



## CONSORTIUM OF APPALACHIAN FIRE MANAGERS **AND** SCIENTISTS

CAFMS strives to increase and accelerate the flow of fire science and improve land management strategies by connecting fire managers and scientists throughout the Appalachian region.

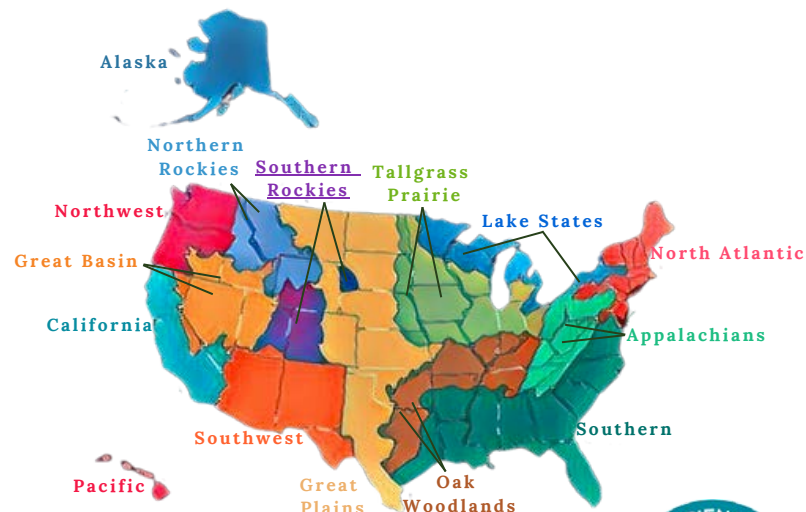


### Newsletter Highlights

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## Contrasting Effects of Prescribed Fire and Wildfire on Terrestrial Salamanders

Terrestrial salamanders in the family Plethodontidae (lungless salamanders) are abundant in eastern forests. Estimating the abundance of salamander populations has been notoriously difficult, because they are nocturnal and spend a majority of time in soil burrows up to a foot deep, only coming to the surface during wetter periods. Recent advances in modeling, coupled with standardized monitoring methods are providing better estimates of salamander abundance. For example, a new study conducted across the range of red-backed salamander found average densities of more than 4,000 per acre, with a biomass comparable to white-tailed deer and mice within forest ecosystems (Grant and others 2024). Terrestrial salamanders require moist conditions for respiration through their skin. They are carnivorous, consuming numerous soil and litter invertebrates, and thus play a significant role in slowing leaf litter decomposition and affecting soil nutrient cycling. They also are an important prey source for other animals including birds, mammals, snakes, turtles, and frogs (Davic and Welch 2004).

Because fire consumes leaf litter and can alter the microclimate of the forest floor, there has been concern that prescribed burning may have negative impacts on terrestrial salamander populations. In response, a number of studies have examined the effects of prescribed fire on salamander populations in the eastern U.S. Most research has concluded that low-intensity prescribed fire has relatively little impact on salamander populations in the short-term, but due to the difficulties of estimating abundance, there remains need for further study. Much less research has been conducted on the effects of wildfire on salamanders in the eastern region. Here we summarize the findings from two recently published papers on the effects of fire on terrestrial salamanders; the first focuses on low-intensity prescribed fire and second on moderate- to high-severity wildfire.

**Prescribed Fire Effects in Southern Indiana Hardwood Forests Ochs, A.E., Swihart, R.K. and Saunders, M.R., 2024. Population-level effects of prescribed fires on terrestrial salamanders. *Forest Ecology and Management*, 560, p.121842.**



Alison Ochs conducting field work. Photo by Alison Ochs.

This study estimated the abundance of red-backed (*Plethodon cinereus*) and zigzag (*Plethodon dorsalis*) salamanders together over a four-year period spanning before and after prescribed fire, and compared those estimates to those found in nearby unburned sites. The research team also estimated fire intensity and measured key environmental factors for salamander habitat. The authors predicted that prescribed fire would result in some decrease in salamander abundance due to potential negative impacts on their forest floor and soil habitat (reduced litter, lower soil moisture, higher soil temperatures).

### Study Site and Methods:

- The study was conducted in two State Forests (Morgan-Monroe and Yellowwood), in stands within the Hardwood Ecosystem Experiment (HEE). For both burned and unburned treatments, study plots were located on both xeric (oak-hickory) and mesic (tulip poplar, beech, maples) slopes. No recent harvesting had occurred on these sites.
- Sampling grids, each consisting of 45 untreated poplar cover boards were established in 2019 and were checked for salamanders multiple times in spring and fall of each year 2019-2022. Leaf litter depth and soil moisture were also quantified within the sampling grids.

- Salamanders found beneath the cover boards were marked with visual implant elastomer marks to provide mark-recapture data.
- During the study, one low-intensity dormant-season prescribed fire (target flame lengths 1-3') was conducted at each burn site in spring or fall, in either 2020 or 2021 (each grid thus included pre- and post-burn monitoring). In addition, these units had been burned once prior to this study, between 2015 and 2017. Fire intensity was estimated with temperature-sensitive paint tags and the height of bark char.
- Models were used to estimate the effects of fire and environmental conditions on salamander populations.

### **Key Findings:**

- Litter depth was reduced more where fire intensity was greater but soil moisture was not affected by fire.
- Throughout the study, each grid was checked 63 times, and a total of 4922 salamanders were found (2923 red-backed; 1947 zigzag), of which 1939 were re-captures. Total captures were similar between unburned (216-613) and burned (149-524) grids. Throughout the study, more salamanders were generally captured when litter depth and soil moisture were greater.
- The models did show some variable fire effects on estimates of post-burn survival and emigration, but estimates of abundance did not indicate a significant fire impact.
- The authors concluded that annual and seasonal factors (e.g., soil moisture) had a much greater effect on salamander captures than did prescribed fire.

### **Take Home Points:**

- Two quotes from the paper provide the take home points:
  - “Overall, we found few and small effects of prescribed fire on terrestrial salamanders”
  - “Prescribed fires for oak regeneration in the Midwest may have little effect on salamander populations over time frames comparable to our study.”
- However, the authors also caution that more research is needed to examine the response of salamander populations to repeated prescribed fires over longer time periods.



[Alison Ochs](#) conducted this study for her PhD dissertation at Purdue University. She is currently a postdoctoral fellow at Carlton University in Ottawa, Canada. Robert Swihart and Mike Saunders were advisors and are faculty members in the [Department of Forestry at Purdue](#).



**Wildfire Effects in the Southern Appalachians Wilk, A.J. and Peterman, W.E., 2024. Impacts of wildfire burn severity on plethodontid salamander populations of Great Smoky Mountains National Park. Herpetologica, 80(2), pp.199-208.**

The southern Appalachians support an exceptionally high diversity of terrestrial salamanders. This study was conducted in and adjacent to the nearly 15,000 acre Chimney Tops Two wildfire that occurred in Great Smoky Mountains National Park in 2016. This wildfire and others in 2016 exhibited a range of fire severities and delayed tree mortality occurred where fires burned deep into the duff layer, consuming fine roots (Carpenter and others 2021). Here, salamander abundances were estimated five years after the wildfire across a variety of elevations and burn severities, as well as in similar sites in adjacent unburned areas. The authors predicted 1) fewer salamanders within the burn boundary, 2) high severity burned sites would support fewer salamanders than low severity burn sites, 3) salamanders would tend to be larger on burned sites, because smaller salamanders are more susceptible to desiccation, and 4) within the burn boundary, salamander abundance would be greater near the burn perimeter than in the interior, due to some immigration from adjacent unburned habitat.

**Study Site and Methods:**

- Sampling sites were located within the burn boundary (35 sites) and also in a 4.6 mile buffer zone of unburned forest around the burned area (30 sites). Sites were balanced across five elevation classes and five burn severity classes (based on satellite imagery). Primary forest types were chestnut oak, northern hardwood, oak-hickory, and yellow pine.
- At each site in the summer of 2021, three nocturnal visual encounter surveys were conducted to record salamanders (species, size). Twelve species were recorded but analyses focused on five: red-cheeked (*Plethodon jordani*), northern slimy (*Plethodon mglutinosus*), pygmy (*Desmognathus wrighti*), imitator (*Desmognathus imitator*), and the Blue Ridge two-lined (*Eurycea wilderae*).
- Data analyses: Topographic data and weather conditions during the surveys were used in data analyses to incorporate the probability of detection. Models were fit to estimate the abundance of each of the five species, based on detection probabilities, burn status (in or out of burn boundary), and burn severity class.



**Key Findings:**

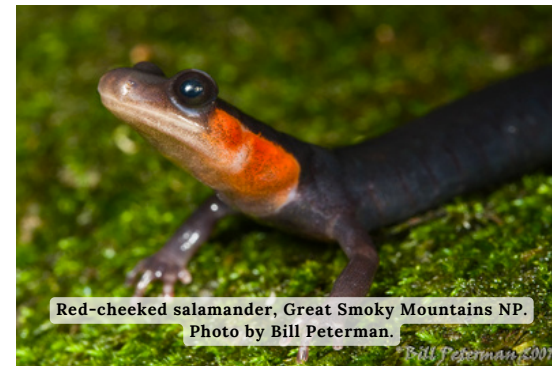
- Among the five species, 1,718 individuals were recorded in the surveys; the most common was the red-cheeked salamander (991).
- All five species were much less abundant on sites within the burned area compared to sites outside the burned area. Also, within the burn, all five species tended to have decreased abundance with increasing burn severity.
- For three of the five species, individuals trended toward larger sizes on burned sites, as predicted, due to greater desiccation risk to smaller individuals.
- The imitator salamander was more abundant closer to the burn boundary, suggesting post-burn immigration from unburned habitat, but results were less clear for the other species, suggesting limited immigration.

## Take Home Points:

- Salamander populations were severely impacted throughout the Chimney Tops Two wildfire boundary, which generally burned at moderate to high severity. This contrasts with previous work showing that salamander populations can recover quickly after low severity wildfire.
- The degree to which fire impacts were caused by direct mortality during the fire or due to indirect effects on their habitat (e.g., forest floor consumption, changes in microclimate, reduced prey populations) is unknown. However, because the fire occurred in November when salamanders are typically inactive (in torpor) and towards the end of a severe several-month drought, it's likely that salamanders were relatively deep in soil burrows and thus possibly escaped direct mortality.

The authors note that:

“These results emphasize that moderate- to high severity burns impact plethodontid populations more severely than prescribed fire or low-severity wildfire. Using prescribed fire to mitigate the chance of high-severity wildfires is justified despite the potential negative effects on plethodontid populations”



This project was a component of Andrew Wilk's M.S. degree in Wildlife Science at Ohio State University. Andrew is currently a Data Manager at the [Renewable Energy Wildlife Institute](#). [Bill Peterman](#) served as Andrew's advisor and is an Associate Professor in Wildlife Ecology and Management at Ohio State University.

## References:

- Carpenter, D.O., Taylor, M.K., Callahan, M.A., Hiers, J.K., Loudermilk, E.L., O'Brien, J.J. and Wurzbarger, N., 2021. Benefit or liability? The ectomycorrhizal association may undermine tree adaptations to fire after long-term fire exclusion. *Ecosystems*, 24, pp.1059-1074.  
[https://www.appalachianfire.org/\\_files/ugd/696505\\_03fa04b765a84e39a4c679ec081d4bb3.pdf](https://www.appalachianfire.org/_files/ugd/696505_03fa04b765a84e39a4c679ec081d4bb3.pdf)
- Davic, R.D. and Welsh Jr, H.H., 2004. On the ecological roles of salamanders. *Annu. Rev. Ecol. Evol. Syst.*, 35(1), pp.405-434.  
[https://www.appalachianfire.org/\\_files/ugd/696505\\_a7462cb55d83472295e9b377ccd7dd06.pdf](https://www.appalachianfire.org/_files/ugd/696505_a7462cb55d83472295e9b377ccd7dd06.pdf)
- Grant, E.H.C., Fleming, J., Bastiaans, E., Brand, A.B., Brooks, J.L., Devlin, C., Epp, K., Evans, M., Fisher-Reid, M.C., Gratwicke, B. and Grayson, K.L., 2024. Range-wide salamander densities reveal a key component of terrestrial vertebrate biomass in eastern North American forests. *Biology Letters*, 20(8), p.20240033.  
[https://www.appalachianfire.org/\\_files/ugd/696505\\_20a13d87fedb4c17b4c4cb5be625d620.pdf](https://www.appalachianfire.org/_files/ugd/696505_20a13d87fedb4c17b4c4cb5be625d620.pdf)

## Links to papers:

- Alison E. Ochs, Robert K. Swihart, Mike R. Saunders., 2024. Population-level effects of prescribed fires on terrestrial salamanders. *Forest Ecology and Management*, Volume 560, 121842.  
<https://doi.org/10.1016/j.foreco.2024.121842>  
[https://www.appalachianfire.org/\\_files/ugd/696505\\_4f6aa1e5ed2e40a19124175df883ee95.pdf](https://www.appalachianfire.org/_files/ugd/696505_4f6aa1e5ed2e40a19124175df883ee95.pdf)
- Andrew J. Wilk, William E. Peterman; Impacts of Wildfire Burn Severity on Plethodontid Salamander Populations of Great Smoky Mountains National Park. *Herpetologica* 30 June 2024; 80 (2): 199-208. doi:  
<https://doi.org/10.1655/Herpetologica-D-23-00050>  
[https://www.appalachianfire.org/\\_files/ugd/696505\\_6ac73a48a9e74a36a35184a14209575f.pdf](https://www.appalachianfire.org/_files/ugd/696505_6ac73a48a9e74a36a35184a14209575f.pdf)

## Related Research:

<http://www.appalachianfire.org/amphibians/reptiles>



To view previous research briefs and browse our publications library, please visit our website:  
<https://www.appalachianfire.org/>



Visit our [research briefs](#) page on our website for plain language summaries of Appalachian Fire Science.

## Publications

Visit our [publications](#) page on our website to find peer reviewed publications, guides, and articles covering many topics.

### 2023 Appalachian Fire Science Papers

|                           |                               |                              |
|---------------------------|-------------------------------|------------------------------|
| Amphibians & Reptiles     | Fact Sheets/ Briefs           | Pine                         |
| Bats                      | Fire and Fire Surrogate Study | Smoke/Emissions              |
| Birds                     | Fire History                  | Social Science/Communication |
| Chemistry/ Nutrients      | Fire Techniques               | Soils & Duff                 |
| Chestnut                  | Fuels                         | Syntheses & Guides           |
| Climate & Weather         | Insects/Arachnids             | Wildfire                     |
| Controlled Burns          | Mammals                       | Water                        |
| Editorial/Public Outreach | Mortality                     |                              |
| Cultural Burning          | Oak                           |                              |

# PANEL DISCUSSIONS

FUELINGCOLLAB.COM

The Fueling Collaboration Series will continue with its 5th season. Fueling Collaboration is a series of interactive panel discussions designed to connect fire managers and researchers. Each discussion will be built on questions from the registered attendees. We're working to bring people together to discuss, explore, and address the latest fire science and fire management issues across the eastern United States. For more information and to register visit the [Fueling Collaboration website](https://fuelingcollab.com).



## January 16, 2025



Photo Credit: MC Murphy, USFS Southern Research Station

Expanding the Fuels Planning Toolkit: Terrestrial Laser Scanning and 3D Fuels Characterization for Improved Wildland Fire Decision Support

## February 20, 2025



Photo Credit: Brian Wiebler

Social Acceptance and Communication Strategies for Wildland Fire Management

## Date To Be Determined



Photo Credit: Polly Weigand, North Atlantic Fire Science Exchange

Flashy Fuels and Resilient Lands - Fueling Distinct Prescriptions for Eastern Grasslands

This series was developed by:



Forest Service  
Northern and Southern Research Stations





# Celebrating the Life of Craig Maier

March 21st, 1981 - November 14th, 2024



It is with heavy hearts that we mourn the passing of our dear friend and colleague Craig Maier. Craig was the Coordinator for the Tallgrass Prairie and Oak Savanna Fire Science Consortium and was part of the Fueling Collaboration planning team. Craig embodied a gentle kindness and had a quiet grace that would fill any room. He carried a wealth of knowledge regarding prairie ecology as well as

the benefits of fire upon the landscape. Craig is missed by many. His deep passion towards restoration and conservation will live on forever as thriving beauty upon the landscape and will reverberate off the hands and minds of those that will continue the work of his legacy.

The Joint Fire Science Program Fire Science Exchange Networks have set up a [Go Fund Me](#) - with a special thanks to Polly Weigand from the North Atlantic Fire Science Exchange for coordinating the set up. All funds raised will be provided to Craig's family, in trust for and benefit to Craig's son, David-Alfred.

[Craig Maier Tribute Page](#): All are welcome and encouraged to provide Tribute, through stories, photos, videos, art, poems, and reflection on this actively engaging online platform.



CAFMS is proud to be leading the field trip portion of the conference on March 23rd.

**March 18 - 23, 2025**  
**Greenville, SC**



The Biennial Southern Silvicultural Research Conference (BSSRC) provides a forum for scientists and practitioners and graduate and undergraduate students broadly engaged in forestry and southern silviculture. Presentations have ranged across topics as diverse as southern pine management, hardwood management, site preparation and vegetation management, natural and artificial regeneration of tree species, midstory competition control, modeling, prescribed fire, forest health, silvicultural history, and economics of forest management.

For more information: [BSSRC](#)

## Trainings

- **February 25, 2025:** Tall Timbers will be offering a virtual NWCG S-131 Firefighter Type 1 Deadline to apply is **December 31, 2024**. [Application Form](#)

## Webinars

- **January 7, 2025:** Integrating science and land stewardship: Using soundscapes to monitor biodiversity in midwestern oak woodlands under managed and unmanaged scenarios: [Registration](#)
- **January 8, 2025:** Prescribed Fire for Forest Management webinar: "Social Science of Prescribed Fire": [Registration](#)
- **January 16, 2025:** Fueling Collaboration Expanding the Fuels Planning Toolkit: Terrestrial Laser Scanning and 3D Fuels Characterization for Improved Wildland Fire Decision Support: [Registration](#)
- **February 5, 2025:** Prescribed Fire for Forest Management webinar: "Fuels Management": [Registration](#)
- **February 20, 2025:** Fueling Collaboration Social Acceptance and Communication Strategies for Wildland Fire Management: [Registration](#)

## Research

- This is a special collection of papers focused on eastern U.S. oak ecosystems and are products from the 7th Fire in Eastern Oak Forests Conference held in Tyler, Texas, USA on May 16-18, 2023. This collection represents diverse contributions relating fire to flora, fauna, water, humans, and much more: [Collected Papers](#)
- 8th Fire in Eastern Oak Forests Conference is to be held in 2026 with dates to be determined.

## Resources

- The Centre for Biodiversity and Conservation Science has a brief [fact sheet](#) on ecological grief—"an emotional response to losing places, species or ecosystems that are important to us"—as well as a collection of [resources](#) for further learning and action.
- Cooke, A., Benham, C., Butt, N., & Dean, J. (2024). Ecological grief literacy: Approaches for responding to environmental loss. Conservation Letters, 17, e13018. <https://doi.org/10.1111/conl.13018>
- The U.S. Forest Service Community Wildfire Defense Grant program is accepting applications for its third round of funding that can be used to develop a community wildfire protection plan (CWPP) or implement projects in a CWPP that is less than 10 years old. See the [CWDP website](#)

# Happy Holidays

AND HAPPY NEW YEAR!



From everyone at CAFMS, we want to wish you a joyful and relaxing holiday season.

We have immense gratitude for your continued partnership and collaboration throughout the years. Success is built upon trusting relationships, and we value the trust that you have instilled in our work. Without your support, knowledge, time, and expertise, we would not be able to accomplish our goals of connecting fire managers and scientists to improve land management strategies. It has been, and will continue to be, our absolutely privilege to have you as part of our fire family.

May the upcoming year bring you good health, joy, and many blessings!

Warmest wishes,

Helen, Todd, and Lindsey







Connecting fire managers and scientists throughout the Appalachian Region.

We value your continued support and feedback!

Find us on Facebook: [Consortium of Appalachian Fire Managers and Scientists](#)

Find us on YouTube: [Appalachian Fire - CAFMS](#)

Website: [www.appalachianfire.org](http://www.appalachianfire.org)



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Some things we have been up to lately