

8TH INTERNATIONAL WILDLAND FIRE CONFERENCE

GOVERNANCE PRINCIPLES:

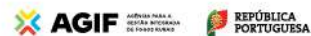
Towards an International
Framework

Porto - Portugal | **May 16-19th**, 2023

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LOCAL ORGANIZER



INTERNATIONAL LIAISON COMMITTEE FOR THE IWFC



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Changes in soil water repellency caused by four 2021-2022 western U.S. mega fires

Vera Samburova, PhD

Fires in the western US

Fire-induced soil water repellency can result in the reduction of soil infiltration, which can lead to an increase in surface runoff, erosion, and the potential for flooding and mudslides



- In the past decade, the severity and frequency of wildfires have increased in forests of the western United States (U.S.) , especially in California, where ecosystems are dominated by dry conifers
- The 2021 Dixie fire was the largest single (i.e., non-complex) fire in the history of California with over 3,890 km² burned and over 1,300 structures destroyed



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Pictures, 2021 mega fires in California



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Summary of fires and sampling locations



Fire name	Start-end date	Fire area (km ²)	Total fraction of moderate and severely burned soil area	Total fraction of high and very high soil erosion hazard area	GPS coordinates	Dominant forest type
Dixie	7/13/21 - 10/25/21	3898	54%	20	39°58'41.9"N 120°21'24.8"W	Sierran mixed conifer (Pinus contorta, Abies concolor)
Beckwourth Complex	7/04/21 - 9/22/21	428	57%	38	39°53'21.1"N 120°12'02.9"W	Sierran mixed conifer and mixed pine (Pinus lambertiana, P. contorta, P. ponderosa, Pseudotsuga menziesii)
Caldor	8/14/21 - 10/21/21	898	56%	28	38°50'37.0"N 120°01'59.8"W	Sierran mixed and Sierran Montane hardwood (Pinus jeffreyi, P. contorta, P. ponderosa, A. magnifica, A. concolor)
Mosquito	9/06/22 - 10/27/22	311	34%	N/A	38°59'22.3"N 120°44'21.1"W	Sierran mixed conifer, Sierran Montane Hardwood; Sierran Montane Hardwood-Conifer (P. ponderosa, P. jeffreyi)

MAPs



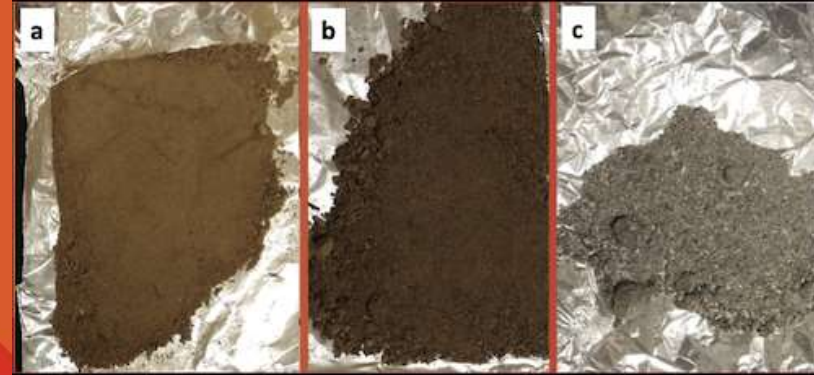
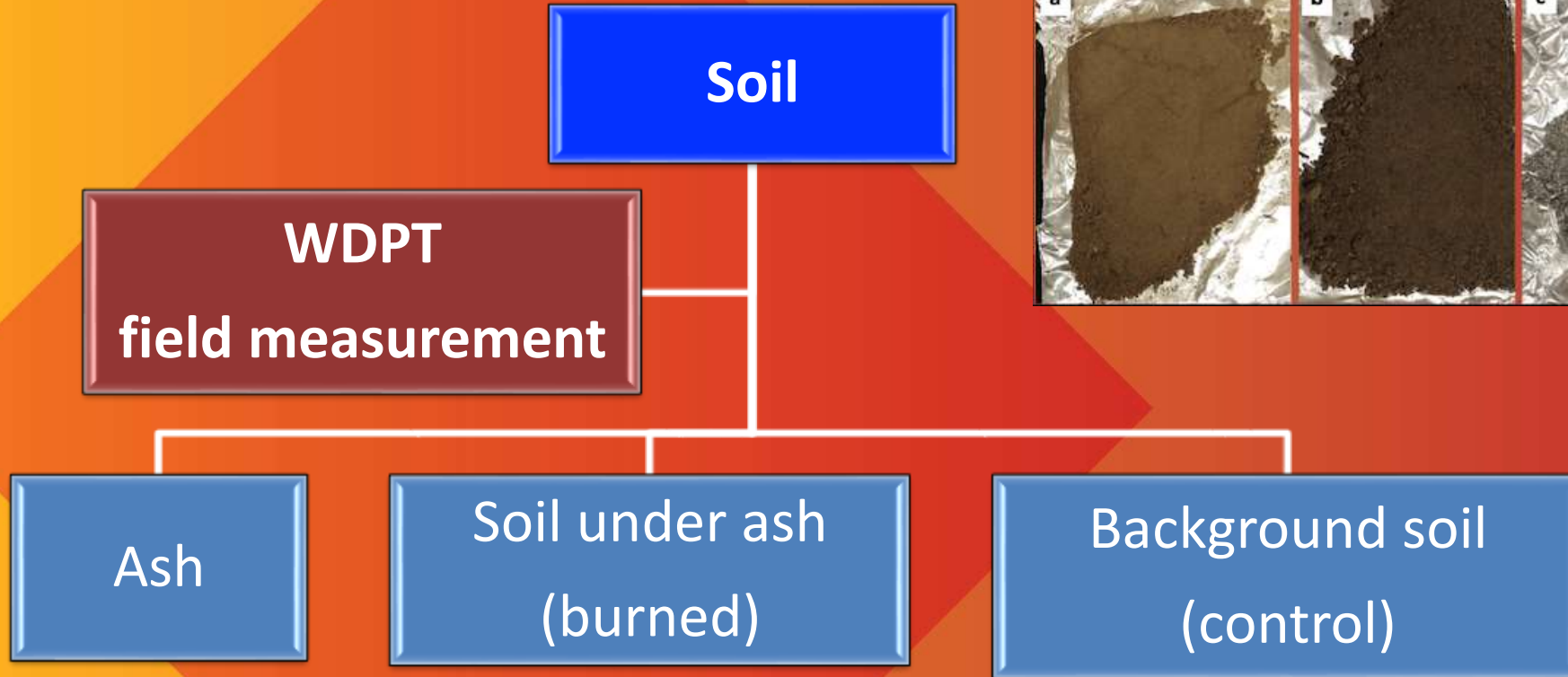
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<https://www.nicepng.com/maxp/u2w7e6w7q8w7a9r5/>

<https://data-nifc.opendata.arcgis.com/datasets/nifc::wfigs-interagency-fire-perimeters/explore?location=-0.000000%2C0.000000%2C8.87>

Sampling and analyses



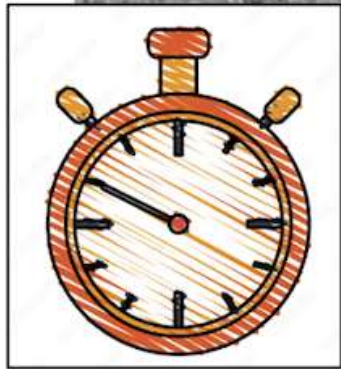
Laboratory analysis

- Physical properties (e.g., contact angle measurements with goniometer)
- Chemistry (e.g., analysis chemical functional groups)
- Spectroscopic properties

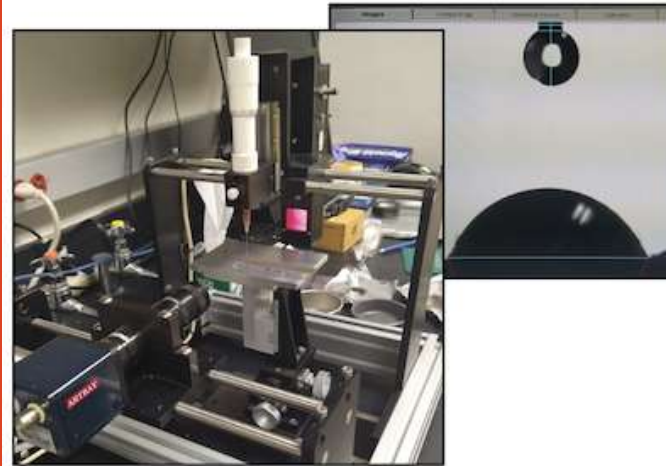
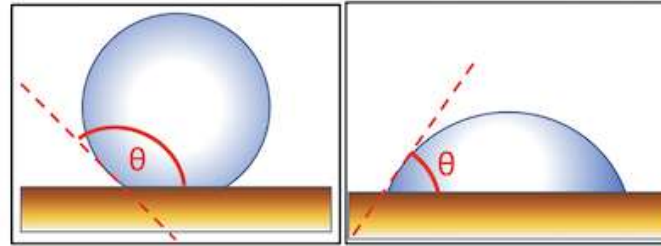
ANALYSES



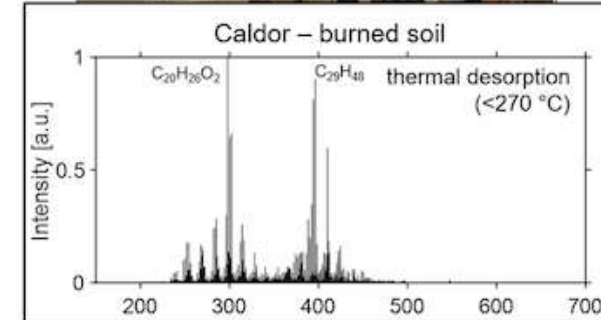
Water Drop Penetration Time (WDPT, sec)



Apparent Contact Angle (ACA, deg)



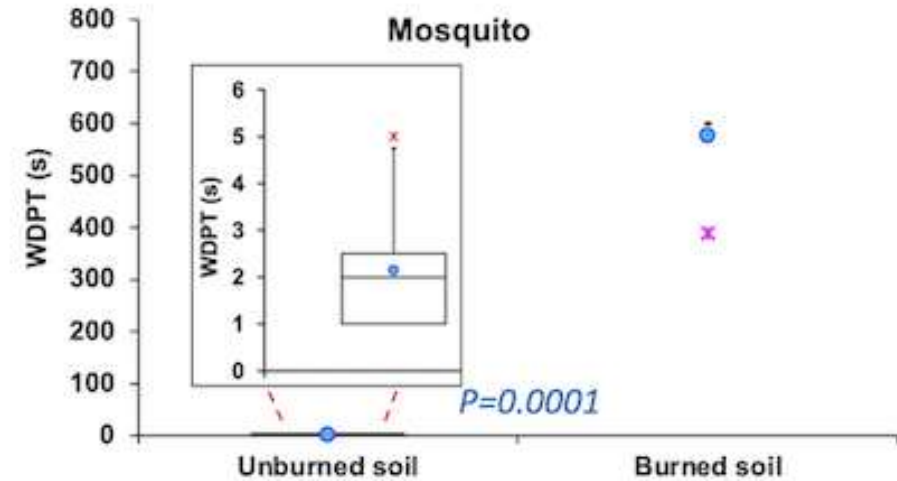
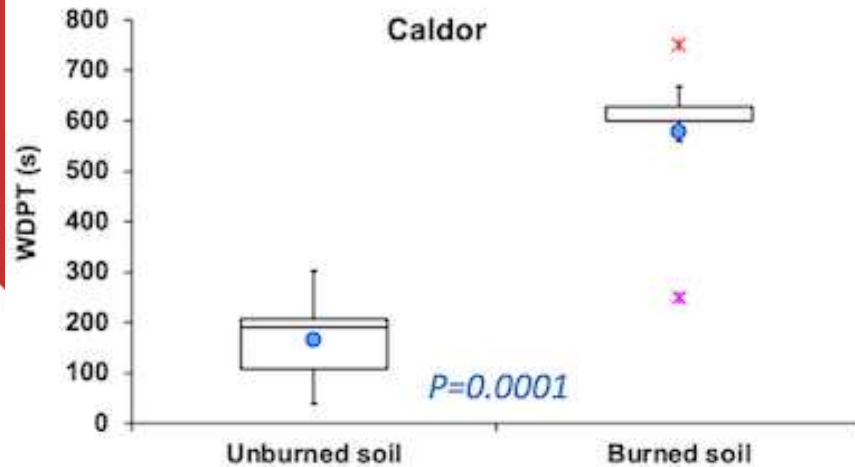
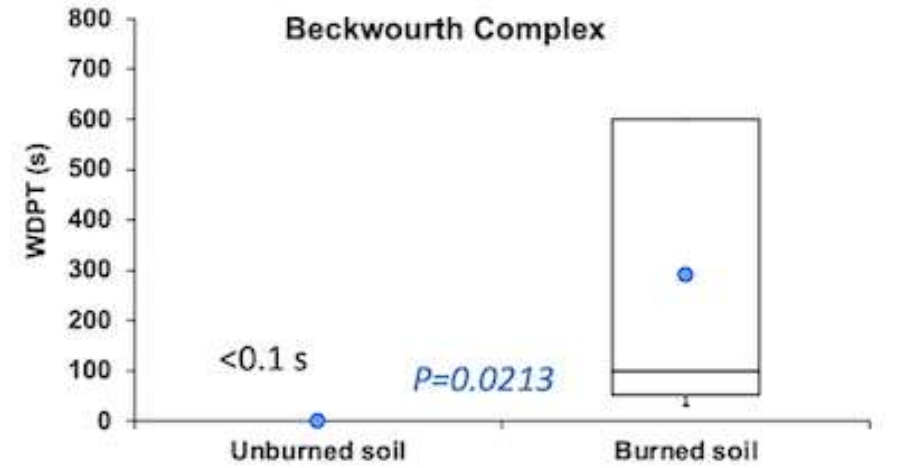
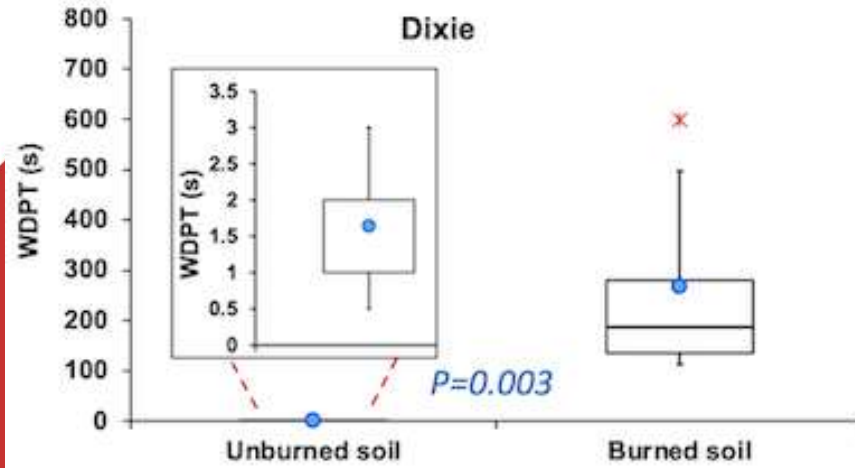
FT-ICR MS (chemical analysis)





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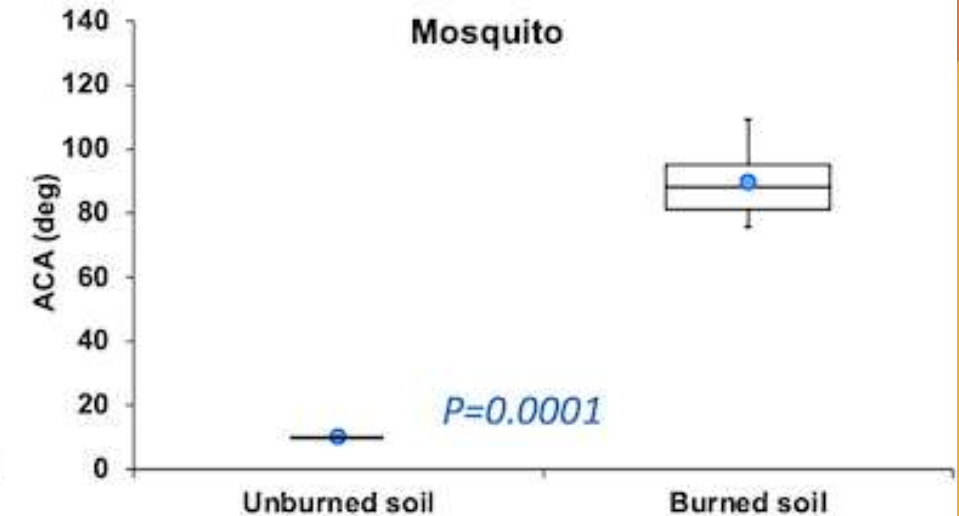
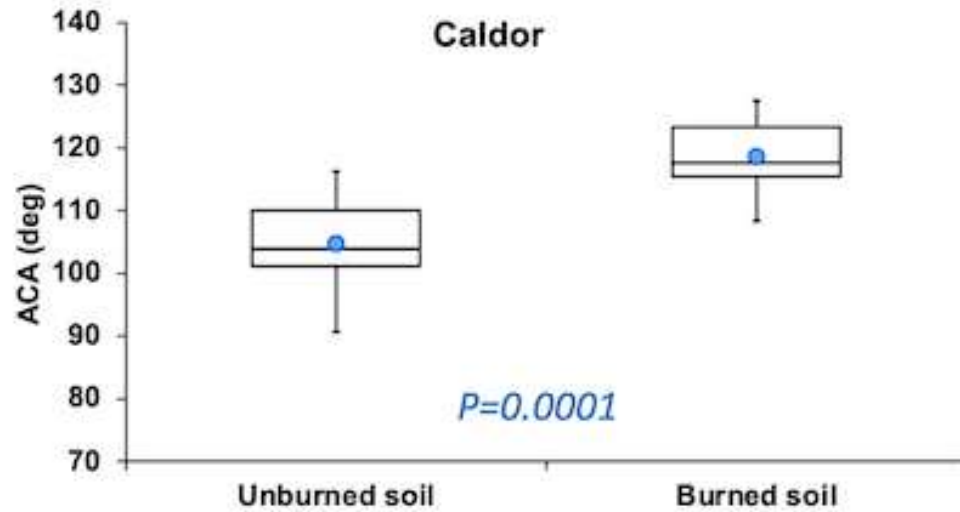
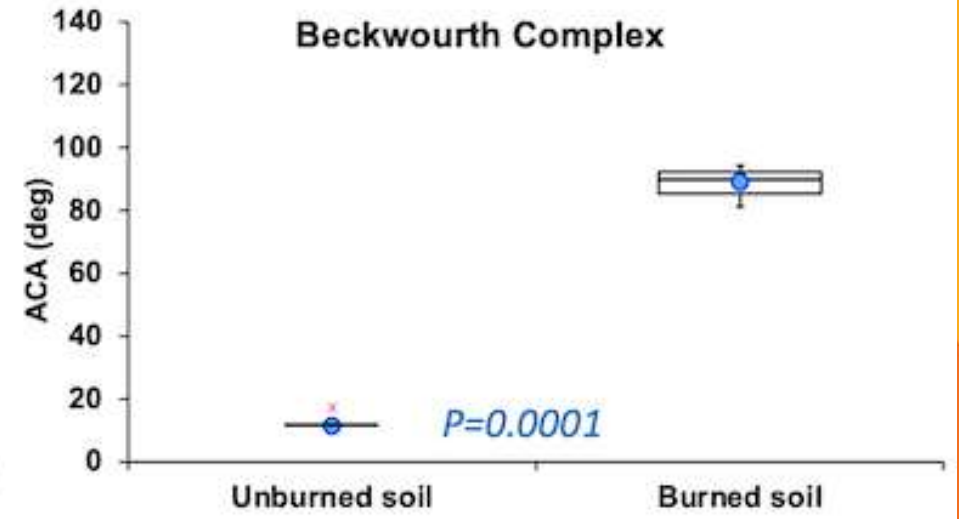
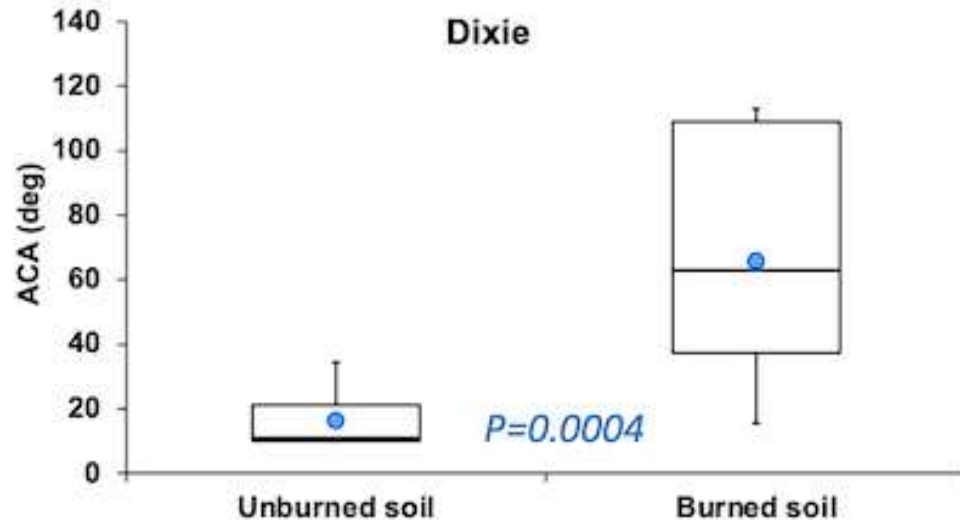
WDPT results





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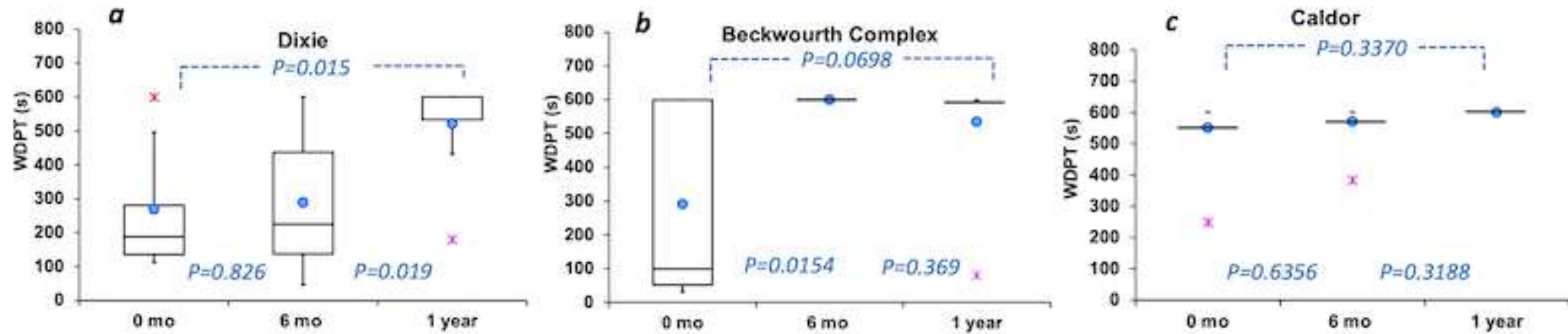
ACA results (goniometer)



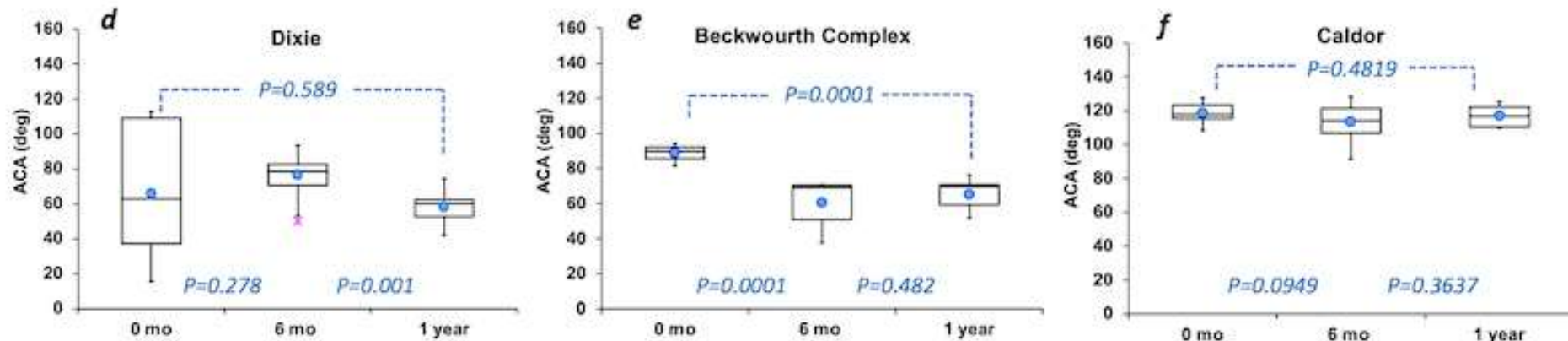
Temporal analysis of SW/R

Ref: Samburova et al., FIRE, 2023, *under review*

WDPT test



Apparent Contact Angle analysis



Formulas:

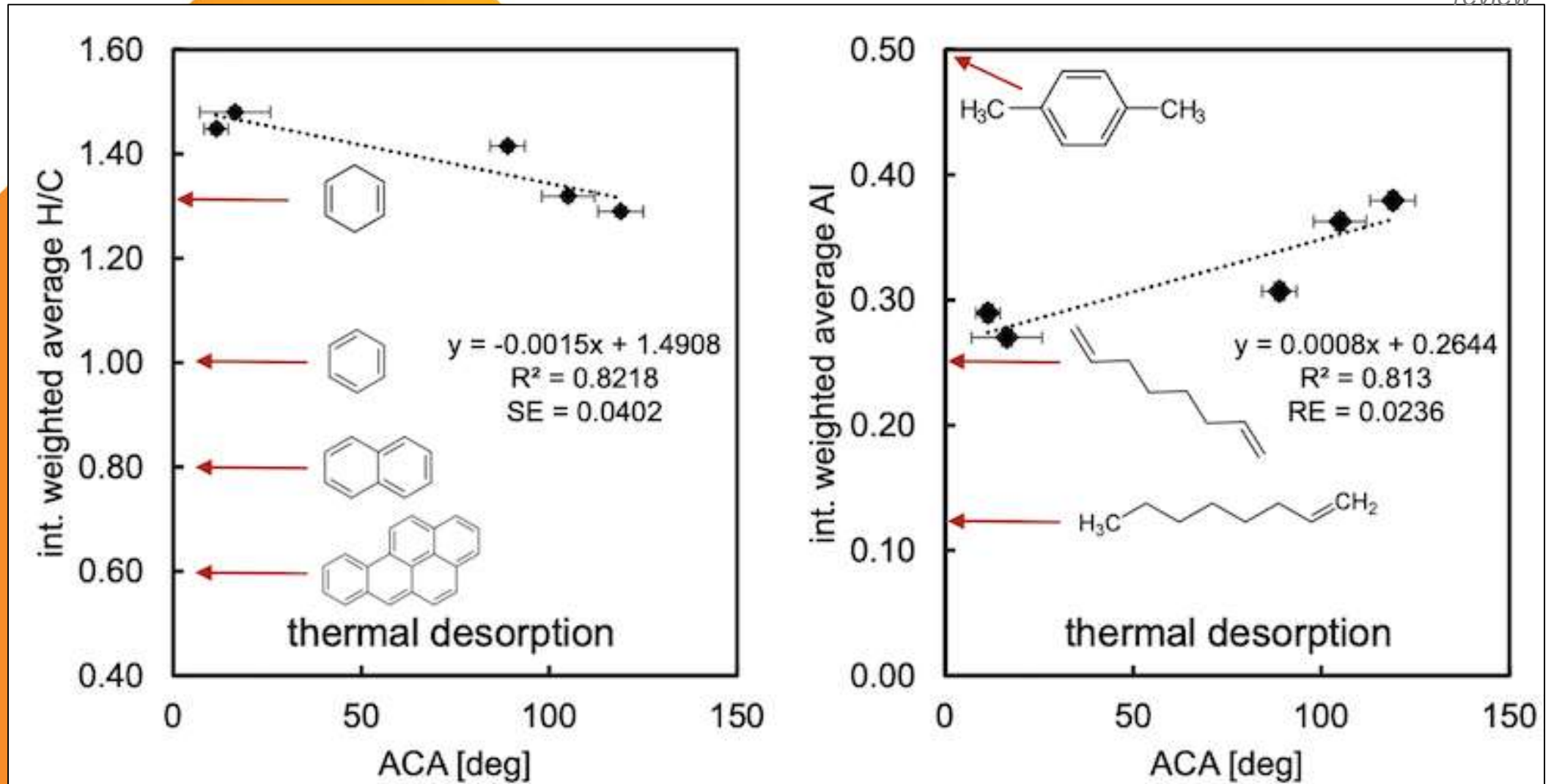
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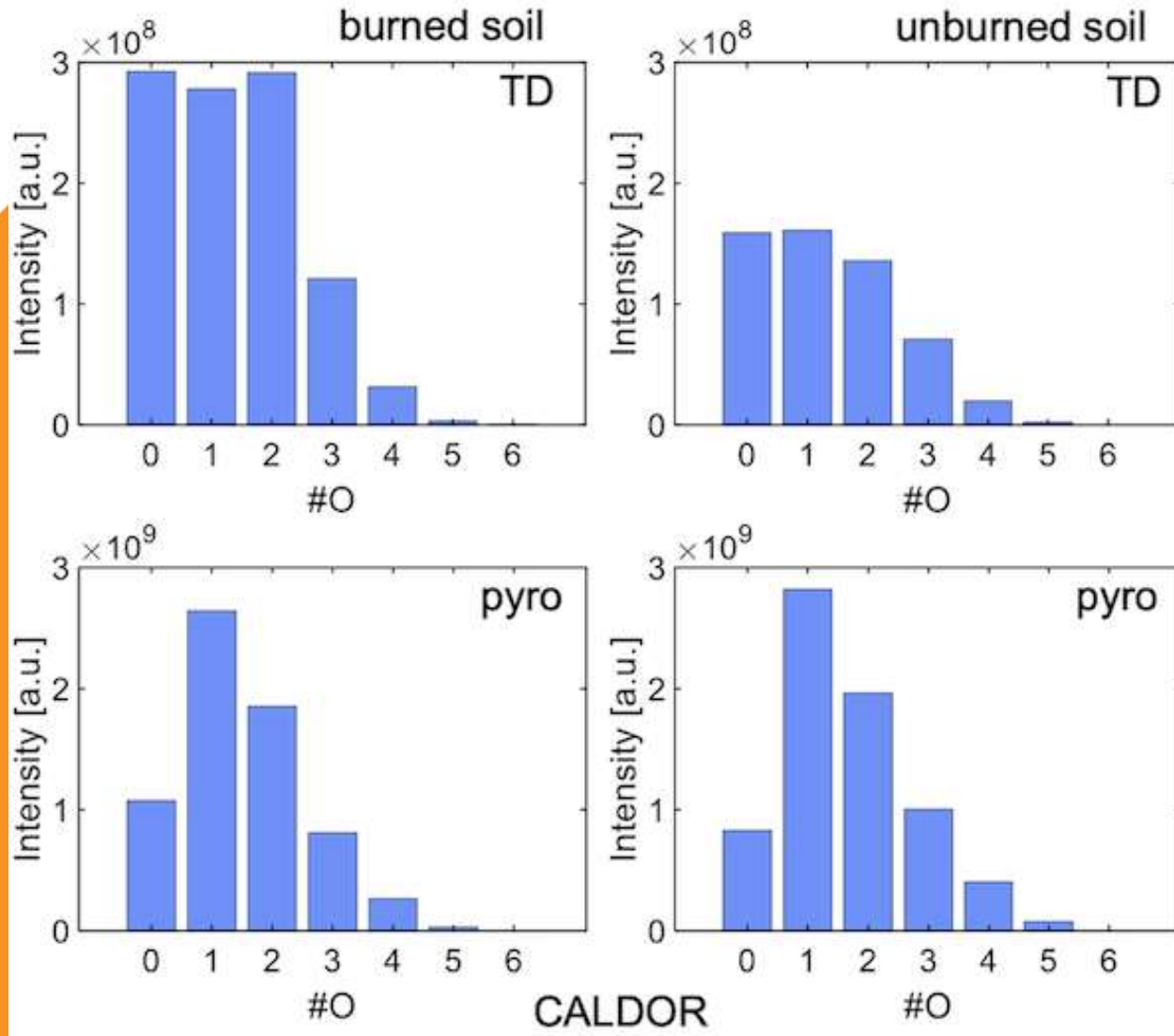
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Chemical analysis Example: Caldor Fire

Samburova et al., FIRE, 2023, *under review*



Summary

For all four fire sites, a significant increase in SWR was observed between unburned and burned soils with WDPT and ACA values increased between 1.1 and 10 times

Six-months and one-year after the 2021 megafires (Dixie, Caldor, and Beckwourth Complex megafires), our WDPT and ACA measurements showed no significant changes in SWR for unburned and burned soils.

The APPI FT-ICR MS analysis showed the positive correlation ($R^2=0.813$) between ACA values and aromaticity (AI for the desorption (or pre-pyrolysis) phase (~20–270 °C temperature range). It suggests that burned soils may become water repellent because of the formation and/or deposition of PAH-like organic species on the soil surface

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THANK YOU!

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