Cover-Weight Relationships

GENE F. PAYNE

Highlight: *Cover-weight relationships on 160 plots in southwestern Montana indicate that cover can be used as a suitable index to herbage production of most species.*

A study of vegetational changes occurring as the result of sagebrush control by 2,4-D provided an opportunity to correlate cover and herbage production data.

The study was conducted on 26 sites on the Beaverhead National Forest in southwestern Montana, 8 of which yielded data for this analysis.

Table 1. Correlation and regression values of cover (X) and weight (Y).

Species	No. of plots occurring	Correlation coefficient	Regression equation
Agropyron dasystachyum	43	.78**	$\hat{Y} = 2.97 + 2.10X$
Agropyron spicatum	67	.87**	$\hat{Y} = -.34 + 3.80X$
Bromus marginatus	20	.84**	$\hat{Y} = 15.33 + 17.07X$
Bromus tectorum	6	.97**	$\hat{Y} = .04 + 2.35X$
Carex spp.	36	.94**	$\hat{Y} = .25 + 1.97X$
Danthonia unispicata	4	.90*	$\hat{Y} = -.53 + 3.43X$
Festuca idahoensis	124	.72**	$\hat{Y} = 2.76 + 1.57X$
Koeleria cristata	20	.88**	$\hat{Y} = -.01 + 2.90X$
Poa spp.	109	.95**	$\hat{Y} = -.44 + 2.52X$
Stipa comata	59	.90**	$\hat{Y} = .79 + 2.59X$
Total grasses	160	.62**	$\hat{Y} = .78 + 2.60X$
Agoseris glauca	10	.84**	$\hat{Y} = -.11 + 1.39X$
Arenaria congesta	40	.65**	$\hat{Y} = .44 + 2.12X$
Arnica fulgens	25	.77**	$\hat{Y} = .25 + .59X$
Astragalus miser	18	.54*	$\hat{Y} = .56 + 1.39X$
Calochortus nitidus	13	.64*	$\hat{Y} = -.02 + 2.08X$
Campanula rotundifolia	6	.91**	$\hat{Y} = -.10 + 2.88X$
Clematis hirsutissima	4	.91*	$\hat{Y} = -.71 + 3.10X$
Collinsia parviflora	28	.65**	$\hat{Y} = .04 + .76X$
Collomia linearis	46	.91**	$\hat{Y} = .24 + 1.31X$
Comandra umbellata	20	.74**	$\hat{Y} = -.22 + 4.11X$
Delphinium bicolor	24	.61*	$\hat{Y} = .13 + .61X$
Erysimum inconspicuum	10	.94**	$\hat{Y} = -.93 + 8.50X$
Galium boreale	6	.85*	$\hat{Y} = .46 + .91X$
Geranium viscosissimum	8	.93**	$\hat{Y} = .28 + 1.83X$
Geum triflorum	6	.98**	$\hat{Y} = -.20 + 1.96X$
Lappula redowskii	7	.96**	$\hat{Y} = 2.22 + 1.20X$
Lomatium triternatum	17	.94**	$\hat{Y} = .25 + 3.05X$
Lupinus spp.	92	.85**	$\hat{Y} = -.95 + 2.42X$
Penstemon eriantherus	6	.90**	$\hat{Y} = -.17 + 2.45X$
Phlox longifolia	54	.76**	$\hat{Y} = -.54 + 3.64X$
Polygonum aviculare	26	.87**	$\hat{Y} = .78 + .76X$
Potentilla gracilis	9	.88**	$\hat{Y} = -1.35 + 3.11X$
Senecio lugens	7	.93**	$\hat{Y} = .47 + 1.67X$
Tragopogon dubius	10	.98**	$\hat{Y} = -1.78 + 9.38X$
Total forbs	160	.76**	$\hat{Y} = .20 + 1.77X$

*Correlation significant at $P < 0.05$.
**Significant at $P < 0.01$.

The author is professor of range science, Montana State University, Bozeman.

This paper (MAES Journal Series No. 481) is taken from the final report of a cooperative study by the Beaverhead National Forest, Forest Service, and the Montana Agricultural Experiment Station.

Manuscript received February 11, 1974.

Table 2. Species not showing significant correlations between cover and weight.

Species	No. of plots occurring	Correlation coefficient
Melica bulbosa	7	.23
Stipa richardsoni	8	.32
Achillea millefolium	60	.22
Arabis holboellii	9	.29
Balsamorhiza sagittata	4	.84
Draba nemorosa	16	−.14
Fritillaria atropurpurea	6	.05
Lithophragma parviflora	6	.44
Lithospermum pilosum	7	.40
Microseris nutans	5	.56
Taraxacum laevigatum	11	.57
Viola nuttallii	16	.42

Cover analysis was based on the Daubenmire (1968) concept of a vertical projection of a polygon drawn about the extremities of the canopy of each plant. Cover was estimated in a 4 X 5 dm plot frame placed at ground level. Cover estimates were aided with separate 1 dm^2 and 4 dm^2 handheld frames. Data were recorded to the nearest 0.1 dm^2 rather than by cover class. There were 50 plots on the unsprayed range and 50 plots on the sprayed range at each site on which cover was estimated. Beginning with the first plot every 5th plot was clipped. This provided 20 plots per site or 160 plots total in which both cover and herbage production were sampled. Species were bagged separately and the samples oven dried and weighed.

Correlations between cover in dm^2 per plot and weight in grams per plot were tested for those species occurring in four or more plots. Regression equations were calculated for species showing statistically significant correlations.

Results

Table 1 lists the species showing significant correlations between cover and weight. Table 2 lists those species tested which did not show significant correlations.

Sixteen species had significant correlations of .90 or higher. Some of these species occurred in fewer than 10 plots.

Only 6 species with significant correlations had correlations below .70. Generally the species which did not have significant correlations occurred in less than 17 plots. The major exception to this was western yarrow (*Achillea millefolium*) which occurred in 60 plots.

Conclusions

Herbage production sampling by species is a very time-consuming process. The high cover-weight correlation values for nearly all the major species occurring in the mountain grasslands of southwestern Montana indicated that a great deal of field and laboratory time might be saved by using cover values alone as an index of herbage production differences. Similar studies should be made in local flora to test the cover-weight relationships and develop appropriate regression equations before applying this method.

Literature Cited

Daubenmire, R. 1968. Plant communities: A textbook of plant synecology. Harper and Row, New York. 300 p.