

Supplementary Information (SI)

Mobility of nitrogen in ashes and soils impacted by wildfires

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Text SI Cross calibration for N measurement and DON determination

Standards of KNO₃ were measured by Shimadzu TOC-L, and calibration curve was developed:

$$C_{NO_3} = a_{NO_3} Area_{NO_3} + b_{NO_3} \quad (1)$$

where C_{NO₃} is the concentration (mg N/L) of NO₃⁻, Area_{NO₃} is the integration area of TOC-L signal for NO₃⁻, a_{NO₃} is the regression coefficient of TOC-L signal for NO₃⁻. b_{NO₃} is the regression intercept of TOC-L signal for NO₃⁻.

Standards of NH₃/NH₄⁺ (ammonia) were measured by Shimadzu TOC-L, and calibration curve was developed:

$$C_{NH_3} = a_{NH_3} Area_{NH_3} + b_{NH_3} \quad (2)$$

where C_{NH₃} is the concentration (mg N/L) of NH₃/NH₄⁺, Area_{NH₃} is the integration area of TOC-L signal for NH₃/NH₄⁺, a_{NH₃} is the regression coefficient of TOC-L signal for NH₃/NH₄⁺. b_{NH₃} is the regression intercept of TOC-L signal for NH₃/NH₄⁺.

Standards of organic nitrogen (glycine) was measured by Shimadzu TOC-L, and calibration curve for DON was developed:

$$C_{DON} = a_{DON} Area_{DON} + b_{DON} \quad (3)$$

where C_{DON} is the concentration (mg N/L) of DON, $Area_{DON}$ is the integration area of TOC-L signal for DON, a_{DON} is the regression coefficient of TOC-L signal for DON. b_{DON} is the regression incept of TOC-L signal for DON.

Based on these, the concentration of DON was calculated using the equation below

$$C_{DON} = a_{DON} \left(area_{TDN} - \frac{C_{NO_3} - b_{NO_3}}{a_{NO_3}} - \frac{C_{NH_3} - b_{NH_3}}{a_{NH_3}} \right) + b_{DON} \quad (4)$$

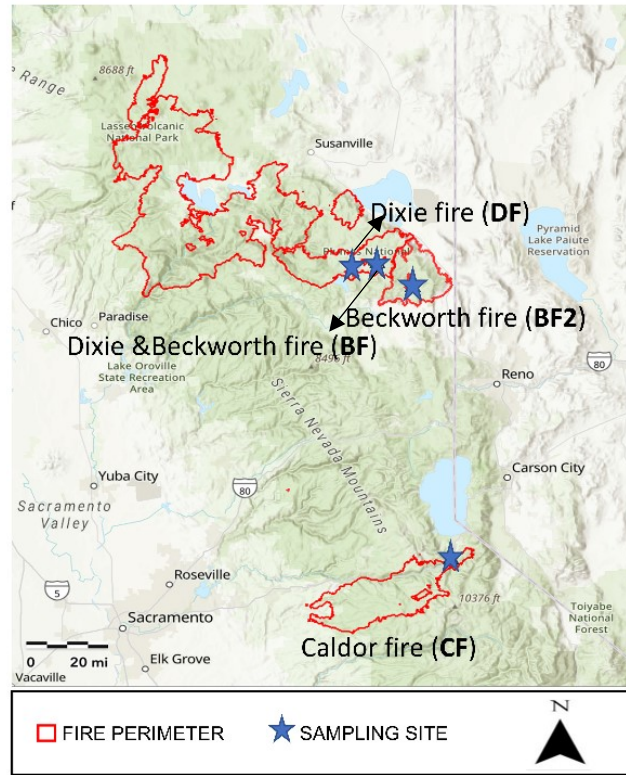


Figure S1. Map of sampling sites (blue stars) of wildfires that occurred in 2021, including the Dixie (DF), Beckwourth Complex (BF), and Caldor (CF) fires (with red lines for the borders of wildfire regions). BF2 represents the overlapped region of BF and DF fires.

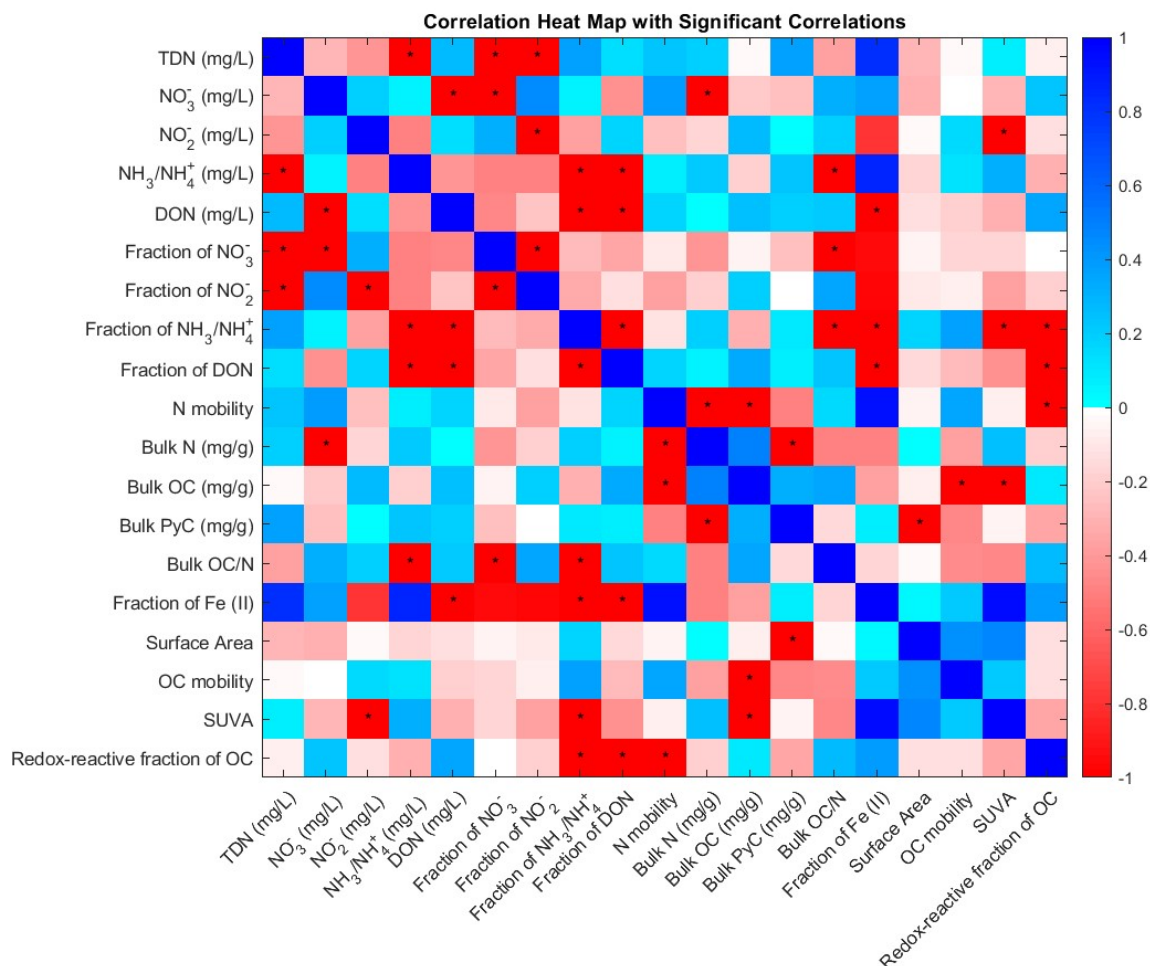


Figure S2. Heat map illustrating Pearson correlation coefficients between variables measured in this study for the mobility of nitrogen (N). Asterisks indicate statistically significant correlations ($p < 0.05$). Blue cells represent positive relationships, when red cells indicate negative correlation. Abbreviations and variables: TDN (mg/L): total dissolved nitrogen; NO_3^- , NO_2^- , $\text{NH}_3/\text{NH}_4^+$, and DON (dissolved organic nitrogen) (mg/L) represent their concentrations in the mobile phase, respectively; Fraction of NO_3^- , NO_2^- , $\text{NH}_3/\text{NH}_4^+$, and DON stand for their fractions in the dissolved N; N mobility stands for the mobile fraction of N; Bulk PyC (mg/g) stands for the bulk content of pyrogenic carbon; Bulk OC/N represents the molar ratio of bulk organic carbon (OC) relative to N; Fraction of Fe (II) stands for the fraction of Fe(II) in total iron (Fe) measured by XANES; SUVA ($1/\text{m}^*\text{L}/\text{mg}$) is the specific UV absorption coefficient at 254 nm; Redox-reactive fraction of OC stands for the fraction of redox-reactive fraction measured for mobile OC.

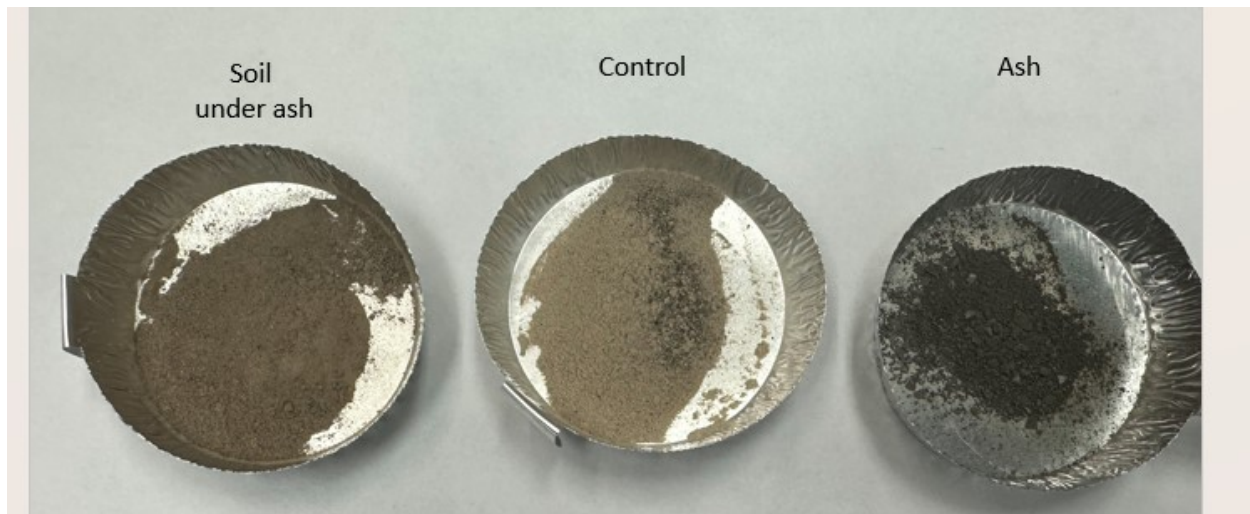


Figure S3. Photos of ashes, soil under ash, and control soils.

Table S1. Summary of sampling site and fire characteristics [1, 2].

Fire	Burned area (acres)	Wildfire Period	Unburned to Low Severity	Medium Severity	High Severity	GPS Coordinates of sampling sites
Beckworth Fire (BF2)	105,670	07/03/21-09/22/21	44%	53%	3%	39° 53' 21.1"N 120° 12' 02.9" W
Caldor Fire (CF)	221,952	08/14/21-10/25/21	47%	40%	13%	38° 50' 37.0" N 120° 01' 59.8" W
Dixie Fire (DF)	963,309	07/03/21-10/22/21	45%	30%	25%	39° 58' 41.9" N 120° 21' 24.8" W
Dixie & Beckwourt h fires (BF)		07/03/21-10/22/21				39°53'21.1"N 120°12'02.9"W

Table S2. Mobility of organic carbon (OC) in ashes (-A), soil under ashes (-S) and control soils (-C) from BF, DF, CF, and BF-2 sites as well as key parameters. Details can be found in our previous report [2]. Bulk OC/N represents the bulk molar ratio of OC/N. Bulk PyC stands for bulk pyrogenic carbon content. SUVA is the specific UV absorption coefficient at 254 nm; Redox-reactive fraction of OC stands for the fraction of redox-reactive fraction measured for mobile OC. Bulk OC/N represents molar ratio of OC/N. Fraction of Fe (II) stands for the fraction of Fe(II) in total iron (Fe) measured by XANES. Average and std represents average values and standard deviation collected from triplicate measurements for most parameters (the replicate numbers are higher for fraction of Fe(II)).

Average	Bulk OC (mg/g)	Bulk OC/N	Mobile fraction of OC	Bulk PyC (mg/g)	Surface area (m ² /g)	Fraction of Fe(II)	Redox fractions	SUVA of mobile OC (1/m ² *L/mg)
BF-A	8.11	8.11	0.02	8.72	6.95	0.66	0.07	4.40
BF-S	19.40	7.34	0.03	5.82	8.84	0.10	0.07	2.40
BF-C	4.30	4.67	0.07	2.08	12.30	0.57	0.14	3.52
DF-A	9.19	2.08	0.03	7.74	16.33		0.00	10.69
DF-S	9.48	11.37	0.07	0.88	18.90		0.00	4.97
DF-C	11.87	19.12	0.02	0.83	13.25		0.00	4.06
CF-A	43.72	15.48	0.03	7.58	13.75		0.00	2.01
CF-S	25.74	10.25	0.03	13.68	3.87		0.15	1.37
CF-C	24.43	22.28	0.01	10.33	7.32		0.00	3.35
BF2-A	57.38	16.53	0.01	3.83	13.39		0.56	0.77
BF2-S	21.83	17.87	0.03	3.71	17.04		0.22	4.39
BF2-C	6.30	17.30	0.03	0.85	9.30		0.94	2.67
Std	Bulk OC	Bulk OC/N	Mobility of OC	Bulk PyC	Surface area	Fraction of Fe(II)	Redox fractions	SUVA of mobile OC
BF-A	0.76	0.31	0.01	0.35	0.37	0.07	0.05	1.11
BF-S	2.61	0.64	0.01	0.10	1.74	0.15	0.05	0.75

BF-C	0.25	1.93	0.01	0.04	5.53	0.01	0.09	0.69
DF-A	0.38	1.58	0.01	0.29	0.40		0.00	1.01
DF-S	1.81	1.91	0.03	0.03	5.04		0.00	2.76
DF-C	0.11	0.16	0.01	0.04	0.10		0.01	0.90
CF-A	3.05	0.16	0.01	0.02	1.79		0.00	0.86
CF-S	2.13	0.77	0.02	0.61	0.38		0.08	1.50
CF-C	4.60	0.67	0.00	1.02	1.41		0.00	0.52
BF2-A	5.38	0.06	0.00	0.06	0.54		0.00	0.39
BF2-S	3.17	1.25	0.01	0.05	16.73		0.24	2.56
BF2-C	1.09	1.65	0.01	0.02	8.62		0.03	1.73

References:

1. Samburova, V.; Schneider, E.; Rüger, C.P.; Inouye, S.; Sion, B.; Axelrod, K.; Bahdanovich, P.; Friederici, L.; Raeofy, Y.; Berli, M.; et al. Modification of Soil Hydroscopic and Chemical Properties Caused by Four Recent California, USA Megafires. *Fire* **2023**, *6*, 186, doi:10.3390/fire6050186.
2. Numan, T.L., S.; Shahriar, Abrar; Timilsina, A.; Lard, M.L.; Clark, J.; Raeofy, Y.; Zhao, Q.; Poulson, S.R.; Verburg, P.; Richardson, J.A.; Cook, R.L.; Samburova, V.; Yang, Y. Post-wildfire mobilization of organic carbon. *Soil Systems* **2025**.