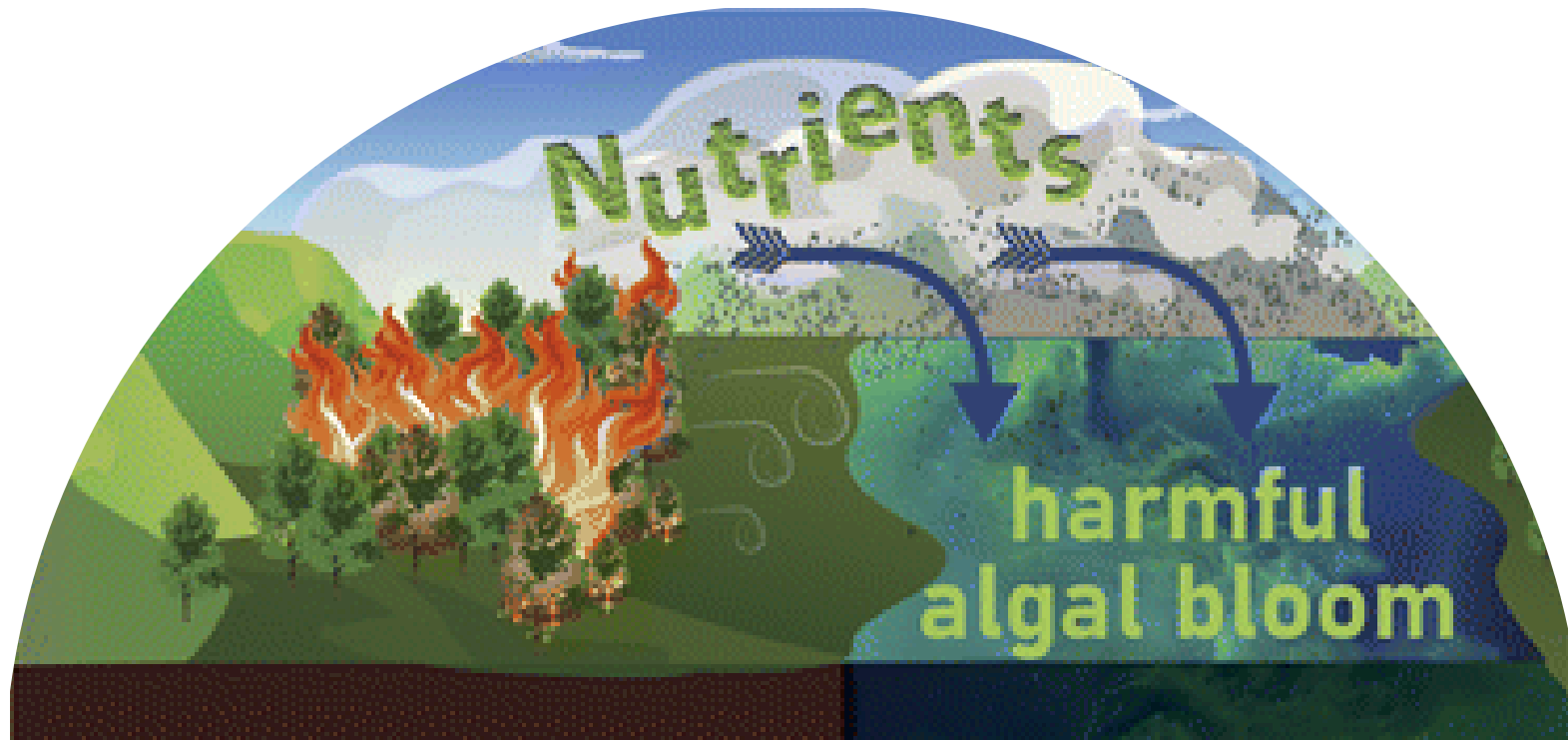


Wildfires and Water Quality

Carly Bauer and Madeline Schreiber, Virginia Tech



(Olson et al., 2023)

Wildfires are becoming more frequent and are more intense in the U.S.

Wildfires are necessary part of forest ecosystems, as they can reduce dead vegetation, stimulate new growth and improve habitat.

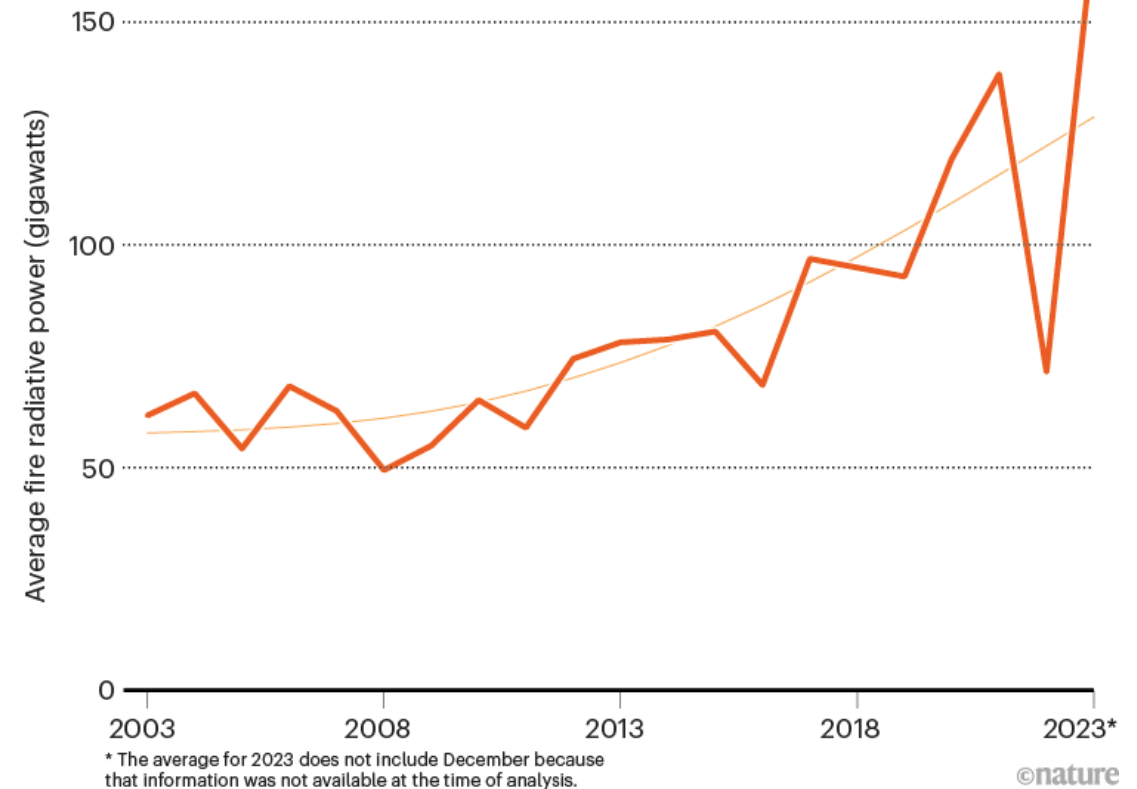
However, frequency of extreme wildfires more than doubled from 2003 – 2023

Cause of wildfires attributed to increasing temperatures and severe droughts.

(Cunningham et al. 2024)

RISING FIRE INTENSITY

The energy intensity of the 20 most extreme wildfires worldwide increased about 2.3-fold over the past two decades, according to an analysis of satellite data.

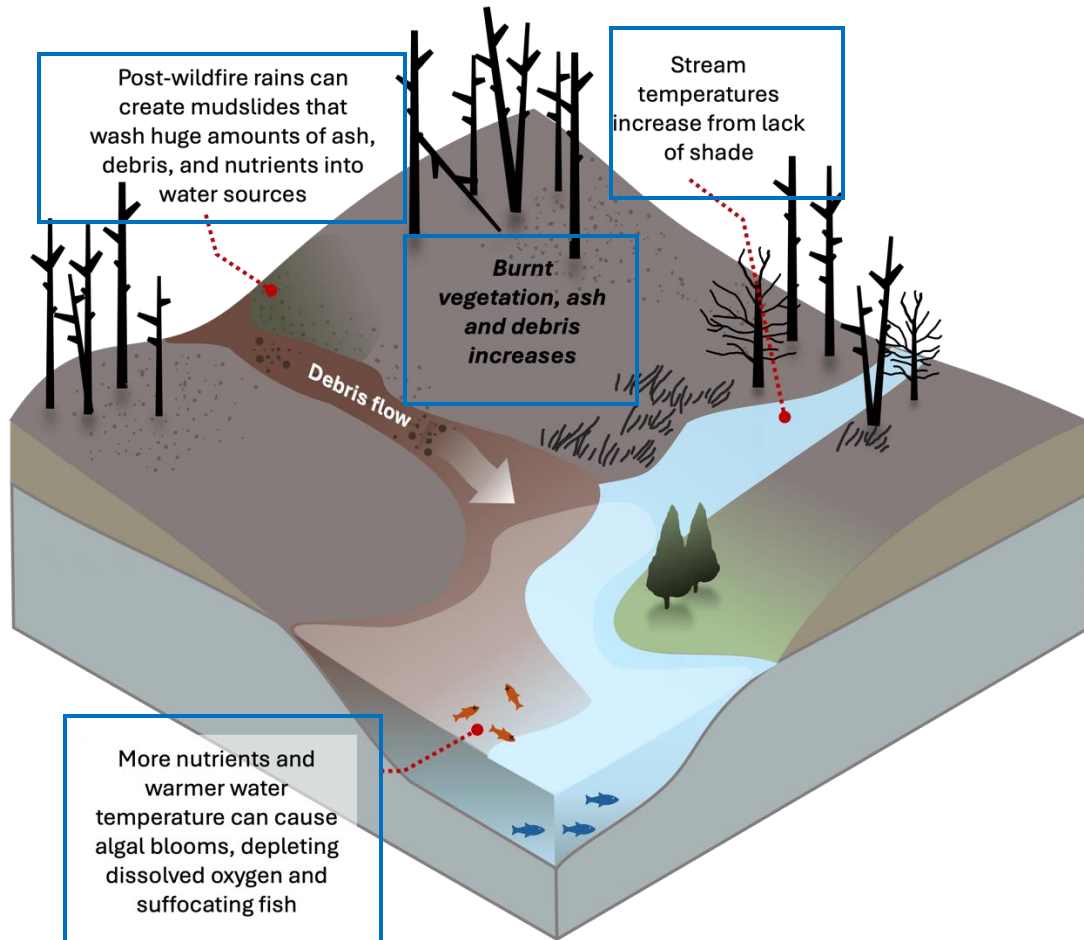


<https://www.nature.com/articles/d41586-024-02071-8>

What are possible impacts of wildfires on water quality?

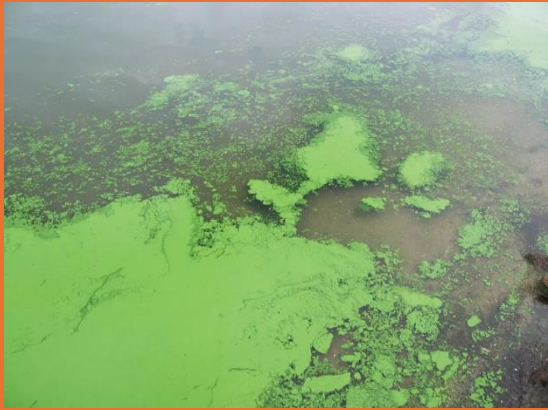


Impacts of wildfires on water quality



- Burned hillslopes can increase soil erosion and mudslides
- Due to lack of shade, stream temperatures can increase
- Burning of vegetation can release ash and nutrients into air and water
 - Nutrients are substances that provide nourishment for growth
 - Nitrogen and phosphorous are key nutrients for algal growth
 - Increased water temperature encourages **algal growth**, potentially causing algal blooms

Algal blooms are harmful to water supplies and ecosystems

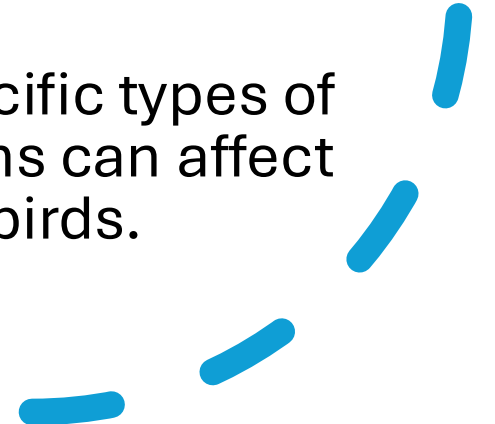


Algal blooms, or rapid increases in algae, are primarily caused by an excess of nutrients, particularly nitrogen and phosphorus, in water.

Nutrients can come from fertilizer, manure, and sewage ... and also wildfires

Algal blooms cause depleted oxygen in water bodies, leading to fish kills.

Harmful algal blooms (HABs) are specific types of blooms that create toxins. These toxins can affect humans, shellfish, other wildlife and birds.



Which reservoir
has an algal
bloom?



Algal blooms in drinking water reservoirs in SW Virginia

Swimming advisory extended as harmful algal bloom continues on Smith Mountain Lake

by Caitlyn Frolo | Fri, June 23rd 2023 at 6:13 PM



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VIEW ALL PHOTOS

*According to the Virginia Department of Health, this algae bloom has produced a blue/ green discoloration of the water.
(Credit: Keri Green)*

<https://wset.com/news/local/swimming-advisory-extended-as-harmful-algal-bloom-continues-smith-mountain-lake-blackwater-arm-roanoke-sml-toxins-testing-vdh-department-health-environmental-services-june-2023>

Student Learning Outcomes

After completing this lesson, students will be able to:

1. Describe the impact of wildfire burning on water quality.
2. Examine impacts of wildfire burning on nutrient inputs in a drinking water reservoir in southwestern Virginia using a data dashboard.
3. Plot and explore time series data from a data dashboard to investigate how nutrient inputs can increase algal growth.

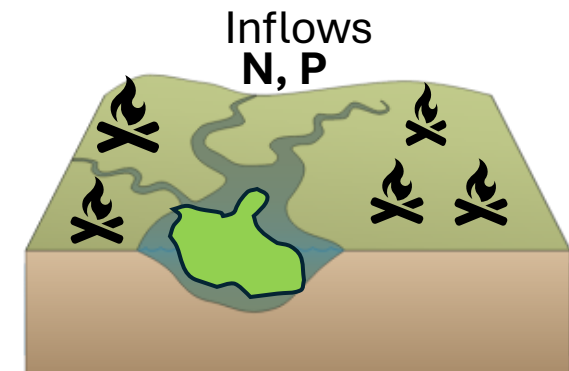
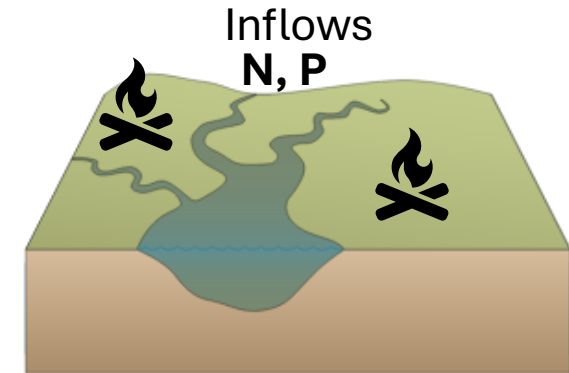
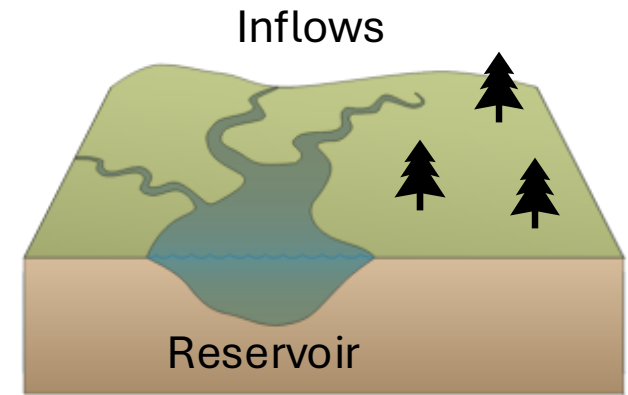
Creation of the data dashboard

We used a **hydrologic model** to simulate inflows of water into a drinking water reservoir in southwestern Virginia. The reservoir has not experienced a wildfire.

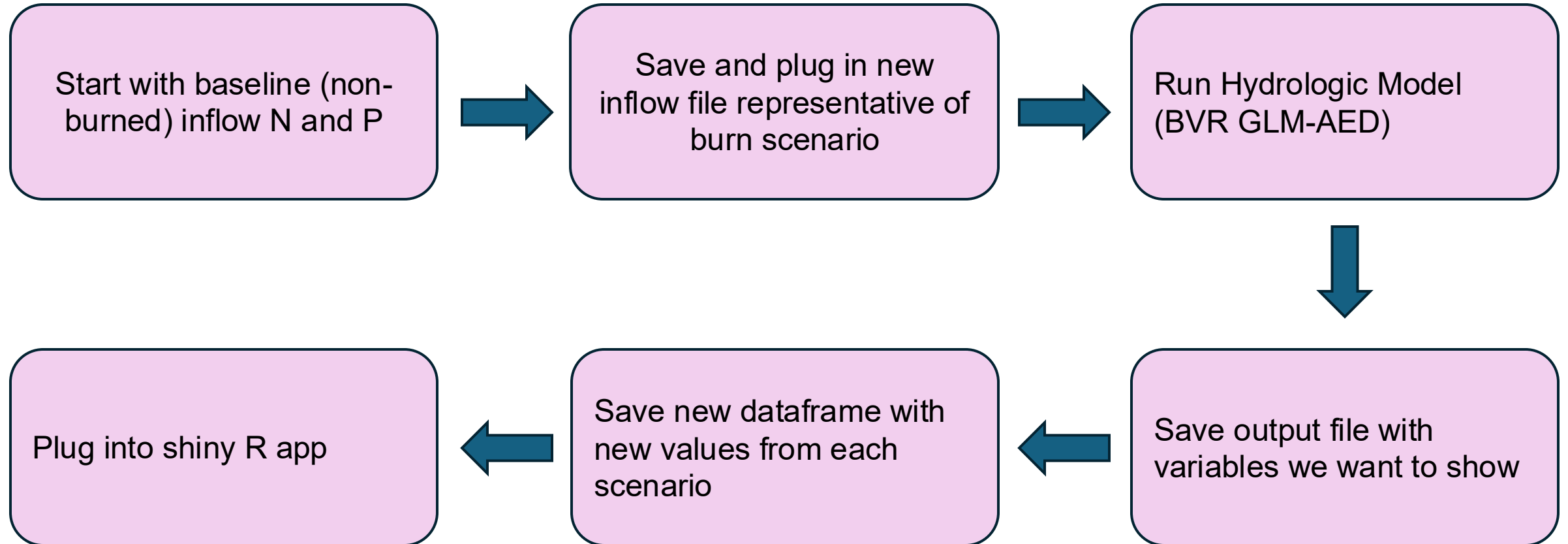
We looked for studies on reservoirs that had experienced wildfires. The studies measured **concentrations of nutrients, nitrogen (N), and phosphorous (P)**, in inflows **before** and **after** wildfire.

We input the different concentrations of N and P from the studies into our model and then **simulated scenarios of different burn intensities** to generate **N and P concentrations in the reservoir**.

We then **simulated the impact of N and P on algal growth**, using **chlorophyll-A** as an indicator of algae.



Workflow of the Data Dashboard



Resources

You Tube Videos

<https://youtube.com/playlist?list=PLr5bB3qcMRzS7TXGbmTYTkNRSTLtFNUrZ&feature=shared>

https://www.youtube.com/watch?v=rrhz_kcYU2g&list=PLr5bB3qcMRzS7TXGbmTYTkNRSTLtFNUrZ&index=3

<https://www.youtube.com/watch?v=Y9yEERskots&list=PLr5bB3qcMRzS7TXGbmTYTkNRSTLtFNUrZ&index=4>

Websites

- [Wildland Fires Could Be Putting Your Health At Risk.](#)
- [Water Quality After a Wildfire](#)
- [Wildfires and Water](#)
- [Benefits of Wildfire](#)

Scientific Articles

Caldwell, P. V., Elliott, K. J., Liu, N., Vose, J. M., Zietlow, D. R., & Knoepp, J. D. (2020). Watershed-scale vegetation, water quantity, and water quality responses to wildfire in the southern Appalachian mountain region, United States. *Hydrological Processes*, 34(26), 5188-5209.

Cunningham, C. X., Williamson, G. J., & Bowman, D. M. (2024). Increasing frequency and intensity of the most extreme wildfires on Earth. *Nature Ecology & Evolution*, 8(8), 1420-1425.

De Palma-Dow, A., McCullough, I. M., & Brentrup, J. A. (2022). Turning up the heat: Long-term water quality responses to wildfires and climate change in a hypereutrophic lake. *Ecosphere*, 13(12), e4271.

Murphy, S. F., Alpers, C. N., Anderson, C. W., Banta, J. R., Blake, J. M., Carpenter, K. D., ... & Ebel, B. A. (2023). A call for strategic water-quality monitoring to advance assessment and prediction of wildfire impacts on water supplies. *Frontiers in Water*, 5, 1144225.

Olson, N. E., Boaggio, K. L., Rice, R. B., Foley, K. M., & LeDuc, S. D. (2023). Wildfires in the western United States are mobilizing PM 2.5-associated nutrients and may be contributing to downwind cyanobacteria blooms. *Environmental Science: Processes & Impacts*, 25(6), 1049-1066.