

Table S1. Soil chemical of field soils that support early-, middle-, and later-successional species.

Soil types	SOC (g kg ⁻¹)	TN (g kg ⁻¹)	TP (g kg ⁻¹)	SAP (g kg ⁻¹)	SAN (g kg ⁻¹)
Early	5.23±0.02a	0.74±0.01a	0.58±0.01a	2.50±0.08a	8.57±0.05a
Middle	4.48±0.01b	0.51±0.02c	0.56±0.00a	1.90±0.03c	6.29±0.06c
Later	5.18±0.01a	0.64±0.01b	0.46±0.01b	2.20±0.03b	8.14±0.04b

Different letters indicate significant differences in soil chemicals among the three soil types based on Duncan’s post hoc test ($p < 0.05$). SOC, soil organic carbon; TN, soil total nitrogen; TP, soil total phosphorus; SAP, soil available phosphorus; SAN, soil available nitrogen.

Table S2. Soil microbial biomass and enzyme activity of field soils that support early-, middle-, and late-successional species.

Soil types	BG ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	CBH ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	NAG ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	LAP ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	AP ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	MBC (mg kg^{-1})	MBN (mg kg^{-1})
Early	3.10 \pm 0.06a	0.25 \pm 0.002a	0.14 \pm 0.004a	4.11 \pm 0.10a	26.20 \pm 0.88a	145.69 \pm 2.07a	33.15 \pm 0.32a
Middle	2.68 \pm 0.01c	0.21 \pm 0.010b	0.09 \pm 0.002c	3.54 \pm 0.04b	20.92 \pm 0.85b	93.38 \pm 1.90c	29.54 \pm 0.45b
Later	2.91 \pm 0.01b	0.23 \pm 0.004b	0.11 \pm 0.001b	3.68 \pm 0.14ab	23.75 \pm 0.28ab	115.39 \pm 0.95b	28.45 \pm 0.18b

Different letters indicate significant differences in soil microbial biomass and enzyme activity among the three soil types based on Duncan's post hoc test ($p < 0.05$). BG, β -1,4-glucosidase; CBH, cellobiose hydrolase; NAG, β -1,4-acetyl-glucosamine glycosidase; LAP, leucine aminopeptidase; AP, phosphatase; MBC, microbial biomass carbon; MBN, microbial biomass nitrogen.

Table S3. F and p values of independent factors (plant growth period (P), species (S), and soil types (ST)) and their interactions to various parameters studied by a three-way ANOVA.

	Plant growth period (P)		Species (S)		Soil types (ST)		P×S		P×ST		S×ST		P×S×ST	
	F	p	F	p	F	p	F	p	F	p	F	p	F	p
Shoot biomass	172.10	<0.001	3.45	0.040	71.21	<0.001	14.29	<0.001	16.38	<0.001	3.13	0.023	5.17	0.002
Root biomass	0.82	0.375	52.60	<0.001	27.92	<0.001	1.25	0.297	0.50	0.612	5.58	<0.001	0.61	0.656
SOC	329.17	<0.001	69.55	<0.001	87.04	<0.001	53.09	<0.001	0.96	0.391	8.59	<0.001	6.37	<0.001
TN	8.70	0.005	2.32	0.110	36.13	<0.001	0.36	0.700	1.84	0.171	0.15	0.963	1.10	0.366
TP	325.26	<0.001	0.03	0.972	45.12	<0.001	61.43	<0.001	9.57	<0.001	0.83	0.512	1.42	0.242
SAP	63.16	<0.001	0.64	0.530	10.44	<0.001	1.10	0.342	1.47	0.240	1.04	0.396	0.67	0.615
SAN	31.41	<0.001	0.95	0.394	0.97	0.386	0.42	0.660	4.48	0.017	0.44	0.779	1.05	0.390
MBC	28.77	<0.001	38.46	<0.001	163.80	<0.001	6.02	0.005	2.76	0.074	5.58	<0.001	0.52	0.719
MBN	57.52	<0.001	17.96	<0.001	82.54	<0.001	0.42	0.661	8.77	<0.001	5.70	<0.001	0.69	0.601
BG	3.57	0.065	38.14	<0.001	124.19	<0.001	39.20	<0.001	20.85	<0.001	3.12	0.025	2.81	0.036
CBH	0.17	0.681	36.35	<0.001	114.21	<0.001	25.84	<0.001	1.96	0.153	3.11	0.024	0.93	0.454
NAG	0.05	0.820	77.36	<0.001	17.62	<0.001	19.59	<0.001	0.61	0.547	1.63	0.182	0.75	0.566
LAP	489.37	<0.001	14.51	<0.001	18.00	<0.001	14.43	<0.001	5.54	0.007	1.64	0.181	2.57	0.045
AP	22.10	<0.001	16.36	<0.001	64.43	<0.001	38.96	<0.001	0.49	0.616	1.23	0.312	0.79	0.534
STBC	103.17	<0.001	83.05	<0.001	117.56	<0.001	2.34	0.108	1.07	0.351	13.88	<0.001	4.66	0.003
STBN	52.84	<0.001	4.75	0.013	73.03	<0.001	1.27	0.292	0.36	0.698	10.25	<0.001	2.79	0.037
STBP	220.97	<0.001	54.54	<0.001	87.90	<0.001	35.98	<0.001	19.71	<0.001	6.45	<0.001	5.99	<0.001
RTBC	30066.30	<0.001	4.55	0.016	64.54	<0.001	4.93	0.011	63.90	<0.001	5.58	<0.001	5.55	<0.001
RTBN	15302.10	<0.001	3.68	0.033	15.19	<0.001	4.04	0.024	10.76	<0.001	0.36	0.834	0.33	0.856
RTBP	3372.34	<0.001	3.19	0.050	34.74	<0.001	3.16	0.052	22.81	<0.001	1.00	0.419	0.75	0.565

SOC, soil organic carbon; TN, soil total nitrogen; TP, soil total phosphorus; SAP, soil available phosphorus; SAN, soil available nitrogen. MBC, microbial biomass carbon; MBN, microbial biomass nitrogen. BG, β -1,4-glucosidase; CBH, cellobiose hydrolase; NAG, β -1,4-acetyl-glucosamine glycosidase; LAP, leucine aminopeptidase; AP, phosphatase. STBC, shoot biomass carbon; STBN, shoot biomass nitrogen; STBP, shoot biomass phosphorus. RTBC, root biomass carbon; RTBN, root biomass nitrogen; RTBP, root biomass phosphorus.

Table S4. T-tests analysis parameters of plant height during the plant growth period of *Artemisia sacrorum*, *Artemisia capillaris*, and *Artemisia giraldii*.

Soil types	<i>Artemisia sacrorum</i>			<i>Artemisia capillaris</i>			<i>Artemisia giraldii</i>		
	60d	90d	120d	60d	90d	120d	60d	90d	120d
Early	-	-	-	**	**	***	-	*	*
Middle	**	**	**	-	***	***	-	*	-
Later	*	**	*	**	***	***	**	-	-

***p < 0.001, **p < 0.01, *p < 0.05. -, did not reach the level of significant difference.

Table S5. T-tests analysis parameters of soil chemicals during growth of *Artemisia sacrorum*, *Artemisia capillaris*, and *Artemisia giraldii*.

Soil types	<i>Artemisia sacrorum</i>					<i>Artemisia capillaris</i>					<i>Artemisia giraldii</i>				
	SOC	TN	TP	SAP	SAN	SOC	TN	TP	SAP	SAN	SOC	TN	TP	SAP	SAN
Early	***	-	***	***	***	***	**	***	***	***	***	-	***	***	***
Middle	***	-	***	***	-	-	-	***	***	***	***	*	***	***	-
Later	***	-	***	*	-	-	-	*	**	***	***	**	-	***	***

***p < 0.001, **p < 0.01, *p < 0.05. -, did not reach the level of significant difference. SOC, soil organic carbon; TN, soil total nitrogen; TP, soil total phosphorus; SAP, soil available phosphorus; SAN, soil available nitrogen.

Table S6. T-tests analysis parameters of soil enzyme activity during the plant growth of *Artemisia sacrorum*, *Artemisia capillaris*, and *Artemisia giraldii*.

Soil types	<i>Artemisia sacrorum</i>					<i>Artemisia capillaris</i>					<i>Artemisia giraldii</i>				
	BG	CBH	NAG	LAP	AP	BG	CBH	NAG	LAP	AP	BG	CBH	NAG	LAP	AP
Early	***	***	***	***	**	*	-	*	***	***	-	-	-	***	***
Middle	***	***	***	***	**	**	-	-	***	***	-	*	**	***	***
Later	***	**	***	***	*	*	-	***	***	-	-	**	-	***	***

***p < 0.001, **p < 0.01, *p < 0.05. -, did not reach the level of significant difference. BG, β -1,4-glucosidase; CBH, cellobiose hydrolase; NAG, β -1,4-acetyl-glucosamine glycosidase; LAP, leucine aminopeptidase; AP, phosphatase.

Table S7. T-tests analysis parameters of soil microbial biomass during the plant growth of *Artemisia sacrorum*, *Artemisia capillaris*, and *Artemisia giraldii*.

Soil types	<i>Artemisia sacrorum</i>		<i>Artemisia capillaris</i>		<i>Artemisia giraldii</i>	
	MBC	MBN	MBC	MBN	MBC	MBN
Early	**	-	*	-	*	-
Middle	-	-	-	*	-	-
Later	**	*	*	*	-	**

***p < 0.001, **p < 0.01, *p < 0.05. -, did not reach the level of significant difference. MBC, microbial biomass carbon; MBN, microbial biomass nitrogen.

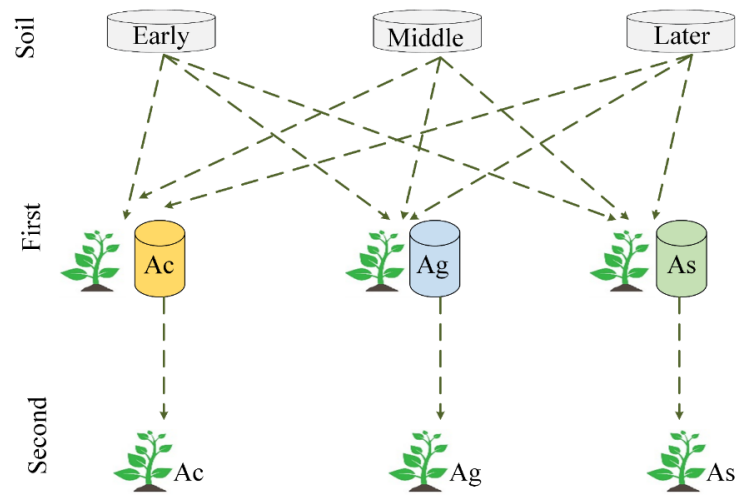


Figure S1. Plant-soil feedback experiment design of companion species *Artemisia sacrorum* (As) *Artemisia capillaris* (Ac), and *Artemisia giraldii* (Ag).