An ecological study of a relict of grassland and an adjacent grazed pasture in Beaverhead Valley, Montana
by Michael P Britton

A THESIS Submitted to the Graduate Faculty i n partial fulfillment of the requirements for the degree of Master of Science in Plant Ecology at Montana State College
Montana State University

Abstract:
A detailed ecological study was made of a relict area which has been protected for 39 years and an adjacent grazed pasture in Beaverhead Valley in southwestern Montana during the summers of 1953 and 1954. The study area is located at an elevation of 5100 to 5200 feet. The soils were classified as sierozems, and four separate types occurred. The average annual precipitation at Dillon, Montana is 15.97 inches, 67 percent being received during the period April 1 to September 30. The average temperature for this period is - 55.6° F. Vegetation density was determined by the point-transect method. List quadrats were used to measure frequency and abundance of forbs and shrubs. Sampling areas were located on each of the four soil types in the relict area and the grazed pasture. Soil profile descriptions were made for each soil type. Differences in community composition on each soil type in the relict area and the grazed pasture are presented in tabular form and are discussed. The Agropyron-Poa type found on the most mature soils was assumed to be the climatic climax of the region. Two edaphic climaxes are discussed. Agropyron spicatum was the dominant plant on the relict area, whereas the grazing disclimax was dominated by Stipa comata.

AN ECOLOGICAL STUDY OF A RELICT OF GRASSLAND AND AN ADJACENT GRAZED PASTURE IN BEAVERHEAD VALLEY, MONTANA

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Dean, Graduate Division

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ABSTRACT

A detailed ecological study was made of a relict area which has been protected for 39 years and an adjacent grazed pasture in Beaverhead Valley in southwestern Montana during the summers of 1953 and 1954. The study area is located at an elevation of 5100 to 5200 feet. The soils were classified as sierozems, and four separate types occurred. The average annual precipitation at Dillon, Montana is 15.97 inches, 67 percent being received during the period April 1 to September 30. The average temperature for this period is 55.6° F. Vegetation density was determined by the point-transect method. List quadrats were used to measure frequency and abundance of forbs and shrubs. Sampling areas were located on each of the four soil types in the relict area and the grazed pasture. Soil profile descriptions were made for each soil type. Differences in community composition on each soil type in the relict area and the grazed pasture are presented in tabular form and are discussed. The Agropyron-Poa type found on the most mature soils was assumed to be the climatic climax of the region. Two edaphic climaxes are discussed. Agropyron spicatum was the dominant plant on the relict area, whereas the grazing disclimax was dominated by Stipa comata.

INTRODUCTION

"Current range vegetation is more often than not a product of varying degrees of past disturbance by man's livestock. Grazing disclimaxes occur over such vast areas, and are of such long standing, that many stockmen do not realize their ranges once did and can again produce a quite different kind of vegetation."[1] This appears to be true of the grasslands occurring on the lower benches and terraces of Beaverhead Valley in southwestern Montana. Since the valley was settled in the late 1800s, most of this grassland has been used for spring-fall range. Stipa comata is the dominant grass on most of these spring-fall ranges and gives them the appearance of the Mixed Prairie Association (Weaver and Clements, 1938). Interspersed in the grassland are communities of plants dominated by Eurotia lanata and Chrysothamnus viscidiflorus (Fig. 1).

The vegetation of southwestern Montana has not been studied intensively. Reitz and Morris (1939) divided the rangelands of Montana into three regions based on the dominant type of vegetation. They included Beaverhead Valley in the Central Mountain Region which was described as being made up of four vegetation types: Short grass, mixed grass, open forest, and the pacific bunchgrass type. Morris (1946) classified the grasslands of Montana into two complexes: Mixed Prairie occupying the Great Plains, and Palouse Prairie in the western valleys and foothills. These in turn were divided into subhumid, semiarid, and arid associations corresponding to soil zones. Dominant species were indicated for each of the associations under moderate and heavy grazing

[1] Cooper, H. W., 1953. Amounts of big sagebrush in plant communities near Tensleep, Wyoming, as affected by grazing treatment. Ecology 34, p. 186.

FIG. 1. GRAZING DISCLIMAX SHOWING STIPA AND CHRYSOTHAMNUS ASPECTS.

on two different soil textures. Wright and Wright (1948) made an ecological study of the grasslands of south-central Montana. They described in detail ten relict areas and grouped these into types based upon the dominant grasses. The diversity of the grasslands of south-central Montana was attributed to the extreme topographic variation, with its associated climatic differences, and was referred to as a tension zone lying between the Palouse Prairie and Mixed Prairie Associations.

Observations made on relict areas during 1953 and 1954 have indicated to the author that the present Mixed Prairie Association occupying the lower elevations of Beaverhead Valley is a disclimax that has resulted from overgrazing

an original Palouse or Bunchgrass Prairie type of vegetation. In support of these observations this thesis presents the results of a detailed study of a relict area which has been protected from grazing for the last 39 years.

ACKNOWLEDGEMENTS

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DESCRIPTION OF STUDY AREA

The study area lies at an altitude between 5100 and 5200 feet above sea level and is located about three miles south of Dillon, Montana on a low gently sloping terrace formed between Beaverhead River and Blacktail Deer Creek. The soils are classified as sierozems, being light gray-brown in color and calcareous throughout. The parent material is tertiary lake bed sediment.

The relict area is fenced on all sides and is about 16 feet wide and one mile long (Fig. 2). According to the present owners, the area was fenced in 1915, and previous to that time it was grazed and had the general appearance of the pastures presently adjacent to it. Although the area has been grazed on several occasions when the fences were in need of repair, it has not been grazed since 1940.

Four soil types are found in the study area (Table I). Three are loams;

FIG. 2. THE RELICT AREA AND ADJACENT PASTURES

two of the loams are deep soils, one of which is gravelly. The third loam is a shallow soil and receives additional moisture from runoff during heavy rains or periods of rapid snowmelt. The fourth soil type is a deep sandy loam lacking a lime layer.

An accurate history of grazing use was not available on the adjoining 640 acre pasture. However, during 1953 and 1954 approximately 150 cows with calves were turned into the pasture during the first week in May and were kept there until July 1. The pasture was utilized again in the fall of the year by approximately 150 cows for a four to six week period. About five horses grazed in the pasture periodically during the entire year. According to the owner

TABLE I. SOIL PROFILE DESCRIPTIONS

SOIL TYPE	HORIZON	DEPTH	BOUNDARY	COLOR	TEXTURE	STRUCTURE	CONSISTENCE	REACTION
DEEP LOAM AND DEEP GRAVELLY LOAM*	A1	0-6"	clear, smooth	dry: light brownish gray moist: dark grayish brown	loam	moderate, thin platy	dry: soft moist: friable	slight effervescence
	B2	6-15"	clear, smooth	dry: pale brown moist: brown	silt loam	moderate, coarse prismatic to coarse subangular blocky	dry: slightly hard moist: friable	slight effervescence
	Cca	15-25"	clear, smooth	dry: very pale brown moist: brown	loam	weak, medium subangular blocky	dry: soft moist: friable	strong effervescence
	C	25-38"	clear, smooth	dry: light yellowish brown moist: yellowish brown	fine sandy loam	massive	dry: soft moist: friable	slight effervescence
	D	38"plus	unassorted sands and gravels					
SHALLOW LOAM	A1	0-6"	clear, smooth	dry: light brownish gray moist: dark gray-brown	loam	moderate, thin platy	dry: soft moist: friable	slight effervescence
	B2	6-11"	clear, smooth	dry: pale brown moist: brown	silt loam	moderate, coarse prismatic to moderately coarse subangular blocky	dry: slightly hard moist: friable	slight effervescence
	Cca	11-22"	clear, smooth	dry: very pale brown moist: brown	silt loam	moderate, medium subangular blocky	dry: slightly hard moist: friable	violent effervescence
	C	22-30"plus; unassorted sands and gravels						
DEEP SANDY LOAM	A1	0-3"	clear, smooth	dry: light brownish gray moist: dark gray-brown	sandy loam	weak, fine crumb	dry: soft moist: friable	strong effervescence
	B2	3-11"	clear, smooth	dry: light brownish gray moist: dark gray-brown	silt loam	moderate, coarse prismatic	dry: slightly hard moist: friable	strong effervescence
	C	11-22"	abrupt, smooth	dry: pale brown moist: brown	sandy loam	medium, subangular blocky	dry: soft moist: friable	strong effervescence
	A1b	22-25"	clear, smooth	dry: light brownish gray moist: dark gray-brown	silty clay loam	moderate, thin platy	dry: slightly hard moist: sticky**	strong effervescence
	B2b	25-36"	clear, smooth	dry: light brownish gray moist: dark gray-brown	silt loam	moderate, coarse subangular blocky	dry: slightly hard moist: friable	strong effervescence
	Cb	36-43"	clear, smooth	dry: pale brown moist: brown	fine sandy loam	massive	dry: soft moist: friable	strong effervescence
		43"plus	unassorted sands and gravels					

*contains 20% gravel

**sticky when wet

this rate of stocking has been practiced for the past 40 or 50 years.

CLIMATE

Average monthly precipitation and temperature data for Dillon, Montana covering a period of 53 years are presented in Table II.

TABLE II. CLIMATIC DATA FOR DILLON, MONTANA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Ave.	Apr. 1 to Sep. 30
Ave. ppt. (in.)	0.83	0.72	1.16	1.68	2.69	2.44	1.39	1.18	1.40	0.94	0.80	0.74	15.97	10.78
Ave. temp. (°F.)	22.5	27.0	34.0	43.2	50.6	57.8	65.1	63.0	54.0	45.8	34.5	26.2	43.9	55.6

The sierozem soils of the study area indicate that the average annual precipitation received there is considerably lower than reported at Dillon. However, seasonal distribution of precipitation and average annual and monthly temperatures should be comparable. Of the total average annual precipitation 67 percent is received between April 1 and September 30. May and June are the months of heaviest rainfall. The average temperature during the period April 1 to September 30 is 55.6° F. Compared to Miles City, a Great Plains station, where the average temperature for the same period is 62.9° F., Dillon has cool summers. The average date of the last killing frost in the spring is May 22 and the average date of the first killing frost in the fall is September 12, giving an average frost free season of 112 days. According to the Thornthwaite (1948) system of classifying climate, Dillon has a microthermal, dry subhumid climate with little or no water surplus.

METHODS OF STUDY

All species of plants encountered on the area were collected and

identified (Table III).

The vegetation of the study area and the pasture was sampled in detail by the point-transect method (Clarke et al., 1942) and by list quadrats. A rectangular frame four feet long and one foot wide was used in making list quadrats. Density of the vegetation was obtained by the point-transect method. List quadrats were used to determine frequency and abundance of herbaceous and shrubby species.

The point-transect method was modified to adapt it to the small size of the areas studied. The point frame was placed at intervals of two feet along a 200 foot transect on the deep loam, deep gravelly loam, and sandy loam soils. One foot intervals along a 100 foot transect were used on the shallow loam soil. On each soil type the grazed and ungrazed vegetation was sampled by 100 frames of ten points each. A "hit" was scored on grasses only if the point was in contact with the plant at ground level. "Hits" on forbs and shrubs were scored only when the plant came in contact with the point from ground level to a height of two inches above the ground. This was done because it was noticed that when the branches of the shrubs were two or more inches above the ground, the area underneath was frequently dominated by grass plants. Because the grass plants actually dominated the soil under the shrubs, it was felt that a measurement of complete crown coverage of the shrubs was not significant.

Soil profile descriptions were made according to the method presently used by the Soil Conservation Service.

DISCUSSION AND CONCLUSIONS

Considering the relict area as a whole, the percentage of soil surface

TABLE III. SCIENTIFIC NAMES OF PLANTS USED.

GRASSES AND SEDGES:

Agropyron cristatum (L.) Beauv.
Agropyron smithii Rydb.
Agropyron spicatum (pursh.) Scribn. and Smith
Bouteloua gracilis (HBK) Lag.
Bromus tectorum L.
Calamagrostis montanensis Scribn.
Koeleria cristata (L.) Pers.
Cryzopsis hymenoides (Roem. and Schult.) Ricker
Poa canbyi (Scribn.) Piper
Poa pratensis L.
Poa secunda Presl.
Sitanion hysterix (Nutt.) J. G. Smith
Stipa comata Trin. and Rupr.
Stipa viridula Trin.
Carex eleocharis Bailey

FORBS AND SHRUBS:

Achillea lanulosa Nutt.
Agoseris glauca (Pursh.) D. Dietr.
Allium textile Nels. and Macbr.
Antennaria microphylla Rydb.
Artemisia frigida Willd.
Artemisia ludoviciana Nutt.
Artemisia tridentata Nutt.
Aster scopulorum Gray
Astragalus inflexus Dougl.
Astragalus miser Dougl. var. decumbens (Nutt.) Cronq.
Atriplex nuttallii A. Watts
Besseya cineria (Raf.) Penn.
Chrysothamnus nausecsus (Pall.) Britt.
Chrysothamnus viscidiflorus (Hook.) Nutt.
Cynoglossum officinale L.
Erigeron compositus Pursh.
Erigeron pumilis Nutt.
Eriogonum ovalifolium Nutt.
Eriogonum microthecum Nutt.
Erysimum cheiranthoides L.
Eurotia lanata (Pursh.) Moq.
Gaura coccinea Pursh.
Grindelia squarrosa (Pursh.) Dunal
Haplopappus acaulis (Nutt.) Gray
Lappula redowskii (Hornem.) Greene
Lithospermum incisum Lehon.
Musineon divaricatum (Pursh.) Raf.
Opuntia polyacantha Haw.
Phlox hoodii Rich.
Phlox longifolia Nutt.
Potentilla pennsylvanica L.
Ribes setosum Lindl.
Sphaeralcea coccinea (Pursh.) Rydb.
Taraxacum officinale Weber
Tragopogon dubius Scop.
Vicia sparsifolia Nutt.

occupied by all species averaged 15.3 percent. Grasses and sedges made up 10.6 percent of this cover, shrubs 3.1 percent, and forbs 1.6 percent.

Agropyron spicatum was the dominant grass, making up 33.3 percent of the total density. Poa secunda and Agropyron smithii, forming 14.4 percent and 7.2 percent of the total cover respectively, were the most important associated grasses. These three grasses formed 54.9 percent of the total density. No attempt was made to differentiate between P. secunda and Poa canbyi in the field; therefore, both of these species are referred to as P. secunda. Calamagrostis montanensis, Stipa comata, Oryzopsis hymenoides, and Carex eleocharis were of secondary importance, making up 14.4 percent of the basal area.

Of the forbs and shrubs, Eurotia lanata was the most important component, making up 46.8 percent of the non-grassy cover. Chrysothamnus viscidiflorus was of next importance forming 14.9 percent of the combined area of forbs and shrubs. Phlox longifolia, Lappula redowskii, Sphaeralcea coccinea, Astragalus miser var. decumbens, Vicia sparsifolia, and the shrub Atriplex nuttallii formed 25.5 percent of the non-grassy cover.

Abundance data show that 20 species of forbs and 6 shrubs were sufficiently abundant to occur in an average of two percent or more of the list quadrats (Table IV).

Variation in soil texture and profile depth caused a significant change in relative dominance as can be seen from an examination of Table V and Figure 3.

On the deep loam soil (Fig. 4), A. spicatum made up 66.8 percent of the total vegetation, declined to 51.8 percent on the deep gravelly loam (Fig.5),

TABLE IV. FREQUENCY AND ABUNDANCE OF SHRUBS AND FORBS.

SPECIES NAME	FREQUENCY %	ABUNDANCE*
Phlox longifolia	54	76.0
Sphaeralcea coccinea	38	21.0
Atriplex nuttallii	32	8.0
Eurotia lanata	30	25.5
Chrysothamnus viscidiflorus	30	13.5
Lappula redowskii	28	56.0
Artemisia frigida	18	6.5
Vicia sparsifolia	10	10.5
Opuntia polyacantha	10	2.5
Gaura coccinea	8	2.0
Taraxacum officinale	8	2.0
Astragalus miser	4	5.5
Chrysothamnus nauseosus	4	1.5
Haplopappus acaulis	4	1.0
Antennaria microphylla	4	1.0
Artemisia ludoviciana	2	4.0
Phlox hoodii	2	1.0
Tragopogon dubius	2	1.0
Achillea lanulosa	2	0.5
Agoseris glauca	2	0.5
Erigeron pumilis	2	0.5
Eriogonum ovalifolium	2	0.5
Eriogonum microthecum	2	0.5
Grindelia squarrosa	2	0.5
Musineon divaricatum	2	0.5
Erysimum cheiranthoides	2	0.5
Allium textile	t**	-***
Artemisia tridentata	t	-
Aster scopulorum	t	-
Astragalus inflexus	t	-
Besseya cineria	t	-
Cynoglossum officinale	t	-
Erigeron compositus	t	-
Lithospermum incisum	t	-
Potentilla pennsylvanica	t	-
Ribes setosum	t	-

* Average number of plants per 100 square feet of area.
** Frequency less than 2%.
*** Less than 1 plant per 200 square feet of area.

TABLE V. DENSITY OF VEGETATION IN PERCENT

GRASSES AND GRASSLIKE PLANTS	DEEP LOAM SOIL		DEEP GRAVELLY LOAM		SHALLOW LOAM		DEEP SANDY LOAM		ENTIRE STUDY AREA	
	PRO-TECTED	GRAZED	PRO-TECTED	GRAZED	PRO-TECTED	GRAZED	PRO-TECTED	GRAZED	PRO-TECTED	GRAZED
Agropyron spicatum	11.7	1.5	6.9	1.8	1.8	.4	----	----	5.1	.9
Poa canbyi)	.6	.1	.7	---	1.5	.1	6.3	2.4	2.2	.6
Poa secunda)										
Agropyron smithii	.7	---	.7	.1	1.3	1.4	1.6	.4	1.1	.4
Calamagrostis montanensis	----	---	---	---	3.7	.6	----	----	.9	.1
Stipa comata	.2	.9	.4	2.3	1.0	4.7	1.0	3.3	.6	2.8
Oryzopsis hymenoides	.5	.5	1.4	.4	.3	.2	----	----	.5	.3
Carex eleocharis	----	----	.1	---	.3	.1	.4	.2	.2	.1
TOTAL GRASS DENSITY	13.7	3.0	9.3	4.6	9.9	6.5	9.3	6.3	10.6	5.2
SHRUBS AND FORBS										
Eurotia lanata	----	---	.1	---	.3	---	8.6	2.3	2.2	.5
Chrysothamnus viscidiflorus	1.6	1.6	1.2	.2	.2	.3	----	----	.7	.5
Phlox longifolia	1.3	.2	.7	.3	---	.1	----	----	.5	.1
Atriplex nuttallii	.4	.2	.1	.1	.3	.1	.2	----	.2	.1
Lappula redowskii	----	---	---	---	.1	---	.9	----	.2	---
Sphaeralcea coccinea	.3	.1	.2	.3	.1	---	----	.1	.1	.1
Astragalus miser var. decumbens	----	---	.4	---	---	---	----	----	.1	---
Vicia sparsifolia	----	---	.3	---	---	---	----	----	.1	---
Chrysothamnus nauseosus	----	---	---	---	.3	---	----	----	---	---
Opuntia polyacantha	----	.3	---	.1	.2	---	.1	.2	.t	.15
Phlox hoodii	----	.1	---	---	---	---	----	----	---	---
Artemisia frigida	----	.1	.1	.1	---	---	----	----	---	---
Astragalus inflexus	----	.1	---	---	---	---	----	----	---	---
Gaura coccinea	.1	---	---	---	---	---	----	----	---	---
Taraxacum officinale	.1	---	---	---	---	---	----	----	---	---
TOTAL SHRUBS AND FORBS	3.8	2.7	3.1	1.1	1.5	0.5	9.8	2.6	4.7*	1.7*
TOTAL DENSITY	17.5	5.7	13.3	5.7	11.3	7.0	19.1	8.9	15.3*	6.8*

*Totals in these columns are averages of the sums of the totals shown for each of the four soil types.

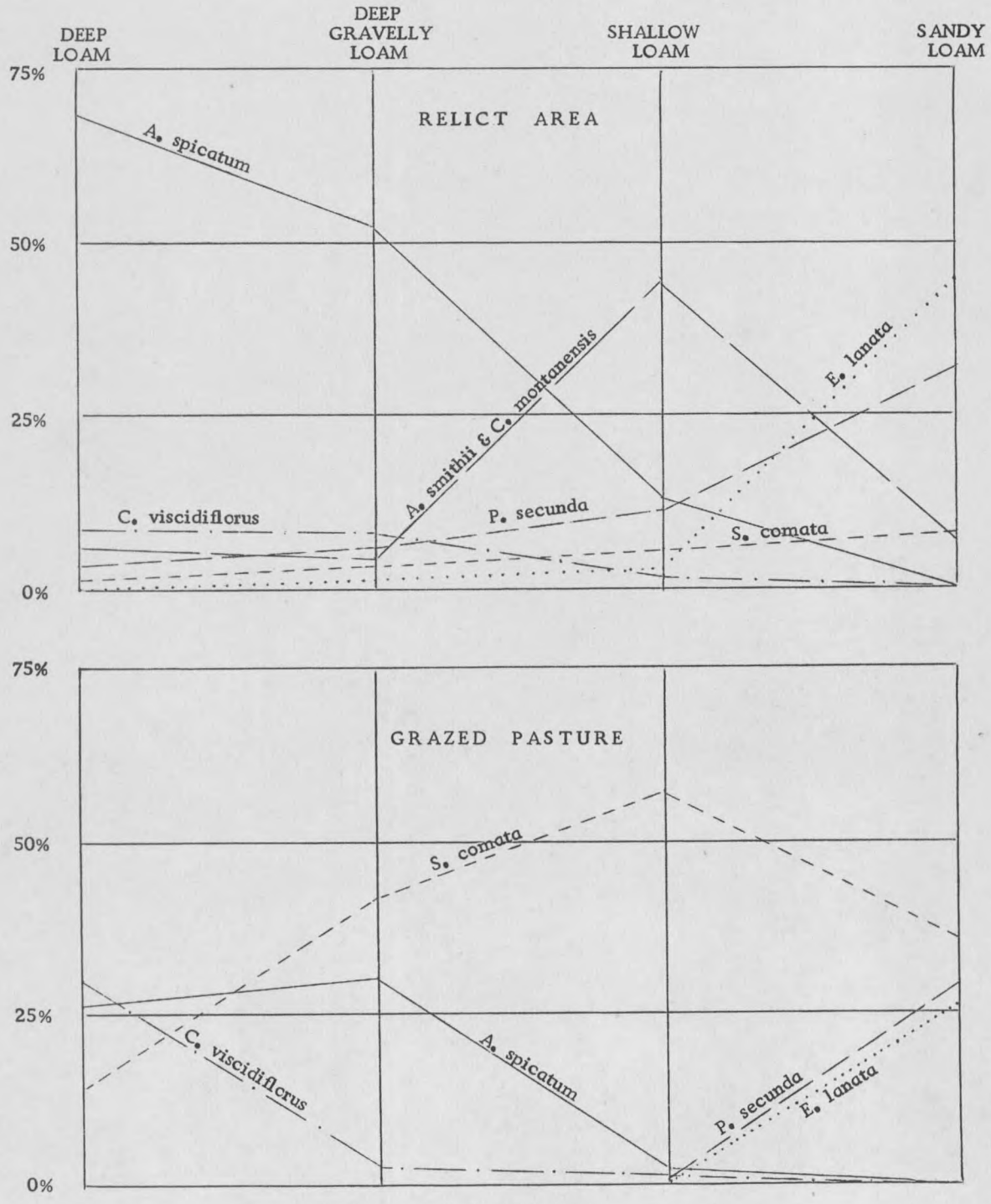

FIG. 3. PERCENTAGE COMPOSITION OF MAJOR PLANTS BY SOIL TYPES.

FIG. 4. AGROPYRON-POA TYPE ON DEEP LOAM SOIL.

FIG. 5. AGROPYRON-POA TYPE ON DEEP GRAVELLY LOAM SOIL.

15 percent on the shallow loam (Fig. 6), and was not recorded on the deep sandy loam (Fig. 7). In contrast, the importance of P. secunda increased, forming 3.4 percent of the vegetation on the deep loam, 5.3 percent on the deep gravelly loam, 13.2 percent on the shallow loam, and 32.9 percent on the deep sandy loam. Stipa comata likewise was most abundant on the shallow loam and deep sandy loam soils. The two rhizomatous grasses, A. smithii and C. montanensis, together making up 44.2 percent of the total density, assumed the greatest degree of dominance on the shallow loam soil.

Of the shrubs, E. lanata was the dominant plant on the deep sandy loam, forming 45 percent of the vegetation, and it was a minor component of the communities on the other three soil types. Chrysothamnus viscidiflorus followed the same trend as A. spicatum, making up 9.1 percent on the deep loam, 9.0 percent on the gravelly loam, 1.5 percent on the shallow loam, and it was not encountered on the deep sandy loam soil.

The total density of the vegetation on the relict area was 15.3 percent compared to 6.8 percent on the grazed area. The density of the grasses dropped from 10.6 percent to 5.2 percent. Agropyron spicatum decreased in density from an average of 5.1 percent to 0.9 percent; P. secunda from 2.2 percent to 0.6 percent; A. smithii from 1.1 percent to 0.4 percent. Stipa comata, however, increased in density from 0.6 percent to 2.8 percent, composing 33.3 percent of the vegetation on the grazed pasture compared to 4.0 percent on the relict area.

Density of shrubs and forbs declined from 4.7 percent to 1.7 percent largely as a result of the reduction in vigor of E. lanata, which suffered a significant decline in density from 2.2 percent to 0.5 percent. The cover of

FIG. 6. EDAPHIC CLIMAX OF RHIZOMATOUS GRASSES OCCUPYING DEPRESSION IN CENTER FOREGROUND, WITH AGROPYRON-POA TYPE IN IMMEDIATE FOREGROUND, ON SHALLOW LOAM SOIL.

FIG. 7. EROTIA-POA TYPE ON DEEP SANDY LOAM SOIL.

C. viscidiflorus averaged slightly less on the grazed area than on the ungrazed, but because of the reduction in total density, this unpalatable shrub made up 7.3 percent of the vegetation on the grazed area as compared to 4.5 percent on the ungrazed.

The climatic climax of any given region is generally considered to occupy the most mature soils. As a result of edaphic and topographic variations, one may recognize edaphic and topographic climaxes within the region (Odum, 1953).

Following this scheme, the most mature soil which occured in the study area was the deep loam type, and the Agropyron-Poa type which occupied this soil was the climatic climax. This type is similar to the Agropyron-Poa zone in southeastern Washington (Daubenmire, 1942) and in British Columbia (Tisdale, 1947). Wright and Wright (1948) described a similar Agropyron spicatum type in southwestern Montana. Koeleria cristata was an important component of the vegetation described by Tisdale, and Wright and Wright, but has been infrequently encountered in the low elevation grasslands of Beaverhead Valley. The only significant difference in community composition on the deep loam and deep gravelly loam soils was the lower total density of vegetation on the latter type.

Two edaphic climaxes were recognized in the study area. On the shallow loam soil a Calamagrostis-Agropyron type was found, and on the deep sandy loam a Eurotia-Poa type was evident.

The dominance of the rhizomatous grasses, C. montanensis and A. smithii, on the shallow loam soil was attributed to the fact that they formed almost pure stands in the depressions where runoff water accumulated. However,

where additional moisture was not received, the community composition was much like that described for the deep loam soil.

The Eurotia-Poa type was found on the driest and most immature soil in the area. The sandy nature of this soil was confined to the upper two feet; below that depth was a well-developed, buried clay loam profile (Table I). The extensive fibrous roots of E. lanata, the major dominant, extended well into the buried clay loam portion. Because of the deep moisture penetration afforded by the sandy surface horizon, E. lanata can continue its growth processes well into the summer dry season, utilizing the moisture stored in the buried soil profile. The interstices between the plants of E. lanata were occupied mainly by P. secunda, whose shallow root system did not extend into the clay loam. Lappula redowskii was another abundant interstitial plant found on this soil, although it was not abundant on any other soil type (Table V). Shantz and Piemeisel (1940) noted that E. lanata and Lappula sp. were associated species in secondary successions of "Winterfat" types in the southern portion of the Northern Desert Shrub Formation in Utah.

The climax communities of the relict portion of the study area were characterized by species which are dominants of the Great Basin region, where winter precipitation is the major climatic factor controlling the development of the climax vegetation. However, in Beaverhead Valley the majority of the precipitation is received during the spring and summer months. This type of moisture distribution is similar to that occurring in the Great Plains. Growing season temperatures in Beaverhead Valley are cooler than in the Great Plains region and it is felt that this may be the factor controlling the development of a bunch grass climax.

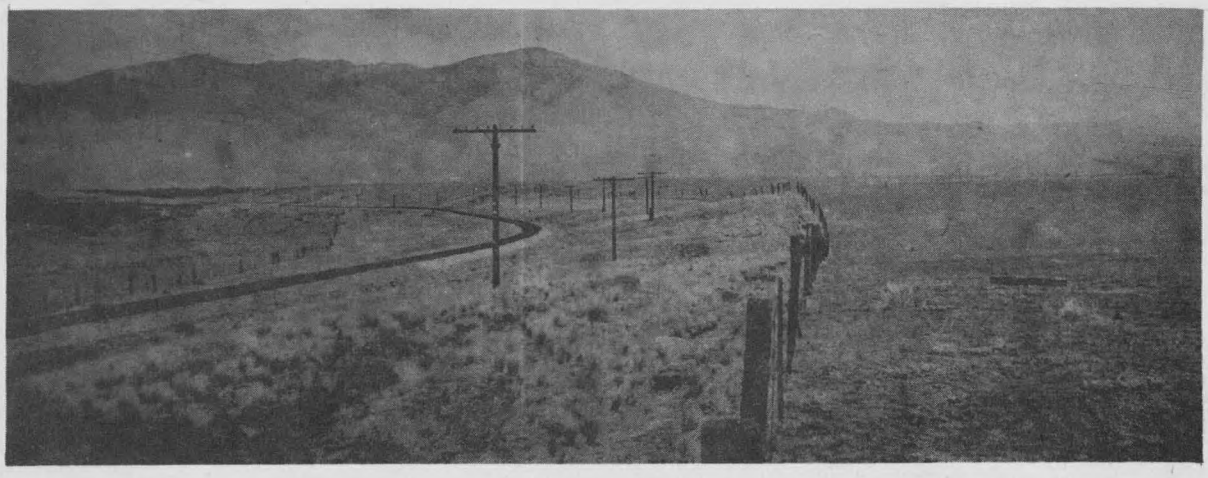

FIG. 8. UNION PACIFIC RIGHT-OF-WAY.

When the competition of the climax plants is reduced by overgrazing, species of plants typical of the Mixed Prairie increase in density, and a disclimax dominated by Stipa comata results. This is the most widespread type of vegetation on the lower elevations in Beaverhead Valley.

In some areas communities of plants dominated by C. viscidiflorus are interspersed with the Stipa aspect as shown in Figure 1. Generally these communities occur on medium textured, deep, loam soils (Table V).

Bouteloua gracilis reaches the limits of its range in Beaverhead County. The author observed that if very heavy grazing was practiced in areas where this grass was present, S. comata was replaced by B. gracilis on gravelly or sandy soils. On such areas the original Agropyron-Poa type is converted to a short grass disclimax. Figure 8 is a photograph of the Union Pacific Railroad right-of-way 12 miles north of Dillon, Montana. The abundant plant on the right-of-way is A. spicatum. On the heavily-grazed pasture, A. spicatum has been practically eliminated and the vegetation is essentially a

pure stand of B. gracilis.

SUMMARY

The data presented in this study show that the climax vegetation of the lower elevation grassland of Beaverhead Valley in southwestern Montana is a bunch grass prairie dominated by Agropyron spicatum. The climatic climax of this area is the Agropyron-Poa type occurring on the mature deep loam soils. Two edaphic climaxes: A Calamagrostis-Agropyron type and a Eurotia-Poa type were found on a shallow loam and a deep sandy loam soil respectively.

It is evident that as a result of heavy grazing the original bunch grass prairie has been largely replaced by a grazing disclimax dominated by Stipa comata, and that if heavier grazing is practiced this disclimax will be replaced by a short grass disclimax dominated by Bouteloua gracilis on sandy or gravelly soils. Communities of plants dominated by Chrysothamnus viscidiflorus occur in the disclimax, generally on medium textured, deep loam soils.

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