MORTALITY TRENDS AND TRAITS OF HARDWOOD ADVANCE REGENERATION FOLLOWING SEASONAL PRESCRIBED FIRES

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Fire ecology studies in eastern hardwood forests generally use traditional, plot-based inventory methods and focus on sprouting stems to detect changes in vegetative composition and structure. Fire intensity often is not quantified or even subjectively classified and, if quantified, is not used in subsequent analysis. Consequently, reported responses of hardwood regeneration to prescribed fires vary widely.

To better understand the varying responses among regeneration of common hardwoods to fire, an individual stem mortality approach was employed. Six hundred stems of eight different species were tagged before winter, spring, and summer prescribed burns conducted in 1995. Fire intensity was classified into four categories (low, medium-low, medium-high, and high) based on fuel consumption and fire behavior. Stems not sprouting following topkill were examined for possible causes of mortality.

Among species, hickory (*Carya* spp.) and five upland oak species including black (*Quercus velutina* Lam.), chestnut (*Q. prinus* L.), northern red (*Q. rubra* L.), scarlet (*Q. coccinea* Muenchh.), and white (*Q. alba* L.) were the most resistant to fire with < 15 percent of all stems failing to sprout following topkill. Mortality for these species was highest following moderate- to high-intensity summer fires. Red maple (*Acer rubrum* L.) exhibited little mortality following winter fires but experienced moderate to heavy mortality after spring and summer fires, especially as fire intensity increased. Tulip-poplar (*Liriodendron tulipifera* L.) had moderate to high levels of mortality regardless of season-of-burn.

Tagged stems that failed to sprout were examined for common traits that may indicate why they were susceptible to complete kill while others of the same species were not. Root collar diameter, root collar depth (location in relation to the soil surface), and fire intensity were strongly correlated with rootstock survival and subsequent sprouting while height and previous growth were not. Generally, stems of all species whose root collar was < 0.10 inch diameter and located at the soil surface were completely killed by winter fire regardless of fire intensity. Root collar diameter and root collar depth had to increase to >0.20 and >0.25 inches, respectively, as fire intensity increased and season-of-burn changed to spring or summer.

Our findings indicate why oak and hickory, with their seed burial, hypogeal germination, and root-development strategies are more likely to survive surface fires than many of their competitors. Also, root collar diameter and depth need to be considered during regeneration inventories and before prescribing fire as a silvicultural treatment.

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