

A fireside chat: large wildfires are a looming threat to US lakes

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November 23, 2022

Abstract

Wildfires are becoming larger and more frequent across much of the US due to a combination of climate change and land use activities. Increasing wildfires have begun to raise concerns about effects on fresh waters, including water quality and other ecosystem services. Despite this, previous research mostly consists of short-term case studies and focuses on streams and rivers rather than lakes and reservoirs (hereafter, lakes). Using the Monitoring Trends in Burn Severity (MTBS) database, we show that 4.5% of lakes [?] 1 ha in the continental US experienced at least one watershed wildfire from 1984-2016. Interestingly, lake watershed fires are not restricted to the western US. Of all the lower 48 states, Florida, Texas and Kansas were the top 3 states with the most lakes experiencing wildfire, whereas Idaho, Arizona and Nevada were the top 3 states by percentage of lakes in respective states experiencing wildfire. Using the LAGOS-US database, we present new regional-scale findings demonstrating effects of large wildfires on lake water quality. For example, we found a negative correlation between post-fire lake water clarity and the proportion of a lake's watershed burned in 11 Minnesota and Wisconsin lakes ($r = -0.61$). We highlight the urgent need for more broad-scale studies that encompass an ecologically diverse set of waterbodies, landscapes and fire regimes, particularly in landscapes in which humans depend on lakes for fresh water. Finally, we emphasize that growing data sources such as MTBS and continental-scale water quality databases (e.g., LAGOS-US) offer prime opportunities for research advances that can help scale up findings from local case studies.

A fireside chat

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Landscape Ecology

Forests, lakes, fire, climate



One day in the mountains



RESEARCH REVIEW

Do lakes feel the burn? Ecological consequences of increasing exposure of lakes to fire in the continental United States

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First published: 13 July 2019 | <https://doi.org/10.1111/gcb.14732> | Citations: 3

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TOOLS



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Volume 25, Issue 9

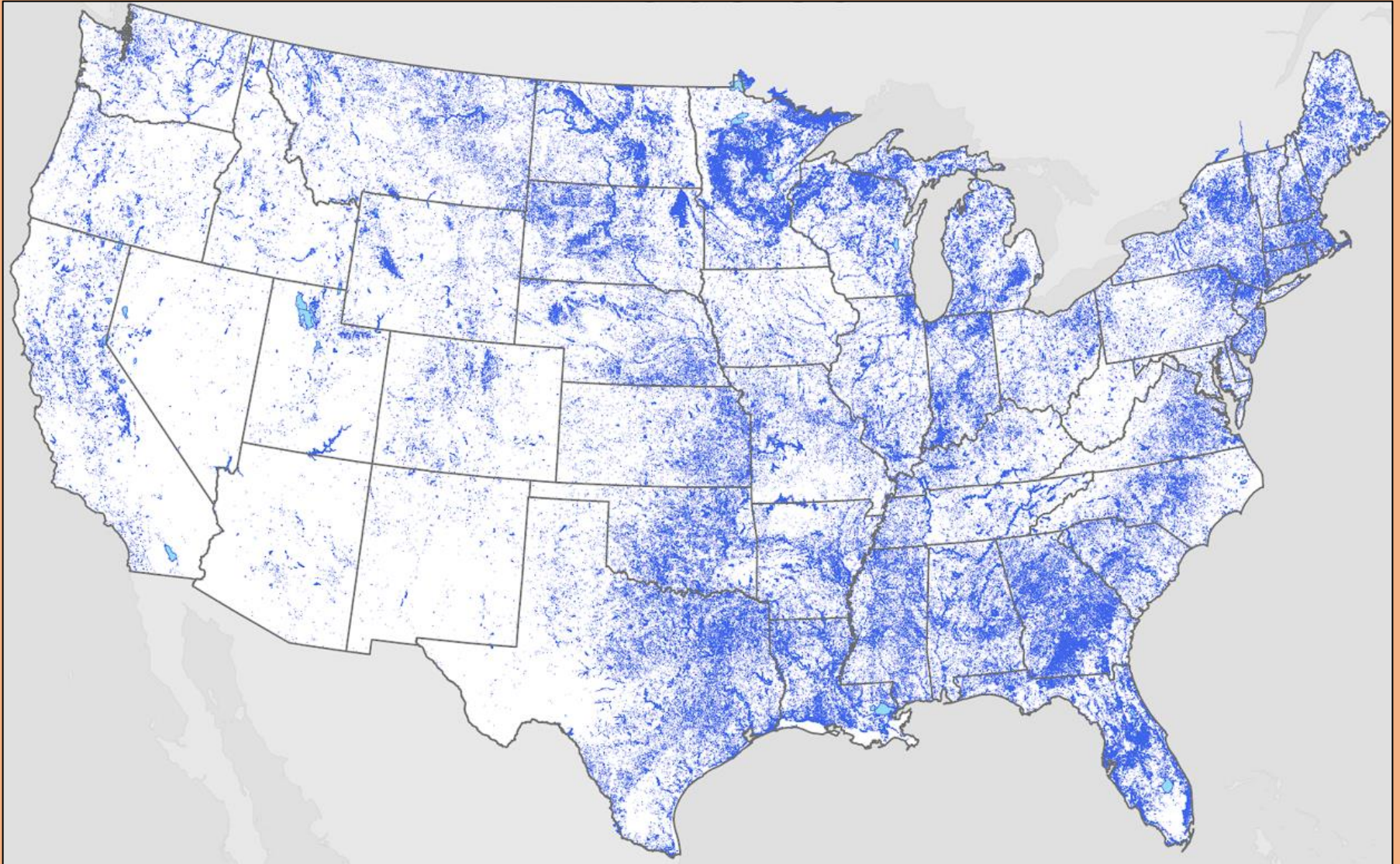
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Lakes of the US: $479,950 \geq 1$ ha



Wildfires of the US

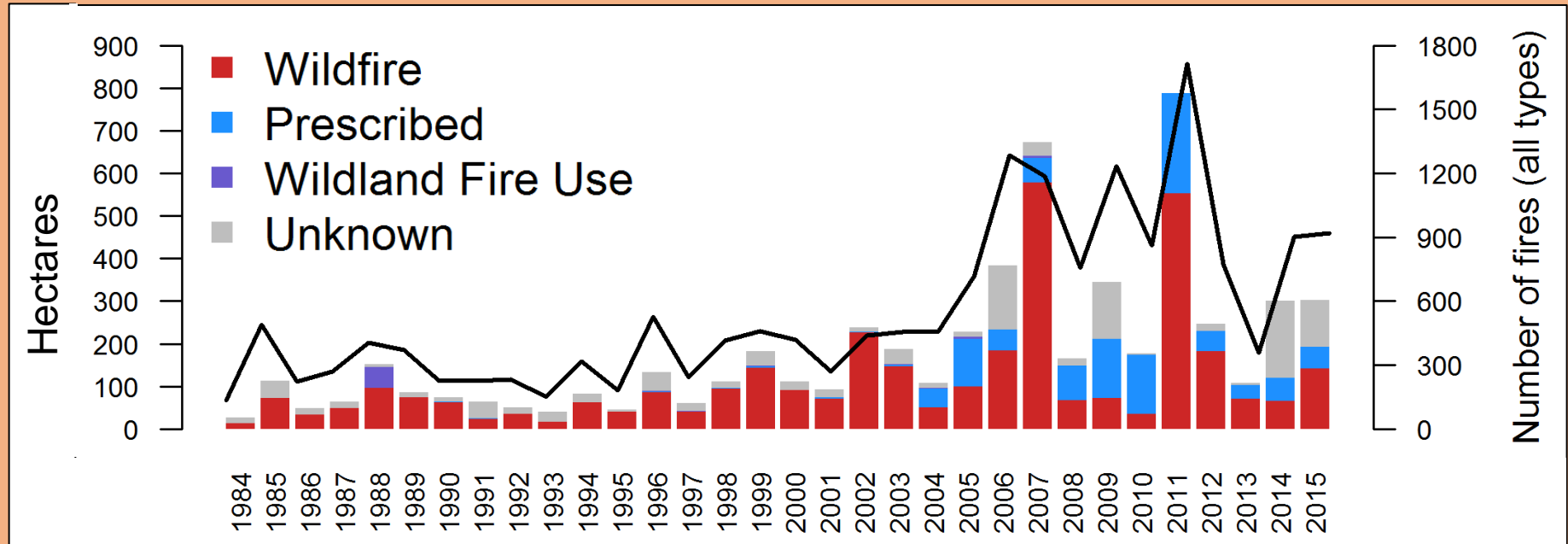
Wildfire, 1984



369400 ha burned (Monitoring Trends in Burn Severity)



Increasing fire in US lake watersheds

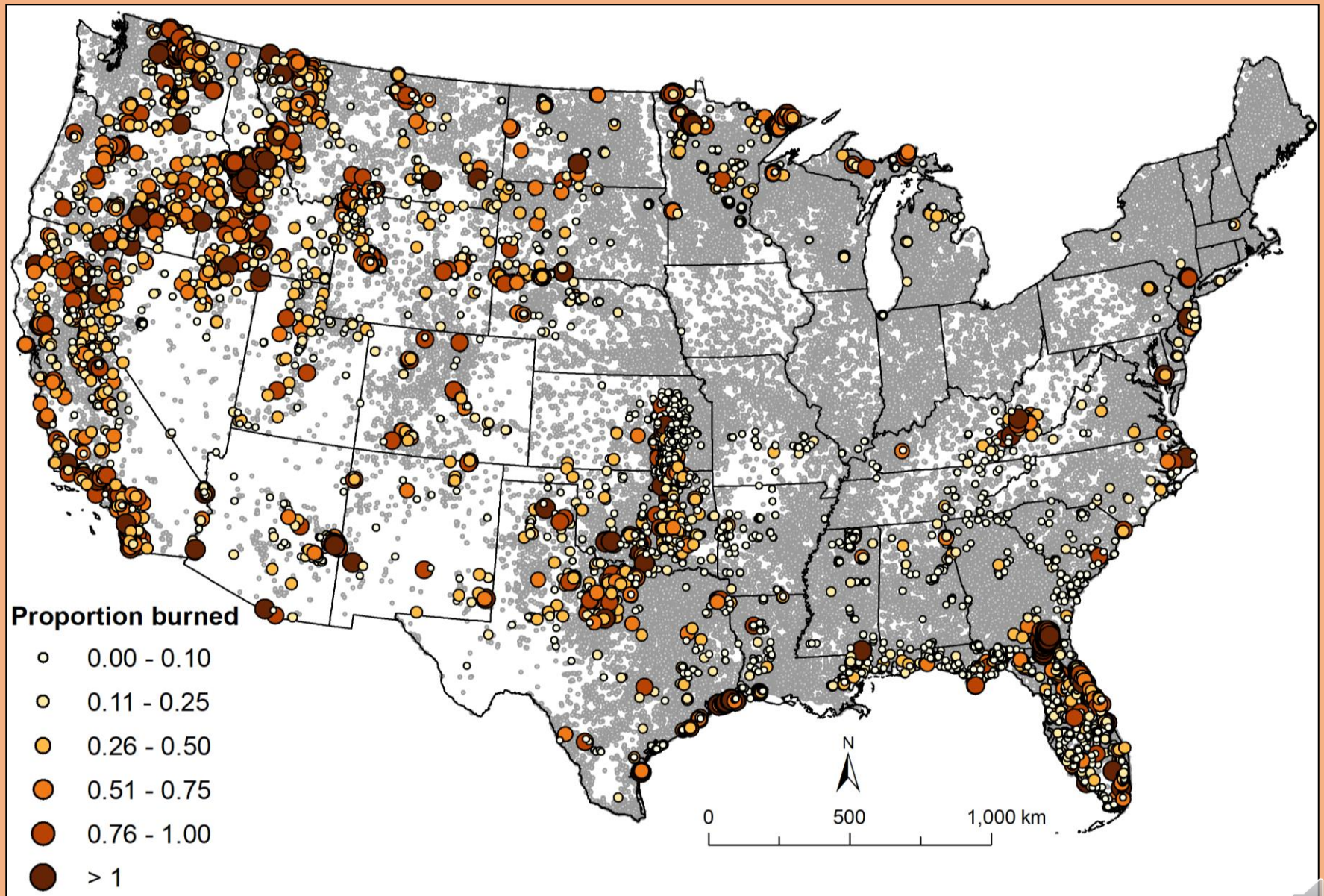


McCullough et al. (2019). *Global Change Biology*.

21500 lakes with at least 1 watershed fire from 1984-2016



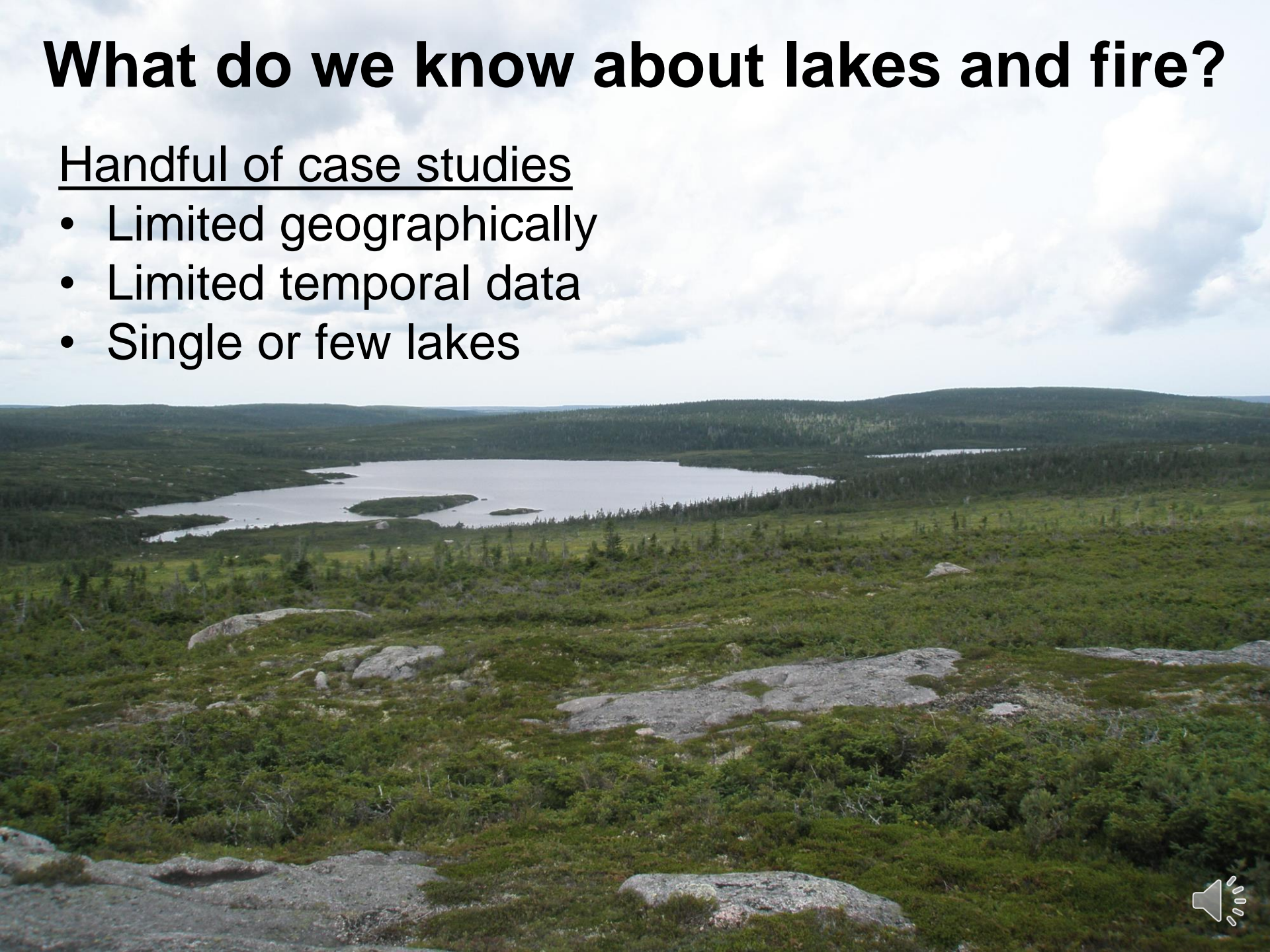
Increasing fire in US lake watersheds



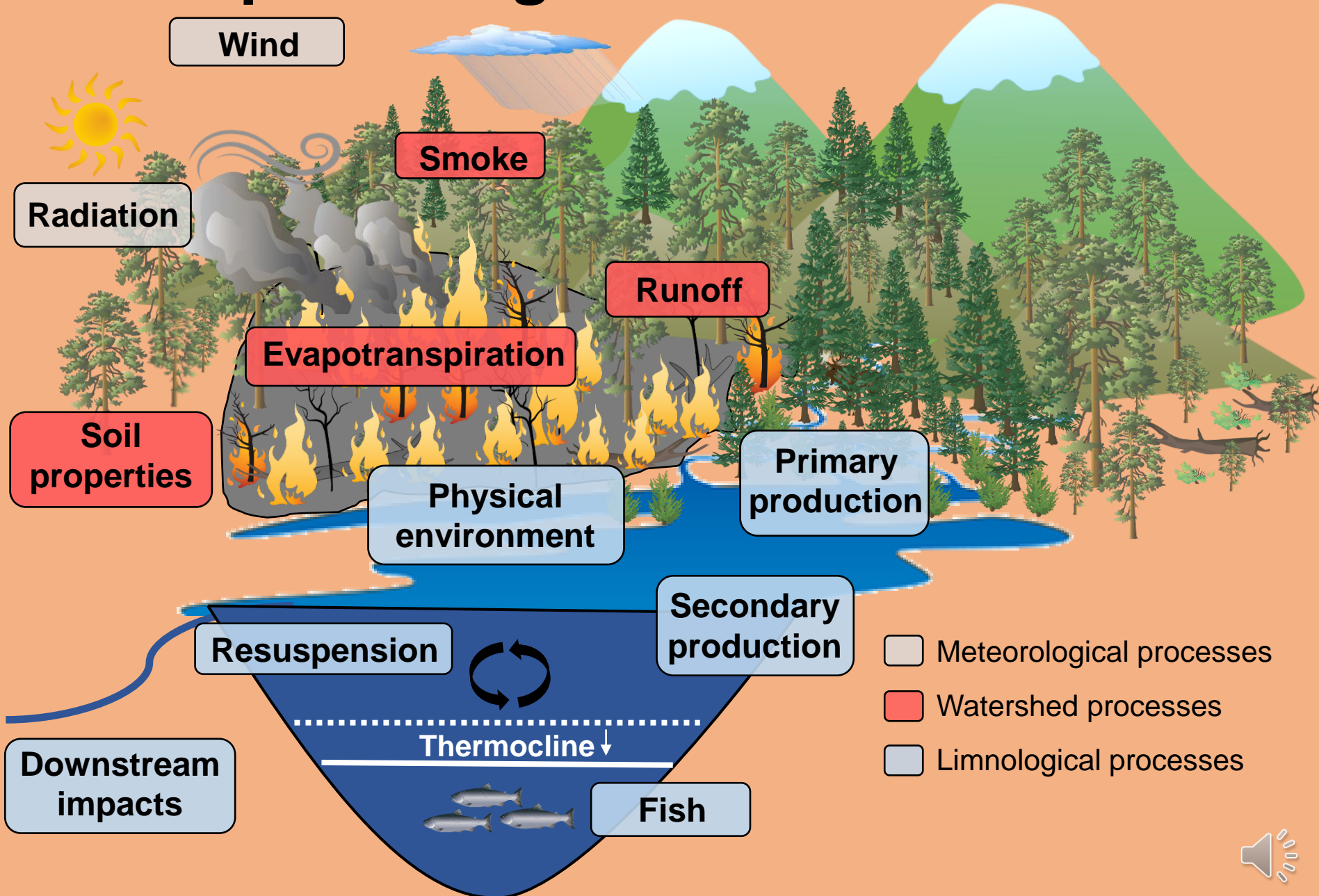
What do we know about lakes and fire?

Handful of case studies

- Limited geographically
- Limited temporal data
- Single or few lakes



Conceptualizing effects of fire on lakes

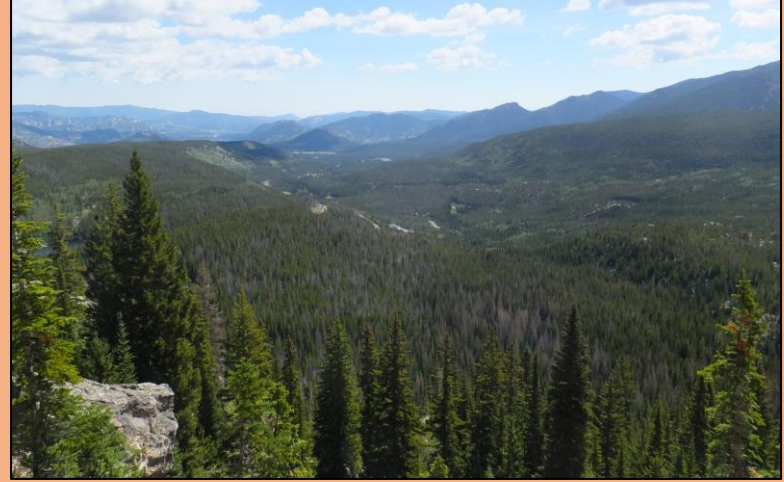


We need broad-scale studies

Lake types



Landscape types



Fire regimes



Now we need some data

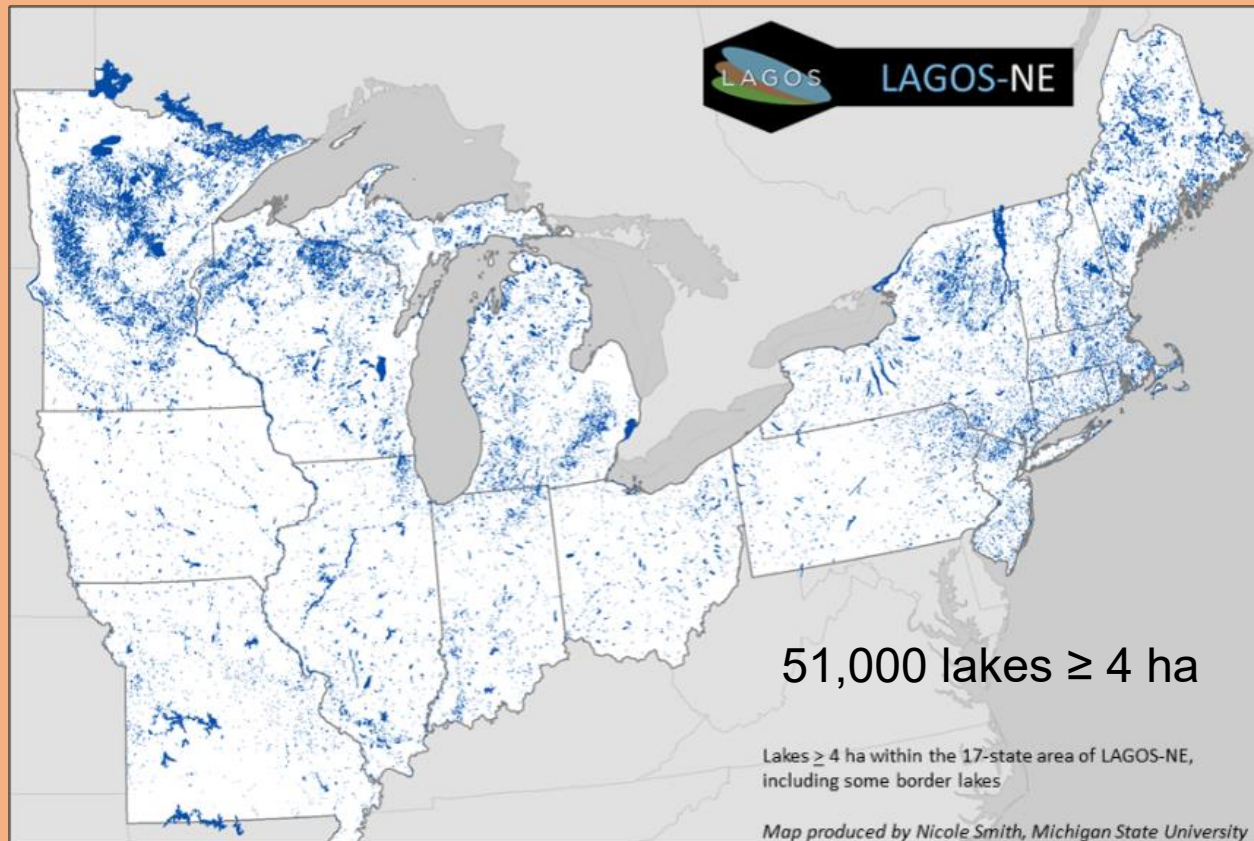


Potential data sources

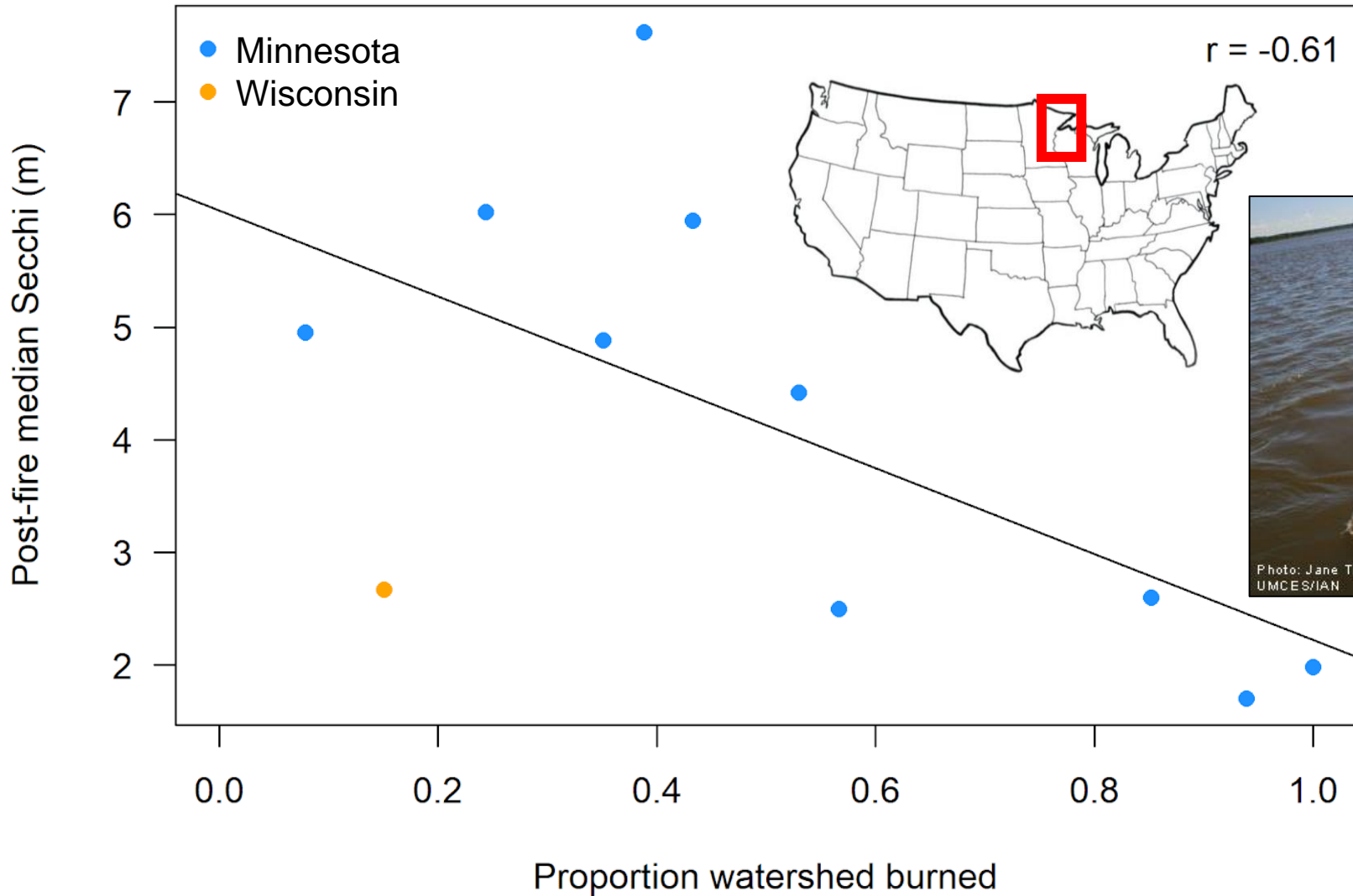


LAke multi-scaled GeOSpatial and temporal database

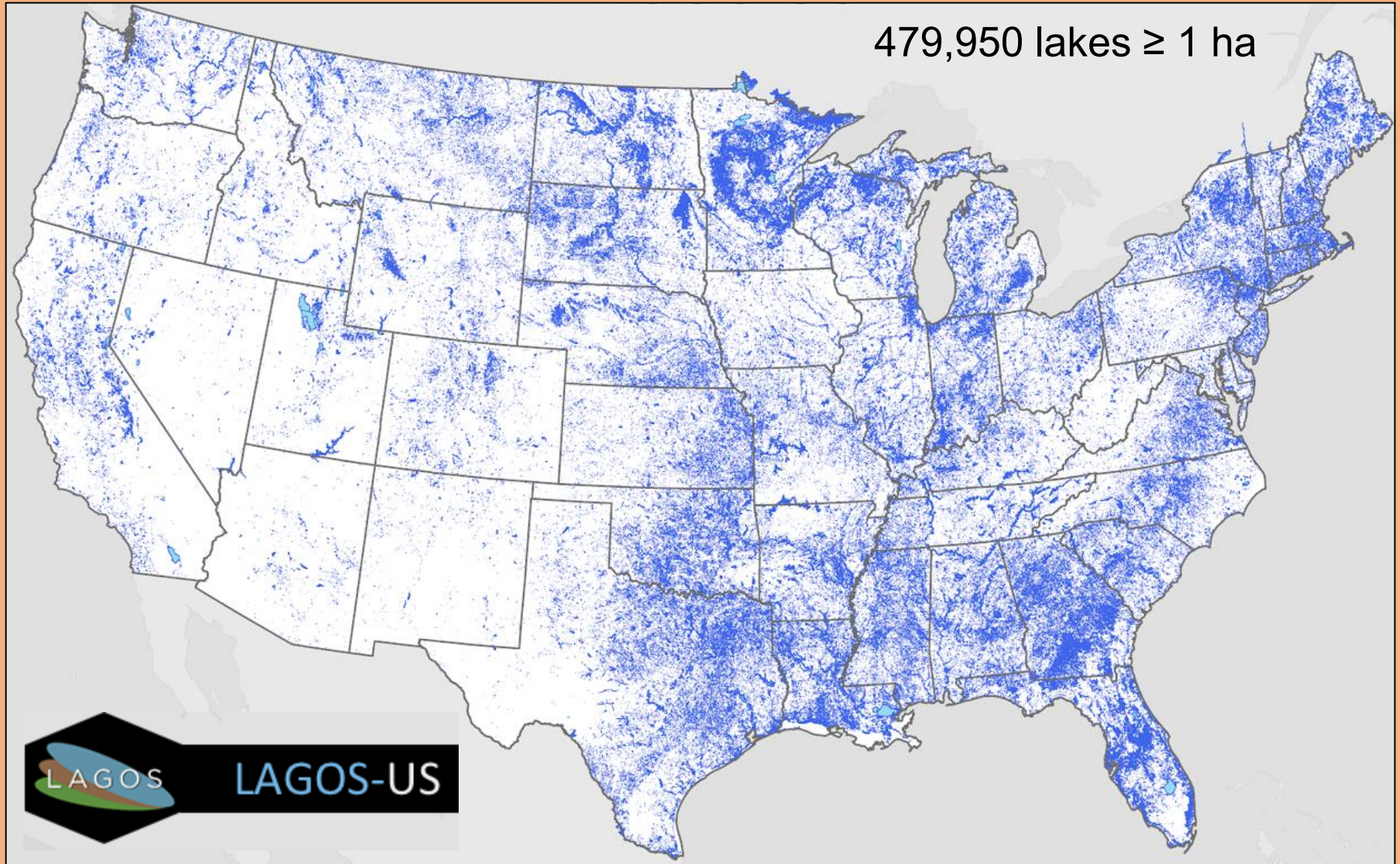
Publicly accessible lake water quality database 17 US states



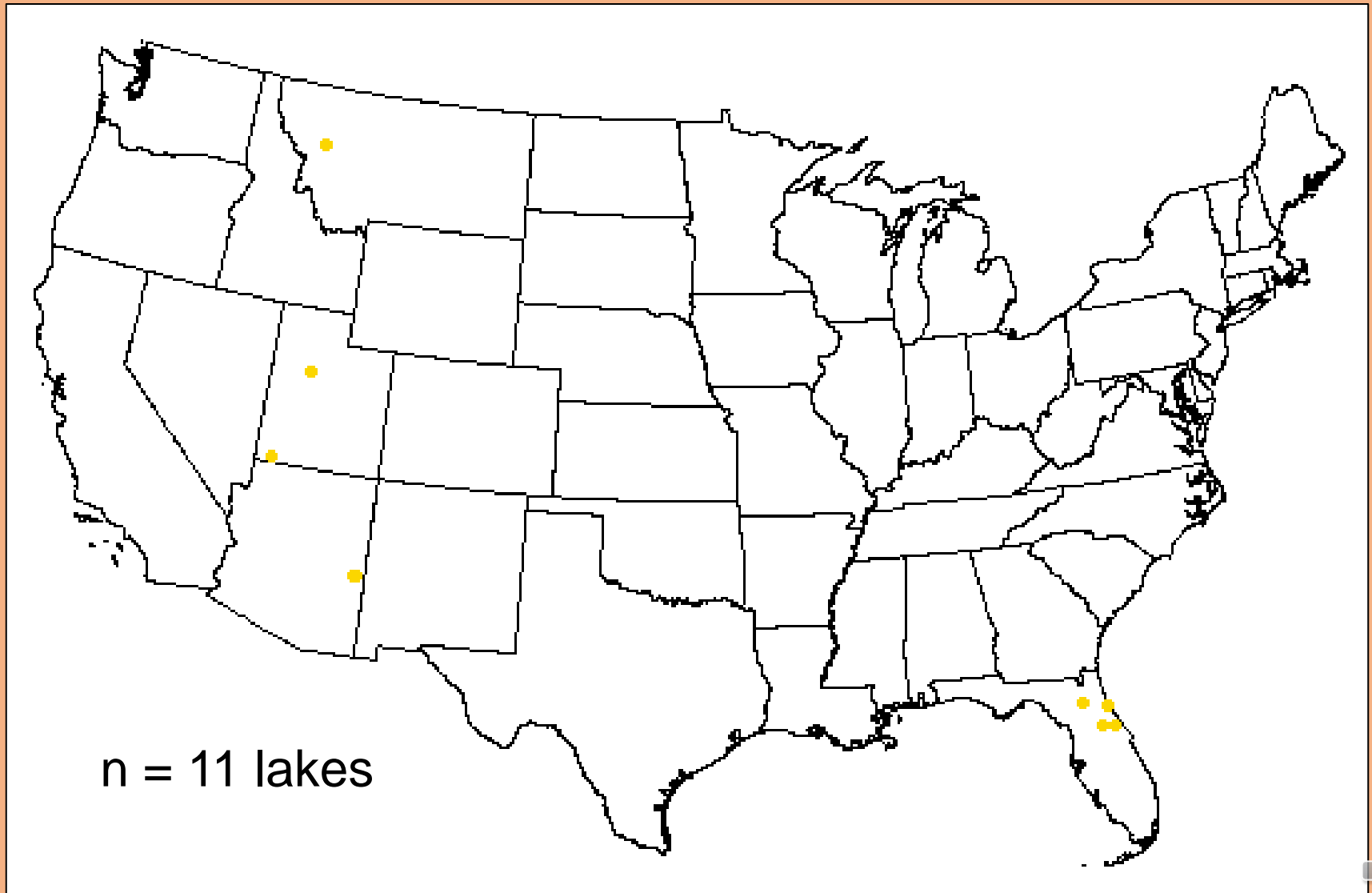
Wildfires reduce Midwest lake clarity



Expanding across continental US



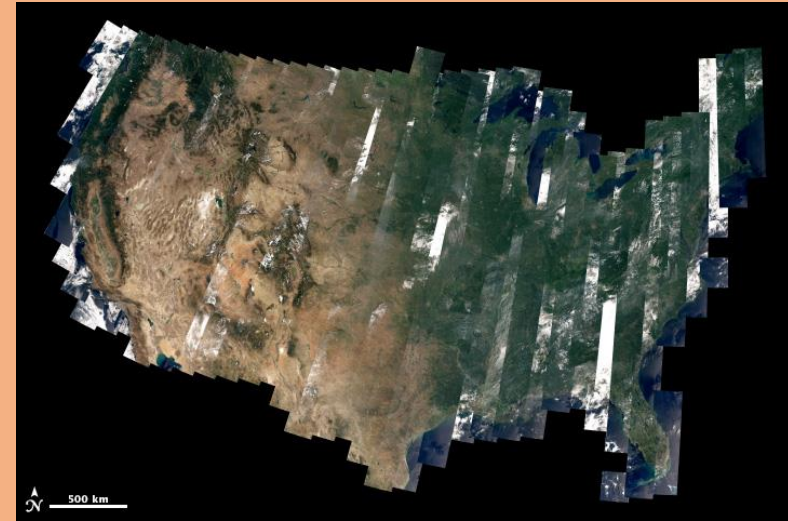
LAGOS-US: lakes with Secchi data year following fire



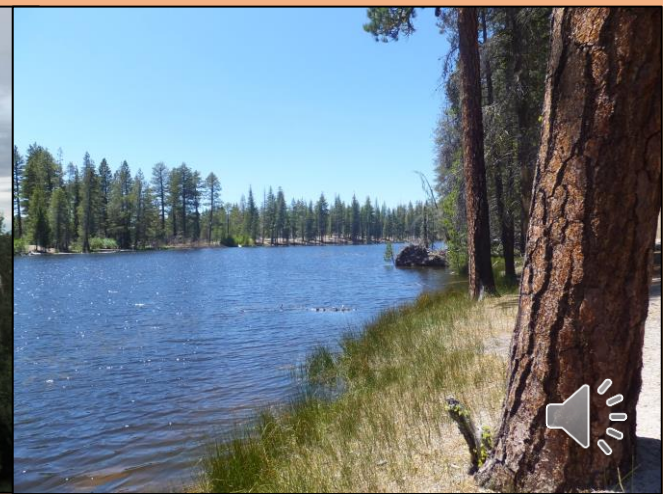
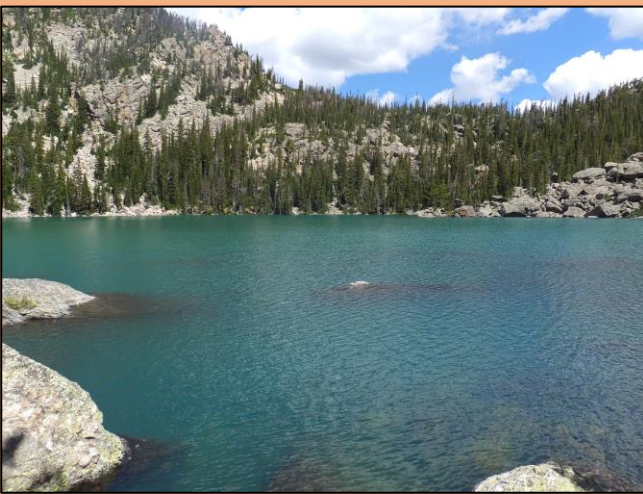
Water quality remote sensing

- Turbidity, chlorophyll-a, Secchi
- Temporal resolution
- Gradients of % watershed burned, burn severity
- Diversity of lakes, landscapes, fire regimes

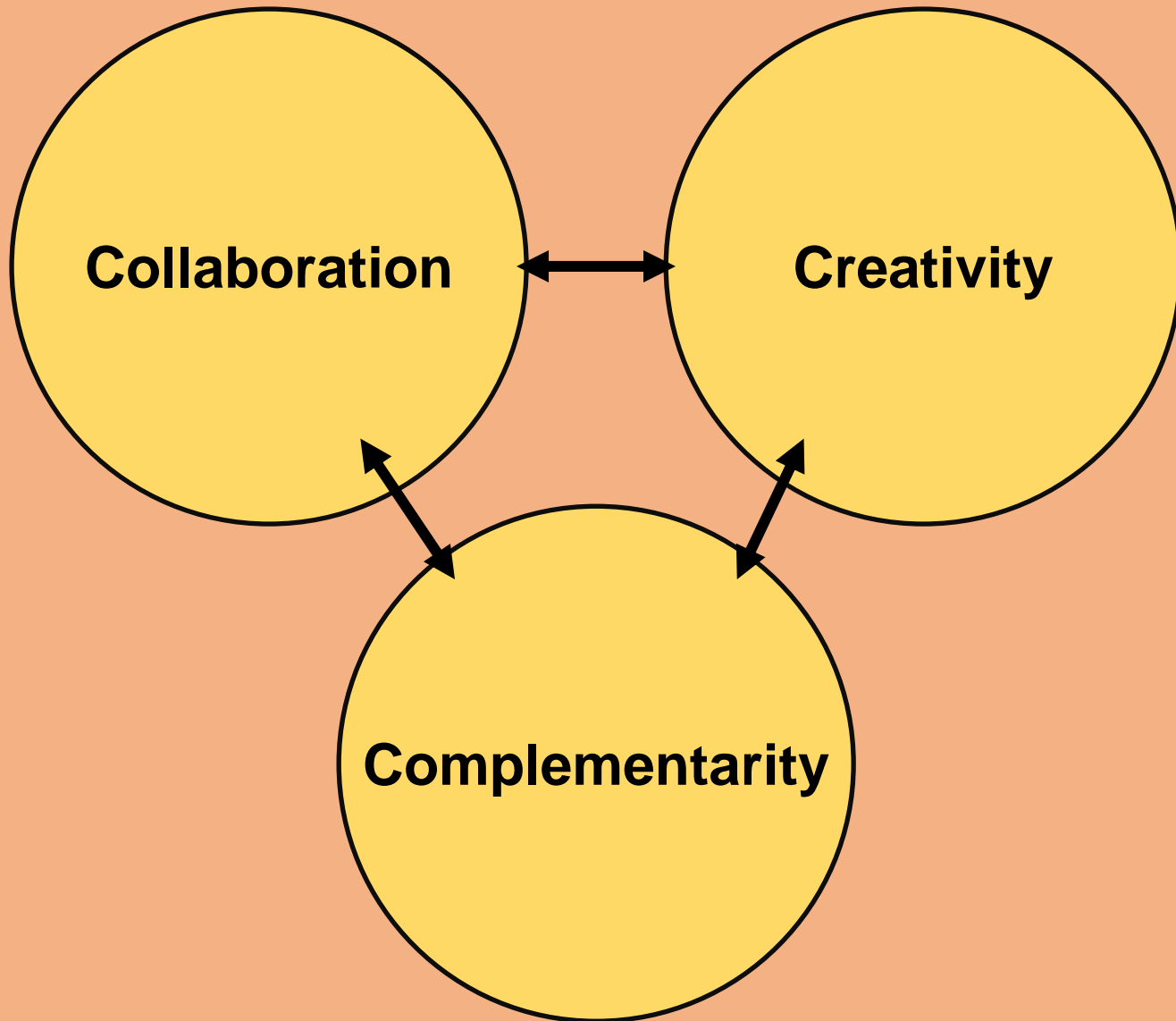
Landsat 8 scenes



<https://earthobservatory.nasa.gov/images/83099/landsat-8s-first-year>



Concluding remarks



Collaboration

- Disciplines, subdisciplines

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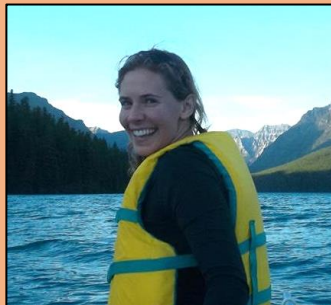


- Researchers and managers

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J. Brentrup

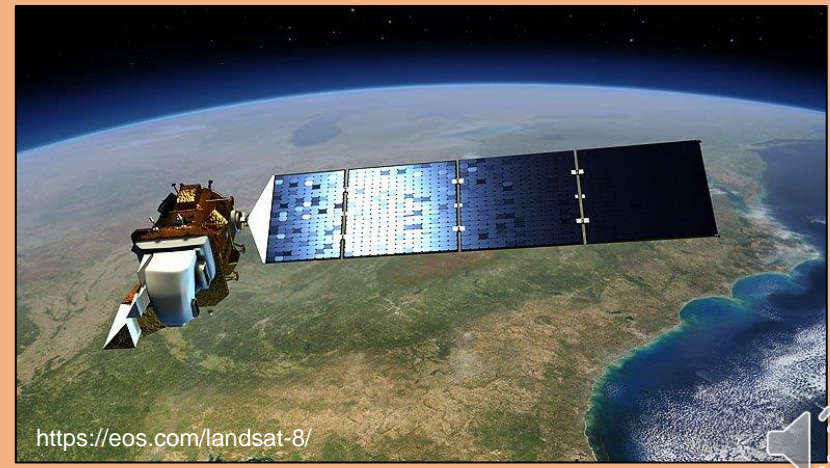
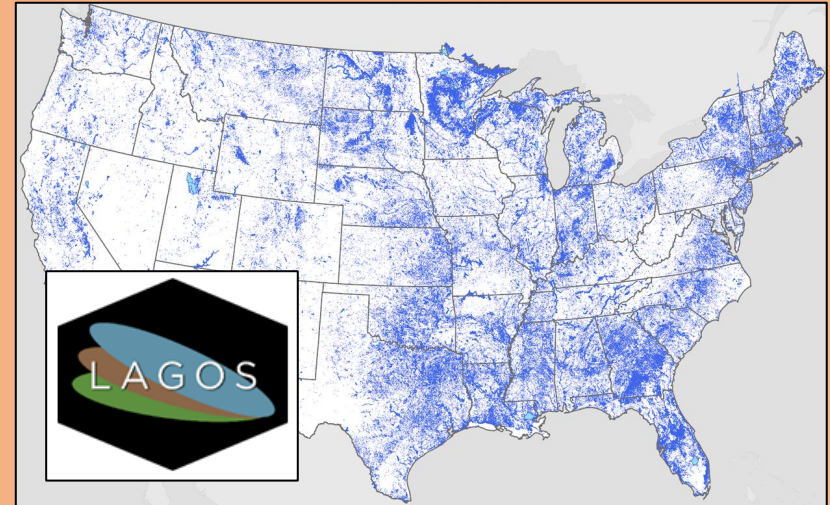
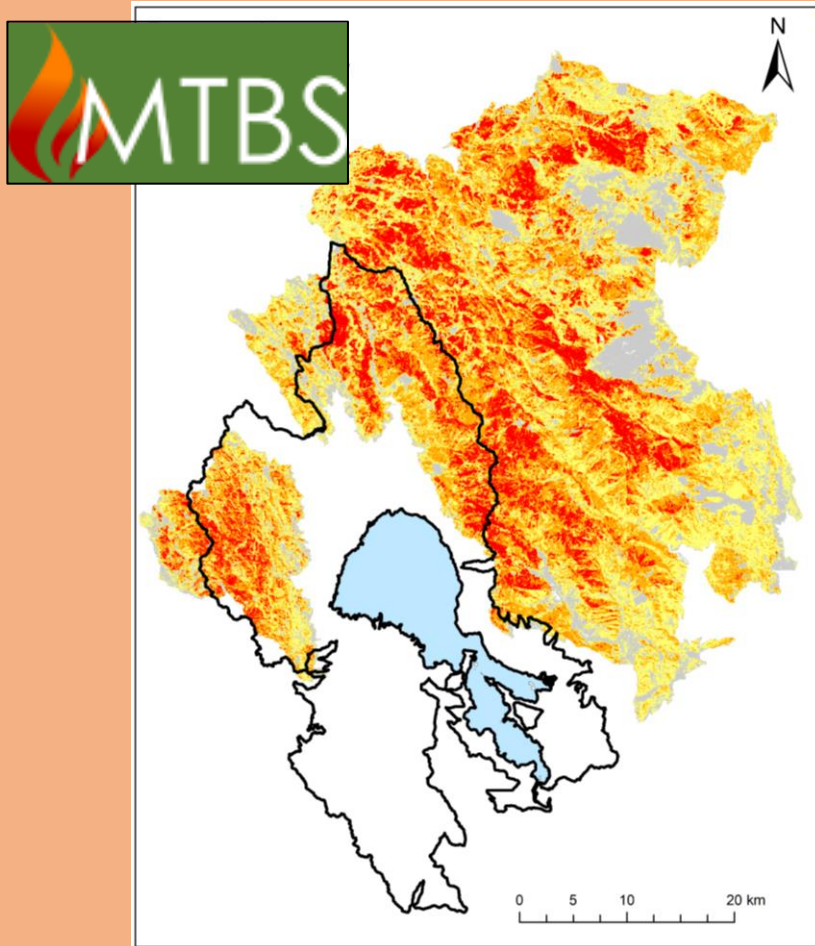


M. Complex Fire



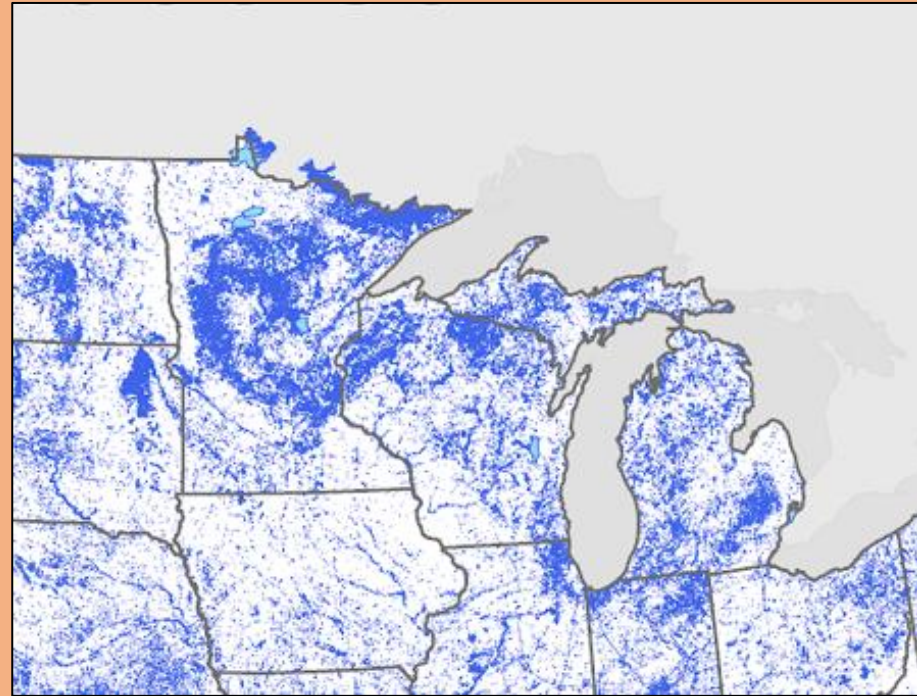
Creativity

- Leverage big data, existing data, remote sensing, others



Complementarity

- Local-scale and broad-scale studies go hand-in-hand



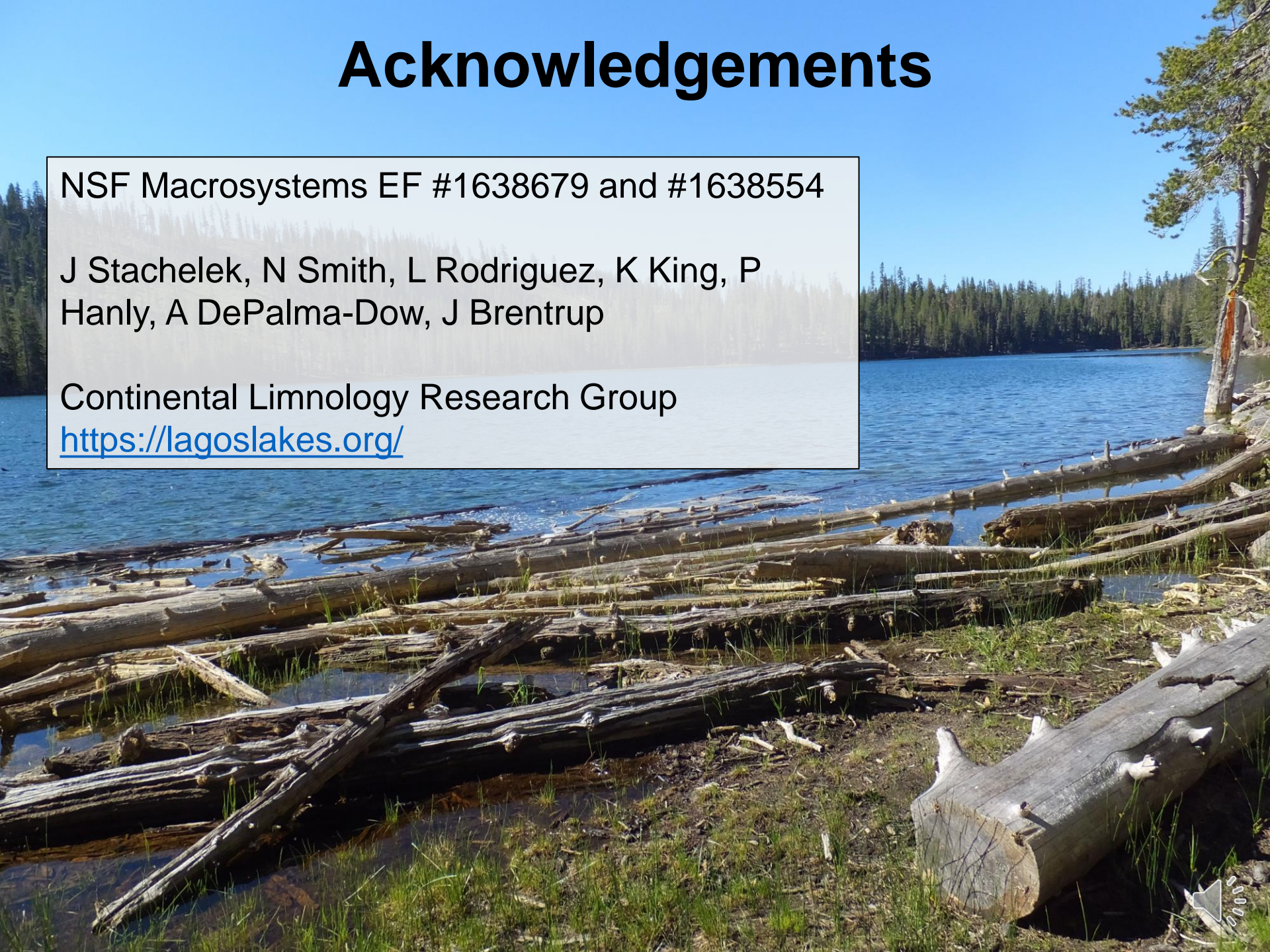
Acknowledgements

NSF Macrosystems EF #1638679 and #1638554

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<https://lagoslakes.org/>



Thank you for watching

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