PRESCRIBED FIRE EFFECTS ON WILDLIFE IN EASTERN OAK ECOSYSTEMS

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Extended abstract—Fire is being prescribed and used increasingly in eastern oak ecosystems to promote open forest conditions (e.g., oak woodlands and savannas) that enhance habitat for wildlife (Brose and others 2014, Harper and Keyser 2016, USDA Forest Service 2015). Recent research has provided a better understanding of the effects of fire on wildlife in the Central Hardwoods and Appalachian regions. Recently, a comprehensive review summarizing research on fire effects on wildlife in these regions was completed with prescriptive recommendations for burning for various wildlife species and guilds (Harper and others 2016).

Managers sometimes are unclear as to why they are burning. Too often, objectives are ambiguous. Furthermore, motivation to burn is often limited without the ability to predict the values, benefits, and costs. "Burning is good for wildlife" is commonly stated. However, effects of fire vary greatly by fire conditions and among wildlife species, and not all species benefit from fire (Rush and others 2012). The notion that "fire is good for wildlife" is just as false as it is true. Because of the diverse requirements of wildlife species that occur in the region, species of interest should be identified in the management plan to ensure fire is implemented in a way that enhances conditions for focal species. Furthermore, for those species that may benefit from fire, how fire is implemented and the resulting fire effects determine whether and the extent to which fire is beneficial or detrimental. Explicit reasoning for how fire will benefit the species should be articulated.

The primary effects of burning on wildlife are indirect (Smith 2000). Fire alters plant structure and composition, which affect habitat quality through food and cover availability. Indirect effects are influenced by fire frequency, fire intensity, and season of burning. Unless fire intensity is great enough to reduce canopy closure, then additional canopy reduction treatments (mechanical or chemical) that allow a minimum of 20 percent of full sunlight to reach the forest floor will be necessary to realize a meaningful understory vegetation response (McCord and others 2014). Low-intensity fire following regeneration harvests, various thinnings, and improvement cuts can be used to enhance food and cover for wildlife without damaging trees retained in the overstory (Lashley and others 2011). Canopy removal without repeated fire commonly stimulates increased woody stem density, which may be desirable for some species, but not for others (Bakermans and others 2012, Kendrick and others 2015, Semlitsch and others 2009, Vander Yacht and others 2016). Oak savanna and oak woodland restoration efforts typically retain 5–30 percent and 30–80 percent overstory coverage, respectively, and require relatively frequent fire (≤ 3- to 6-year mean fire return interval) to provide habitat for species that require more open structure and maintain groundcover dominated by herbaceous species (Nelson 2005; Stambaugh and others 2016; Vander Yacht and others 2017a, 2017b).

A fire-return interval of 2–6 years in forests with partial canopy cover benefits a variety of wildlife species, depending on site and objectives, by providing diverse understory structure for nesting and cover, and increased browse, forage, insect abundance, and soft mast (Chitwood and others 2017, Greenberg and others 2013, Lashley and others 2011, McCord and others 2014), but see Lashley and others (2017). Within this range of fire frequency, shorter return intervals maintain shorter understory structure with more visibility, whereas longer intervals maintain taller understory structure and less visibility, which can influence use by different wildlife species (Ford and others 2016, Greenberg and others 2013, Lashley and others 2015a).

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Periodic burning during the early growing season (April–May) has not led to compositional change from periodic burning during the dormant season in the Central Hardwoods and Appalachian regions; woody sprouts continue to dominate response (McCord and others 2014). Burning during the latter portion of the growing season (August–October) provides additional burn days, provides increased heterogeneity of cover, may alter composition with increased forb coverage and reduced woody resprouting, expands availability of high-quality forage, and alleviates concerns with burning during reproductive periods of most wildlife species (Gruchy and others 2009; Harper and others 2016; Lashley and others 2015b; Nanney and others, in press; Weir and Scasta 2017). Regardless, repeated burning over time usually is necessary to affect considerable change in vegetation composition (Knapp and others 2015).

Direct effects of prescribed fire on wildlife (injury/death) are relatively rare and largely associated with timing, intensity, and firing technique (Ford and others 1999, Howey and Roosenburg 2013). In particular, several snake species and eastern box turtles (*Terrapene carolina*) are most vulnerable soon after emerging from hibernacula because they are relatively lethargic at that time. Burning early in the growing season would be least desirable where these animals are of concern (Beaupre and Douglas 2012). Nonetheless, there is no indication that prescribed fire in eastern oak ecosystems is leading to reduced populations of any wildlife species (Greenberg and others 2018a), including taxa of conservation concern, such as Indiana bat (*Myotis sodalis*) or northern long-eared bat (*M. septentrionalis*), which are ESA-listed species. Alternatively, there is indication prescribed fire has enhanced conditions for foraging and roosting for these and other bat species (Johnson and others 2010, Silvis and others 2015, Womack and others 2013). Prescribed fire outside the maternal colony period, May through early August, can be implemented to reduce midstory clutter (improving bat foraging conditions) and create snag availability (provide roost sites) with no direct effects (Austin and others 2018).

Burning consumes leaf litter and leads to relatively dry microsite conditions for several months following fire, which is not favorable for some wildlife, including ovenbird (Seiurus aurocapilla; Rush and others 2012), shrews (Matthews and others 2009), or woodland salamanders (Plethodontidae; O'Donnell and others 2015), but is favorable to other species, including various lizards and snakes (Greenberg and others 2018a, 2018b; Matthews and others 2010), supporting the need to articulate objectives prior to burning. However, when burning is allowed to follow environmental patterns, such as being more frequent on south- and west-facing slopes and less frequent in more mesic and productive sites (where woodland salamanders are concentrated), then concern of negatively impacting salamander populations is alleviated (Moorman and others 2011).

We contend a lack of fire in the Central Hardwoods and Appalachian regions is a limiting factor for increased landscape heterogeneity and biological diversity. The lack of fire-mediated communities limits the abundance of many wildlife species, including at-risk species as well as iconic game species. Applying fire on ecologically appropriate sites and at the appropriate scales will help achieve objectives related to wildlife conservation and ecosystem restoration in these regions.

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