

Canopy Reduction and Growing-Season Fire Effects on Deer and Turkey Habitat in Upland Appalachian Hardwoods, Tennessee

In upland hardwoods, understory vegetation provides critical habitat components for a number of wildlife species. In closed-canopy stands, deer and turkey benefit from canopy cover reduction because of increased understory food resources and cover. Frequent prescribed fire can maintain desirable understory conditions after canopy reduction. For deer, fresh resprouting vegetation after fire is more nutritious (especially important for lactating females) and increased understory vegetation improves bedding and fawning cover. For turkeys, a well-developed understory can improve nesting cover and more open post-fire conditions above 1.5 ft post fire can provide better visibility allowing enhanced detection of predators for hens with poults (brooding cover).

Most burning in upland hardwoods occurs during the dormant season, but growing season burns may provide different or additional benefits because of different vegetation responses. University of Tennessee researchers Mark Turner, Jacob Bones, Spencer Marshall, and Craig Harper investigated the effects of canopy reduction followed by frequent early (April/early-May) or late growing season (September-October) burns on white-tailed deer and wild turkey habitat by comparing understory vegetation composition and structure, forage availability and quality, and deer and turkey use (via camera detections). Their findings were published in a 2024 paper in the journal *Forest Ecology and Management*.

Predictions: The authors made several predictions on understory habitat conditions and deer/turkey use in the summer season following the last of six early- or late-growing season burns (2-year return interval)

- Late growing season burns (LGS) will have the greatest understory plant coverage (visual obstruction) the following summer because of a longer vegetation response time after fire.
- Early growing season burns (EGS) will provide the most nutrition (nutritional carrying capacity) for deer because of newly resprouted vegetation is more digestible with increased nutrient availability.
- Deer use: More deer will be detected in EGS units in early summer because of more digestible and nutritious plants; by late summer, deer use will be similar in EGS and LGS.
- Turkey use: More turkeys will be detected in EGS units in early summer because of less visual obstruction above 1.5 feet, which provides greater visibility and predator detection for hens with poults.



Turkey with poults



Doe and fawn



Control Treatment Unit



Early Growing Season Burn Unit



Late Growing Season Burn Unit

Methods:

Study Site and Treatments:

- The study was conducted at the 25,000-acre [Chuck Swan State Forest](#), an hour north of Knoxville, TN. Study sites were four mature 12-acre upland hardwood stands on south to west-facing slopes. Dominant tree species included white oak, black oak, northern red oak, southern red oak, yellow-poplar, and red maple.
- The team divided each stand into three 4-acre units and randomly assigned EGS, LGS, or control (CON) treatments.
- In the EGS and LGS units, shelterwood harvests were conducted in 2010 to allow ~30% sunlight to the understory (residual basal area = 50-60 ft²/acre); no cutting was done in the CON units.
- For both EGS and LGS units, all 6 fires were low-intensity (flame lengths < 3 feet), but the LGS burns generally were less complete and less intense. In particular there was less topkill of understory trees in the LGS burns.

Field Methods:

- *Understory cover*: The team collected the following data in each unit in the first summer (2023) after the most recent burns (LGS: fall 2022; EGS: spring 2023)
 - Cover of vegetation <4.5 ft tall by categories of grasses, forbs, brambles, vines, shrubs, and trees.
 - Understory horizontal visual obstruction at: 0 – 1.6 ft, 1.6 – 3.3 ft, 3.3 – 5.0 ft, and 5.0 - 6.5 ft.
- *Forage quantity and quality*: The team collected plants of selected deer forage in early summer to estimate biomass, crude protein and nutritional carrying capacity (NCC). Samples were analyzed at the Clemson University Agricultural Services Lab.
- *Deer and turkey use*: Camera traps recorded deer and turkey use in early summer (mid-May through June) and late summer (July through mid-August)

Key Findings:

- Canopy reduction followed by frequent burns increased understory plant cover and visual obstruction (0 to 3 ft) substantially compared to the uncut/unburned controls.
- Visual obstruction from 1.6 – 5.0 ft was greater in LGS burn units compared to EGS units (as predicted), as LGS treatments had greater understory bramble and tree cover.
- Select forage biomass was greater in both burn treatments compared to the controls, but nutritional carrying capacity was greater in EGS compared to LGS, as predicted.



Early Growing Season Burn

- Deer and turkey detections with camera traps:
 - There was significantly more deer use in cut and burn units than in controls throughout the summer. As the authors predicted, deer use in early summer was greatest in the EGS units (with newer, more nutritious vegetation), but by late summer deer use was similar in EGS and LGS units.
 - Turkey detections were significantly greater in the EGS units than the LGS units during both the early and late summer periods, likely because of a more open structure above 3 feet, which provided better visibility and predator detection.



Take Home Points:

- In this study, canopy reduction with prescribed fire in both EGS and LGS effectively increased understory vegetation, but the overall vegetation structure differed by burn season because of the differences in vegetation recovery time, as well as fire coverage and intensity, which was lower in the late-summer burns. Managers may therefore adjust fire season and intensity to generate vegetation according to their management objectives.
- For deer, managers should consider implementing fire on the landscape at various seasons to continuously provide highly digestible and nutritious forage.
- For turkeys, managers may consider implementing relatively higher-intensity EGS fires that top-kill more woody saplings to create the open understory structure selected by hens with poults.

Link to Paper: Turner, M.A., Bones, J.T., Marshall, S.G. and Harper, C.A., 2024. Canopy reduction and fire seasonality effects on deer and turkey habitat in upland hardwoods. *Forest Ecology and Management*, 553, p.121657. https://www.appalachianfire.org/files/ugd/696505_8c88571cbcd34ad6833301a9c1f6c9a7.pdf

Related Research: Harper, C.A., Ford, W.M., Lashley, M.A., Moorman, C.E. and Stambaugh, M.C., 2016. Fire effects on wildlife in the Central Hardwoods and Appalachian regions, USA. *Fire Ecology*, 12, pp.127-159. https://www.appalachianfire.org/files/ugd/696505_c7590a23d04c401ca32838ac7acdd3d0.pdf

About the Authors: The lead author, Mark Turner, recently earned a PhD at the University of Tennessee; his doctoral dissertation is titled “*Evaluating the effects of forage availability and landscape composition on white-tailed deer morphometrics across the eastern U.S.*” Craig Harper was his major professor; Craig is a professor and the Extension Wildlife Specialist at the University of Tennessee. To learn more about his work, click [here](#). Photos provided by Mark Turner.