Supplementary Materials

Effects of Soil Fauna on Aggregate-Associated Soil Organic Carbon Allocation in Subtropical Forests with Different Management

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Table S1. Site characteristics and stand attributes of the natural forest, castanopsis plantation, and fir plantation.

Forest Type	Natural Forests	Castanopsis Plantations	Fir Plantations
slope (°)	31.7	32	33
Forest age (years)	46	13	13
Mean Height (m)	15.80	8.77	11.30
Mean diameter at breast height (cm)	21.99	9.93	14.8
Forest density (trees ha^{-1})	3788	2400	2860

Table S2. Soil physicochemical properties, litter characteristics, and soil fauna attributes under fauna-access and fauna-exclusion treatments across three forest types.

Forest Type/Treatment	Soil Temperature 0–10 cm (°C)	Soil Moisture 0–10 cm (%)	Light (Lux)	Soil pH 0–10 cm	Soil pH 10–20 cm
Nat_access	23.77 ± 0.03	31.93 ± 0.35	450.00 ± 23.09	5.36 ± 0.06	5.44 ± 0.03
Nat_exclusion	23.77 ± 0.03	31.93 ± 0.35	450.00 ± 23.09	5.12 ± 0.10	4.89 ± 0.06
Ccp_access	25.77 ± 0.03	28.77 ± 0.33	1096.67 ± 3.33	5.35 ± 0.01	5.11 ± 0.08
Ccp_exclusion	25.77 ± 0.03	28.77 ± 0.33	1096.67 ± 3.33	4.98 ± 0.07	5.04 ± 0.04
Clp_access	25.00 ± 0.06	27.20 ± 0.17	495.67 ± 17.85	5.56 ± 0.05	5.67 ± 0.03
Clp_exclusion	25.00 ± 0.06	27.20 ± 0.17	495.67 ± 17.85	5.10 ± 0.05	5.18 ± 0.03
Forest Type/Treatment	**Soil N 0–10 cm (g/kg)**	**SOC 0–10 cm (g/kg)**	**Soil N 10–20 cm (g/kg)**	**SOC 10–20 cm (g/kg)**	**Soil C/N 0–10 cm**
Nat_access	2.05 ± 0.08	30.60 ± 0.51	1.87 ± 0.07	28.18 ± 0.95	14.98 ± 0.44
Nat_exclusion	2.21 ± 0.04	31.24 ± 0.20	1.93 ± 0.09	28.12 ± 0.72	14.17 ± 0.20
Ccp_access	1.69 ± 0.41	22.15 ± 1.06	1.12 ± 0.02	17.95 ± 0.38	14.24 ± 2.32
Ccp_exclusion	1.29 ± 0.08	19.48 ± 0.74	1.08 ± 0.06	16.15 ± 0.56	15.11 ± 0.33
Clp_access	1.60 ± 0.17	26.57 ± 1.70	1.20 ± 0.09	19.40 ± 0.75	16.89 ± 1.68
Clp_exclusion	1.32 ± 0.05	21.22 ± 0.50	1.24 ± 0.06	19.67 ± 0.49	16.06 ± 0.26
Forest Type/Treatment	**Soil C/N 10–20 cm**	**Soil P 0–10 cm (mg/kg)**	**Soil P 10–20 cm (mg/kg)**	**Litter Area (mm^2)**	**Litter Mass (g/m^2)**
Nat_access	15.07 ± 0.31	167.21 ± 6.95	158.00 ± 5.77	523.34 ± 29.86	63.96 ± 7.23
Nat_exclusion	14.59 ± 0.47	152.71 ± 2.14	124.79 ± 23.04	523.34 ± 29.86	63.96 ± 7.23
Ccp_access	15.99 ± 0.12	134.73 ± 8.91	123.73 ± 5.25	613.79 ± 19.12	74.36 ± 20.38
Ccp_exclusion	14.96 ± 0.43	97.29 ± 17.60	122.36 ± 3.27	613.79 ± 19.12	74.36 ± 20.38
Clp_access	16.27 ± 0.61	150.33 ± 2.35	130.41 ± 9.71	130.18 ± 11.70	31.44 ± 17.59
Clp_exclusion	15.90 ± 0.39	129.93 ± 4.92	138.91 ± 1.03	130.18 ± 11.70	31.44 ± 17.59
Forest Type/Treatment	**Litter Cellulose (%)**	**Litter Lignin (%)**	**Litter N (g/kg)**	**Litter C (g/kg)**	
Nat_access	17.06 ± 0.72	14.42 ± 0.86	15.64 ± 0.11	451.37 ± 1.31	
Nat_exclusion	17.06 ± 0.72	14.42 ± 0.86	15.64 ± 0.11	451.37 ± 1.31	
Ccp_access	19.60 ± 0.46	15.07 ± 0.58	16.27 ± 0.34	411.60 ± 1.16	
Ccp_exclusion	19.60 ± 0.46	15.07 ± 0.58	16.27 ± 0.34	411.60 ± 1.16	
Clp_access	24.28 ± 0.32	31.93 ± 0.21	6.63 ± 0.11	472.57 ± 0.31	
Clp_exclusion	24.28 ± 0.32	31.93 ± 0.21	6.63 ± 0.11	472.57 ± 0.31	
Forest Type/Treatment	**Fauna Abundance 0–10 cm (ind/m^2)**	**Fauna Abundance 10–20 cm (ind/m^2)**	**Fauna Biomass 0–10 cm (g/m^2)**	**Fauna Biomass 10–20 cm (g/m^2)**	
Nat_access	603.61 ± 49.91	264.08 ± 82.22	7.468 ± 6.184	0.019 ± 0.017	
Ccp_access	603.61 ± 185.78	622.47 ± 163.36	2.234 ± 2.054	7.867 ± 5.226	
Clp_access	282.94 ± 117.80	169.77 ± 86.44	1.140 ± 1.124	0.097 ± 0.090	
Forest Type/Treatment	**OM Abundance_0–10 (ind/m^2)**	**PR Abundance_0–10 (ind/m^2)**	**PH Abundance_0–10 (ind/m^2)**	**SA Abundance_0–10 (ind/m^2)**	
Nat_access	113.18 ± 56.59	37.73 ± 18.86	188.63 ± 82.22	264.08 ± 136.02	
Ccp_access	75.45 ± 37.73	37.73 ± 37.73	75.45 ± 49.91	414.98 ± 123.69	
Clp_access	37.73 ± 37.73	37.73 ± 18.86	0.00 ± 0.00	207.49 ± 150.90	
Forest Type/Treatment	**OM Abundance_10–20 (ind/m^2)**	**PR Abundance_10–20 (ind/m^2)**	**PH Abundance_10–20 (ind/m^2)**	**SA Abundance_10–20 (ind/m^2)**	
Nat_access	37.73 ± 37.73	0.00 ± 0.00	0.00 ± 0.00	226.35 ± 56.59	
Ccp_access	377.26 ± 164.44	56.59± 32.67	18.86 ± 18.86	169.77 ± 32.67	
Clp_access	37.73 ± 18.86	0.00 ± 0.00	0.00 ± 0.00	132.04 ± 68.01	

Values are presented as mean ± SE (n = 3). Nat, natural forest; Ccp, castanopsis plantation; Clp, fir plantation; access, fauna-access treatment; exclusion, fauna-exclusion treatment. Soil physicochemical variables include soil temperature, soil moisture, pH, SOC, N, C/N ratio, and soil P. Litter characteristics include litter area, litter mass, cellulose, lignin, C, and N. Soil fauna attributes include abundance, biomass, and the abundances of four functional groups: omnivores (OM), predators (PR), herbivores (PH), and saprophages (SA). No soil fauna were recovered from the fauna-exclusion treatment during the June sampling.

Table S3. Soil fauna taxonomic groups and functional groups in different forests.

Taxonomic Group	Functional Group	Natural Forest	Castanopsis Plantation	Fir Plantation
Cleridae	OM	−	+	−
Diptera larva	OM	+	−	−
Formicidae	OM	+	+	+
Ichneumonidae	OM	−	+	−
Scarabaeidae	OM	−	+	−
Staphylinidae	OM	−	−	+
Cecidomyiidae	OM	−	−	+
Coleoptera larva	OM	+	+	−
Cicadellidae	PH	−	+	−
Curculionidae	PH	+	−	−
Latridiidae	PH	+	+	−
Tetranychidae	PH	+	−	−
Trigonidiidae	PH	+	−	−
Araneidae	PR	+	−	−
Carabidae	PR	−	+	+
Geophilidae	PR	+	−	−
Linyphiidae	PR	−	+	+
Lycosidae	PR	−	+	−
Achipteriidae	SA	−	−	+
Calliphoridae	SA	−	+	−
Enchytraeidae	SA	−	−	+
Entomobryidae	SA	+	+	+
Heterorhabditidae	SA	+	+	+
Hypochthoniidae	SA	−	+	+
Isotomidae	SA	+	+	+
Megascolecidae	SA	+	+	−
Neanuridae	SA	+	+	+
Parajapygidae	SA	−	+	−
Scolopendrellidae	SA	+	−	−
Sminthuridae	SA	−	−	+
Termitidae	SA	−	−	+
Tomoceridae	SA	−	+	−

"+" indicates presence and "−" indicates absence in the June records.

Table S4. Two-way ANOVA results for the interactive effects of forest type and soil fauna treatment on aggregate mass proportion, aggregate-associated SOC concentration, and relative SOC contribution.

		Forest Type × Fauna Treatment					
Particle Size (mm)	Soil Layer	Aggregate Mass Proportion		SOC Concentration		Relative SOC Contribution	
		F	*p*	*F*	*p*	*F*	*p*
1–2	0–10 cm	4.747	**0.030**	9.870	**0.003**	7.184	**0.009**
	10–20 cm	0.274	0.765	4.699	**0.031**	1.875	0.196
0.25–1	0–10 cm	2.670	0.110	8.714	**0.005**	5.601	**0.019**
	10–20 cm	0.249	0.783	7.202	**0.009**	2.298	0.143
0.053–0.25	0–10 cm	0.133	0.877	15.514	**<0.001**	3.153	0.079
	10–20 cm	0.040	0.961	1.292	0.310	0.980	0.403
<0.053	0–10 cm	1.643	0.234	1.162	0.346	13.800	**<0.001**
	10–20 cm	0.531	0.601	0.589	0.570	3.133	0.080

Two-way ANOVAs were conducted separately for each aggregate-size fraction and soil layer, with forest type (natural forest, castanopsis plantation, and fir plantation) and soil fauna treatment (fauna access and fauna exclusion) as fixed factors. The table presents the *F* and *p* values for the forest type × soil fauna treatment interaction. Aggregate mass proportion refers to the proportion of soil mass represented by each aggregate-size fraction. Aggregate-associated SOC concentration refers to the SOC concentration within each aggregate-size fraction, whereas relative SOC contribution refers to the relative contribution of each aggregate-size fraction to aggregate-associated SOC. Significant *p* values ($p < 0.05$) are indicated in bold.