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Spiders' Response to Fire and Fire Surrogate Treatments in the Southern Appalachians



The jumping spider *Naphrys pulex* was significantly more abundant in the fuel reduction treatments than in the untreated control stands.

In forests, spiders are conspicuous in the understory, from the wolf spiders hunting on the forest floor to the orb weavers that we've all ran into in the shrub layer. Spiders are an important component of the woodland food web as significant predators on invertebrate decomposer organisms such as springtails and millipedes. In turn, spiders are prey for many bird species, as well as mammals and amphibians. It is known that the composition and abundance of spider communities is linked with vegetation structure and thus they can serve as biological indicators of forest habitat and forest management practices.

In 2001, a replicate of the national Fire and Fire Surrogate (FFS) Study, funded by the [Joint Fire Science Program](#), was installed in the Blue Ridge of western North Carolina – the Green River Site. The national study compared forest response to fuel reduction and restoration treatments in a variety of forest types that were historically shaped by frequent surface fires. At each site there were three active treatments 1) mechanical/thin only (M), 2) prescribed burn only (B), and 3) mechanical plus burn (MB), as well as untreated controls (C). Green River is one of only a few FFS sites that remain active today, and it has served as an important location for understanding the long-term effects of fuel reduction treatments on wildlife (e.g., breeding birds, reptiles, and amphibians). In addition, Dr. Joshua Campbell and his colleagues have studied the FFS treatment effects on a variety of forest insects. Most recently, Dr. Campbell is the lead author on a 2022 paper titled "*Prescribed fire and other fuel-reduction treatments alter ground spider assemblages in a Southern Appalachian hardwood forest*"

Study Site and Methods

- *Site*: Oak-hickory forests on Green River Game Land, managed by the North Carolina Wildlife Resources Commission. The shrub layer was dominated by mountain laurel and rhododendron.
- *Treatments*: The M treatment consisted of chainsaw felling of shrubs and small trees (<4" DBH) in year 1 on both the M and MB treatments; repeated in year 11 on only the M units. Prescribed burns were conducted on the B and MB treatments in years 2, 5, 11, and 14. Fires were mostly low to moderate intensity; however, on the MB units, the year 2 fires were moderate to high severity with significant overstory mortality due to greater fuel loads after the mechanical treatment.
- *Field sampling of spiders*: Spiders were collected through the growing seasons in years 13-15, with pitfall traps placed on the forest floor. In addition, spiders were collected in colored pan traps placed on the forest floor and in the midstory (30' high); the pan traps were intended to capture bees and wasps (separate study), but also captured a significant number of spiders. The sampling captured both major types of spiders, the hunting spiders and web builders.



Co-author Dr. Cindy Vigueira, High Point University, hoisting colored pan traps into the midstory.

Key Findings

- In all, 1,600 spiders were collected, representing 151 species. The most abundant groups were the jumping spiders (family Salticidae), wolf spiders (Lycosidae), and the sheet weavers (Linyphiidae). Nearly one-quarter of the spiders were collected in the midstory traps.
- Overall, the long-term fuel reduction treatments led to significant differences in the abundance and species composition of spider communities, by years 13-15.
- The abundance of spiders was generally greater in the fuel reduction treatments compared to the controls. The authors concluded that the more varied understory structure in the treated stands created more varied microhabitats for spiders, which likely contributed to their greater abundance.
- In the MB stands, where canopy openness reached 30%, a greater abundance of herbaceous plants and flowers attracted more insects (see reference below) that are potential prey for spiders, which could also have contributed to greater spider abundance.
- The authors also note that the increased abundance of spiders in treated stands could benefit a variety of birds, mammals, and amphibians, for which spiders are an important food source.

Link to the paper:

Campbell, J.W., Grodsky, S.M., Milne, M.A., Vigueira, P., Vigueira, C.C., Stern, E. and Greenberg, C.H., 2022. Prescribed fire and other fuel-reduction treatments alter ground spider assemblages in a Southern Appalachian hardwood forest. *Forest Ecology and Management*, 510, p.120127. <https://doi.org/10.1016/j.foreco.2022.120127>

Other related papers:

Campbell, J.W., Vigueira, P.A., Viguiera, C.C. and Greenberg, C.H., 2018. The effects of repeated prescribed fire and thinning on bees, wasps, and other flower visitors in the understory and midstory of a temperate forest in North Carolina. *Forest Science*, 64(3), pp.299-306. <https://www.fs.usda.gov/treearch/pubs/56769>

Waldrop, T.A., Hagan, D.L. and Simon, D.M., 2016. Repeated application of fuel reduction treatments in the Southern Appalachian Mountains, USA: implications for achieving management goals. *Fire Ecology*, 12(2), pp.28-47. <https://www.fs.usda.gov/treearch/pubs/52641>



Colored pan traps situated on the forest floor.

The lead author, [Dr. Joshua Campbell](#), is a Research Ecologist with the USDA Agricultural Research Service, located in Sidney, Montana. His current research focuses on native bees and pollination in agroecosystems. While earning a PhD at the University of Georgia in 2005, he studied pollinator communities at the Green River FFS site, and continued research at the site on bees, wasps, beetles, ants, and spiders. Josh made this statement about the research: *“Our study found numerous species of spiders (including two new species!) within different forest fuel-reduction treatments. Spiders are important bioindicators of forest health and our data emphasize how diverse and important southern Appalachian forests are for maintaining important components of the overall food web.”*

SAVE THE DATE

MAY 24-27, 2022 – DILLARD, GA

5 Years Since the Fires of 2016

Join us for 4 days of management and research outcomes since the fall 2016 wildfires. The Southern Blue Ridge FLN and CAFMS are putting together a joint workshop. How has management changed in the wake of the fires and what new research has emerged since the fires?

Registration opens soon at www.sbrfln.com

A Few More Publications from 2021

Our last issue of the [newsletter](#) had a great list of new publications that came out in 2021. We realized that we missed a few, check them out below!

Chongpinitchai, A.R. and Williams, R.A., 2021. The response of the invasive princess tree (*Paulownia tomentosa*) to wildland fire and other disturbances in an Appalachian hardwood forest. *Global Ecology and Conservation*, 29, p.e01734. <https://www.sciencedirect.com/science/article/pii/S2351989421002845>

Hahn, G.E., Coates, T.A. and Aust, W.M., 2021. Soil Chemistry following Single-Entry, Dormant Season Prescribed Fires in the Ridge and Valley Province of Virginia, USA. *Communications in Soil Science and Plant Analysis*, 52(17), pp.2065-2073. <https://www.tandfonline.com/doi/abs/10.1080/00103624.2021.1908327>

Nation, R.E., Alexander, H.D., Denny, G., McDaniel, J.K. and Paulson, A.K., 2021. Impacts of increasing fine fuel loads on acorn germination and early growth of oak seedlings. *Fire Ecology*, 17(1), pp.1-13. <https://fireecology.springeropen.com/articles/10.1186/s42408-020-00088-8>

Perles, S.J., Niu, X.M., Ruth, A.D. and Gibbons, L.D., 2021. Initial conditions influence effects of prescribed burns and deer exclosure fences on tree regeneration and understory diversity in Appalachian oak-dominated forests. *Forest Ecology and Management*, 495, p.119353. <https://www.sciencedirect.com/science/article/abs/pii/S0378112721004412?via%3Dihub>

Fueling Collaboration.... Seasons 1&2

If you missed Fueling Collaboration or just want to re-watch a previous episode you can check them out here: www.fuelingcollab.com

These are interactive panel discussions designed to encourage collaboration between fire managers and scientists. The series is built on questions from the registered attendees.



Save the Date!

The 5th National Cohesive Wildland Fire Management Strategy Workshop will be in Asheville, NC this year!

November 14-18, 2022

Registration will open this summer.



Request for Research Needs

Do you have ideas for research needs in the Appalachian region?

If so, we would like to hear from you! We are compiling a list of research needs to submit to the Joint Fire Science research needs database. Please send your ideas to helen@cafms.org.



Communicate with Us!

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Find us on twitter @APfirescience or find us on Facebook by searching Consortium of Appalachian Fire Managers and Scientists.

Join CAFMS:

The consortium is for all land managers and researchers in the region who deal with any aspect of fire. To join, simply provide us with some contact information at the web site listed below.

www.apalachianfire.org

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