥ 25 cm DBH). We measured acorn abundance by examining 12, 0.27-m^2 subplots systematically placed in the larger 0.2-ha plot. We dried samples of sound acorns to a constant mass and extrapolated masses to kg/ha. We sampled acorn abundance during three time periods, December 2008 – February 2009. We used ANOVA to test for differences in acorn abundance between study sites and among sampling periods and the interaction of these.

Cumulative acorn production was nearly twice as great at Delta National Forest in the MAV of western Mississippi (372 ± 69 [SE] kg/ha) compared with Noxubee NWR in the Interior Flatwoods of eastern Mississippi (242 ± 29 kg\ha). Site and sampling period interacted on variation in acorn abundance ($F_{2, 109} = 4.36$, $P = 0.015$). Acorn abundance at Delta National Forest was 4 times greater in January and nearly 10 times greater in February compared to estimates from Noxubee NWR (Fig. 2). Peak abundance of acorns at Delta National Forest occurred in January 2009, whereas peak abundance of acorns at Noxubee NWR was in December 2008 (Fig. 2). Across all sites and sampling periods, acorn abundance was greatest at Delta National Forest in January 2009 (96 ± 26 kg/ha).

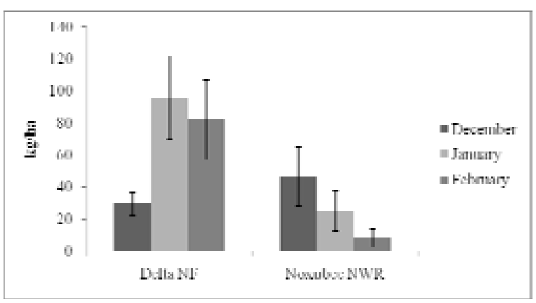

Figure 2. *Estimated abundance of red oak acorns (with standard error bars) at Delta National Forest and Noxubee NWR during three periods in winter of 2008-2009.*

Average cumulative acorn production across study sites ($\bar{x}$ =307 ± 52 kg/ha) far exceeded our maximal January 2009 estimate of acorn abundance. Therefore, simply using production estimates to infer acorn abundance and potential availability is unwarranted. One reason for this discrepancy is our production estimate is positively biased, because we sampled only under the canopy of red oak trees. In contrast, our abundance estimate is unbiased and accurately reflects potential availability to waterfowl, because we sampled ground plots regardless of the presence of a red oak canopy. To our knowledge, our unbiased estimate of acorn abundance is the first for the MAV.

Species differences between red oak trees at Delta National Forest and Noxubee NWR likely explain the difference in timing of acorn fall between our study sites. Nuttall oaks (*Q. nuttalli*), which retain acorns longer into winter, represented 95% of trees sampled at Delta National Forest. In contrast, water (*Q. nigra*), willow (*Q. phellos*), and cherrybark oaks (*Q. pagoda*) were sampled at Noxubee NWR and typically drop acorns earlier in winter.

Comparison of acorn abundance with other natural seeds for waterfowl forage, such as moist-soil seeds, indicates peak abundance of acorns is low. Abundance of moist-soil seeds across the MAV was recently estimated at >550 kg/ha (Kross et. al 2008). In contrast, our greatest estimate of acorn abundance was 96 kg/ha. However, estimates of moist-soil seed abundance are for late fall-early winter before most wintering waterfowl arrive in the MAV. Our acorn and moist-soil seed research is continuing to provide estimates of abundance and carrying capacity for both BLHW forests and moist-soil wetlands.

We will expand our acorn study to sites throughout the MAV for 3 additional years. Our MAV-wide estimates of acorn and aquatic invertebrate abundances will complement our earlier estimates of seed abundances for croplands and moist-soil wetlands (Kross et al. 2008), thus providing data to estimate foraging carrying capacity of agricultural and natural wetlands used by waterfowl in the MAV.

Kross, J., R.M. Kaminski, K.J. Reinecke, E.J. Penny, and A.T. Pearse. 2008. Moist-soil seed abundance in managed wetlands in the Mississippi Alluvial Valley. Journal of Wildlife Management. 72:707-714.