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Sampling Vegetation Attributes, Technical Reference 1734-4,
Bureau of Land Management. Denver, Colorado.
BLM/RS/ST-96/002+1730
online @ www.blm.gov/nstc/library/pdf/samplveg.pdf

D. Daubenmire Method

1. *General Description* The Daubenmire method consists of systematically placing a 20- x 50-cm quadrat frame along a tape on permanently located transects (see Figure 4 on page 13). The following vegetation attributes are monitored using the Daubenmire method:

   - Canopy cover
   - Frequency
   - Composition by canopy cover

   It is important to establish a photo plot (see Section V.A) and take both close-up and general view photographs. This allows the portrayal of resource values and conditions and furnishes visual evidence of vegetation and soil changes over time.

2. *Areas of Use* This method is applicable to a wide, variety of vegetation types as long as the plants do not exceed waist height.

3. *Advantages and Limitations* This method is relatively simple and rapid to use. A limitation is that there can be large changes in canopy cover of herbaceous species between years because of climatic conditions, with no relationship to the effects of management. In general, quadrats are not recommended for estimating cover (Floyd and Anderson 1987; Kennedy and Addision 1987). This method cannot be used to calculate rooted frequency.

4. *Equipment* The following equipment is needed (see also the equipment listed in Section V.A, page 31, for the establishment of the photo plot):

   - Study Location and Documentation Data form Appendix A)
   - Daubenmire forms (see Illustration 9 and 10)
   - Hammer
   - Permanent yellow or orange spray paint
   - Two stakes: 3/4 - or 1-inch angle iron not less than 16 inches long
   - Tape: 100- or 200-foot, delineated in tenths and hundreds, or a metric tape of the desired length.
   - Steel pins (reinforcement bar) for marking zero, mid, and end points of the transect
   - Frame to delineate the 20- x 50-cm quadrats (see Illustration 11)
   - Compass
   - Steel post and driver

5. *Training* The accuracy of data depends on the training and ability of the examiners. Examiners must be able to identify the plant species. They must receive adequate and consistent training in laying out transects and making canopy coverage estimates using the frame.

6. *Establishing Studies* Careful establishment of studies is a critical element in obtaining meaningful data (see Section III).

   a **Site Selection** The most important factor in obtaining usable data is selecting representative areas (critical or key areas) in which to run the study (see Section II.D). Study sites should be located within a single plant community within a single ecological site. Transects and sampling points need to be randomly located within the critical or key areas (see Section III).

b Pilot Studies Collect data on several pilot studies to determine the number of samples (transects or observation points) and the number and size of quadrats needed to collect a statistically valid sample (see Section III.B.8).

c Number of Studies Establish a minimum of one study on each study site; establish more if needed (see Section II.D and III.B).

d Study Layout Data can be collected using the baseline, macroplot, or linear study designs described in Section III.A.2 beginning on page 8. The linear technique is the one most often used.

(1) Align a tape (100-, or 200-foot, or metric equivalent) in a straight line by stretching it between the transect location and the transect bearing stakes. Do not allow vegetation to deflect the alignment of the tape. A spring and pulley may be useful to maintain a straight line. The tape should be aligned as close to the ground as possible.

(2) Drive steel pins almost to the ground surface at the zero point on the tape and at the end of the transect. A pin may also be driven into the ground at the midpoint of the transect. (see Figure 4 on page 13)

e Reference Post or Point Permanently mark the location of each study with a reference post and a study location stake (see beginning of Section III).

f Study Identification Number studies for proper identification to ensure that the data collected can be positively associated with specific sites on the ground (See Appendix B).

g Study Documentation Document pertinent information concerning the study on the Study Location and Documentation Data form (see beginning of Section III and Appendix A).

7. *Taking Photographs* The directions for establishing photo plots and for taking close-up and general view photographs are given in Section V.A.

8. *Sampling Process* In addition to collecting the specific studies data, general observations should be made of the study sites (see Section II.F).

a Cover Classes This method uses six separate cover classes (Daubenmire 1959). The cover classes are:

Cover Class	Range of Coverage	Midpoint of Range
1	0 - 5%	2.5%
2	5 - 25%	15.0%
3	25 - 50%	37.5%
4	50 - 75%	62.5%
5	75 - 95%	85.0%
6	95 - 100%	97.5%

b Ten Cover Classes Where narrower and more numerous classes are preferred, a ten-cover class system can be used.

c Collecting Cover Data As the quadrat frame is placed along the tape at the specified intervals, estimate the canopy coverage of each plant species. Record the data by quadrat, by species, and by cover class on the Daubenmire form (see Illustration 9). Canopy coverage estimates can be made for both perennial and annual plant species.

(1) Observe the quadrat frame from directly above and estimate the cover class for all individuals of a plant species in the quadrat as a unit. All other kinds of plants are ignored as each plant species is considered separately.

(2) Imagine a line drawn about the leaf tips of the undisturbed canopies (ignoring inflorescence) and project these polygonal images onto the ground. This projection is considered "canopy coverage." Decide which of the classes the canopy coverage of the species falls into and record on the form.

(3) Canopies extending over the quadrat are estimated even if the plants are not rooted in the quadrat.

(4) Collect the data at a time of maximum growth of the key species.

(5) For tiny annuals, it is helpful to estimate the number of individuals that would be required to fill 5% of the frame (the 71- x 71-mm area). A quick estimate of the numbers of individuals in each frame will then provide an estimate as to whether the aggregate coverage falls in Class 1 or 2, etc.

(6) Overlapping canopy cover is included in the cover estimates by species; therefore, total cover may exceed 100 percent. Total cover may not reflect actual ground cover.

9. *Calculations* Make the calculations and record the results in the appropriate columns on the Daubenmire form (see Illustrations 9 and 10).

a Canopy Cover Calculate the percent canopy cover by species as follows:

(1) On the Daubenmire form (Illustration 9) count the number of quadrats in each of the six cover class (by species) and record in the Number column on the Daubenmire Summary form (Illustration 10).

(2) Multiply this value times the midpoint of the appropriate cover class (Illustration 10).

(3) Total the products for all cover classes by species.

(4) Divide the sum by the total number of quadrats sampled on the transect.

(5) Record the percent cover by species on the form.

b Frequency Calculate the percent frequency for each plant species by dividing the number of occurrences of a plant species (the number of quadrats in which a plant species was observed) by the total number of quadrats sampled along the transect. Multiply the resulting value by 100. Record the percent frequency on the form (Illustration 10).

c Species Composition With this method, species composition is based on canopy cover of the various species. It is determined by dividing the percent canopy cover of each plant species by the total canopy cover of all plant species. Record the percent composition on the form (Illustration 10).

10. Data Analysis Tests should be directed at detecting changes in cover of the species and/or in major ground cover classes. Tests for changes in minor species will have low power to detect change. If quadrats are spaced far enough apart on each transect so as to be considered independent, the quadrat can be analyzed as the sampling unit. Otherwise, the transects should be considered the sampling units. If the transects are treated as the sampling unit, and given that the transects are permanent, either the paired t-test or the nonparametric Wilcoxon signed rank test should be used to test for change between two years. Repeated measures ANOVA can be used to test for differences between 3 or more years. If the quadrats are treated as the sampling units, care must be taken to ensure they are positioned the same along each transect in each year of measurement. A paired t-test, Wilcoxon signed rank test, or ANOVA is then used as described above for transects.

11. References

Daubenmire, Rexford. 1959. A Canopy-coverage method of vegetational analysis. Northwest Science 33:43-64.

——— 1968. Plant communities: a textbook of plant synecology. Harper and Row, New York. 300 p.

USDI, Bureau of Land Management. 1985. Rangeland monitoring - Trend Studies TR4400-4.

Daubenmire

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Study Number	Date	Examiner	Allotment Name & Number	Pasture

Transect Number and Location	Number of Quadrats

Plant Species	Quadrat																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Plant Species	Quadrat																								
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Illustration 9

Daubenmire

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Study Number 035-27W-08-02 | Date 7/24/95 | Examiner Chuck Wagon | Allotment Name & Number Quaking Aspen -10373 | Pasture Sheep Creek

Transect Number and Location 3 miles north of Eagle Creek on the west side of the road | Number of Quadrats 50

Plant Species	Quadrat																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
AGSP	2		1		2				1				2			3		4					3	1	
PONE	1					2	3												4		1			2	
ORHY		3																							
STTH2				1	1					3													1		
SIHY								1																	
BRTE										1		1								1				1	
PHHO														2								1	2		
CRAC 2												1									1	1			
ASTER												2													
ARTR 2														3	3			4				4			
CHVI 8													4											3	

Plant Species	Quadrat																								
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
AGSP			1							1	2				1			2	1		1	1	1		
PONE								2			1			1	3					1					
ORHY						1																		1	
STTH 2					3																2				
SIHY					1																				
BRTE												1	2										1		
PHHO							1									1							1		
ASTER							1	1			2									1					
ARTR 2		4							4		4	4			1				2			2			
CHVI 8				3	3			5						2		2			4						

Illustration 9

Daubenmire Summary

Page ____ of ____

Study Number | Date | Examiner | Allotment Name & Number | Pasture

Study Location | Number of Quadrats

Cover Class	Mid-Point	Species		Species		Species		Species		Species		Species		Species		Species		Species		Species		Species	
		Number	Product	Number	Product	Number	Product	Number	Product	Number	Product	Number	Product	Number	Product	Number	Product	Number	Product	Number	Product	Number	Product
1 1-5%	2.5																						
2 5-25%	15																						
3 26-50%	37.5																						
4 51-75%	62.5																						
5 76-95%	85																						
6 96-100%	97.5																						
Total canopy																							
Number of Samples																							
% canopy cover																							
Species composition																							
Frequency																							

Daubenmire Summary

Page 1 of 1

Study Number 035-27W-08-02 | Date 7/24/95 | Examiner Chuck Wagon | Allotment Name & Number Quaking Aspen 11037 | Pasture Sheep Creek

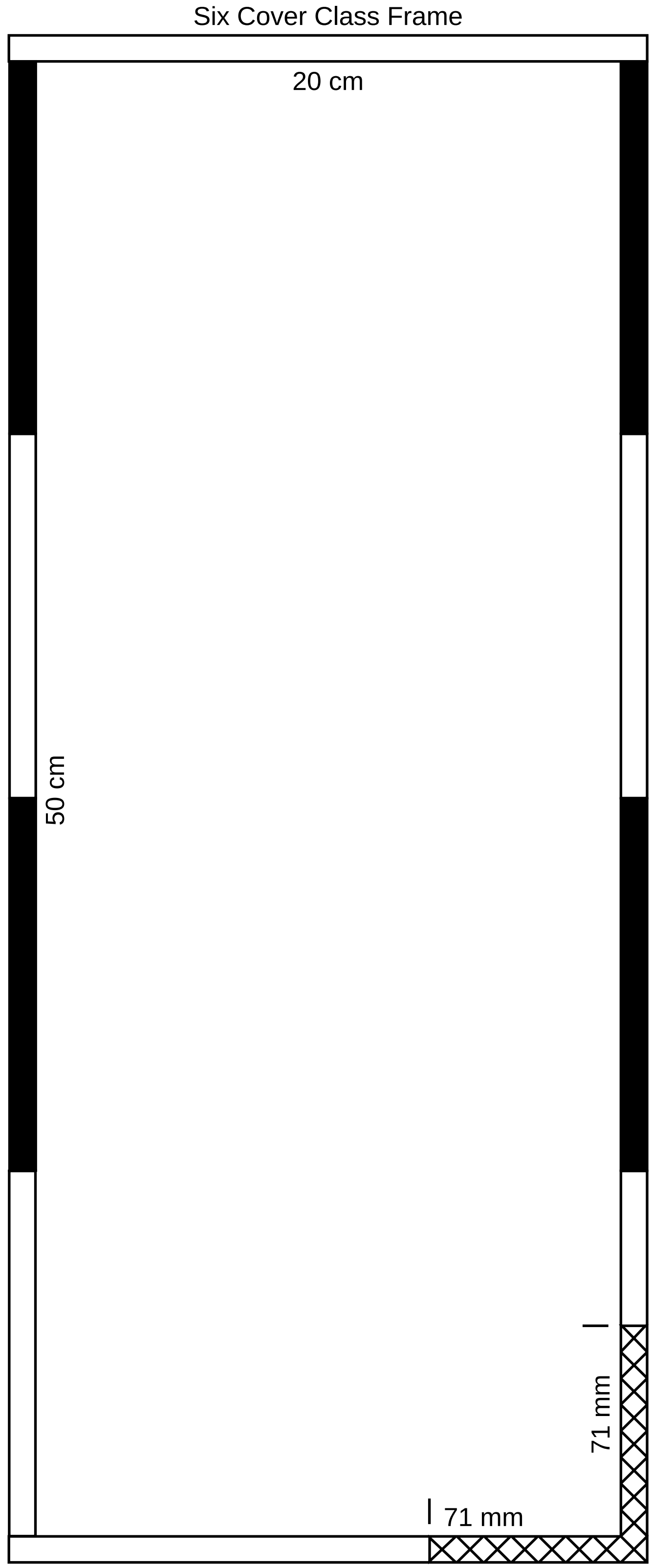
Study Location Three miles north of Eagle Tank on the west side of road. | Number of Quadrats 50

Cover Class	Mid-Point	Species AGSP Number	AGSP Product	Species PONE Number	PONE Product	Species ORHY Number	ORHY Product	Species STTH2 Number	STTH2 Product	Species SIHY Number	SIHY Product	Species BRTE Number	BRTE Product	Species PHHO Number	PHHO Product	Species CRAC2 Number	CRAC2 Product	Species Aster Number	Aster Product	Species ARTR2 Number	ARTR2 Product	Species CHIV8 Number	CHIV8 Product
1 1-5%	2.5	10	25	5	12.5	2	5	3	7.5	2	5	6	15	4	10	3	7.5	3	7.5	1	2.5		
2 5-25%	15	5	75	3	45			1	15			1	15	2	30			2	30	2	30	2	30
3 26-50%	37.5	2	75	2	75	1	37.5	2	75											2	75	3	112.5
4 51-75%	62.5	1	62.5	1	62.5															6	375	2	125
5 76-95%	85																					1	85
6 96-100%	97.5																						
Total canopy			237.5		195		42.5		97.5		5		30		40		7.5		37.5		482.5		352.5
Number of Samples			50		50		50		50		50		50		50		50		50		50		50
% canopy cover			5		4		1		2		—		1		1		—		1		10		7
Species composition			16		13		3		6		—		3		3		—		3		31		22
Frequency			36		22		6		12		4		14		12		6		10		22		16

Illustration 10

Rangeland Monitoring

Daubenmire Frame



The frame is made of 3/8-inch iron rod. The inside dimensions of the frame are 20 x 50 centimeters. The frame should have sharpened legs 3 centimenters long welded to each corner to help hold the frame in place.

The six cover class frame is divided into fourths by painting alternate sections of the frame different colors as illustrated. Use orange and white or red and white paint.

In one corner of the frame, delineate two sides of an area 71 millimeters square as illustrated. This area represents 5% of the quadrat area.

The painted design provides visual reference areas equal to 5, 25, 50, 75, 95, and 100% of the plot area.

Illustration 11