Table S1: Soil series at each site extracted from the web soil survey (Ogeen 2017, https://casoilresource.lawr.ucdavis.edu/gmap/). Sites 4, 5, 19, 20 and 21 were not resampled in 2016

Site	Invasion Stage	Elevation (m)	CaCO3	Soil Series
1	Intact sagebrush	1462	0	Fine, montmorillonitic, mesic Xerollic Durargids
2	Intact sagebrush	1608	0	Loamy, mixed, superactive, mesic, shallow Cambidic Haplodurids
3	Intact sagebrush	1539	0	Loamy, mixed, superactive, mesic, shallow Cambidic Haplodurids
4	Intact sagebrush	1479	5%	Ashy over loamy, glassy over mixed, superactive, mesic Durinodic Haplocambids
5	Intact sagebrush	1434	1%	Loamy-skeletal, mixed, mesic Typic Camborthids
6	Intact sagebrush	1348	0	Coarse-loamy, mixed, mesic Haploxerollic Durorthids
7	Intact sagebrush	1600	0	Coarse-loamy, mixed, mesic Haploxerollic Durorthids
8	Intact sagebrush	1529	1-5%	Loamy, mixed, mesic, shallow Haploxerollic Durorthids
10	Invaded sagebrush	1416	0	Fine-loamy, mixed, mesic Xerollic Nadurargids
11	Invaded sagebrush	1394	0	Coarse-loamy, mixed, mesic Durixerollic Camborthids
12	Invaded sagebrush	1478	0	Coarse-loamy, mixed, mesic Durixerollic Camborthids
13	Invaded sagebrush	1376	0	Clayey over sandy or sandy-skeletal, montmorillonitic, mesic Durixerollic Natrargids
14	Invaded sagebrush	1316	0	Sandy-skeletal, mixed, mesic Xerollic Camborthids
16	Cheatgrass dominated	1521	0	Fine, montmorillonitic, mesic Xerollic Durargids
18	Cheatgrass dominated	1412	0	Clayey over sandy or sandy-skeletal, montmorillonitic, mesic Durixerollic Natrargids
19	Cheatgrass dominated	1315	0	Sandy-skeletal, mixed, mesic Xerollic Camborthids
20	Cheatgrass dominated	1302	0	Sandy-skeletal, mixed, mesic Xerollic Camborthids
21	Cheatgrass dominated	1300	0	Sandy-skeletal, mixed, mesic Xerollic Camborthids
22	Cheatgrass dominated	1494	0	Fine, montmorillonitic, mesic Xerollic Durargids
23	Cheatgrass dominated	1448	1%	Loamy, mixed, mesic, shallow Entic Durorthids
24	Cheatgrass dominated	1297	0	Sandy-skeletal, mixed, mesic Xerollic Camborthids
25	Cheatgrass Die-off	1441	0	Fine, montmorillonitic, mesic Xerollic Durargids
26	Cheatgrass Die-off	1451	0	Fine-loamy, mixed, mesic Xerollic Nadurargids
27	Cheatgrass Die-off	1469	0	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Durixerollic Camborthids
28	Cheatgrass Die-off	1384	0	Loamy, mixed, superactive, mesic, shallow Xeric Natridurids

Table S2: Species list

Species	Species
Achnatherum thurberianum	*Grayia spinosa*
Agropyron cristatum	*Hesperostipa comata*
Allium sp.	*Lactuca seriola*
Alyssum desertorum	*Lepidium perfoliatum*
Amsinckia intermedia	*Leymus cinereus*
Artemisia tridentata	*Lomatium sp.*
Astragalus lentiformis	*Machaeranthera canescens*
Bromus tectorum	*Mentzelia albicaulis*
Calochortus bruneaunis	*Microsteris gracilis*
Carex sp.	*Oryzopsis hymenoides*
Ceratocephala testiculata	*Pascopyrum smithii*
Chaenactis douglasii	*Phlox diffusa*
Chrysothamnus viscidiflorus	*Phlox hoodii*
Collinsia parviflora	*Phlox longifolia*
Crepis acuminata	*Poa secunda*
Cryptantha watsonii	*Salsola tragus*
Cymopterus ibapensis	*Sisymbrium altissimum*
Descurainia pinnata	*Stellaria media*
Descurainia sophia	*Taeniatherum caput-medusae*
Elymus elymoides	*Tetradymia glabrata*
Ericameria nauseosa	*Tragopogon dubius*
Eriogonum ovalifolium	*Vulpia bromoides*
Erodium cicutarium	

Table S3: Significant (p < 0.5) Correlations of plant function group cover and plant tissue concentrations with the NMS ordination. Soil variables were also tested but none were significantly correlated with the ordination.

Variable	NMDS1	NMDS2	R^2	p
Plant Functional Groups				
AIG	0.70	-0.71	0.92	0.0001
AIF	0.60	0.80	0.70	0.0001
PNG	-0.89	-0.46	0.92	0.0001
PNF	-0.31	0.95	0.43	0.0001
Annuals	1.00	-0.01	0.95	0.0001
Perennials	-1.00	0.01	0.95	0.0001
Forbs	0.16	0.99	0.87	0.0001
Grasses	-0.16	-0.99	0.87	0.0001
Soil Nutrients				
Soil Total C	-0.24	0.32	0.16	0.0279
Soil Total N	-0.29	0.29	0.17	0.0219
Plant Tissue Nutrents				
Litter N	0.12	-0.35	0.14	0.0455
Litter C	0.26	0.26	0.14	0.0478
Other N	0.37	0.08	0.15	0.0359
Other C	0.56	-0.21	0.35	0.0002
Poa C	0.23	-0.36	0.19	0.0458
Poa C:N	0.14	-0.41	0.18	0.0427
Bromus C	0.38	-0.29	0.22	0.0057

Table S4: Standard deviations of three replicated samples at each site, grouped by invasion stage and then averaged. Letters indicate significantly different groups according to a Bonferonni-adjusted Kruskal-Wallis test.

	I. Intact Sagebrush		II. Invaded Sagebrush		III. Cheatgrass-dominated		IV. Cheatgrass Dieoff	
Litter N (%)	0.1		0.1		0.1		0.1	
Litter C (%)	3.2		2.3		2.5		2.6	
Litter C:N	6.8		4.7		6.4		6.9	
Soil C:N	1.0	ab	1.8	a	0.7	b	0.8	ab
Soil Total N (kg/ha)	109.1		78.2		91.4		75.7	
Soil Total C (kg/ha)	1425.4	a	1065.0	ab	957.9	ab	667.4	b

Table S5: Mean understory cover values for each invasion stage.

variable	Intact Sagebrush	Invaded Sagebrush	Cheatgrass-Dominated	Cheatgrass Dieoff
2013				
Bare Ground	73.46	44.02	14.21	33.38
Litter	23.56	52.99	81.70	50.14
Biological Soil Crust	0.48	0.17	0.00	0.03
Rock	0.15	1.12	1.80	12.65
Annual Introduced Grass	0.21	2.38	4.15	2.72
Annual Introduced Forb	0.01	0.05	4.27	4.10
Perennial Native Forb	0.65	0.05	0.19	0.77
Perennial Native Grass	5.32	3.03	0.51	2.93
Annual Native Forb	0.03	0.07	0.07	0.08
2016				
Bare Ground	51.64	41.35	15.52	25.87
Litter	39.50	48.25	80.46	70.02
Biological Soil Crust	4.01	3.14	0.03	0.04
Rock	1.67	3.80	0.70	1.65
Annual Introduced Grass	1.93	6.36	10.44	6.82
Annual Introduced Forb	0.53	0.98	6.48	12.73
Perennial Native Forb	0.28	0.03	0.01	0.01
Perennial Native Grass	6.46	4.47	0.52	1.80
Annual Native Forb	0.12	0.10	0.00	0.01

Table S6: Path model results and fit indices.

Model	df	p	X^2	CFI	TLI	RMSEA	SRMR
Stages I and II	11	0.99	3.18	1	1.32	0	0.03
Stages III and IV	2	0.90	0.21	1	1.15	0	0.01

Note:

CFI: Comparative Fit Index.

TLI: Tucker-Lewis Index.

RMSEA: Root Mean Square Error of Approximation.

SRMR: Standardized Root Mean Square Residual.

Table S7: Covriance matrix for the Soil C and N path model for invasion stages I and II

x	sN	sC	lCN	PNG	NF	aet	p2	Shrubs	BSC	sd_cwd
sN	0.026	0.026	0.008	0.030	0.051	-0.004	-0.011	0.000	0.029	0.003
sC	0.026	0.042	0.030	0.031	0.080	-0.004	-0.028	-0.004	0.052	0.013
lCN	0.008	0.030	0.076	-0.006	0.046	-0.002	-0.028	-0.003	0.013	-0.003
PNG	0.030	0.031	-0.006	0.182	0.112	0.006	0.005	-0.042	0.084	0.007
NF	0.051	0.080	0.046	0.112	0.587	0.010	-0.078	0.015	0.404	0.012
aet	-0.004	-0.004	-0.002	0.006	0.010	0.056	-0.022	0.018	0.020	-0.013
p2	-0.011	-0.028	-0.028	0.005	-0.078	-0.022	0.075	0.014	-0.129	-0.009
Shrubs	0.000	-0.004	-0.003	-0.042	0.015	0.018	0.014	0.069	-0.045	-0.018
BSC	0.029	0.052	0.013	0.084	0.404	0.020	-0.129	-0.045	0.873	0.009
sd_cwd	0.003	0.013	-0.003	0.007	0.012	-0.013	-0.009	-0.018	0.009	0.024

Table S8: Covriance matrix for the Soil C and N path model for invasion stages III and IV

x	sN	sC	AIG	AIF	sd_cwd	p2	aet	tmn
sN	0.035	0.052	-0.031	-0.005	0.008	-0.003	0.005	0.012
sC	0.052	0.085	-0.078	-0.046	0.009	-0.021	0.009	0.011
AIG	-0.031	-0.078	0.315	0.143	0.018	0.120	-0.025	0.020
AIF	-0.005	-0.046	0.143	0.853	0.027	0.120	0.041	0.048
sd_cwd	0.008	0.009	0.018	0.027	0.017	0.011	-0.010	0.006
p2	-0.003	-0.021	0.120	0.120	0.011	0.074	-0.011	0.032
aet	0.005	0.009	-0.025	0.041	-0.010	-0.011	0.032	0.006
tmn	0.012	0.011	0.020	0.048	0.006	0.032	0.006	0.037