

North Atlantic Fire Science Exchange



**Research Brief for Resource Managers** 

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## Can restoration of fire-dependent ecosystems reduce ticks and tickborne disease prevalence in the eastern United States?

Michael R. Gallagher, Jesse Kreye, Erika Machtinger, Alexis Everland, Nathaniel Schmidt, and Nicholas S. Skowronski (2022) Can restoration of fire-dependent ecosystems reduce ticks and tick-borne disease prevalence in the eastern United States? Ecological Applications, e2637 https://doi.org/10.1002/eap.2637

The mesophication of forests (a shift from drier, fire-adapted ecosystems to wetter, cooler conditions) driven largely by fire suppression has coincided with an increase in tick populations (Figure 1). While tick control measures have focused on preventing individual infections, a larger-scale approach can more effectively address tick-borne disease prevalence. Restoring fire-dependent ecosystems through prescribed fire could be a part of integrated pest management of medically important ticks.

The decline of fire-dependent landscapes through mesophication has been accompanied by increases in habitat for ticks, wildlife hosts such as small mammals, and transmission of tick pathogens between both humans and wildlife (Figure 2). Prescribed fire, the main tool to reverse mesophication, has been used in only a limited capacity to effectively increase diversity of understory plants and wildlife habitat and reduce fuels that could lead to uncontrolled wildfire. Prescribed fire also

## Management Implications

- A paradigm shift is needed from managing tick bites to managing the ecosystems in which ticks are found.
- Forest mesophication and • fragmentation encourages tick populations to thrive.
- Managing land in part with • prescribed fire enhances firedependent natural communities and decreases ticks as a potential health hazard.
- Prescribed fire can have direct and indirect detrimental effects on tick populations.

reduces habitat for *Ixodes scapularis* (deer tick or black legged tick), Amblyomma americanum (lone star tick), Amblyomma maculatum (gulf coast tick), and Dermacentor variabilis (dog tick or wood tick). Ticks prefer high-moisture environments with dense understory growth that allows them to reach the body height of host mammals. Fire creates drier, xeric, and less-dense landscapes.

Fire was once an integral part of the culture and forests of North America, with evidence of intentional burning by Indigenous peoples dating back 5,000

years. Though European colonization changed fire patterns, regular burning continued through the late 1800s to early 1900s, and accounts from as early as the 1700s note the benefits of fire for controlling ticks. Today, 2.6 million hectares (6.4 million acres) of land are managed with fire in the United States annually. Prescribed fire is gaining public acceptance as community-based education and understanding increases.

Prescribed fire is a scientifically sound and increasingly culturally acceptable tool to reduce the transmission of tickborne pathogens. Rehabilitation of degraded fire-adapted communities could reduce tick populations while also creating habitat for fire-adapted species. The timing and frequency of prescribed fire, targeting individual species, can impact the efficacy of applications. Prescribed fire that is aligned with ticks' life stages (and, thus, vulnerability to fire) can cause direct mortality to populations. Second order fire effects can also reduce tick numbers after a burn.

To drastically decrease tick-borne disease in humans, a paradigm shift is needed from managing tick bites to managing the ecosystems in which ticks are found. Prescribed fire as a landscape management strategy can be utilized to decrease the escalating tick populations and associated human-health hazard.



Fire

Tick predators Parasite

nd pathoge

Tick Populations Figure 1. Current ranges of three tick species in the eastern United States. Shading shows the average number of years between fires, before fire suppression.

Figure 2. Fire intensity, frequency, seasonality, and severity impact tick habitat components such as vegetation and soil, wildlife hosts and predators, and, both directly and indirectly through habitat and wildlife interactions, tick populations.

Micro

climate

Soil