

Equation (1): $F_N = \frac{Q}{A} \times \frac{1}{V_m} \times (x_{out}(t) - x_{in})$

where F_N denotes the flux of Nr gases ($\text{ng N m}^{-2} \text{ s}^{-1}$); Q denotes the flow rate of the gases ($\text{m}^3 \text{ s}^{-1}$); A denotes the surface area of the soil (m^2); V_m denotes the molar volume of air ($\text{m}^3 \text{ mol}^{-1}$); t represents the 30 s before chamber switching; and χ_{out} and χ_{in} denote the headspace mixing ratios at the outlet and inlet of the chamber (ppb).

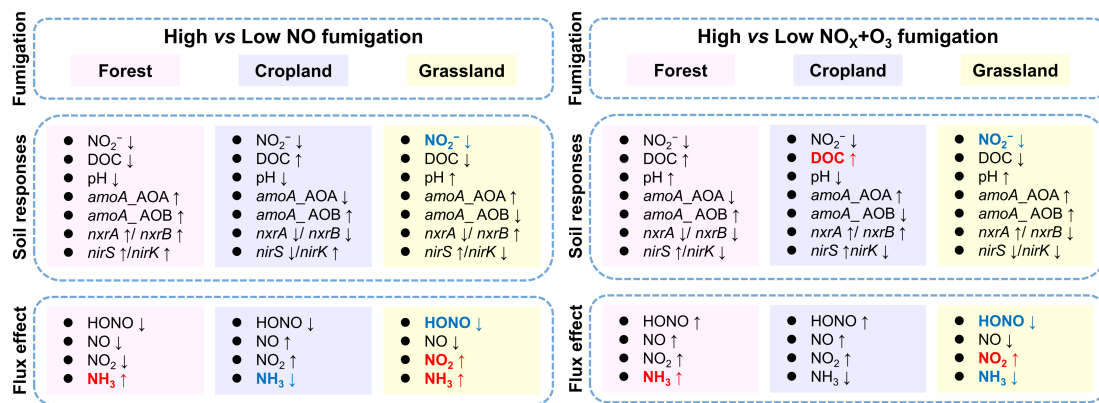


Figure 5: Conceptual diagram linking the effects of fumigation with high and low concentrations of NO and NO_x+O₃ on soil microbial functional genes, physicochemical properties, and Nr fluxes across forest, grassland, and cropland soils. Red bold indicate statistically significant increases, while blue bold indicate statistically significant decreases.

Table S1. Gas flux results for NO gas fumigation at 50 ppb for 3, 5, and 7 days (sample F3).

Fumigation duration	HONO	NO	NO ₂	NO _x	NH ₃
Average flux (ng N m ⁻² s ⁻¹)					
DAY3	2.28	6.88	1.93	8.39	589.76
DAY5	13.92	33.50	6.72	37.19	364.06
DAY7	9.99	63.29	5.15	62.95	396.20
Optimum flux (ng N m ⁻² s ⁻¹)					
DAY3	43.51	23.94	16.67	25.18	3046.20
DAY5	165.95	96.62	29.85	117.71	1645.00
DAY7	301.24	266.26	30.13	271.61	1965.78
Integrated emission (mg N m ⁻²)					
DAY3	0.22	0.56	0.16	0.65	47.23
DAY5	1.25	2.70	0.58	2.89	29.06
DAY7	0.85	5.12	0.43	4.91	31.72

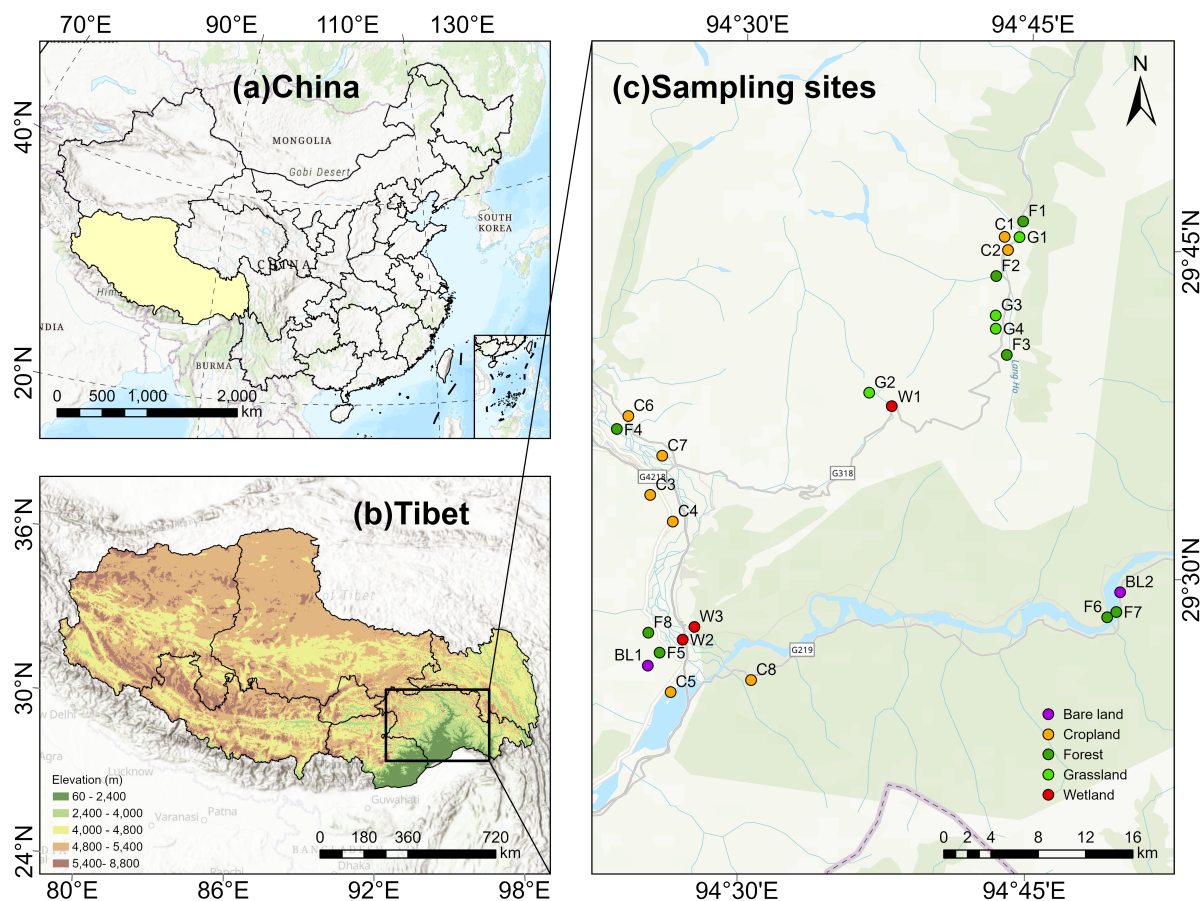


Fig. S1. Spatial distribution of the sampling sites in the study area.