The Phenology of Ticks and the Effects of Long-Term Prescribed Burning on Tick Population Dynamics in Southwestern Georgia and Northwestern Florida

Elizabeth R. Gleim, L. Mike Conner, Roy D. Berghaus, Michael L. Levin, Galina E. Zemtsova, Michael J. Yabsley, Plos One, November 2014, Vol. 9, No. 11

In this study, researchers assessed impacts of regular, long-term prescribed fire on tick population dynamics (tick abundance and species composition) in the southeastern United States. The study differed from previous work by examining sites with repeated burns, and by considering how fire interacts with other factors that may influence tick populations, such as microclimate, structure of surrounding vegetation, and host abundance. Previous studies, mostly conducted on small areas and/or after one burn, have generally found that tick populations were reduced immediately post-burn, but rebounded soon after.

A total of 21 study plots, ranging from 7.2 to 78.9 ha (~18-192 acres), were located in northwestern Florida and southwestern Georgia and included the following treatments: 1) burned plots surrounded by burned land (BB), 2) burned plots surrounded by unburned (BUB), 3) unburned plots surrounded by burned (UBB), and 4) control plots, which were unburned surrounded by unburned (UBUB). Control sites had not been burned for at least 10 years, and burned sites were burned during the dormant season every two to four years, over a period of at least 10 years.

Tick sampling occurred monthly over two years during 2010 and 2011, using one-meter-square white flannel cloth flags. Flagging to collect ticks was conducted for at least one hour per site, but only during dry conditions when the temperature was above 7.2°C. Tick species were morphologically identified using a microscope and also through DNA analyses. Host abundance was assessed using trail camera surveys.

Vegetation was surveyed to measure forest canopy closure, tree density, and the composition and percent cover of ground vegetation and litter. Microclimate measurements were taken at all plots using a handheld weather meter, and weather data (including temperature and precipitation on the day of sampling and on the three previous days) were collected from nearby weather stations. Statistical models were used to analyze how tick abundance was affected by long-term prescribed burning, vegetation composition, host abundance, weather, and microclimate.

Tick captures in the various treatment areas varied markedly. Of the total ticks collected (n= 47,184), the vast majority (88.4 percent) was found in the control plots (UBUB) and all but 208 were *Amblyomma americanum* (common name: lone star tick). Another 7.9 percent were caught in the unburned plots surrounded by burned areas (UBB), and just 3.7 percent came from burned plots surrounded by unburned areas (BUB). As with the control, both of these treatments had a high percentage of the lone star tick. In contrast, only 43 ticks (< 0.1%) were captured in the burned plots surrounded by burned plots (BB) and only one was a lone star tick. Instead, 86 percent of captures in BB areas were *A. maculatum* (common name: Gulf Coast tick).

While previous studies concluded that prescribed fire significantly reduced tick populations immediately after a burn, but recovered within a year, the current study found sustained reductions of tick populations in areas subjected to long-term burning. Authors suggest...
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that the previous studies did not see sustained tick reductions due to the fact that they did not simulate real-world conditions (i.e., large-scale, repeated fires) typical of regional prescribed fire practices, which appear to deplete tick source populations.

Statistical modeling did not identify a relationship between host and tick abundance. Trail camera surveys recorded deer and medium-sized mammals, but analyses indicated that their presence did not impact the tick counts. However, because of trail camera limitations, the study was not able to quantify presence of small mammals and birds, known to be important hosts for tick larvae and nymphs. Other studies have shown that small mammals and birds are consistently abundant in the dense, food-rich ground cover that typically grows up following burns, yet, in this study, tick counts in burned areas were considerably lower than in unburned areas. Authors suggest, instead, that this study’s findings indicate that environmental conditions may be more important to tick populations than host abundance in this particular ecosystem.

Unburned plots, where the majority of ticks were collected, generally were hardwood-dominated forests, which tended to be closed-canopied, dense, and moist, with litter-covered, sparse groundcover. Burned plots, with very few ticks, were generally more open-canopied and pine-dominated, which tended to be hotter and drier than unburned plots.

Modeling shows that the factors affecting total tick counts include multi-year prescribed fire, season of year, and variables that would affect their ability to retain moisture. Litter cover greater than 95 percent was associated with a doubling of tick numbers, and greater tree density was associated with nearly a six-fold increase.

This study indicates that long-term repeated burning reduces tick population levels. Thus, authors conclude that prescribed fire may be a cost effective and efficient way to reduce risk of tick-borne diseases. They suggest that future studies should examine the length of time needed to reduce overall tick populations in areas not previously burned, and should include pathogen testing to better understand tick borne disease dynamics in prescribed fire managed landscapes (see Gleim et al. 2019 for new information related to this point).

FOR FURTHER READING

Gleim, E.R, Zemtsova, G.E, Berghaus, R.D., Levin, M.L., Connor, M., and Yabsley, M.J. (2019) Frequent Prescribed Fires Can Reduce Risk of tick-born Diseases. Scientific Reports, 9:9974.