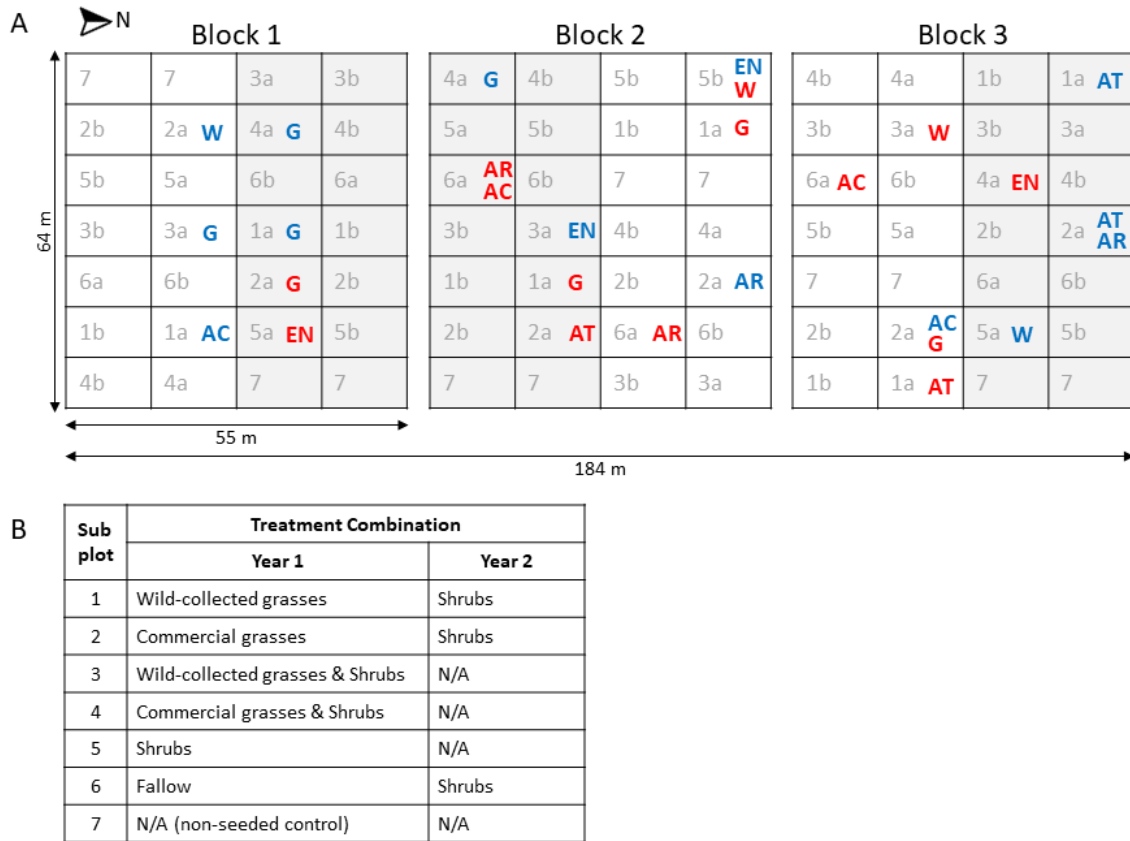
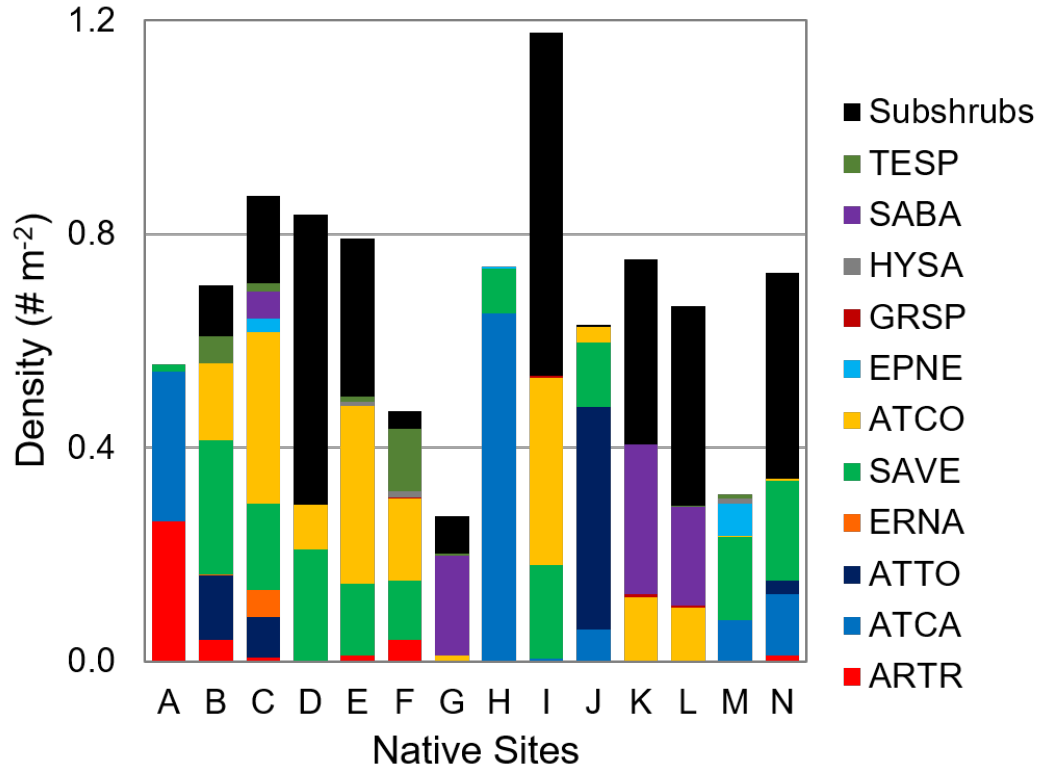


Supplementary Material

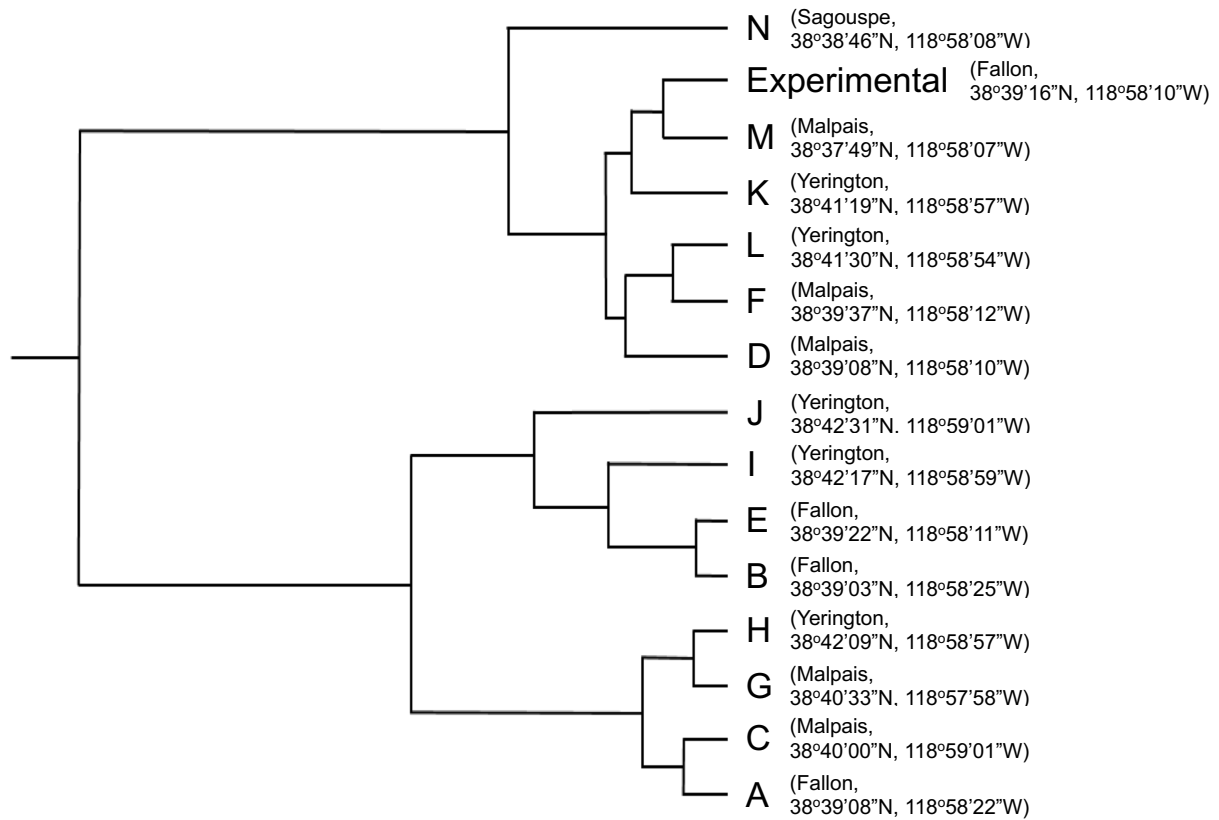
Persistent Agricultural Legacy in Soil Influences Plant Restoration Success in a Great Basin Salt Desert Ecosystem



Supplementary Figure S1: (A) Diagram of experimental layout in the experimental field, including 3 replicate blocks with 28 subplots per block. Non-shaded subplots received irrigation in the spring and grey-shaded subplots received irrigation in the spring and fall. The colored letter codes indicate the species or functional group sampled in each subplot, with red indicating a hotspot and blue a coldspot for that species (or functional group). Grey number/letter codes correspond with the treatment combination (B) applied to each subplot, with (a) representing locally and (b) representing distantly sourced shrubs. Subplots with distantly sourced shrubs and non-seeded control subplots were excluded in this study. Abbreviations: AT = ATTO, AR = ARTR, EN = ERNA, AC = ATCA, G = grasses, W = weeds.



Supplementary Figure S2: Shrub densities ($\# \text{ m}^{-2}$) at each of the native plots, A through N. Subshrubs includes the combined densities of KRLA, NEAM, and PIDE. Species codes are defined in Table 1 in the main text.



Supplementary Figure S3: Hierarchical cluster analysis (Ward's Method) dendrogram for soil characteristics at each native plot (A through N) and the average experimental plot. Soil characteristics for all experimental plots were averaged to represent the average experimental plot. The USDA soil series name and coordinates of plot centers are provided in parentheses.

Supplementary Table S1: Akaike's Information Criterion (AIC) scores for experimental plot models consisting of the best subsets of each soil characteristic type, given all possible combinations of soil characteristics. Models selected for use assembling the final candidate models are indicated in bold. Underlined model parameters indicate parameters that were transformed by squaring. Community codes are defined in Table 1 in the main text.

Community	Soil Characteristic Type	Model Parameters	AIC Score
Experimental Target	Chemical	pH + C:N	143.042
		pH + C:N + $\delta^{15}\text{N}$	143.356
		$\delta^{15}\text{N}$	143.564
		pH + P + C:N + $\delta^{15}\text{N}$	144.610
		pH + P + N + C:N + $\delta^{15}\text{N}$	146.372
		pH + P + C + N + C:N + $\delta^{15}\text{N}$	148.347
	Physical	FC	143.466
		infiltration rate + FC	144.619
		clay + BD + FC	146.041
		clay + BD + infiltration rate + FC	147.307
		clay + gravel + BD + infiltration rate + FC	149.091
		sand + clay + gravel + BD + infiltration rate + FC	150.844
	Physicochemical	$\delta^{13}\text{C}$	144.061
		$\delta^{13}\text{C}$ + EC	145.739
		$\delta^{13}\text{C}$ + EC + <u>ESP</u>	147.258
ARTR	Chemical	pH + P	-321.616
		pH + P + $\delta^{15}\text{N}$	-320.874
		pH + P + C:N + $\delta^{15}\text{N}$	-319.930
		P	-318.824
		pH + P + C + N + C:N	-318.671
		pH + P + C + N + C:N + $\delta^{15}\text{N}$	-317.749
	Physical	FC	-322.771
		infiltration rate + FC	-321.878
		clay + infiltration rate + FC	-321.134
		sand + clay + infiltration rate + FC	-320.499
		sand + clay + BD + infiltration rate + FC	-318.900
		sand + clay + gravel + BD + infiltration rate + FC	-316.922
	Physicochemical	EC	-319.889
		EC + ESP	-319.293
		$\delta^{13}\text{C}$ + EC + <u>ESP</u>	-317.624
ATTO	Chemical	$\delta^{15}\text{N}$	-178.690
		N + $\delta^{15}\text{N}$	-177.540
		pH + P + $\delta^{15}\text{N}$	-177.447
		pH + P + N + $\delta^{15}\text{N}$	-175.678
		pH + C + N + C:N + $\delta^{15}\text{N}$	-174.469

		pH + P + C + N + C:N + $\delta^{15}\text{N}$	-172.995
	Physical	infiltration rate	-175.529
		sand + infiltration rate	-174.870
		sand + infiltration rate + FC	-173.207
		sand + BD + infiltration rate + FC	-171.314
		sand + gravel + BD + infiltration rate + FC	-169.526
	Physicochemical	sand + clay + gravel + BD + infiltration rate + FC	-167.537
		EC	-176.921
		$\delta^{13}\text{C}$ + EC	-175.672
		$\delta^{13}\text{C}$ + EC + <u>ESP</u>	-174.159
ATCA	Chemical	pH + $\delta^{15}\text{N}$	47.950
		$\delta^{15}\text{N}$	48.352
		P + N + $\delta^{15}\text{N}$	48.468
		pH + P + N + $\delta^{15}\text{N}$	49.590
		pH + P + C + N + $\delta^{15}\text{N}$	51.439
		pH + P + C + N + C:N + $\delta^{15}\text{N}$	52.724
	Physical	sand	52.110
		sand + BD	53.375
		clay + BD + FC	54.284
		clay + gravel + BD + FC	55.139
		sand + clay + gravel + BD + FC	57.016
		sand + clay + gravel + BD + infiltration rate + FC	58.979
	Physicochemical	$\delta^{13}\text{C}$	50.691
		$\delta^{13}\text{C}$ + EC	52.434
		$\delta^{13}\text{C}$ + EC + <u>ESP</u>	54.297
ERNA	Chemical	pH + C:N	143.199
		C:N	143.339
		pH + C:N + $\delta^{15}\text{N}$	144.477
		pH + P + C:N + $\delta^{15}\text{N}$	145.541
		pH + P + N + C:N + $\delta^{15}\text{N}$	147.483
		pH + P + C + N + C:N + $\delta^{15}\text{N}$	149.483
	Physical	FC	142.749
		infiltration rate + FC	143.803
		clay + infiltration rate + FC	145.549
		clay + BD + infiltration rate + FC	147.110
		sand + clay + BD + infiltration rate + FC	148.850
		sand + clay + gravel + BD + infiltration rate + FC	150.738
	Physicochemical	$\delta^{13}\text{C}$	142.967
		$\delta^{13}\text{C}$ + EC	144.724
		$\delta^{13}\text{C}$ + EC + <u>ESP</u>	146.318

Grasses	Chemical	P + N	51.934	
		pH + P + N	52.251	
		pH + P + N + $\delta^{15}\text{N}$	53.695	
		pH	53.856	
		pH + P + C + N + C:N	54.830	
		pH + P + C + N + C:N + $\delta^{15}\text{N}$	56.248	
		infiltration rate	53.720	
	Physical	infiltration rate + FC	54.353	
		clay infiltration rate + FC	55.773	
		clay + BD + infiltration rate + FC	57.724	
		clay + gravel + BD + infiltration rate + FC	59.721	
		sand + clay + gravel + BD + infiltration rate + FC	61.721	
		Physicochemical	$\delta^{13}\text{C}$ + EC	53.968
			$\delta^{13}\text{C}$	55.210
$\delta^{13}\text{C}$ + EC + <u>ESP</u>	55.706			
Weeds	Chemical	C	387.418	
		P + C	388.716	
		P + C + $\delta^{15}\text{N}$	389.523	
		P + C + N + $\delta^{15}\text{N}$	390.643	
		P + C + N + C:N + $\delta^{15}\text{N}$	392.338	
		pH + P + C + N + C:N + $\delta^{15}\text{N}$	394.337	
		infiltration rate	388.208	
	Physical	infiltration rate + FC	389.670	
		gravel + BD + infiltration rate	389.684	
		clay + gravel + BD + infiltration rate	391.361	
		sand + clay + gravel + BD + infiltration rate	392.731	
		sand + clay + gravel + BD + infiltration rate + FC	394.683	
		Physicochemical	$\delta^{13}\text{C}$ + EC	388.488
			$\delta^{13}\text{C}$	390.021
	$\delta^{13}\text{C}$ + EC + <u>ESP</u>		390.488	

Abbreviations: P = available phosphorus as phosphate, C:N = carbon:nitrogen ratio, BD = bulk density, EC = electrical conductivity, ESP = exchangeable sodium percentage, ARTR = *A. tridentata*, ATTO = *A. torreyi*, ATCA = *A. canescens*, ERNA = *E. nauseosa*

Supplementary Table S2: Akaike's Information Criterion (AIC) scores for the best candidate models in the experimental plots using combinations of chemical, physical, and physicochemical soil characteristics identified from models in Supplementary Materials Table 1, given all possible combinations of candidate soil characteristics. The final model selected for each community, species, and functional group is indicated in bold. Community and species codes are defined in Table 1 in the main text.

Community, Species, Functional Group	Model Parameters	AIC Score
Experimental Target	pH + C:N + $\delta^{13}\text{C}$	142.310
	pH + C:N	143.042
	BD	143.337
	pH + C:N + BD + $\delta^{13}\text{C}$	143.431
ARTR	pH + P + FC	-322.855
	FC	-322.771
	pH + FC	-322.460
	pH + P + EC + FC	-321.040
ATTO	$\delta^{15}\text{N}$ + infiltration rate	-179.433
	$\delta^{15}\text{N}$	-178.690
	$\delta^{15}\text{N}$ + EC + infiltration rate	-178.191
ATCA	pH + $\delta^{15}\text{N}$	47.950
	$\delta^{15}\text{N}$	48.352
	pH + $\delta^{15}\text{N}$ + sand	48.616
	pH + $\delta^{13}\text{C}$ + $\delta^{15}\text{N}$ + sand	50.610
ERNA	pH + C:N + $\delta^{13}\text{C}$	141.229
	pH + C:N + $\delta^{13}\text{C}$ + FC	142.265
	FC	142.749
	C:N + $\delta^{13}\text{C}$	142.917
Grasses	P + EC + infiltration rate	43.249
	$\delta^{13}\text{C}$ + P + EC + infiltration rate	44.931
	$\delta^{13}\text{C}$ + N + P + EC + infiltration rate	46.750
	P + infiltration rate	50.343
	infiltration rate	53.720
Weeds	C	387.418
	$\delta^{13}\text{C}$ + infiltration rate	388.066
	$\delta^{13}\text{C}$ + EC + infiltration rate	388.606
	C + $\delta^{13}\text{C}$ + EC + infiltration rate	390.461

Abbreviations: P = available phosphorus as phosphate, C:N = carbon:nitrogen ratio, FC = field capacity, EC = electrical conductivity, ARTR = *A. tridentata*, ATTO = *A. torreyi*, ATCA = *A. canescens*, ERNA = *E. nauseosa*

Supplementary Table S3: Numeric hierarchical partitioning results for all community-level, species-level, and functional group models in the experimental plots comparing soil characteristics and shrub density; only soil characteristics included in the partitioning models (Supplementary Materials Table 2) are listed. Values represent the individual R² contribution for the soil characteristic. Italic text indicates a negative relationship between shrub density and the soil characteristic. Values in parentheses represent the *p* value for each soil characteristic. Significant soil characteristics (*p* < 0.05) are indicated in bold text.

Soil Characteristic	Experimental Target	ARTR	ATTO	ATCA	ERNA	Grasses	Weeds
pH	8.335 (0.060)	7.345 (0.084)		7.382 (0.148)	6.273 (0.080)		
P		<i>10.550 (0.158)</i>				19.034 (0.001)	
C							<i>15.270 (0.044)</i>
C:N	8.161 (0.059)				9.194 (0.046)		
δ ¹⁵ N			<i>20.274 (0.023)</i>	<i>17.338 (0.029)</i>			
Infiltration rate			10.797 (0.122)			16.502 (0.005)	
Field capacity		<i>17.577 (0.100)</i>					
δ ¹³ C	5.417 (0.131)				8.535 (0.069)		
EC						<i>12.932 (0.006)</i>	
Overall Model R ²	0.219	0.355	0.311	0.247	0.240	0.485	0.153
Overall Model <i>p</i>	0.121	0.016	0.012	0.033	0.092	0.001	0.044

Abbreviations: P = available phosphorus as phosphate, C:N = carbon:nitrogen ratio, EC = electrical conductivity, ARTR = *A. tridentata*, ATTO = *A. torreyi*, ATCA = *A. canescens*, ERNA = *E. nauseosa*

Supplementary Table S4: Akaike's Information Criterion (AIC) scores for native plot models consisting of the best subsets of each soil characteristic type, given all possible combinations of soil characteristics. Models selected for use assembling the final candidate models are indicated in bold. Underlined model parameters indicate parameters that were log transformed. Community codes are defined in Table 1 in the main text.

Community	Soil Characteristic Type	Model Parameters	AIC Score
Native	Chemical	pH + P + N + $\delta^{15}\text{N}$	-3.098
		pH + N + $\delta^{15}\text{N}$	-1.244
		pH + P + <u>C</u> + N + $\delta^{15}\text{N}$	-1.197
		N + $\delta^{15}\text{N}$	-0.417
		pH + P + <u>C</u> + N + C:N + $\delta^{15}\text{N}$	0.785
		P	1.423
	Physical	<u>gravel</u>	2.588
		clay + <u>gravel</u>	2.719
		clay + <u>gravel</u> + BD	4.136
		clay + <u>gravel</u> + BD + infiltration rate	5.585
		sand + clay + <u>gravel</u> + BD + infiltration rate	7.099
		sand + clay + <u>gravel</u> + BD + infiltration rate + FC	9.067
	Physicochemical	$\delta^{13}\text{C}$	2.202
		$\delta^{13}\text{C}$ + ESP	3.017
		$\delta^{13}\text{C}$ + EC + ESP	5.016
GS	Chemical	<u>C</u> + C:N	3.152
		pH + P + <u>C</u> + C:N + $\delta^{15}\text{N}$	3.779
		P + <u>C</u> + C:N	4.456
		P + <u>C</u> + C:N + $\delta^{15}\text{N}$	5.404
		pH + P + <u>C</u> + N + C:N + $\delta^{15}\text{N}$	5.762
		C:N	6.840
	Physical	clay + <u>gravel</u> + BD	11.652
		sand + clay + <u>gravel</u> + BD + infiltration rate	11.971
		<u>gravel</u>	12.062
		clay + <u>gravel</u>	12.186
		clay + <u>gravel</u> + BD + infiltration rate	12.395
		sand + clay + <u>gravel</u> + BD + infiltration rate + FC	13.648
	Physicochemical	$\delta^{13}\text{C}$ + EC + ESP	10.602
		ESP	10.635
		$\delta^{13}\text{C}$ + ESP	11.072
FW	Chemical	C:N + $\delta^{15}\text{N}$	-10.364
		P + <u>C</u> + C:N	-9.603
		P + <u>C</u> + C:N + $\delta^{15}\text{N}$	-8.579
		C:N	-8.331
		P + <u>C</u> + N + C:N + $\delta^{15}\text{N}$	-7.023

		pH + P + <u>C</u> + N + C:N + $\delta^{15}\text{N}$	-5.269
	Physical	sand + BD + FC	-1.717
		sand + <u>gravel</u> + BD + FC	-0.810
		<u>gravel</u>	-0.716
		sand + field capacity	-0.293
		sand + clay + <u>gravel</u> + BD + FC	0.785
	Physicochemical	sand + clay + <u>gravel</u> + BD + infiltration rate + FC	2.358
		EC + ESP	-7.859
		$\delta^{13}\text{C}$ + EC + ESP	-7.055
		ESP	-4.020
Native Target	Chemical	P + C:N + $\delta^{15}\text{N}$	-5.957
		P + C:N	-5.233
		pH + P + C:N + $\delta^{15}\text{N}$	-3.975
		P + <u>C</u> + N + C:N + $\delta^{15}\text{N}$	-2.008
		pH + P + <u>C</u> + N + C:N + $\delta^{15}\text{N}$	-0.047
		<u>C</u>	0.217
	Physical	FC	-1.381
		sand + FC	-0.517
		sand + FC + infiltration rate	0.380
		sand + <u>gravel</u> + infiltration rate + FC	1.992
		sand + <u>gravel</u> + BD + infiltration rate + FC	3.917
		sand + clay + <u>gravel</u> + infiltration rate + FC	5.835
	Physicochemical	EC	-1.188
		EC + ESP	-0.521
		$\delta^{13}\text{C}$ + EC + ESP	1.366

Abbreviations: P = available phosphorus as phosphate, C:N = carbon:nitrogen ratio, BD = bulk density, EC = electrical conductivity, ESP = exchangeable sodium percentage, FC = field capacity, GS = greasewood-shadscale community, FW = fourwing saltbush community

Supplementary Table S5: Akaike's Information Criterion (AIC) scores for the best candidate models in the native plots using combinations of chemical, physical, and physicochemical soil characteristics identified from models in Supplementary Materials Table 4, given all possible combinations of candidate soil characteristics. The final model selected for each community is indicated in bold. Underlined parameters indicate parameters that were log transformed. Community and species codes are defined in Table 1 in the main text.

Community	Model Parameters	AIC Score
Native	N + $\delta^{15}\text{N}$ + <u>gravel</u>	-3.209
	pH + N + $\delta^{15}\text{N}$ + P	-3.098
	pH + N + $\delta^{15}\text{N}$ + P + <u>gravel</u>	-2.845
	pH + $\delta^{13}\text{C}$ + N + $\delta^{15}\text{N}$ + P + <u>gravel</u>	-1.842
	N + $\delta^{15}\text{N}$	-0.417
	P	1.423
GS	C:N + <u>C</u> + $\delta^{13}\text{C}$ + <u>gravel</u>	2.647
	C:N + BD + ESP	2.654
	C:N + BD	2.660
	C:N + <u>C</u> + $\delta^{13}\text{C}$ + <u>gravel</u> + ESP	3.400
	C:N + <u>C</u> + $\delta^{13}\text{C}$ + <u>gravel</u> + BD + ESP	4.782
	C:N + <u>C</u> + $\delta^{13}\text{C}$ + clay + <u>gravel</u> + BD + ESP	6.329
	C:N	6.840
	C:N + <u>C</u> + $\delta^{13}\text{C}$ + clay + <u>gravel</u> + BD + EC + ESP	8.327
FW	C:N + BD + EC + ESP	-12.567
	$\delta^{15}\text{N}$ + sand + BD + EC + ESP	-12.542
	BD + EC + ESP	-11.618
	$\delta^{15}\text{N}$ + sand + BD + FC + EC + ESP	-11.094
	C:N + $\delta^{15}\text{N}$	-10.364
	C:N + $\delta^{15}\text{N}$ + sand + BD + FC + EC + ESP	-9.132
	C:N	-8.331
Native Target	C:N + $\delta^{15}\text{N}$ + P + FC	-6.121
	C:N + $\delta^{15}\text{N}$ + P	-5.957
	C:N + P	-5.233
	C:N + $\delta^{15}\text{N}$ + P + FC + EC	-4.247
	FC	-1.381

Abbreviations: P = available phosphorus as phosphate, C:N = carbon:nitrogen ratio, EC = electrical conductivity, ESP = exchangeable sodium percentage, BD = bulk density, FC = field capacity, GS = greasewood-shadscale community, FW = fourwing saltbush community

Supplementary Table S6: Numeric hierarchical partitioning results for all community-level models in the native plots comparing soil characteristics and shrub density; only soil characteristics included in the partitioning models (Supplementary Materials Table 5) are listed. Values represent the individual R^2 contribution for the soil characteristic. Italic text indicates a negative relationship between shrub density and the soil characteristic. Values in parentheses represent the P value for each soil characteristic. Significant soil characteristics ($p < 0.05$) are indicated in bold text.

Soil Characteristic	Native	GS	FW	Native Target
P				0.164 (0.138)
C		0.098 (0.049)		
N	0.147 (0.037)			
C:N ratio		<i>0.451</i> (0.004)	0.296 (0.180)	0.269 (0.020)
$\delta^{15}\text{N}$	0.271 (0.013)			0.065 (0.177)
Gravel	0.127 (0.071)	0.098 (0.232)		
Bulk density			0.089 (0.033)	
Field capacity				0.180 (0.251)
$\delta^{13}\text{C}$		0.063 (0.144)		
EC			0.126 (0.083)	
ESP			<i>0.234</i> (0.033)	
Overall Model R^2	0.546	0.709	0.745	0.678
Overall Model p	0.041	0.016	0.009	0.025

Abbreviations: P = available phosphorus as phosphate, C:N = carbon:nitrogen ratio, EC = electrical conductivity, ESP = exchangeable sodium percentage, GS = greasewood-shadscale community, FW = fourwing saltbush community

Supplementary Table S7: Comparison of soil characteristics between experimental and native plots using a Welch's two-sample t-test. Values represent the mean, and values in parentheses represent one standard deviation. Bolded p values indicate characteristics which are significantly different between the native and experimental plots ($p < 0.05$). The sample size was 14 for all native plot characteristics and 28 for all experimental plot characteristics.

Soil Characteristics	Unit	Native	Experimental	p value
pH		7.6 (0.5)	7.4 (0.2)	0.045
EC _{1:2}	mS cm ⁻¹	0.16 (0.09)	0.12 (0.04)	0.025
C	%	0.38 (0.25)	0.48 (0.11)	0.064
δ ¹³ C	‰ v. VPDB	-20.5 (2.1)	-22.8 (0.5)	0.000
N	%	0.04 (0.02)	0.05 (0.01)	0.003
δ ¹⁵ N	‰ v. air	10.5 (2.5)	5.5 (0.7)	0.000
C:N ratio		10.2 (1.9)	9.3 (0.7)	0.017
Available P	mg kg ⁻¹	97.4 (35.9)	64.7 (14.7)	0.000
Na	mg kg ⁻¹	119.0 (124)	78.3 (17.2)	0.097
Mg	mg kg ⁻¹	179.0 (82.7)	252.7 (44.8)	0.000
K	mg kg ⁻¹	320.8 (118.8)	296.0 (80.1)	0.364
Ca	mg kg ⁻¹	1655.3 (1104.2)	1523.1 (232)	0.540
ESP	%	8.1 (4.5)	5.8 (1.1)	0.011
SAR		0.23 (0.17)	0.15 (0.03)	0.027
Sand	%	82.7 (7.9)	78.8 (4.7)	0.027
Silt	%	13.8 (6.7)	15.9 (4.1)	0.166
Clay	%	3.5 (1.9)	5.4 (1.3)	0.000
Soil texture		loamy fine sand	loamy fine sand	
Bulk density	kg m ⁻³	1380 (162)	1390 (113)	0.794
Infiltration rate	cm hr ⁻¹	0.75 (0.49)	0.65 (0.36)	0.375
Field capacity	%	15.5 (6.3)	12.2 (2.5)	0.010
Gravel cover	%	2.3 (2.1)	2.4 (2.2)	0.854
Litter cover	%	10.1 (7.5)	10.6 (8.0)	0.811

Abbreviations: EC = electrical conductivity, ESP = exchangeable sodium percentage; SAR = sodium adsorption ratio