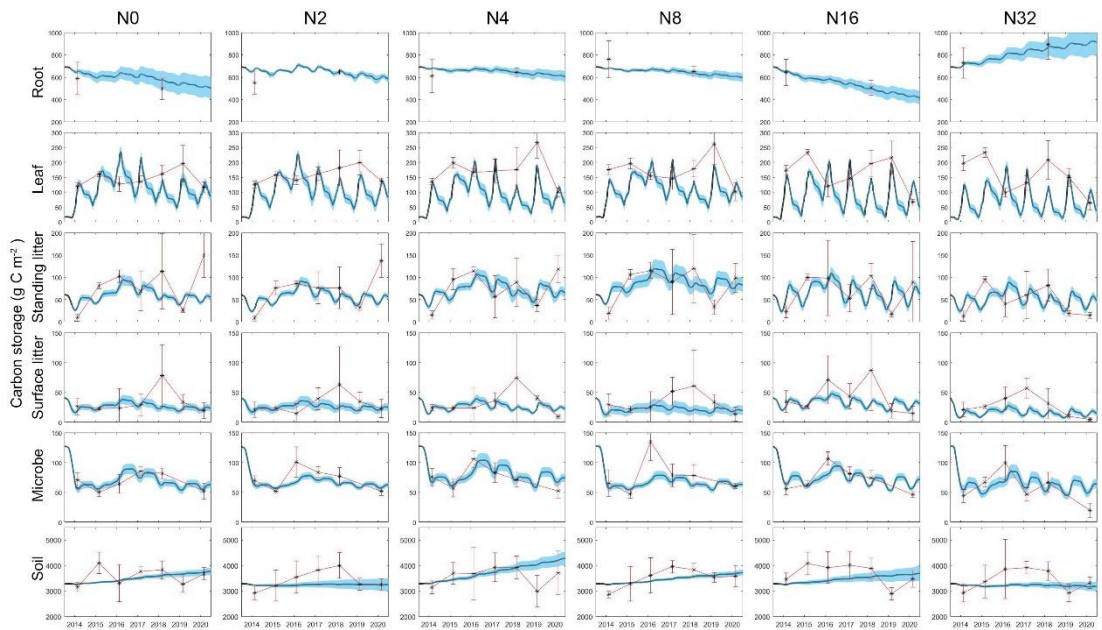


**Figure S1** Modeled and observed pool size changes from 2014 to 2020. The modeled (shaded areas) and measured Carbon (C) pools (points with error bars) are compared for root, leaf, standing litter, surface litter, microbe and soil simulated by the C-only model under different N addition treatments. The shaded areas represent the range of 25 and 75 percent quantiles of model simulations.



**Figure S2** Modeled and observed pool size changes from 2014 to 2020. The modeled (shaded areas) and measured Carbon (C) pools (points with error bars) are compared for root, leaf, standing litter, surface litter, microbe and soil simulated by the C-N coupling model under different N addition treatments. The shaded areas represent the range of 25 and 75 percent quantiles of model simulations.

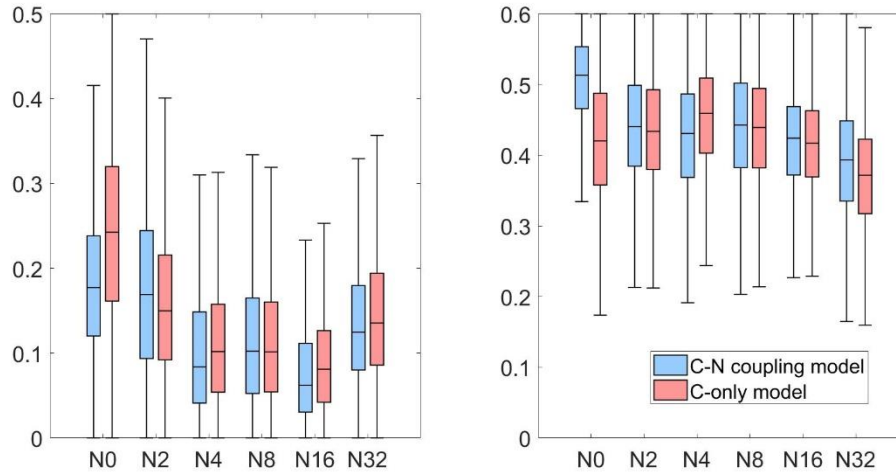


Figure S3 Posterior distributions the allocation coefficients of C to root and leaf constrained by the C-only model and the C-N coupling model under different N addition treatments.

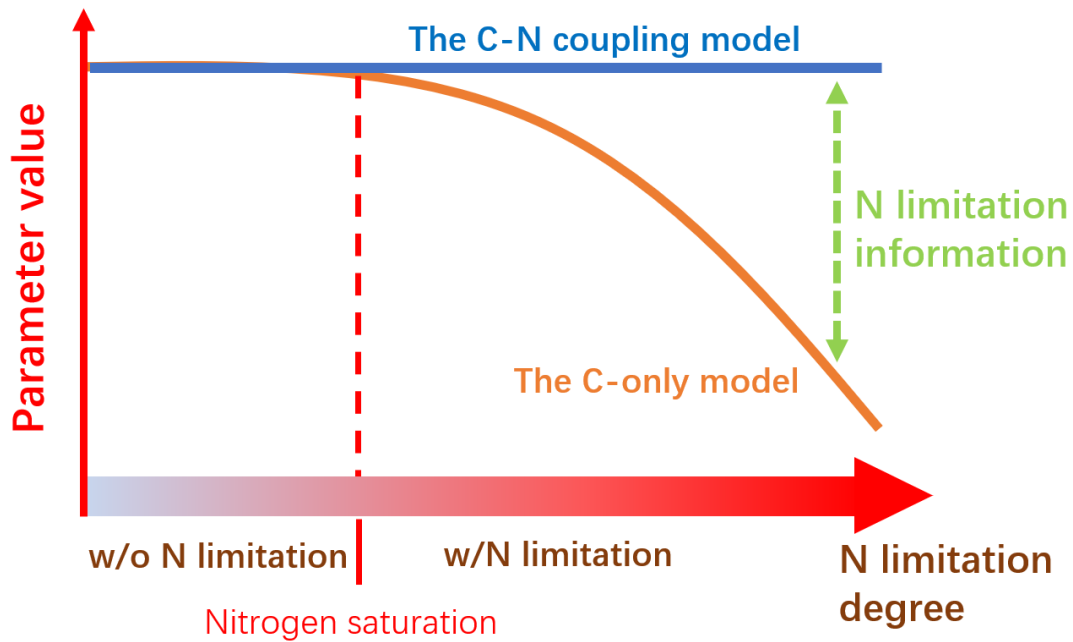


Figure S4 The influence of different N limitation degree on the parameterization of the C-only model and the C-N coupling model. Blue line is key parameters (i.e., photosynthetic rate and plants growth rate) estimated by the C-N coupling model with data assimilation, orange line is key parameters estimated by the C-only model with data assimilation.

Table S1: observed variables, measurement period and frequency used in this study

No.	Variable	Measurement period	Frequency
1	photosynthetically active radiation	2014-2020	hourly
2	wind speed	2014-2020	hourly
3	relative humidity	2014-2020	hourly
4	air temperature	2014-2020	hourly
5	Gross primary production-Chamber	2014-2020	biweekly

6	Soil moisture	2014-2020	daily
7	Temperature	2014-2020	daily
8	Soil respiration	2014-2020	biweekly
9	Heterotrophic respiration	2014-2020	biweekly
10	Leaf biomass	2014-2020	annual
11	Root biomass	2014-2020	annual
12	Standing litter biomass	2014-2020	annual
13	Surface litter biomass	2014-2020	annual
14	Microbe biomass	2014-2020	annual
15	Total soil C	2014-2020	annual
16	Leaf N	2014-2020	annual
17	Root N	2014-2020	annual
18	Standing litter N	2014-2020	annual
19	Surface litter N	2014-2020	annual
20	Microbe N	2014-2020	annual
21	Total soil N	2014-2020	annual
22	Soil inorganic N	2014-2020	annual

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