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Table 1. Average percent cover of vascular plants for 43 core vegetation plots at the Idaho National Engineering and Environmental Laboratory, measured by point interception in 1985 and 1995 (43 rather than 47 plots used for this analysis because plots 20-23 were not sampled by point interception in 1985) and cover on peripheral plots in 1995. Relative values are based on total vascular plant cover. Within plant growth forms, species are listed in the order of descending cover values in 1995.

Species	Cover (%)			Relative Cover (%)		
	Core		Periph	Core		Periph
	1985	1995	1995	1985	1995	1995
Trees						
Juniperus osteosperma	-	-	1.948	-	-	5.113
Shrubs						
Artemisia tridentata	12.231	9.448	6.537	49.997	25.152	17.157
Chrysothamnus viscidiflorus	4.645	7.324	5.143	18.986	19.498	13.497
Artemisia tripartita	-	-	4.033	-	-	10.586
Leptodactylon pungens	0.381	0.587	1.820	1.558	1.562	4.778
Artemisia nova	-	-	1.319	-	-	3.461
Grayia spinosa	0.180	0.456	-	0.734	1.214	-
Tetradymia canescens	0.256	0.380	0.296	1.046	1.011	0.768
Ceratoides lanata	0.137	0.298	0.801	0.560	0.794	2.102
Atriplex confertifolia	0.019	0.260	-	0.079	0.691	-
Gutierrezia sarothrae	0.154	0.067	-	0.628	0.179	-
Eriogonum microthecum	0.024	0.061	0.565	0.100	0.162	1.482
Haplopappus acaulis	-	0.014	0.002	-	0.038	0.005
Chrysothamnus nauseosus	-	0.001	0.144	-	0.003	0.379
Symphoricarpos oreophilus	-	-	0.296	-	-	0.778
Artemisia arbuscula	-	-	0.062	-	-	0.163
Atriplex confertifolia	-	-	0.023	-	-	0.061
Gutierrezia sarothrae	-	-	0.009	-	-	0.024
Total shrub cover	18.027	18.896	21.050	73.689	50.304	55.241
Perennial Graminoids						
Stipa comata	0.479	1.504	0.899	1.959	4.003	2.359
Elymus elymoides	0.492	1.224	0.307	2.012	3.257	0.804
Elymus lanceolatus	0.947	1.080	0.694	3.871	2.875	1.820
Agropyron desertorum	0.054	0.593	0.359	0.222	1.579	0.943
Oryzopsis hymenoides	0.267	0.443	0.258	1.093	1.180	0.678
Pascopyrum smithii	0.068	0.277	-	0.280	0.736	-
Poa nevadensis	0.041	0.177	0.263	0.169	0.471	0.691
Pseudoroegneria spicata	0.039	0.163	1.577	0.158	0.434	4.139
Poa secunda	0.032	0.127	1.106	0.132	0.337	2.904
Carex douglasii	0.004	0.044	0.002	0.016	0.117	0.005
Stipa thurberiana	0.003	0.040	0.012	0.011	0.107	0.032
Leymus cinereus	0.101	0.035	0.111	0.412	0.093	0.292
Sporobolus cryptandrus	0.001	0.005	-	0.005	0.014	-
Leymus triticoides	0.018	-	-	0.074	-	-
Stipa occidentalis	-	0.001	0.007	-	0.003	0.019
Aristida purpurea	-	-	0.389	-	-	1.021
Koeleria cristata	-	-	0.139	-	-	0.365
Elymus ambiguous	-	-	0.065	-	-	0.170
Total graminoid cover	2.546	5.712	6.188	10.414	15.206	16.242

Species	Cover (%)			Relative Cover (%)		
	Core		Periph	Core		Periph
	1985	1995	1995	1985	1995	1995
Perennial Forbs						
Phlox hoodii	0.630	1.153	0.815	2.577	3.071	2.139
Astragalus lentiginosus	0.010	0.335	0.019	0.042	0.891	0.049
Astragalus filipes	0.216	0.258	0.171	0.882	0.688	0.450
Astragalus ceramicus	0.028	0.162	0.113	0.116	0.430	0.296
Psoralea lanceolata	0.034	0.142	-	0.137	0.378	-
Phacelia hastata	0.010	0.140	-	0.042	0.371	-
Erigeron pumilus	0.004	0.097	0.131	0.016	0.258	0.345
Astragalus calycosus	0.004	0.089	0.020	0.016	0.237	0.053
Stephanomeria spinosa	-	0.062	0.057	-	0.165	0.151
Eriogonum ovalifolium	0.014	0.056	0.124	0.058	0.148	0.325
Gilia congesta	0.017	0.056	0.207	0.069	0.148	0.544
Crepis acuminata	0.001	0.047	0.201	0.005	0.124	0.527
Castilleja angustifolia	-	0.038	-	-	0.100	-
Schoenocrambe linifolia	0.032	0.036	-	0.132	0.096	-
Cryptantha interrupta	0.004	0.034	0.120	0.016	0.089	0.316
Astragalus geyeri	-	0.025	0.148	-	0.065	0.389
Arabis holboellii	-	0.021	0.032	-	0.055	0.085
Arenaria franklini	-	0.019	0.013	-	0.052	0.034
Sphaeralcea munroana	0.037	0.016	-	0.153	0.041	-
Lupinus pusillus	-	0.016	0.030	-	0.041	0.078
Aster scopulorum	0.004	0.014	-	0.016	0.038	-
Astragalus pursuii	0.005	0.012	0.017	0.021	0.031	0.044
Phlox longifolia	-	-	0.453	-	-	1.188
Lupinus argenteus	-	-	0.406	-	-	1.067
Antennaria microphylla	-	-	0.245	-	-	0.644
Astragalus miser	-	-	0.137	-	-	0.360
Oenothera pallida	-	-	0.131	-	-	0.345
Castilleja angustifolia	-	-	0.054	-	-	0.141
Comandra umbellata	-	-	0.054	-	-	0.141
Lithospermum ruderale	-	-	0.041	-	-	0.107
Erigeron filifolius	-	-	0.035	-	-	0.092
Townsendia florifer	-	-	0.024	-	-	0.063
Psoralea lanceolata	-	-	0.013	-	-	0.034
Lomatium triternatum	-	-	0.013	-	-	0.034
Others (n = 12, 20)	0.212	0.082	0.091	0.867	0.228	0.238
Total perennial forb cover	1.262	2.910	3.915	5.165	7.746	10.279
Succulents						
Opuntia polyacantha	0.611	0.543	0.157	2.498	1.444	0.411
Native Annuals and Biennials						
Gayophytum diffusum	0.065	0.755	0.078	0.264	2.009	0.204
Lappula redowski	0.066	0.598	0.312	0.269	1.592	0.819
Gilia sinuata	0.001	0.571	0.116	0.005	1.520	0.304
Cordylanthus ramosus	0.049	0.526	1.035	0.201	1.400	2.717
Descurainia pinnata	0.009	0.442	0.139	0.037	1.176	0.365
Eriastrum sparsiflorum	0.036	0.320	-	0.148	0.853	-
Collomia tenella	-	0.310	0.501	-	0.825	1.315
Machaeranthera canescens	1.195	0.297	0.214	4.885	0.791	0.561

Species	Cover (%)			Relative Cover (%)		
	Core		Periph	Core		Periph
	1985	1995	1995	1985	1995	1995
Native Annuals and Biennials: (cont.)						
Eriogonum cernuum	0.089	0.253	0.076	0.364	0.674	0.199
Chenopodium leptophyllum	-	0.187	0.098	-	0.499	0.258
Chaenactis fremontii	0.001	0.182	0.030	0.005	0.485	0.078
Cryptantha scoparia	-	0.112	0.115	-	0.299	0.301
Oxytheca dendroidea	-	0.099	-	-	0.265	-
Mentzelia albicaulis	0.105	0.044	0.068	0.428	0.117	0.177
Gilia minutiflora	-	0.037	-	-	0.100	-
Chaenactis douglasii	0.028	0.036	0.061	0.116	0.096	0.160
Cryptantha fendleri	-	0.014	-	-	0.038	-
Ambrosia acanthicarpa	0.001	0.013	0.033	0.005	0.034	0.088
Coldenia nuttallii	-	0.012	-	-	0.031	-
Erucastrum sparsiflorum	-	-	0.220	-	-	0.578
Linanthus septentrionalis	-	-	0.126	-	-	0.331
Phacelia glandulosa	-	-	0.020	-	-	0.054
Others (n = 6, 8)	0.012	0.031	0.022	0.054	0.083	0.057
Total native annual/biennial cover	1.657	4.839	3.264	6.781	12.887	8.566
Introduced Annuals and Biennials						
Bromus tectorum	0.149	2.492	0.986	0.607	6.635	2.588
Sisymbrium altissimum	0.125	0.776	0.146	0.512	2.067	0.384
Descurainia sophia	0.008	0.717	0.147	0.032	1.909	0.386
Alyssum desertorum	-	0.612	0.038	-	1.630	0.100
Longfoxia setosissima	0.022	0.058	-			-
Tragopogon dubius	0.031	0.017	0.017	0.127	0.045	0.044
Malcolmia africana	-	-	0.127	-	-	0.340
Halogeton glomeratus	-	-	0.060	-	-	0.158
Salsola kali	-	-	0.050	-	-	0.131
Others	0.043	0.019	0.007	0.175	0.048	0.017
Total introduced annual/biennial cover	0.356	4.655	1.587	1.453	12.392	4.148
Unknowns	-	0.008	-	-	0.021	-
Total vascular plant cover	24.459	37.563	38.160	100.000	100.000	100.000

Table 2. Occurrence of *Bromus tectorum* on core and peripheral plots based on density data. F is the number of plots upon which B. tectorum was recorded, N is the number of plots sampled, D is the mean density (plants/m2) on all plots sampled, and R is the range of densities on the plots where B. tectorum was recorded in that year.

	Core				Peripheral			
Year	F	N	D	R	F	N	D	R
1950	0	39	0	-	9	27	111	1.7 - 857
1957	0	47	0	-	7	32	57	5 - 1285
1965	0	47	0	-	9	32	88	3 - 1013
1975	17	47	11	0.5-135	13	32	54	1 - 777
1985	13	47	11	1.7-145	9	32	8	1.7 - 183
1990	21	36	10	0.2-67		No data		
1995	26	47	6	0.2-64	15	32	2	0.2 - 37

Table 3. Significant and marginally significant correlations between cover of plant groups or individual species with various measures of precipitation, for core, peripheral, and all sampled plots. N = 9 sample years for all analyses.

	Core		Peripheral		All	
	Measure	P	Measure	P	Measure	P
Shrubs	TOTY3[1]	0.038	AVG5Y	0.074	AVG5Y	0.030
	AVG4Y	0.040				
	AVG5Y	0.023				
ARTR2	TOTY4	0.019	TOTY5	0.012	TOTY4	0.010
CHVI	A-JY5	0.050	AVG3Y	0.015	A-JY5	0.044
TECA	TOTY4	0.025[3]	AVG4Y	0.077[3]	A-JY4	0.010[3]
	AVG4Y	0.018[3]				
ATCO			TOTY1	0.011	A-JY1	0.032
			A-JY1	0.034	A-J5Y	0.058
			A-JY3	0.042		
			A-J3Y	0.031		
			A-J4Y	0.044		
			A-J5Y	0.038		
Perennial Grasses	TOTY5	0.133				
Agropyrons	TOTY5	0.133				
Poas			TOTY1	0.075	TOTY1	0.030
					A-JY1	0.079
STCO	TOTY5	0.039			TOTY5	0.021
ELEL	(no significant correlations)					

[1]Precipitation measures:
TOTY1 = total annual precipitation for the year of the sample
TOTY2 = total annual precipitation for the year prior to the sample year
TOTY3 = total annual precipitation for the 2nd year prior to the sample year
TOTY4 = total annual precipitation for the 3rd year prior to the sample year
TOTY5 = total annual precipitation for the 4th year prior to the sample year
AVG2Y = average annual precipitation for the sample year and 1 year prior
AVG3Y = average annual precipitation for the sample year and 2 years prior
AVG4Y = average annual precipitation for the sample year and 3 years prior
AVG5Y = average annual precipitation for the sample year and 4 year prior
A-JY1 = April through July precipitation for the sample year
A-JY2 = April through July precipitation for the year prior to the sample year
A-JY3 = April through July precipitation for the 2nd year prior to the sample year
A-JY4 = April through July precipitation for the 3rd year prior to the sample year
A-JY5 = April through July precipitation for the 4th year prior to the sample year
A-J2Y = average April through July precipitation for the sample year and 1 year prior
A-J5Y = average April through July precipitation for the sample year and 4 years prior

[2] Species codes: ARTR = *Artemisia tridentata*, CHVI = *Chrysothamnus viscidiflorus*, TECA = *Tetradymia canescens*, ATCO = *Atriplex confertifolia*, STCO = *Stipa comata*, ELEL = *Elymus elymoides*.
[3]All correlations between cover of *Tetradymia canescens* and precipitation measures were negative.

Table 4. Number of 35 core plots on which species, or species groups, were recorded in either cover or density samples in each of 8 census years (35 plots used in this analysis because data are available for them for the eight census years). This table includes all species that were recorded in any of the census years in which both cover and density were sampled. The last two lines list species richness of shrubs and perennial grasses on the aggregate 35-plot sample. See Methods for species included in *Agropyron* sp.

	1950	1957	1965	1975	1978	1985	1990	1995
*Artemisia tridentata**	35	35	35	35	35	34	34	3
Chrysothamnus viscidiflorus	22	19	21	21	21	25	27	29
Leptodactylon pungens	10	6	9	11	11	11	13	11
Grayia spinosa	1	9	8	6	7	4	5	6
Tetradymia canescens	6	5	3	7	4	5	7	0
Gutierrezia sarothrae	0	1	0	7	5	6	6	5
Ceratoides lanata	4	2	3	3	3	2	2	3
Eriogonum microthecum	0	0	3	4	3	4	4	1
Atriplex confertifolia	5	1	2	1	0	1	1	1
Haplopappus nanus	0	1	0	0	1	0	0	1
Artemisia arbuscula	2	0	1	0	0	0	0	0
Atriplex canescens	1	0	0	0	0	0	0	0
Artemisia tripartita	0	1	0	0	0	0	0	0
Elymus elymoides	28	27	33	34	31	30	30	30
Agropyron sp.	24	22	24	26	30	29	29	33
Oryzopsis hymenoides	23	22	18	29	25	25	21	28
Stipa comata	15	17	12	22	22	26	24	26
Poa sp.	10	12	16	14	17	20	22	25
Leymus cinereus	1	1	1	1	1	1	1	2
Carex douglasii	0	1	0	1	0	1	0	2
Stipa occidentalis	3	0	0	0	0	0	1	0
Sporobolus cryptandrus	0	0	0	0	0	2	1	1
Stipa thurberiana	0	0	0	0	0	1	0	1
Elymus triticoides	0	0	0	0	0	1	0	0
Shrub species richness	9	10	9	9	9	9	9	10
Perennial grass species richness	7	7	6	7	6	10	8	9

**Artemisia tridentata* includes subspecies *wyomingensis* and *tridentata*.

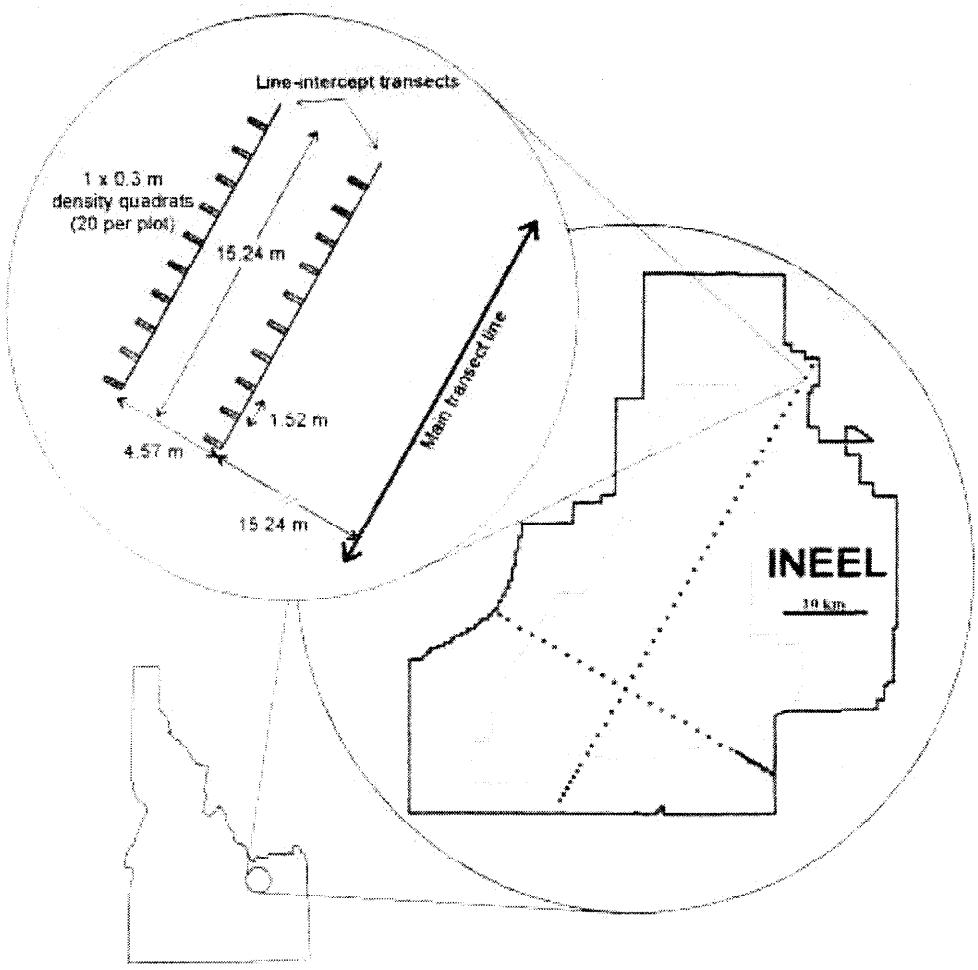

Fig. 1. Outline of the Idaho National Engineering and Environmental Laboratory showing the location of the two long-term vegetation transects. Locations of the permanent plots are indicated by circles. Dotted line indicates grazing boundary; the area within this boundary is closed to livestock grazing (see Appendix 1 for details on which plots were considered "ungrazed" for current analyses). The enlarged inset shows the layout of the two 15.24-m line-intercept transects and 20 density quadrats (0.1 m x 1 m) at each of the plots.

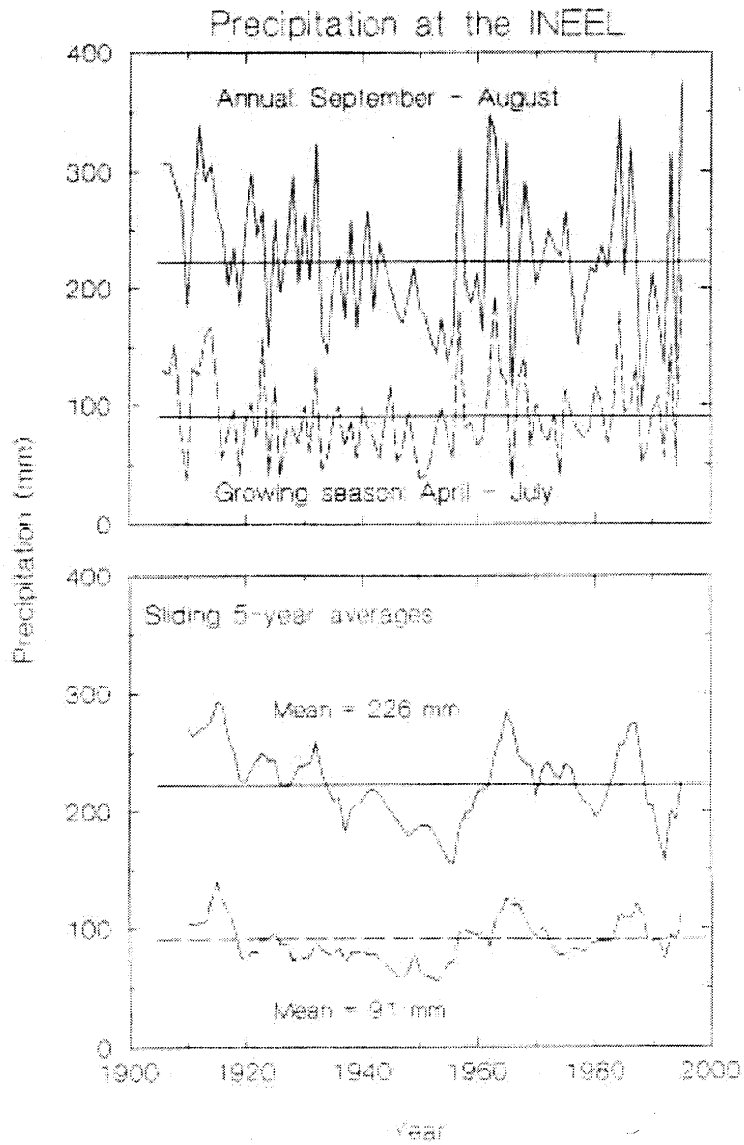

Fig. 3. Precipitation data for the Idaho National Engineering and Environmental Laboratory. Annual precipitation was calculated for the period from September 1 of the previous year through August 31 of the current year. Growing season precipitation is the sum of precipitation from April through July. Sliding averages represent the average of precipitation in the current year and four preceding years. Data for year prior to 1950 were estimated using correlations between INEEL data and rainfall at 2-3 nearby locations (see Methods). Means shown include estimates for years prior to 1950.