EFFECTS OF DORMANT SEASON FLOODING ON PIN OAK (*QUERCUS PALUSTRIS*) ROOT GROWTH

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PURPOSE AND SCOPE

Many bottomland forests in the Lower Mississippi Alluvial Valley have experienced changes to their historic hydrologic regimes (Heitmeyer et al. 2006). Some forests, managed as greentree reservoirs (GTRs), are artificially flooded during the late fall/early winter to create seasonal habitat for migratory waterfowl. Oak species (*Quercus* spp.) provide important habitat structure and a food source via acorn production in GTRs. Observations of oak mortality and poor regeneration success create concerns for sustaining the oak component, habitat quality, and forest health. Relatively little is known about how artificial flooding for waterfowl habitat may contribute to the decline of oaks in these forests. This flooding often occurs earlier in the year, when soil temperatures may still be relatively warm compared to that of historic hydrologic conditions. We conducted this study to determine how flooding during the apparent dormant season affects above and belowground growth of pin oak (*Q. palustris*) seedlings overwintered at different soil temperatures.

METHODS AND APPROACH

This study was conducted in a greenhouse at the Center for Bottomland Hardwoods Research in Stoneville, MS. Pin oak acorns were sown into 1-L nursery pots filled with potting mix, and the resulting seedlings were grown in a greenhouse. Seedlings of similar size and morphology were randomly selected and placed into insulated water baths arranged in a 3 by 2 factorial, randomized complete block design. Soil temperature treatment levels were 5, 10, and 15 °C, and flooding treatment levels were 60-day soil flooding from January 6 to March 7 and no soil flooding. A random sample of seedlings were destructively sampled every 30 days and measured for tap root, lateral root, stem, and leaf masses. We used linear mixed effects models to test the effects of soil flooding, soil temperature, time, and their interactions on seedling biomass growth. Statistical differences were determined using an alpha of 0.05.

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FINDINGS AND IMPLICATIONS

Soil temperature and soil flooding had no significant effects on stem or leaf masses ($P \geq 0.108$). Tap root mass was affected by the interactions of soil flooding and soil temperature ($P = 0.040$) and soil flooding and time ($P = 0.013$). Seedlings that did not receive soil flooding had the greatest root mass at the highest soil temperature, and those that did receive soil flooding showed a similar tap root mass for all temperature levels. Additionally, seedlings raised in 15 °C soil and subjected to flooding developed a lesser tap root mass than those that did not experience soil flooding. Seedlings subjected to soil flooding, regardless of temperature, showed reduced tap root mass during and immediately after flooding, however, tap root mass did not differ between these treatment levels by the end of the study (fig. 1).

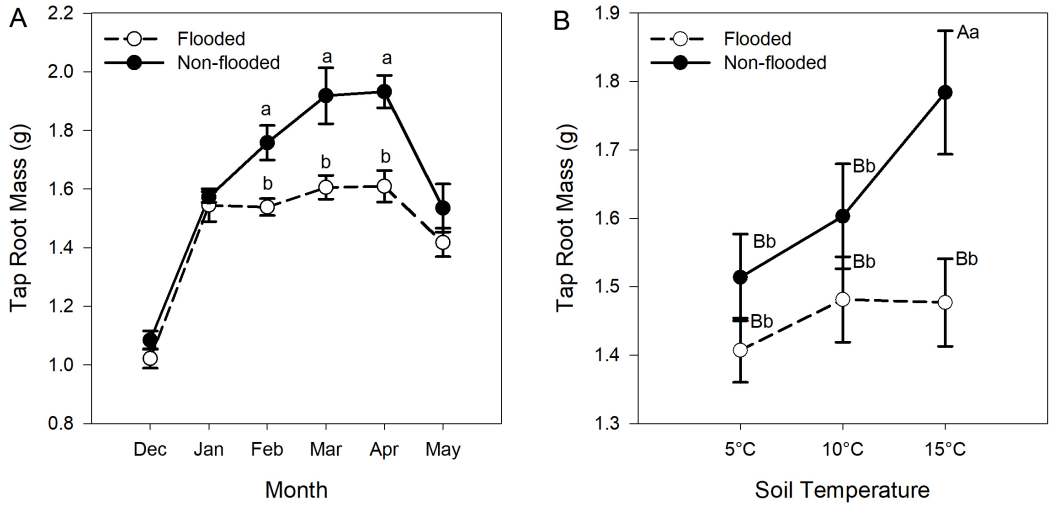

Figure 1—Mean tap root mass by flooding treatment through (A) time and (B) soil temperature. Lowercase letters indicate significant differences between (A) flooding levels and (B) soil temperature levels within a flooding level; (B) uppercase letters indicate significant differences between flooding levels within a soil temperature level. Error bars show one standard error from the mean.

Pin oak seedlings subjected to soil flooding in the late fall/early winter showed reduced root growth, with the greatest reduction occurring at the highest soil temperature. Delaying the application of floodwater in GTRs until soil temperatures cool to 10 °C or less may limit the effects of flooding induced stress on pin oak seedlings. Following drainage, seedlings in all temperature treatments recovered from flooding stress. The ability of pin oak to recover from 60 days of apparent dormant season soil flooding is indicative of their resilience to this stress, however, more severe effects are expected with increased flooding depth or duration (Hall and Smith 1955).

LITERATURE CITED

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ACKNOWLEDGMENTS

Funding for this work was provided by Missouri Department of Conservation through cooperative agreement 434 under the master memorandum of understanding MCC-01-01-00; the Pittman-Robertson Wildlife Restoration Program (Grant #AR-W-F 14AF002920) of the U.S. Fish and Wildlife Service, through an agreement with the Arkansas Game and Fish Commission; U.S. Department of Agriculture, National Institute of Food and Agriculture, McIntire-Stennis Federal Capacity Funds; and the U.S. Department of Agriculture, Forest Service, Southern Research Station.