Electronic Supplementary Material (ESM)

Appendix S2. Cluster analysis dendrograms and results of discriminant analysis leave-one-out cross validation of cluster assignments.

Do key dimensions of seed and seedling functional trait variation capture variation in recruitment probability?

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Fig. S1 Dendrogram from initial cluster analysis performed on a trait matrix with all 47 grass varieties and 11 seed and seedling traits (see Methods in manuscript). The six isolated clusters are shown in red boxes. A potential outlier, *Psathyrostachys juncea* var. Vinall (variety 22, highlighted in blue) was distant from all and subsequently removed from cluster analysis (Fig. S2).

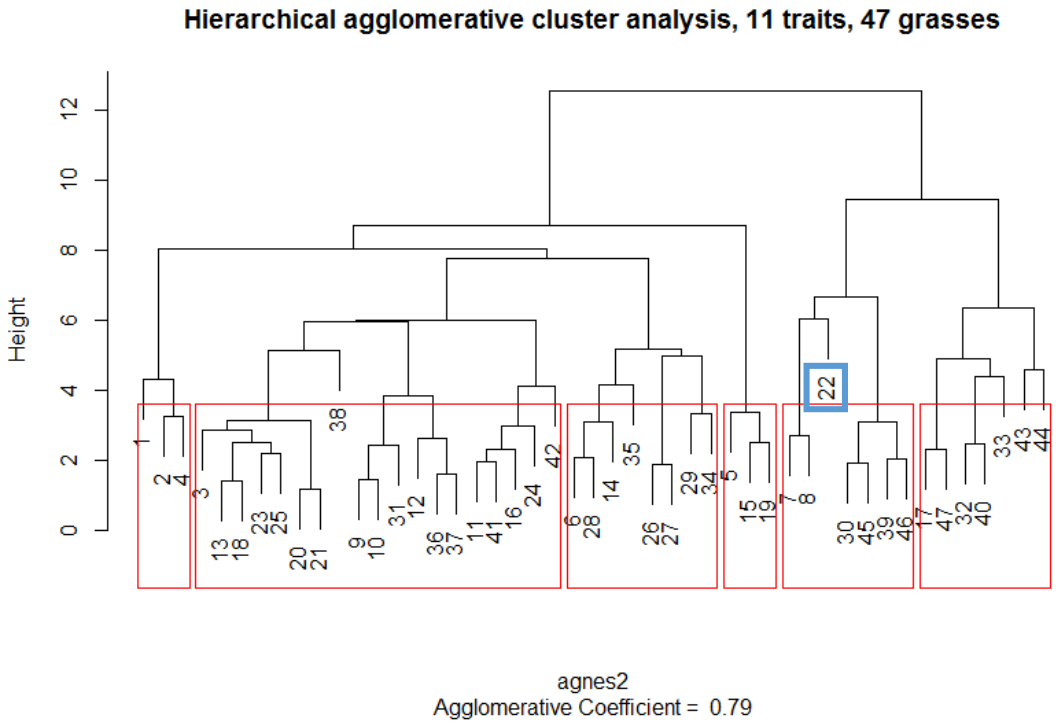

Table S1. Species and variety key for Fig. S1 cluster analysis

Code	Species	Variety	Code (cont'd)	Species (cont'd)	Variety (cont'd)
1	Bromus tectorum	N/A	27	Elymus trachycaulus	(2) Pryor
2	Bromus japonicus	N/A	28	Agropyron cristatum	(1) Kirk
3	Lolium multiflorum		29	Agropyron cristatum	(2) Fairway
4	Eremopyrum triticeum	N/A	30	Elymus lanceolatus	(1) Bannock
5	Poa secunda	(1 or 2) Sherman	31	Elymus lanceolatus	(2) Critana
6	Poa secunda	(1 or 2) Opportunity	32	Pascopyrum smithii	(1) Recovery
7	Poa secunda	(3) Mountian Home	33	Pascopyrum smithii	(2) Rodan
8	Poa secunda	(4) Reliable	34	Bromus inermis	(1) Manchar
9	Pseudoroegneria spicata	(1) P7 (G6)	35	Bromus inermis	(2) Lincoln
10	Pseudoroegneria spicata	(2) Goldar	36	Bromus riparius	(1) Cache
11	Pseudoroegneria spicata	(3) Anatone	37	Bromus riparius	(2) Regar
12	Pseudoroegneria spicata	(4) T 1561 [Idaho ecotype]	38	Thinopyrum intermedium	Rush
13	Elymus elymoides	(1) Antelope Creek	39	Festuca ovina	Covar
14	Elymus elymoides	(3) Toe Jam Creek	40	Thinopyrum ponticum	Alkar
15	Elymus elymoides	(3) Fish Creek	41	Elymus wawawaiensis	Secar
16	Elymus elymoides	(4) Rattlesnake	42	Elymus multisetus	Boardman
17	Agropyron desertorum	(1)Hycrest	43	Hesperostipa comata	N/A
18	Agropyron desertorum	(2)Hycrest II	44	Achnatherum lemmonii	N/A
19	Agropyron desertorum	(3)Nordan	45	Festuca idahoensis	Joseph
20	Psathyrostachys juncea	(1) Bozoisky-Select	46	Koeleria macrantha	N/A
21	Psathyrostachys juncea	(2) Bozoisky II	47	Leymus cinereus	Trailhead
22	Psathyrostachys juncea	(3) Vinall			
23	Agropyron fragile	P27			
24	Agropyron fragile	Vavilov			
25	Agropyron fragile	Vavilov II			
26	Elymus trachycaulus	(1) First Strike			

Fig. S2 Dendrogram from final cluster analysis performed on a trait matrix with 11 seed and seedling traits and 46 grass varieties, after outlier *Psathyrostachys juncea* var. Vinall was excluded. The six isolated clusters are shown in red boxes. Cluster membership was not affected by outlier removal.

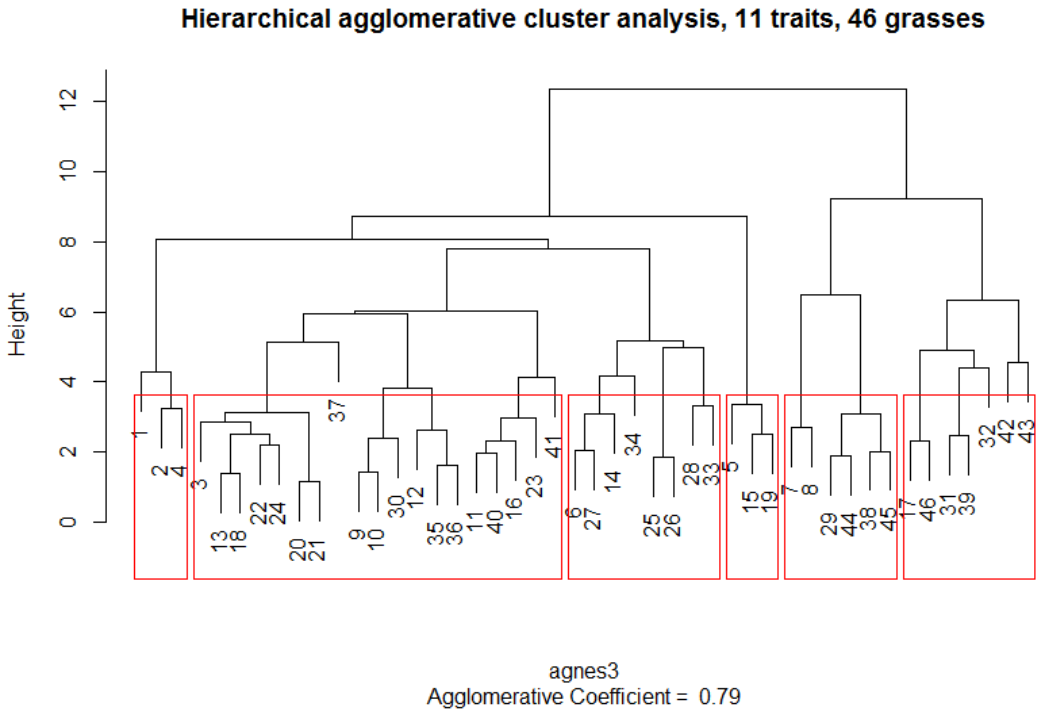

Table S2. Species and variety key for Fig. S2 cluster analysis

Code	Species	Variety
1	Bromus tectorum	N/A
2	Bromus japonicus	N/A
3	Lolium multiflorum	
4	Eremopyrum triticeum	N/A
5	Poa secunda	(1 or 2) Sherman
6	Poa secunda	(1 or 2) Opportunity
7	Poa secunda	(3) Mountian Home
8	Poa secunda	(4) Reliable
9	Pseudoroegneria spicata	(1) P7 (G6)
10	Pseudoroegneria spicata	(2) Goldar
11	Pseudoroegneria spicata	(3) Anatone
12	Pseudoroegneria spicata	(4) T 1561 [Idaho ecotype]
13	Elymus elymoides	(1) Antelope Creek
14	Elymus elymoides	(3) Toe Jam Creek
15	Elymus elymoides	(3) Fish Creek
16	Elymus elymoides	(4) Rattlesnake
17	Agropyron desertorum	(1)Hycrest
18	Agropyron desertorum	(2)Hycrest II
19	Agropyron desertorum	(3)Nordan
20	Psathyrostachys juncea	(1) Bozoisky-Select
21	Psathyrostachys juncea	(2) Bozoisky II
22	Agropyron fragile	P27
23	Agropyron fragile	Vavilov
24	Agropyron fragile	Vavilov II
25	Elymus trachycaulus	(1) First Strike

Code (cont'd)	Species (cont'd)	Variety (cont'd)
26	Elymus trachycaulus	(2) Pryor
27	Agropyron cristatum	(1) Kirk
28	Agropyron cristatum	(2) Fairway
29	Elymus lanceolatus	(1) Bannock
30	Elymus lanceolatus	(2) Critana
31	Pascopyrum smithii	(1) Recovery
32	Pascopyrum smithii	(2) Rodan
33	Bromus inermis	(1) Manchar
34	Bromus inermis	(2) Lincoln
35	Bromus riparius	(1) Cache
36	Bromus riparius	(2) Regar
37	Thinopyrum intermedium	Rush
38	Festuca ovina	Covar
39	Thinopyrum ponticum	Alkar
40	Elymus wawawaiensis	Secar
41	Elymus multisetus	Boardman
42	Hesperostipa comata	N/A
43	Achnatherum lemmonii	N/A
44	Festuca idahoensis	Joseph
45	Koeleria macrantha	N/A
46	Leymus cinereus	Trailhead

Table S3. Results of leave-one-out cross validation in discriminant analysis (MASS package in R v. i386 3.1.3, R Core Team 2014). Cluster columns show the probability of a given grass variety belonging to each cluster after cross-validation (i.e. sequentially leaving each grass variety out of analysis). Original assignments identified by cluster analysis are shaded gray. Cluster membership was reassigned for three clusters with >0.60 probability of belonging to another cluster (highlighted in red and italicized).

Species	**Variety**	**Cluster**					
		A	B	C	D	E	F
Bromus tectorum	N/A	1.00	0.00	0.00	0.00	0.00	0.00
Bromus japonicus	N/A	0.99	0.00	0.01	0.00	0.00	0.00
Lolium multiflorum	N/A	0.00	1.00	0.00	0.00	0.00	0.00
Eremopyrum triticeum	N/A	1.00	0.00	0.00	0.00	0.00	0.00
Poa secunda	Sherman	0.00	0.00	0.00	1.00	0.00	0.00
Poa secunda	Opportunity	0.00	0.04	0.94	0.00	0.02	0.00
Poa secunda	Mountian Home	0.00	0.00	0.00	0.00	1.00	0.00
Poa secunda	Reliable	0.00	0.00	0.00	0.00	1.00	0.00
Pseudoroegneria spicata	P7 (G6)	0.00	1.00	0.00	0.00	0.00	0.00
Pseudoroegneria spicata	Goldar	0.00	1.00	0.00	0.00	0.00	0.00
Pseudoroegneria spicata	Anatone	0.00	1.00	0.00	0.00	0.00	0.00
Pseudoroegneria spicata	T 1561 [Idaho ecotype]	0.00	1.00	0.00	0.00	0.00	0.00
Elymus elymoides	Antelope Creek	0.00	1.00	0.00	0.00	0.00	0.00
Elymus elymoides	*Toe Jam Creek*	*0.00*	*0.00*	*0.01*	*0.00*	***0.99***	*0.00*
Elymus elymoides	Fish Creek	0.00	0.00	0.00	1.00	0.00	0.00
Elymus elymoides	Rattlesnake	0.00	0.97	0.03	0.00	0.00	0.00
Agropyron desertorum	(1)Hycrest	0.00	0.00	0.03	0.00	0.00	0.96
Agropyron desertorum	(2)Hycrest II	0.00	0.94	0.06	0.00	0.00	0.00
Agropyron desertorum	(3)Nordan	0.00	0.01	0.00	0.99	0.00	0.00
Psathyrostachys juncea	Bozoisky-Select	0.00	0.97	0.03	0.00	0.00	0.00
Psathyrostachys juncea	Bozoisky II	0.00	1.00	0.00	0.00	0.00	0.00
Agropyron fragile	P27	0.00	1.00	0.00	0.00	0.00	0.00
Agropyron fragile	Vavilov	0.00	1.00	0.00	0.00	0.00	0.00
Agropyron fragile	Vavilov II	0.00	0.99	0.00	0.00	0.01	0.00
Elymus trachycaulus	First Strike	0.00	0.00	1.00	0.00	0.00	0.00
Elymus trachycaulus	Pryor	0.00	0.00	1.00	0.00	0.00	0.00
Agropyron cristatum	Kirk	0.00	0.02	0.98	0.00	0.00	0.00
Agropyron cristatum	*Fairway*	*0.34*	***0.64***	*0.02*	*0.00*	*0.00*	*0.00*
Elymus lanceolatus	Bannock	0.00	0.36	0.05	0.00	0.60	0.00
Elymus lanceolatus	Critana	0.00	0.45	0.55	0.00	0.00	0.00
Pascopyrum smithii	Recovery	0.00	0.00	0.00	0.00	0.00	1.00
Pascopyrum smithii	Rodan	0.00	0.00	0.00	0.00	0.00	1.00
Bromus inermis	Manchar	0.00	0.00	1.00	0.00	0.00	0.00
Bromus inermis	*Lincoln*	*0.00*	***0.62***	*0.38*	*0.00*	*0.00*	*0.00*
Bromus riparius	Cache	0.00	1.00	0.00	0.00	0.00	0.00
Bromus riparius	Regar	0.00	1.00	0.00	0.00	0.00	0.00
Thinopyrum intermedium	Rush	0.00	1.00	0.00	0.00	0.00	0.00
Festuca ovina	Covar	0.00	0.00	0.00	0.00	1.00	0.00
Thinopyrum ponticum	Alkar	0.00	0.00	0.00	0.00	0.00	1.00
Elymus wawawaiensis	Secar	0.01	0.53	0.46	0.00	0.00	0.00
Elymus multisetus	Boardman	0.00	1.00	0.00	0.00	0.00	0.00
Hesperostipa comata	N/A	0.00	0.00	0.00	0.00	0.00	1.00
Achnatherum lemmonii	N/A	0.00	0.00	0.34	0.00	0.00	0.66
Festuca idahoensis	Joseph	0.00	0.00	0.00	0.00	1.00	0.00
Koeleria macrantha	N/A	0.00	0.00	0.00	0.00	1.00	0.00
Leymus cinereus	Trailhead	0.00	0.00	0.00	0.00	0.00	1.00