

1 Supplementary Material

2 **Differential effects of redox conditions on the decomposition of litter and soil organic matter**

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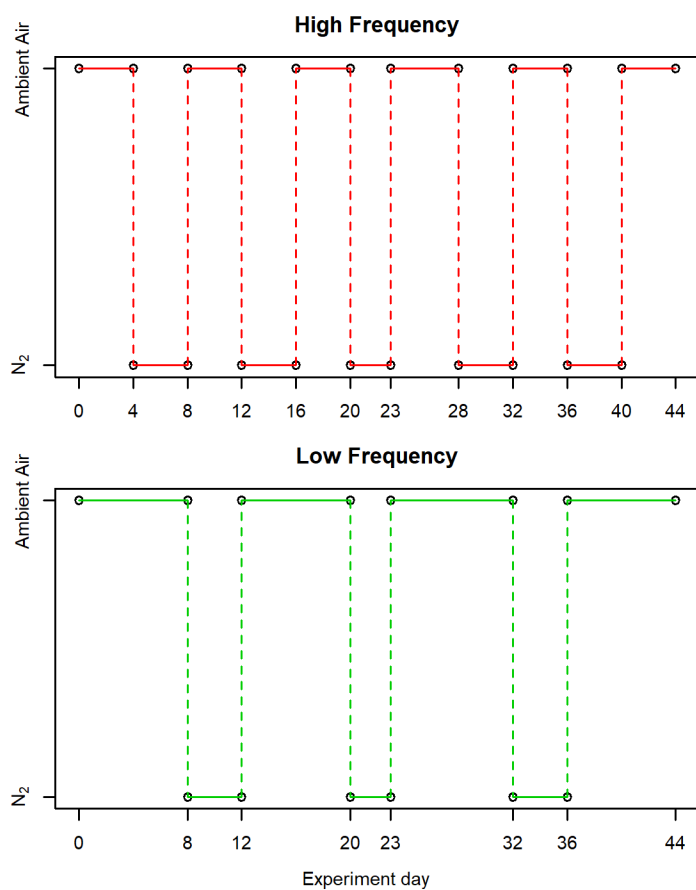
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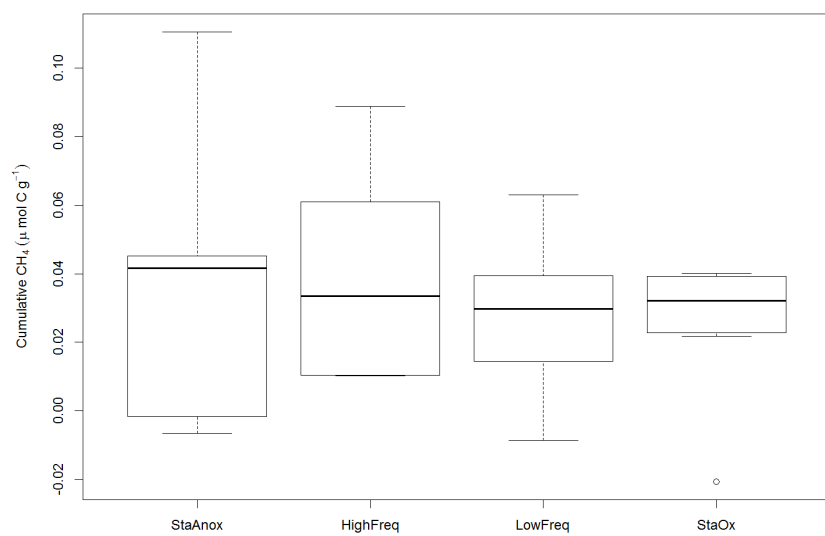
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18 Fig. S1. Changes in headspace composition for samples from the two redox fluctuating
19 treatments.

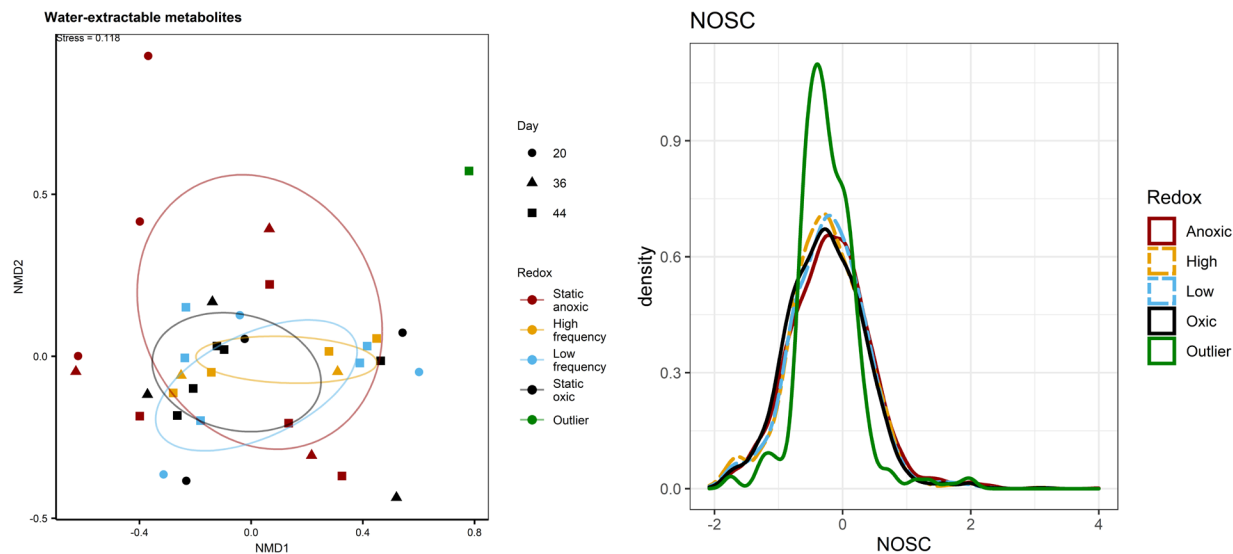
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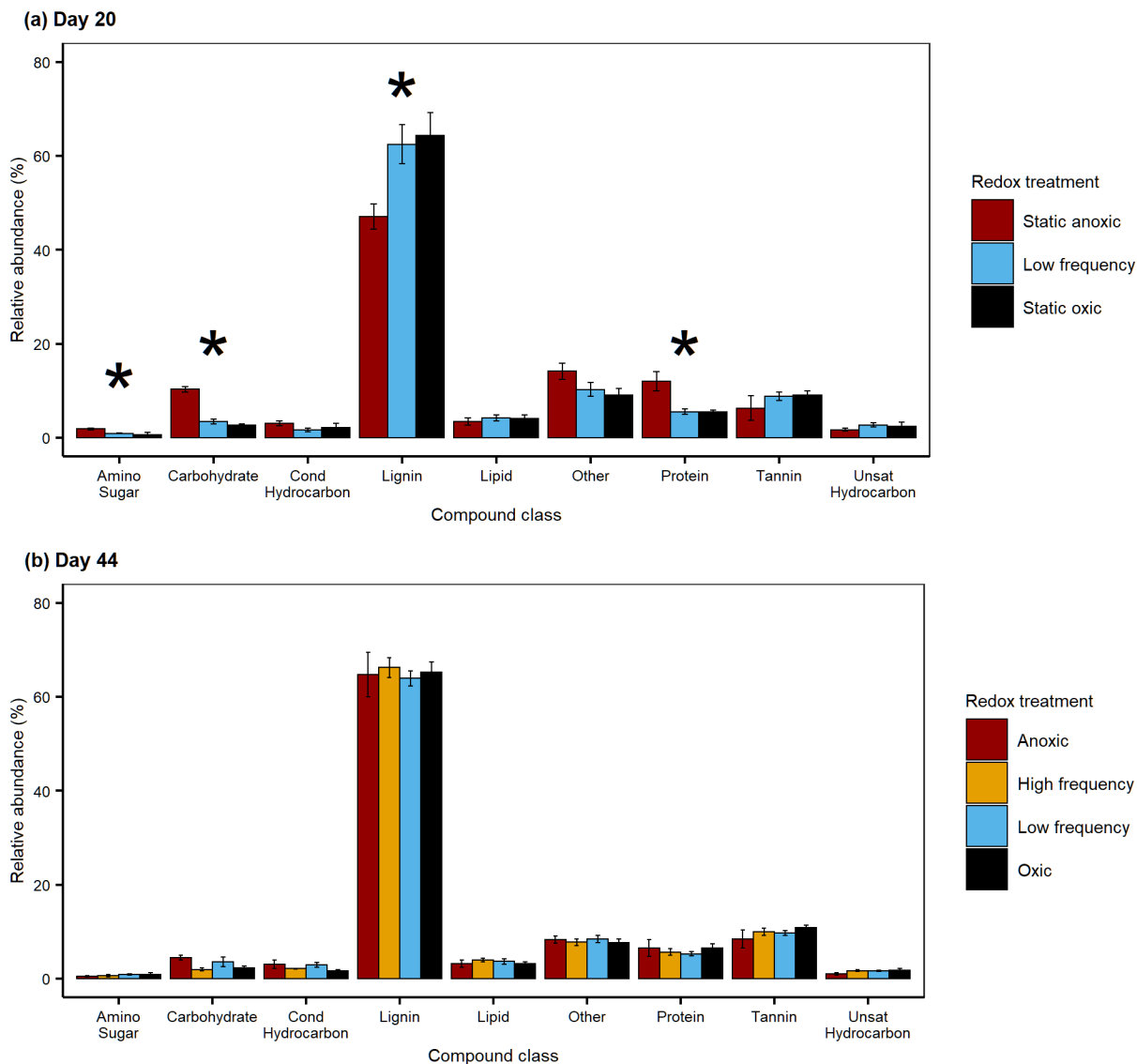
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22 Fig. S2. Cumulative CH₄ production over the incubation experiment.

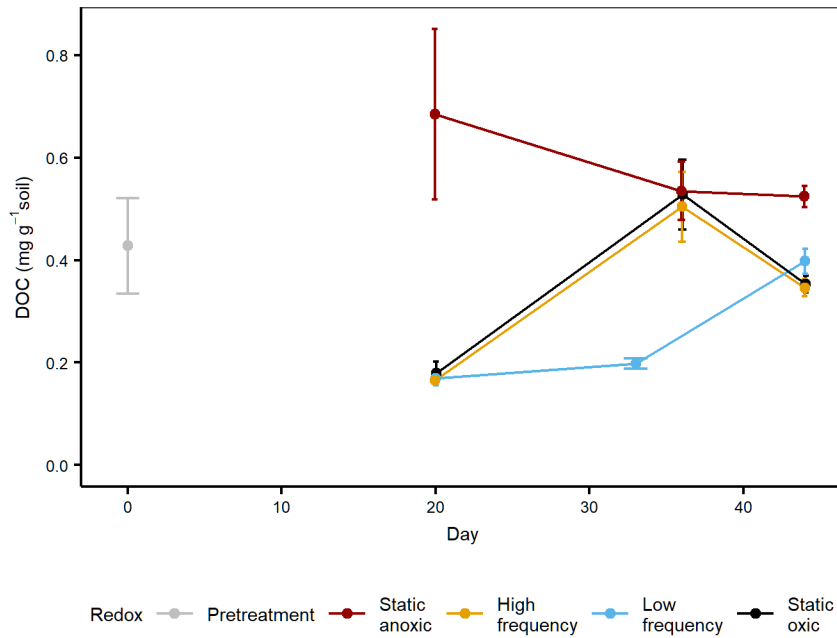
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 25 Fig. S3. (left) Non-metric multidimensional scaling (NMDS) plot comparing the composition of
 26 water-extractable organic matter between the outlier and other samples. Data were derived from
 27 FTICR-MS analysis. The eclipse indicates the standard deviation of each redox treatment. Note
 28 the deviation of outlier from rest of the samples. (right) The probability density curves of NOSC
 29 values of water-extractable organic matter comparing the outlier with other samples. Note the
 30 large difference between the outlier and other samples and the small differences among redox
 31 treatments.



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 33 Fig. S4. Effects of four redox treatments on the relative abundances of chemical compound
 34 classes extracted by water on day 20 (a) and day 44 (b) of a tropical soil incubation. Data
 35 were derived from FTICR-MS analysis. Error bars indicate standard errors of means. *
 36 indicate significant effects of redox treatments (ANOVA) at $\alpha = 0.05$ level. On days 20 and
 37 44, $n = 3$ and 5 per treatment, respectively. High frequency treatment from day 20 was not
 38 included. Two outliers were removed from day 44. See the Materials and Methods for details.
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41 Fig. S5. Effects of redox treatments on the concentrations of water-extractable dissolved organic

42 C (DOC). Pretreatment values are in grey. $n = 3$ per timepoint and treatment except $n = 5$ on day

43 44.

44

45 Table S1. Carbon concentration and ^{13}C abundance of background soil and ryegrass litter (Mean
46 \pm S.E.).

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| | C concentration | ^{13}C abundance |
|-------------------------|------------------|-------------------------------|
| Background soil (n = 3) | $6.1 \pm 0.4\%$ | $-29.0 \pm 0.8 \text{ ‰}$ |
| Ryegrass litter (n = 6) | $41.0 \pm 0.1\%$ | $96.7 \pm 0.1 \text{ atom\%}$ |

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50 Table S2. Total number of water-extractable molecular formulas identified by FTICR-MS
 51 analysis per sampling days and treatments.

| Sampling Day | Static anoxic | High frequency | Low frequency | Static oxic |
|--------------|---------------|------------------|------------------|-------------|
| 20 | 3795 | 584 ^a | 2635 | 2499 |
| 36 | 3070 | 1786 | N/A ^b | 2888 |
| 44 | 3938 | 3394 | 4364 | 4697 |

57 ^a Treatment was removed from further analysis due to the extremely low number of peaks
 58 identified.

59 ^b Treatment was not included in the original experimental design.