

## Supplementary materials

**Formula S1:**  $\delta AT(\text{‰}) = [(R_{\text{sample}} - R_{\text{standard}}) - 1] \times 1000$ . Where  $AT$  is the abundance of  $^{15}\text{N}$  and  $R$  is the ratio of  $^{15}\text{N}/^{14}\text{N}$  in samples and the international standards for atmospheric N. We repeatedly measured the  $\delta AT(\text{‰})$  of international standards after 12 sample measurements to ensure the within-run precision was 0.2‰ for  $\delta^{15}\text{N}$ .

**Formula S2:**  $NUE = \delta AT(\text{‰}) \times B \times TN$ ;  $\delta AT(\text{‰})$  is the abundance of  $^{15}\text{N}$ ;  $B$  is the biomass of plant stem, root, foliar tissues, and forbs;  $TN$  is the total nitrogen concentration of plant stem, root, foliar tissues and forbs.

**Formula S3:**  $Competition = (NUE_{\text{Foliar}} + NUE_{\text{Stem}} + NUE_{\text{Root}}) / NUE_{\text{Forbs}}$ ;  $NUE_{\text{Foliar}}$ ,  $NUE_{\text{Stem}}$ ,  $NUE_{\text{Root}}$ , and  $NUE_{\text{Forbs}}$  are the plant N use of eucalyptus foliar, stem, and root tissues and forbs.

**Table S1** Basic properties of biochar in our research. (Fixed C: fixed carbon; Olsen-P: Olsen available phosphorus; Avail K: available potassium).

Fixed C (mg kg <sup>-1</sup> )	Olsen-P (g kg <sup>-1</sup> )	Avail K (g kg <sup>-1</sup> )	Volume-weight (g cm <sup>-3</sup> )	Specific surface area (m <sup>2</sup> g <sup>-1</sup> )	Total porosity	pH	Electrical conductivity (mS cm <sup>-1</sup> )	Cation exchange capacity (cmol kg <sup>-1</sup> )
0.65	10.2	55.65	0.19	9	67.83%	10.24	4.68	60.8

**Table S2** Topological properties of bacterial networks under biochar and fertilizer applications.

Network metrics	CK	BC	NF	NFB
Number of nodes	20	29	29	30
Number of edges	99	195	192	144
Number of positive edges	71	99	95	69
Number of negative edges	28	96	97	75
P/N <sup>a</sup>	2.54	1.03	0.98	0.92
Average degree	9.9	13.49	13.24	9.6
Centralization betweenness	0.0002	0.16	0.11	0.0084
Modularity	0.33	0.22	0.2	0.59

<sup>a</sup> the ratio of positive to negative edges.

**Table S3** Means ( $\pm$ standard errors, N = 8) for root, stem, foliar, and forb biomass measured in January, 2020. Treatment types include the control (CK, no biochar and no  $^{15}\text{N}$ -labeled fertilizer), BC (20 t  $\text{hm}^{-2}$  biochar), NF (8 g  $\text{plant}^{-1}$   $^{15}\text{N}$ -labeled fertilizer), and NFB (20.0 t  $\text{hm}^{-2}$  biochar plus 8.0 g  $\text{plant}^{-1}$   $^{15}\text{N}$ -labeled fertilizer). Differences in lowercase letters within columns indicate statistically significant differences among biochar treatments at  $\alpha = 0.05$  level.

Treatment	Foliar (g)	Stem (g)	Root (g)	Forbs (g)
CK	4.95 $\pm$ 2.96 c	26.19 $\pm$ 6.76 b	8.81 $\pm$ 0.083 b	2.5 $\pm$ 1.22
BC	3.35 $\pm$ 1.94 c	32.93 $\pm$ 6.48 b	15.87 $\pm$ 2.09 ab	1.3 $\pm$ 0.23
NF	21.76 $\pm$ 47.82 b	47.82 $\pm$ 29.77 b	13.65 $\pm$ 7.21 b	2.59 $\pm$ 0.75
NFB	38.83 $\pm$ 4.67 a	101.76 $\pm$ 44.26 a	25.05 $\pm$ 8.42 a	1.8 $\pm$ 0.36

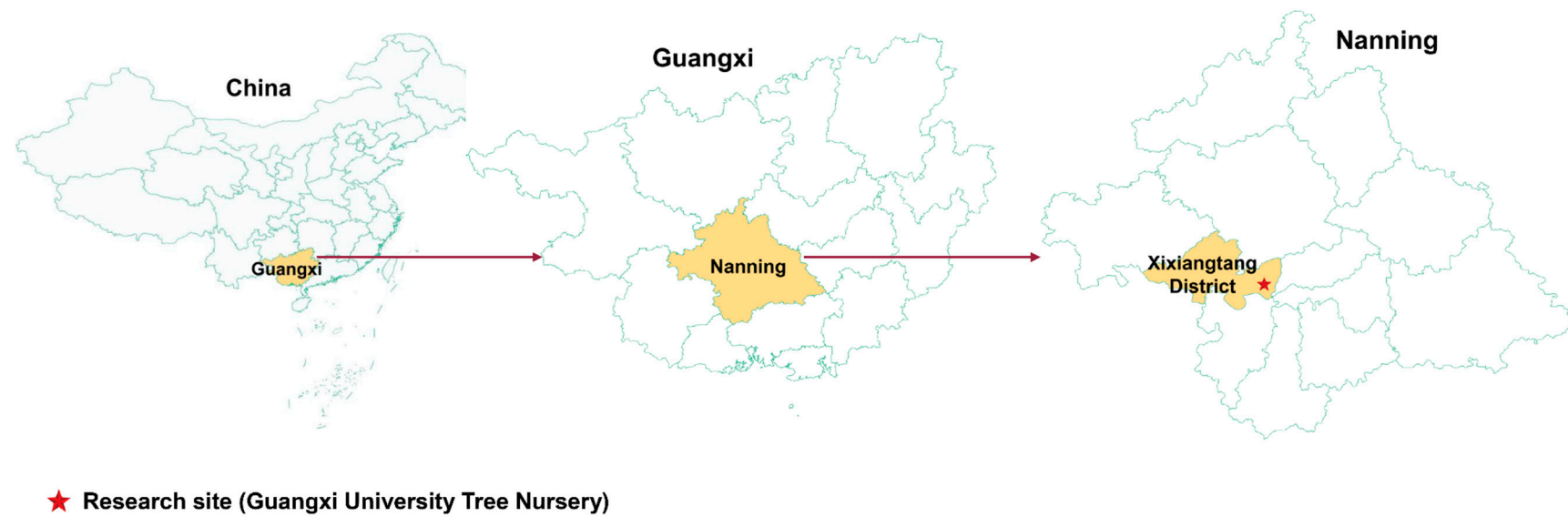
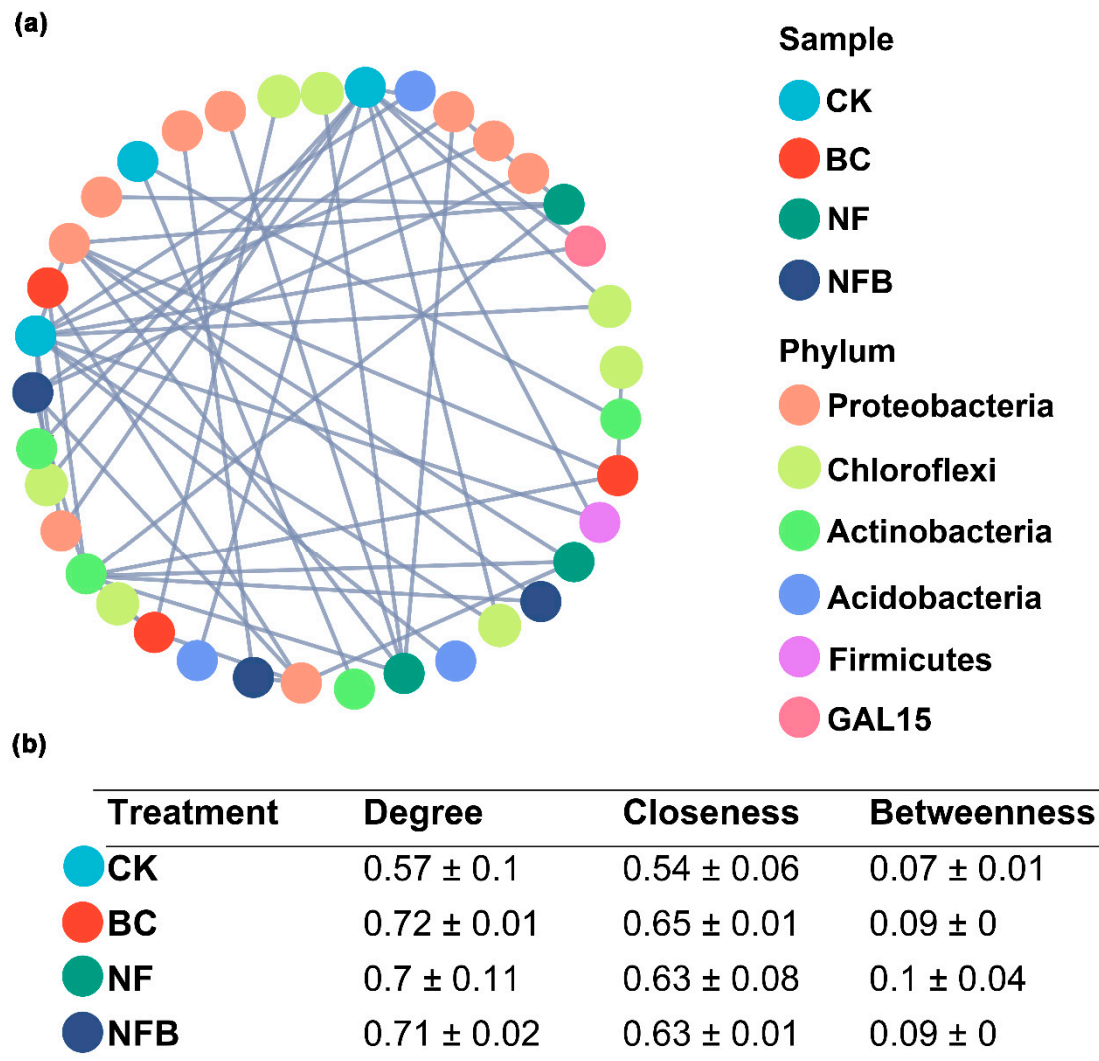


Figure S1 Location map of our research site in Nanning, Guangxi, China



**Figure S2** The bacterial co-occurrence networks in soils for each treatment and the control (a), as well as the degree, closeness, and betweenness of Centrality, are shown (b). The top 32 species nodes and 4 sample nodes are selected for this network. The nodes are colored by different soil samples and the keystone taxa are represented in circles, modules with less than 4 members were excluded.