

Soil and Vegetation Inventory of Near-pristine Sites

MONTANA



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



" Of all the things that live and grow upon this earth, grass is the most important. Should its harvest fail for a single year, famine would depopulate the earth."

For thousands of years nature's grasses have waved in the breeze, bowed their heads to the wind, shook their seeds to the earth, and then died back into the rich brown soil they were helping to build. All the creatures of nature lived on the plants or on each other. When the hungry winds swept over the range, the grass held the line from erosion. When the power-packed rain pellets smashed into it, they exploded harmlessly in the spongy, shock-proof blanket of vegetation and were absorbed by the life-giving soil.

Nature had reached a climax in a marvelous self-perpetuating ecosystem that could have endured indefinitely without change. The grass provided sustenance for the vegetarians, and they for the carnivores and omnivores; and the wastes and residues from all returned to earth to provide sustenance for the grass.

Front Cover Picture - Square Butte, north of Cascade, Montana, is a well-known landmark that Charles M. Russell included in many of his paintings. A portion of the top of the Butte has been protected from livestock grazing to preserve the vegetation as a permanent relict area. The picture "Charles M. Russell and His Friends" was made available through the Montana Historical Society -- MacKay Collection.

SOIL AND VEGETATION INVENTORY OF
NEAR-PRISTINE SITES IN MONTANA

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the ranchers and many others who helped
make this inventory possible.

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P R E F A C E

Nature had a good thing going with her perpetuating system of checks and balances between soil, climate, vegetation, and the living creatures; but when man entered the grassland picture, the scene changed.

As the settlers moved northward and westward into Montana Territory, much of the valley bottoms and deeper soils were plowed and farmed; but, primarily, Montana attracted rancher-type settlers who realized that the best use of the uplands was to leave them as rangeland.

At present, sixty-five million acres (70 percent) of the land area of Montana is rangeland. Rangeland is the basis for the livestock business which is the largest income-producing industry in the state. It also provides watershed protection, high quality water production, wildlife habitat, aesthetics, and many other values.

Rangelands have often been left in native vegetation because they are generally too steep, too dry, too rocky, or have too short a growing season to be used for cultivated crop production. Because of physical and climatic limitations, rangelands are easily damaged by excessive grazing.

Nature tries to keep the soil covered with vegetation as long as any soil remains. If the original kinds of taller-growing grasses are allowed to be grazed out, nature will cover the soil with either weedy, woody, spiny and unpalatable plants, or with grasses so short that they escape close grazing.

The misuse of rangelands by man in his effort to maximize profit, and his poor understanding of grazing management, has caused the over-grazing and the decimation of much of Montana's rangeland.

Overgrazing did not happen in a short time; but like population increases, water pollution, air pollution and erosion, the loss of nature's rich carpet of stirrup-high grass was so gradual that man was not aware of the changes.

Fortunately, there are many areas in Montana that still have the original or near-pristine kinds of vegetation. There has been little or no grazing by either domestic livestock or by wildlife in these areas.

Near-pristine areas show the kinds and/or amounts of vegetation that nature will produce on a given soil and in a given climate.

Climax or near-pristine vegetation provides benchmarks for determining the condition of rangelands. The Soil Conservation Service uses these areas to fulfill its responsibility for monitoring land-use conditions and for treatment needs.

For several years, the Soil Conservation Service has conducted detailed studies of soil, climate, and vegetation on near-pristine areas found throughout Montana. The purpose of these studies is to locate by geographical area those range sites in climax or near-pristine condition and to document plant communities by species.

Climax vegetation is not necessarily the goal of range management; however, it is an ecological benchmark on which range condition is based. The more closely the rangeland ecosystems are understood, the more accurate the range management techniques will be.

Our objective for managing plant communities in harmony with nature is to insure the continuing production of rangeland ecosystems on a sustained-yield basis.

A.B. Linford
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Highlight

Climax plant communities are recognized as being ecological standards used in monitoring rangeland ecosystems.

Climax or near-pristine areas inventoried in this study are categorized according to geographical areas, average annual precipitation, and soil characteristics.

In a northern grassland climate, climax vegetation is dominated by taller-growing, higher-producing grasses with a very small percentage of short grasses, forbs and shrubs. Disturbances to natural grasslands such as grazing, fire, and cultivation bring about changes in the composition of plant communities.

Near-pristine vegetation on the areas studied has a dominance (composition by weight) of rough fescue (*Festuca scabrella*) in the 15- to 19-inch precipitation zone, silty range site; a dominance of bluebunch wheatgrass (*Agropyron spicatum*) in the 10- to 14-inch precipitation zone, silty range site; and a very low percentage of annuals and big sagebrush (*Artemisia tridentata*) in all sites. In many instances, heavy invasions of big sagebrush, short grasses and annual and perennial forbs are evident on overgrazed ranges adjacent to the near-pristine areas studied.

Range research and ranchers' experience have proven that deteriorated ranges improve with well-planned and applied grazing management systems; this is a basic concept of range management.

The diet preference of grazing animals may change according to the availability of forage species in the plant community. Animals, domestic or wild, naturally graze preferred species first. If the preferred species have been eliminated from the plant community, grazing animals are forced

to graze on the less preferred species. In plant communities with high percentages of big sagebrush or other woody plants, there may be insufficient grasses or forbs to provide adequate forage at certain times of the year for either livestock or big game animals. Hence, grazing animals are forced to either go hungry or to use more sagebrush than naturally preferred.

The management of rangelands is based on the entire ecosystem and not on a specific plant or class of animal.

In addition to their value as natural vegetation reference points, relict areas serve not only as sanctuaries for small mammals and birds, but also as opportunities for studying the entire undisturbed biota.

Discussion

Climax plant communities align along a continuum; however, distinct plant communities do exist and can be identified. These communities are associated with recognizable differences in soil, physiography, and climate.

A specific soil or group of soils with similar characteristics in a given climate comprises a range site. In the absence of abnormal disturbance or physical site deterioration, the range site in climax condition supports a natural, native plant community (climax) that is typified by distinct kinds and/or amounts of vegetation which differs from any other range site. Through thousands of years, this natural plant community has evolved as best adapted to the particular environmental complexities of the site. It is relatively stable and is in dynamic equilibrium with its environment.

Relict or near-pristine areas provide a standard for comparing presently existing vegetation against nature's potential. Ecologically

viewed, range condition is a comparison of the present or existing plant community in relation to the climax or potential plant community for a particular range site.

Condition of most rangelands in Montana has changed considerably in the past hundred years because of grazing pressure and other disturbances; however, Montana has an abundance of relict areas supporting near-pristine vegetation that serve as benchmarks. These areas are widely distributed throughout the State representing all geographical areas and many range sites.

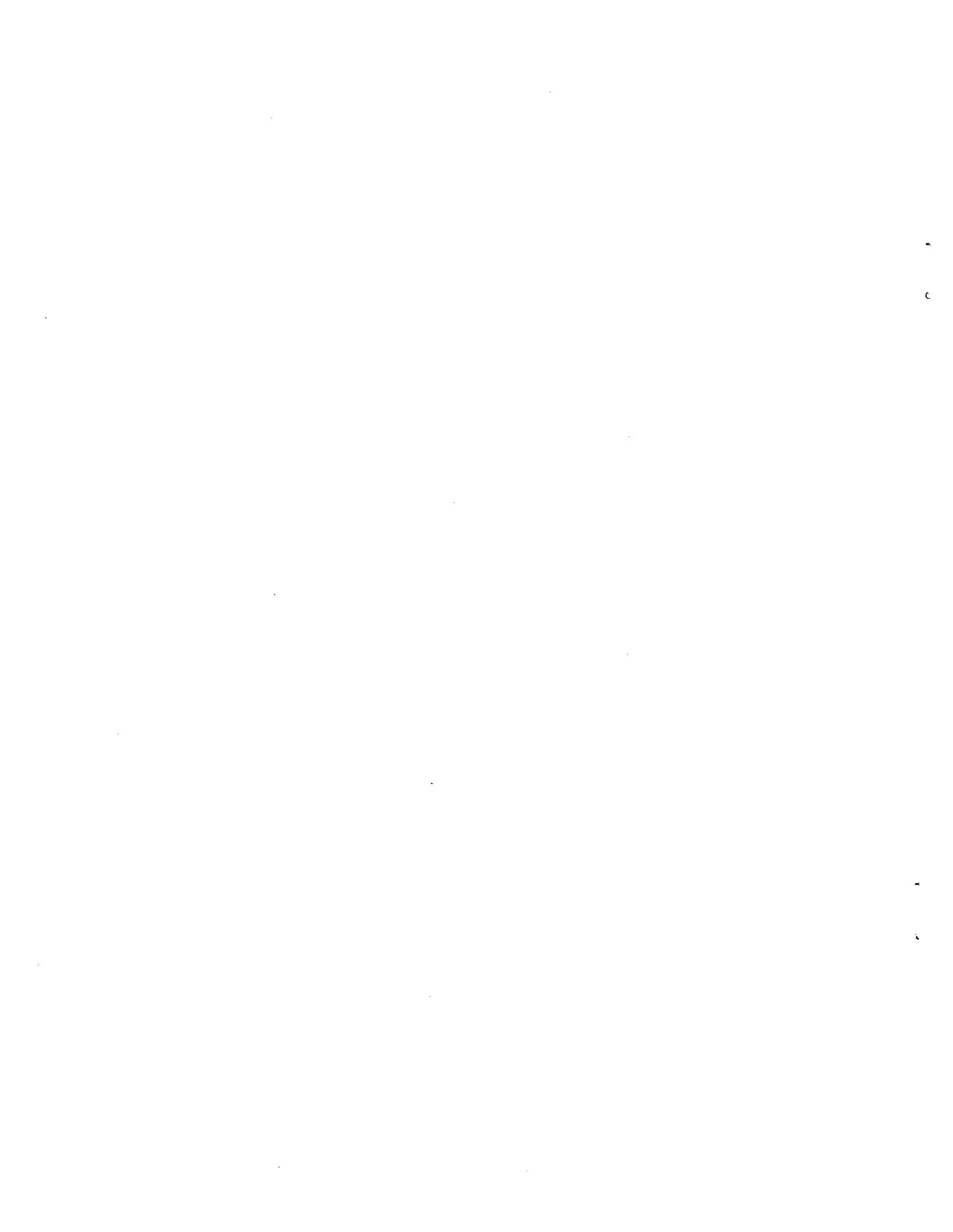
Methods and Procedures

For the most part, plant yield data were gathered by use of the double sampling method as described in SCS National Handbook for Rangeland and Related Grazing Lands. In some instances, actual clippings were avoided to protect the site and ocular estimates of species composition were recorded. The site number of ocular estimated studies are preceded by the number "0" and are asterisked and footnoted in the tables.

Annual precipitation figures are from precipitation maps based on data compiled by the SCS Snow Survey & Water Supply Forecast Unit and the National Weather Service.

Geographical areas are those used by SCS for Technician's Guide to Range Sites and Condition Classes. Detailed descriptions of soil series for individual relict areas are available from the Soil Conservation Service, Bozeman, Montana. Range sites are described in the attached Range Site Criteria.

The following tables are organized by geographical areas, range sites, and precipitation zones.



Climax or Near-Pristine Vegetation
 TABLE 1. Foothill Area, Silty Range Site 10-14" Precipitation Zone

	#31	#029	#12	#13	#14	#17	#18	#26	#30	#39	#011	#4
	Fort Harrison Entrance Sappington Loam	* Old Airport at Roundup Boxwell Loam	Cooper Pasture (2 yr. Ave.) Turner Loam	North of Belgrade Amsterdam Silt Loam	Chico Cemetery (2 yr. Ave.) Windham Cobbly Loam	Winston Cemetery (2 yr. Ave.) Martinsdale Loam	Laurin Cemetery Avalanche Very Fine Sandy Loam	LaHood Canyon Fan (2 yr. Ave.) Crago Gravelly Loam	LaHood Canyon Slope (2 yr. Ave.) Unnamed Gravelly Clay Loam	Miller Butte Cushman Very Fine Sandy Loam	*Springdale Highway Right-of-way	Big Timber Airport (4 yr. Ave.) Sweetgrass Gravelly Clay Loam
Percent Composition By Weight												
Bluebunch wheatgrass	67	65	80	57	47	96	78	84	88	60	85	59
Western wheatgrass	1	5	2	2	2	T	3		T			4
Green needlegrass		8							6			
Blue grama	T	5	T			T		T		T		T
Needleandthread	11	5	1	1	4		18	4		1	T	7
Sandberg bluegrass	8	T	1	2	T	1	T	1	T	T	T	1
Cusick bluegrass					T							
Prairie junegrass	T		9	22	11	1	T	2	T	21	3	5
Threadleaf sedge	1	T	T	T	T	1	1	T	T	T	T	1
Perennial forbs	8	4	6	13	34**	1	T	7	3	2	7	17
Annuals & biennials	2	T	1	1	T	T	T	1	T	T	5	2
Big sagebrush		5								13		
Silver sagebrush	2											
Fringed sagewort	T	T	T	2	1	T		1	3	3		4
Rubber rabbitbrush												
Cactus		3			1		T	T			T	
Pincussion cactus								T				

* Ocular estimates, not clippings

**About 1/3 of this figure is Prairie milkvetch (Astragalus striatus)

Climax or Near-Pristine Vegetation

TABLE 2. Foothill Area, Silty Range Site 15-19" Precipitation Zone

	#43	#44	#025	#02	#021	#022	#24	#6	#46
	Rimini Turnoff Blaine Gravelly Loam	^{1/} Rimini Turnoff (NE slope) Martinsdale Gravelly Loam	*Rimini Turnoff (East slope) Martinsdale Gravelly Loam	^{1/} *Gold Butte Ceme- tery	*Thompson Ranch (SE of Whitlash) Glikon Loam	*Oswood Ranch (SE of Whitlash) Monad Loam	Grace R. R. Right- of-way Martinsdale Cobbly Loam	Square Butte Cascade (5 yr. Ave.) Ess Loam	Municipal Watershed White Sulphur Springs

Percent Composition By Weight

Rough fescue		65	10	80	92	93		59	51
Idaho fescue		12	1	T	2	1	53	11	5
Bluebunch wheatgrass	89	11	75				22	7	14
Western & thickspike wheatgrass	T	1	T	5	T				
Prairie junegrass	T		T				3	T	T
Sandberg bluegrass	1	T					T		2
Blue grama							T	T	
Needleandthread							T	T	
Green needlegrass		T	T	5	1				
Cusick bluegrass	2	2	3	T					
Threadleaf sedge	T	T	T	T	T	1	T		5
Perennial forbs	5	7	10	10	5	4	16	15	16
Annuals & biennials	1	2	1	T	T	T	2	2	5
Rubber rabbitbrush							2		
Green rabbitbrush	2						2		
Grey horsebrush		T							
Fringed sagewort	T							6	2
Arkansas rose						1			
Cactus	T	T							

^{1/} See page 24 for comparison of near-pristine vegetation and adjacent grazed area.

* Ocular estimates, not clippings.

Relict or Near-Pristine Vegetation

TABLE 3. Foothill Area, Clayey Range Site 10-14" Precipitation Zone

#34	
Bearcreek ^{1/}	
Cemetery	
Heldt	
Clay Loam	

Percent Composition By Weight

Bluebunch wheatgrass	70
Western wheatgrass	T
Green needlegrass	T
Cussick bluegrass	5
Sandberg bluegrass	1
Prairie junegrass	2
Threadleaf sedge	2
Perennial forbs	7
Annuals & biennials	T
Big sagebrush	10
Silver sagebrush	T
Fringed sagewort	T
Winterfat	3
Rubber rabbitbrush	T

^{1/} See page 24 for comparison of near-pristine vegetation and adjacent grazed area.

TABLE 4. Foothill Area, Clayey Range Site 15-19" Precipitation Zone

#7	
Bowman's	
Corner	
(5 yr. Ave.)	
Gerber	
Clay	

Percent Composition By Weight

Rough fescue	70
Idaho fescue	21
Bluebunch wheatgrass	5
Western wheatgrass	1
Sandberg bluegrass	T
Prairie junegrass	T
Perennial forbs	2
Annuals & biennials	T
Fringed sagewort	1

Climax or Near-Pristine Vegetation
 TABLE 5. Foothill Area, Sandy Range Site 10-14" Precipitation Zone

#25
Rochester Cemetery Chinook Gravelly Sandy Loam

Percent Composition By Weight

Bluebunch wheatgrass	54
Needleandthread	25
Blue grama	2
Sandberg bluegrass	T
Perennial forbs	2
Fringed sagewort	12
Broom snakeweed	5

Climax or Near-Pristine Vegetation
 TABLE 6. Foothill Area, Stony Range Site 10-14" Precipitation Zone

#15	#16
Antelope Range Radersberg Very Cobbly Loam	LaHood Canyon Flat (2 yr. Ave.) Radersberg Stony Loam

Percent Composition By Weight

Bluebunch wheatgrass	56	67
Western wheatgrass	2	
Sandberg bluegrass	1	1
Needleandthread	T	1
Blue grama	3	1
Threadleaf sedge	T	T
Perennial forbs	3	17
Annuals & biennials	T	1
Fringed sagewort	26	11
Cactus	9	1
Pincussion cactus	T	
Clubmoss	T	T

Climax or Near-Pristine Vegetation
TABLE 7. Foothill Area, Limy Range Site 10-14" Precipitation Zone

#32	
Fort Harrison ^{1/}	
Ballpark	
Mussellshell	
Loam	
<u>Percent Composition By Weight</u>	
Bluebunch wheatgrass	49
Western wheatgrass	2
Prairie junegrass	10
Needleandthread	5
Sandberg bluegrass	1
Blue grama	T
Perennial forbs	11
Annuals and biennials	T
Fringed sagewort	3
Silver sagebrush	10
Grey horsebrush	4
Broom snakeweed	4
Winterfat	1

^{1/} See page 25 for comparison of near-pristine vegetation and adjacent grazed areas.

Climax or Near-Pristine Vegetation
TABLE 8. Foothill Area, Shallow to Gravel Range Site 10-14" Precipitation Zone

#11	
Belgrade	
Railroad	
R/W	
Beaverton	
Loam	
<u>Percent Composition By Weight</u>	
Bluebunch wheatgrass	65
Western wheatgrass	5
Prairie junegrass	15
Sandberg bluegrass	4
Needleandthread	4
Blue grama	1
Threadleaf sedge	T
Perennial forbs	6
Annuals & biennials	T

Climax or Near-Pristine Vegetation
 TABLE 10. Sedimentary Plains Area, Sandy Range Site 10-14" Precipitation Zone

	#01	#38	#2	#47	#48
	*Pompey's Pillar North Slope	Chalk Butte Vebar Fine Sandy Loam	Square Butte (W. of Laurel) (2 yr. Ave.) Ryegate Sandy Loam	Ferris Ranch Tullock Fine Sandy Loam	Griffith Ranch
	10	26	12	13	14
	10	3	29	42	47
	25	5	6	T	14
	5	8	3	6	10
	3	1	1	T	T
	2	1	3	T	1
	T	T	T	T	1
	T				2
				33	
	10	25	25	3	9
	12	27	4	3	2
	3	4	T	T	T
	10		17		
	10				

Percent Composition By Weight

Prairie sandreed
 Needleandthread
 Bluebunch wheatgrass
 Little bluestem
 Western & thickspike
 wheatgrass
 Blue grama
 Prairie junegrass
 Green needlegrass
 Sandberg bluegrass
 Plains reedgrass
 Indian ricegrass
 Sand dropseed
 Sand bluestem

Threadleaf sedge
 Perennial forbs
 Annuals and biennials
 Fringed sagewort
 Shrubs

1/ See page 26 for comparison of near-pristine vegetation and adjacent grazed area.

* Ocular estimates, not clippings

Climax or Near-Pristine Vegetation

TABLE 9. Sedimentary Plains Area, Silty Range Site 10-14" Precipitation Zone

	#8	#07	#35	#45	#016	#018	#019	#1
Shaw				Chicks	*Wagon Box	*Calamity	*Blue	Starvation
Butte		*Mussell	Carbonado	Tits	Cemetery	Jane	Mountain	Butte
(3 yr. Ave.)		shell	Cemetery	Flasher	N. Hardin	Horse	Flasher	(5 yr. Ave.)
Farnuf		Ceme-	Yegen	Fine Sandy	Travassilla	Lavina	Fine Sandy	Parshall
Loam		tery	Loam	Loam	Loam	Loam	Loam	Light Loam

Percent Composition By Weight

Needleandthread	8	15	14	30	25	3	10	9
Bluebunch wheatgrass	25	15	46		5	50	25	16
Western wheatgrass	39	5	6	21	10	2	T	18
Plains reedgrass	1							9
Green needlegrass		3					18	
Sandberg bluegrass	T	T	1	T	5	3	T	T
Blue grama	10	T	2	11		5	12	2
Prairie junegrass	2	25	10	T	5	3	20	3
Prairie sandreed	2							
Bottlebrush squirreltail					2			
Red three-awn					3			
Fendler three-awn						3		
Threadleaf sedge	10	25	T	25	25	T	T	34
Perennial forbs	2	5	10	3	5	11	12	3
Annuals & biennials	T	T	3	1	5	2	3	T
Skunkbrush sumac		T						
Fringed sagewort	1	2	1	8	10	3		6
Big sagebrush						10		
Silver sagebrush		5	7	1				
Yucca						3		
Cactus					T	2		

1/ See page 26 for comparison of near-pristine vegetation and adjacent grazed area.

* Ocular estimates, not clippings

Climax or Near-Pristine Vegetation
 TABLE 10. Sedimentary Plains Area, Sandy Range Site 10-14" Precipitation Zone

	#01	#38	#2	#47	#48
	*Pompey's Pillar North Slope	Chalk Butte Vebar Fine Sandy Loam	Square Butte (W. of Laurel) (2 yr. Ave.) Ryegate Sandy Loam	Ferris Ranch Tullock Fine Sandy Loam	Griffith Ranch
	10	26	12	13	14
	10	3	29	42	47
	25	5	6	T	14
	5	8	3	6	10
	3	1	1	T	T
	2	1	3	T	1
	T	T	T	T	1
	T			33	2
	10	25	25	3	9
	12	27	4	3	2
	3	4	T	T	T
	10		17		
	10				

Percent Composition By Weight

Prairie sandreed
 Needleandthread
 Bluebunch wheatgrass
 Little bluestem
 Western & thickspike
 wheatgrass
 Blue grama
 Prairie junegrass
 Green needlegrass
 Sandberg bluegrass
 Plains reedgrass
 Indian ricegrass
 Sand dropseed
 Sand bluestem

Threadleaf sedge
 Perennial forbs
 Annuals and biennials
 Fringed sagewort
 Shrubs

1/ See page 26 for comparison of near-pristine vegetation and adjacent grazed area.

* Ocular estimates, not clippings

Climax or Near-Pristine Vegetation
 TABLE 11. Sedimentary Plains Area, Clayey Range Site 10-14" Precipitation Zone

	#014 *Dry Creek Power Station (North of Belfry) Thurlow Clay Loam	#08 *Melstone Cemetery	#37 *Reno Benteen Battlefield Kyle Clay	#020 *U.L. Bend Wildlife Refuge Thebo Clay	#50 Eveling Ranch
Percent Composition By Weight					
Bluebunch wheatgrass	55	80	25	75	
Western wheatgrass	15	T	19		52
Green needlegrass	1	10	4	2	41
Sandberg bluegrass	2	3	T		
Blue grama	T	T	1		
Prairie junegrass	2		10		
Side-oats grama			T		
Prairie sandreed				7	
Threadleaf sedge	T	T			
Perennial forbs	12	2	15	1	5
Annuals & biennials	5	T	16	T	T
Big sagebrush	8		10		
Fringed sagewort					2
Greasewood		5		15	

1/ See page 27 for comparison of near-pristine vegetation and adjacent grazed area.

* Ocular estimates, not clippings

Climax or Near-Pristine Vegetation
 TABLE 12. Sedimentary Plains Area, Sands Range Site 10-14" Precipitation Zone

#017 *Creek-Decock ^{1/} Ranch N.W. Hysham Flasher Loamy Fine Sand	
Percent Composition By Weight	
Needleandthread	50
Indian ricegrass	15
Prairie sandreed	20
Western wheatgrass	T
Blue grama	T
Threadleaf sedge	2
Perennial forbs	7
Annuals & biennials	2
Skunkbrush sumac	3
Cactus	T
Yucca	1

^{1/} See page 25 for comparison of near-pristine vegetation and adjacent grazed area.

Climax or Near-Pristine Vegetation
 TABLE 13. Sedimentary Plains Area, Thin Hilly 10-14" Precipitation Zone

#012 *Big Timber (3 miles North) Hillon Channery Loam	
Percent Composition By Weight	
Bluebunch wheatgrass	65
Western wheatgrass	4
Green needlegrass	4
Prairie junegrass	T
Blue grama	T
Needleandthread	T
Perennial forbs	6
Annuals & biennials	2
Rubber rabbitbrush	1
Green rabbitbrush	1
Skunkbrush sumac	15
Rocky Mountain juniper	2
Cactus	T

* Ocular estimates, not clippings

Climax or Near-Pristine Vegetation

TABLE 14. Sedimentary Plains Area, Shallow Clay Range Site 10-14" Precipitation Zone

#015	
*Custer	
Battlefield,	
South Gate	
Midway	
Clay Loam	
<u>Percent Composition By Weight</u>	
Bluebunch wheatgrass	25
Western wheatgrass	10
Green needlegrass	3
Prairie junegrass	15
Sandberg bluegrass	T
Side-oats grama	5
Blue grama	T
Prairie sandreed	T
Needleandthread	15
Threadleaf sedge	7
Perennial forbs	10
Annuals & biennials	5
Big sagebrush	5
Shadescale saltbush	T

* Ocular estimates, not clippings

Climax or Near-Pristine Vegetation

TABLE 15. Sedimentary Plains Area, Shallow Range Site 10-14" Precipitation Zone

#49	
Foster	
Ranch	
<u>Percent Composition By Weight</u>	
Bluebunch wheatgrass	75
Needleandthread	8
Blue grama	9
Prairie junegrass	2
Threadleaf sedge	1
Sandberg bluegrass	T
Perennial forbs	5
Annuals & biennials	T

Climax or Near-Pristine Vegetation
Sedimentary Plains Area,

TABLE 16. Very Shallow Range Site 10-14" Precipitation Zone

	#06	#3
	*Table Butte (N.E. Forsyth)	Square Butte West of Laurel Travessilla Sandy Loam
	<u>Percent Composition By Weight</u>	
Bluebunch wheatgrass	50	44
Western wheatgrass	T	
Needleandthread	15	
Indian ricegrass	T	
Blue grama	5	4
Sandberg bluegrass	T	T
Prairie junegrass	5	
Fendler threeawn		2
Threadleaf sedge	10	6
Perennial forbs	10	5
Annuals & biennials	T	
Yucca		4
Rubber rabbitbrush	T	
Fringed sagewort	T	1
Shadescale saltbush	T	
Skunkbrush sumac	5	
Squaw current	T	
Broom snakeweed		34

* Ocular estimates, not clippings

Climax or Near-Pristine Vegetation
Sedimentary Plains Area,

TABLE 17. Shale Range Site 10-14" Precipitation Zone

	#51
	DeLaney Ranch 13 mi. North Grass Range
	<u>Percent Composition By Weight</u>
Prairie sandreed	69
Threadleaf sedge	16
Perennial forbs	12
Annuals & biennials	T
Shrubs	3

Climax or Near-Pristine Vegetation

TABLE 18. Glaciated Plains Area, Silty Range Site 10-14" Precipitation Zone

	#05	#04	#023
	*Theony Cemetery (20 mi. West of Opheim)	*Midale <u>1</u> / Cemetery 35 mi. SW of Malta)	*Willow Rounds Cemetery (N. of Valier) Yamac Loam
	Percent Composition By Weight		

Western Wheatgrass	35	30	30
Needleandthread	30	40	35
Green needlegrass	20		2
Plains reedgrass	T		2
Sandberg bluegrass	5		1
Blue grama		T	T
Prairie junegrass		5	13
Threadleaf sedge		5	T
Perennial forbs	5	7	10
Annuals & biennials	T	5	2
Club moss	T	T	
Cactus	5		
Silver sagebrush	T	5	
Fringed sageswort		3	5

1/ See page 27 for comparison of near-pristine vegetation and adjacent grazed area.

* Ocular estimates, not clippings

Climax or Near-Pristine Vegetation
 Glaciated Plains Area,

TABLE 19. Clayey Range Site 10-14" Precipitation Zone

#5
 Benton Lake
 Wildlife
 Refuge
 Pendroy
 Clay
 (5 yr. Ave.)

Percent Composition By Weight

Thickspike & western wheatgrass	40
Green needlegrass	37
Prairie junegrass	9
Threadleaf sedge	1
Perennial forbs	6
Annuals & biennials	1
Fringed sagewort	6

Climax or Near-Pristine Vegetation
 Glaciated Plains Area,

TABLE 20. Thin Hilly Range Site 10-14" Precipitation Zone

#40
 UL
 Bend
 Wildlife
 Refuge
 Bercail Silty Clay

Percent Composition By Weight

Bluebunch wheatgrass	47
Prairie junegrass	6
Prairie sandreed	5
Blue grama	T
Plains muhly	3
Threadleaf sedge	3
Perennial forbs	29
Annual & biennials	2
Silver sagebrush	T
Big sagebrush	1
Fringed sagewort	4
Yucca	T

Climax or Near-Pristine Vegetation

TABLE 21. Rocky Mountain Area, Silty Range Site 10-14" Precipitation Zone

	#21	#22
	Grass Valley, Missoula (2 yr. Ave.) Brockway Silt Loam	Spokane Y, Missoula Cobbly Loam

Percent Composition By Weight

Bluebunch wheatgrass	96	8
Rough fescue		67
Prairie junegrass	T	1
Sandberg bluegrass	T	T
Perennial forbs	2	24
Annuals & biennials	T	T
Rubber rabbitbrush	2	
Green rabbitbrush	T	

Climax or Near-Pristine Vegetation

TABLE 22. Rocky Mountain Area, Silty Range Site 15-19" Precipitation Zone

	#23	#27	#41	#42	#010	#024	#9	#10	#027	#028
	Helmville ^{1/} Cemetery (2 yr. Ave.) Rattler Loam	Basin Cemetery (2 yr. Ave.) Sandy Loam	Elliston (½ mi. east) Lolon Cobbly Loam	Sun River Game Range Judith Clay Loam	* Babe ^{1/} Buck Range	*Elliston ^{1/} (3 mi. east)	Clearwater Junction, Concave Lolo Loam	Clearwater Junction, Convex Rattler Loam	*Big Draw ^{1/} 2 Mi. West Elmo Perma Gravelly Loam	*Kerr Dam 3 Mi. SW Polson Perma Gravelly Loam
Percent Composition By Weight										
Rough fescue	78	90	82	92		62	73	17	75	75
Idaho fescue	1	5	3	T	10	2	8	40	10	T
Basin wildrye					20					
Bluebunch wheatgrass	2	T	5	2			1	1	5	5
Prairie junegrass	1	T	1	T			T	5		
Sandberg bluegrass	T		T				T	1	3	
Needleandthread									2	
Western & thickspike wheatgrass					7					
Slender & Bearded wheatgrass					10	4				
Richardson needlegrass					10	10				
Columbia needlegrass							1	T	T	
Timber danthonia										
Big bluegrass					5					
Alpine timothy							T			
Perennial forbs	13	5	7	5	20	7	11	28	5	15
Threadleaf sedge	T		T		5	12	5	4		
Annuals & biennials	2	T	2	1	5	2	2	4	T	T
Green rabbitbrush			T							5
Rubber rabbitbrush										
Shrubby cinquefoil				T						
Big sagebrush					8					
Fringed sagewort	T		T	T						
Threetip sagebrush	3									

* Ocular estimates, not clippings

^{1/} See page 28 for comparison of near-pristine vegetation and adjacent grazed area.

Climax or Near-Pristine Vegetation

TABLE 23. Rocky Mountain Area, Silty Range Site 20-24" Precipitation Zone

	#19	#28	#026
	Poison Patch Mord Gravelly Loam	Copper Creek Allotment (2 yr. Ave.) Passcreek Silt Loam	*Georgetown Lake Hanson Gravelly Loam
<u>Percent Composition By Weight</u>			
Rough fescue	42	95	55
Idaho fescue	8	2	5
Bluebunch wheatgrass	T		T
Western wheatgrass		T	
Slender wheatgrass	1		1
Columbia needlegrass			T
Richardson needlegrass			8
Timber danthonia	1		1
Purple oniongrass	T		
Mountain brome		T	
Mountain muhly		T	
Prairie junegrass	1	1	T
Threadleaf sedge	T	T	20
Perennial forbs	40	2	10
Annuals & biennials	7	T	T

Climax or Near-Pristine Vegetation

TABLE 24. Rocky Mountain Area, Shallow Range Site 15-19" Precipitation Zone

	#03
	*Square Butte (Highwoods) Woodhurst Loam
<u>Percent Composition By Weight</u>	
Rough fescue	85
Idaho fescue	T
Bluebunch wheatgrass	1
Bearded wheatgrass	T
Pumpelly brome	T
Timber danthonia	1
Ticklegrass	T
Prairie junegrass	1
Plains reedgrass	1
Threadleaf sedge	1
Perennial forbs	10
Annual & biennials	T

* Ocular estimates, not clippings



Fig. 1.

Close up view of a typical upland site in near-pristine condition. The dense ground cover produced by the taller growing, high producing grasses makes maximum use of the moisture. A natural mulch accumulates on the surface and lets water soak into the ground quickly. Erosion is controlled and aesthetic values and production are at their maximum.



Figure 2.

A landscape view of a typical silty site 10- to 14-inch precipitation zone in near-pristine condition. Percentage composition by weight is approximately:

Mid grasses	72%
Short grasses and dryland sedges	15%
Perennial forbs	8%
Shrubs	5%

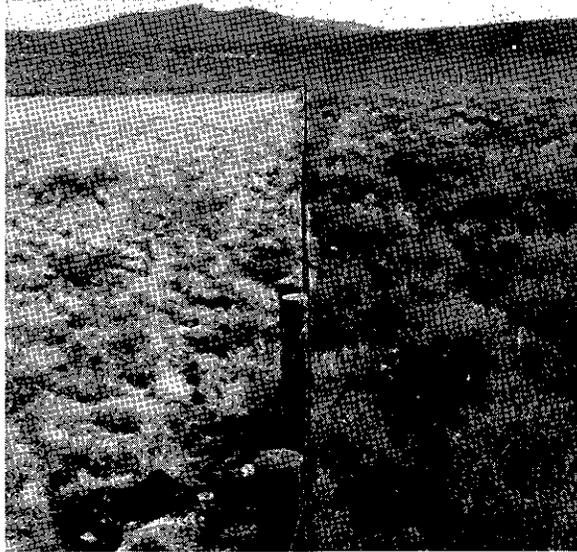


Fig. 3.

Climate and soil do not change at fence lines. Differences in kinds of plants can be attributed to differences in grazing pressure and past management. Near-pristine vegetation to the left of the fence is the result of natural species selection through thousands of years of survival of the fittest.

Years of heavy grazing pressure on range to the right of the fence has resulted in an increase of big sagebrush, short grasses, weedy plants, compacted soil, slow moisture intake, and excessive runoff and erosion.

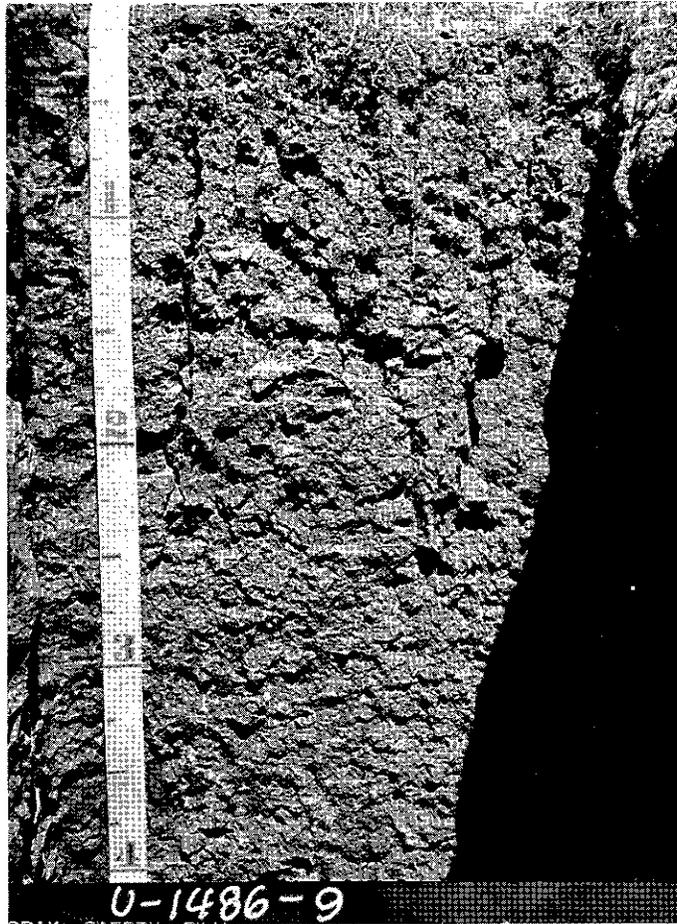


Figure 4.

Soil profile of pendroy clay series (clayey range site) shows depth of moisture holding capacity, root penetration, texture and structure of the soil, rodent and microorganism activity, and other physical features. Soil and vegetation are in equilibrium. Vigorous, healthy, "top" condition range is produced on, develops, and maintains a healthy fertile soil.

Comparison of Near-Pristine Vegetation
 TABLE 25. and Adjacent Grazed Areas. Foothills,
 Silty Range Site 15-19" Precipitation Zone.

	#02	Grazed Area	#44	Grazed Area
	Gold Butte Cemetery		Remini Turnoff	
<u>Percent Composition By Weight</u>				
Rough fescue	80	5	65	T
Idaho fescue	T		12	15
Western wheatgrass	5	5	1	
Green needlegrass	5		T	T
Threadleaf sedge	T	5		
Needleandthread		50	T	
Prairie junegrass		15		5
Bluebunch wheatgrass			11	20
Cussicks bluegrass	T		2	5
Annuals	T	3	2	10
Perennial forbs	10	15	7	35
Rubber rabbitbrush			T	10
Broom snakeweed		2		

Comparison of Near-Pristine Vegetation and
 TABLE 26. Adjacent Grazed Area. Foothill, clayey
 Range Site 10-14" Precipitation Zone.

	#34	Grazed Area
	Bearcreek Cemetery	
<u>Percent Composition By Weight</u>		
Bluebunch wheatgrass	70	30
Cussicks bluegrass	5	1
Sandberg bluegrass	1	2
Prairie junegrass	2	15
Threadleaf sedge	2	1
Perennial forbs	7	10
Annuals & biennials	T	5
Big sagebrush	10	30
Phlox		3
Rabbitbrush		1
Broom snakeweed		1
Cactus		1
Winterfat	3	T

TABLE 27. Comparison of Near-Pristine Vegetation and Adjacent Grazed Area. Foothill; Limy Range Site 10-14" Precipitation Zone.

	#32	
	Ft. Harrison Ballpark	Grazed Area
	<u>Percent Composition By Weight</u>	
Bluebunch wheatgrass	49	T
Western wheatgrass	2	T
Prairie junegrass	10	T
Needleandthread	5	10
Sandberg bluegrass	1	15
Blue grama	T	45
Perennial forbs	11	10
Annuals & biennials	T	5
Winterfat	1	
Fringed sagewort	3	
Silver sagebrush	10	10
Grey horsebrush	4	
Broom snakeweed	4	5

TABLE 28. Comparison of Near-Pristine Vegetation and Adjacent Grazed Area. Sedimentary Plains, Sands 10-14" Precipitation Zone.

	#017	
	Creek-DeCock Ranch	Grazed Area
	<u>Percent Composition By Weight</u>	
Needleandthread	50	45
Indian ricegrass	15	
Prairie sandreed	20	5
Blue grama	T	10
Sandberg bluegrass		10
Threadleaf sedge	2	15
Perennial forbs	7	8
Annuals	2	2
Skunkbush sumac	3	
Cactus	T	3
Yucca	1	2

Comparison of Near-Pristine Vegetation and
 TABLE 29. Adjacent Grazed Area. Sedimentary Plains,
 Sandy Range Site 10-14" Precipitation Zone

	#2	
	Square Butte West of Laurel	Grazed Area
	Percent Composition By Weight	
Needleandthread	12	T
Bluebunch wheatgrass	29	40
Western wheatgrass	6	5
Blue grama	3	
Prairie junegrass	1	
Sandberg bluegrass	3	
Threadleaf sedge	25	12
Green meedlegrass	T	2
Perennial forbs	4	2
Annuals & biennials		10
Big sagebrush		25
Fringed sagewort	17	4

Comparison of Near-Pristine Vegetation and
 TABLE 30. Adjacent Grazed Areas. Sedimentary Plains,
 Silty Range Site 10-14" Precipitation Zone

	#07		#016	
	Musselshell Cemetery	Grazed Area	Wagon Box Cemetery	Grazed Area
	Percent Composition By Weight			
Needleandthread	15	10	25	10
Bluebunch wheatgrass	15	15	5	
Western wheatgrass	5	10	10	15
Green needlegrass	3	T		
Sandberg bluegrass	T		5	10
Blue grama	T	20		5
Prairie junegrass	25	5	5	
Bottlebrush squirreltail			2	
Red threeawn			3	5
Threadleaf sedge	25	30	25	15
Perennial forbs	5	5	5	5
Annuals	T	T	5	10
Skunkbush sumac	T			
Fringed sagewort	2	2		
Big sagebrush			10	25
Silver sagebrush		3		

Comparison of Near-Pristine Vegetation and
 TABLE 31. Adjacent Grazed Areas. Sedimentary Plains,
 Clayey Range Site 10-14" Precipitation Zone

	#37		#014	
	Reno-Benteen Battlefield	Grazed Area	Dry Creek Power Station	Grazed Area
	<u>Percent Composition By Weight</u>			
Bluebunch wheatgrass	25	10	55	15
Western wheatgrass	19	15	15	10
Green needlegrass	4	T	1	
Sandberg bluegrass	T	T	2	5
Blue grama	1	5	T	
Prairie junegrass	10	25	2	5
Red threeawn		T		
Perennial forbs	15	15	12	10
Annuals & biennials	16	10	5	20
Big sagebrush	10	20	8	35
Broom snakeweed		T		

Comparison of Near-Pristine Vegetation and
 TABLE 32. Adjacent Grazed Area. Glaciated Plains, Silty
 Range Site 10-14" Precipitation Zone.

	#04	
	Midale Cemetery	Grazed Area
	<u>Percent Composition By Weight</u>	
Western wheatgrass	30	40
Needleandthread	40	15
Blue grama	T	15
Prairie junegrass	5	5
Threadleaf sedge	5	5
Perennial forbs	7	5
Annuals & biennials	5	5
Silver sagebrush	5	5
Fringed sagewort	3	5

TABLE 33. Comparison of Near-Pristine Vegetation and Adjacent Grazed Areas. Rocky Mountain Area, Silty Range Site 15-19" Precipitation Zone

	#23 Helmville Cemetery		#010 Babe Buck Range		#024 Elliston 3 Mi. East		#027 Big Draw	
		Grazed Area		Grazed Area		Grazed Area		Grazed Area
			<u>Percent Composition By Weight</u>					
Rough fescue	78	3			62	35	75	15
Idaho fescue	1	T	10	3	2		10	25
Basin wildrye			20	3				
Bluebunch wheatgrass	2	5				T	5	15
Prairie junegrass	1	4	T			5		15
Sandberg bluegrass	T	5					3	10
Needleandthread							2	
Western wheatgrass		3	7	5				
Slender & bearded wheat- grass			10	5	4			
Richardson & Columbia needlegrass			10	15	10			
Timber danthonia					1	5		
Big bluegrass			5			15		
Kentucky bluegrass		5						
Threadleaf sedge	T		5	4	7	30		15
Perennial forbs	13	10	20	18			5	5
Annuals	2	T	5	7		10		
Threetip sagebrush	3							
Big sagebrush		65	8	40				
Fringed sagewort	T							
Rabbitbrush								

Narrative Description of Near-Pristine Sites

Starvation Butte

#1

Starvation Butte is one of a series of high-geologic remnants that are referred to as Chalk Buttes in the southeast corner of Montana, about 15 miles southwest of Ekalaka.

Starvation Butte rises about 400 feet above the valley floor and has a rimrock surrounding the Butte except in one area where a man may climb to the top. The Butte top is nearly level to slightly rolling and covers about 15 acres. The study area is a Silty range site (Sedimentary Plains).

Starvation Butte received its name from an Indian legend. One Indian party when jumped by a group of Sioux took refuge on the Butte's top and prepared to defend it. The Sioux, with both the way up and the way down well covered, decided to negotiate. When the party on top starved to death, negotiations were over.

The vegetation is dominated by threadleaf sedge. Western wheatgrass, bluebunch wheatgrass, plains reedgrass, and needleandthread are associated grasses. Fringed sagewort makes up 6% of the composition.

The Parshall soil at this site is deep, well drained, and formed in alluvium. It is in a swale of the uplands at an elevation of about 4100 feet. The exposure is north and the slope is 2 percent. The mean annual air temperature is 44 degrees F, and the frost-free season is 120 to 140 days. The annual precipitation is about 14 inches.

The soil profile at this site has a dark grayish-brown loam surface layer about 14 inches thick. The subsoil is grayish-brown light loam about 24 inches thick. The underlying material is light grayish-brown light loam.

Permeability is moderate and the available water capacity to a depth of two feet is about 4 inches.

The Butte is not grazed by livestock but is accessible to deer; however, there has been no sign of grazing by ungulates.

With the buildup of mulch, conditions are favorable for small rodents such as mice, pocket gophers, and moles. Numerous mice and moles were seen and a network of runways covered the study area. No doubt the rodent population has had some influence on plant species composition and annual production.

Square Butte West of Laurel

#2 & #3

This relict area known locally as "Square Butte" is six miles west of Laurel, Montana. It is an oval-shaped butte rising about 250 feet above the floor of the Yellowstone Valley. The top of the Butte is five acres in

size and is inaccessible to livestock; however, there is evidence of an occasional deer getting up on the Butte. Rabbits, mice and rattlesnakes also inhabit the Butte's top.

The rock of the Butte is classified as Telegraph Creek formation of the Montana group in the Upper Cretaceous series. The Telegraph Creek formation consists of gray sandy shale interbedded with thin layers of soft sandstone. It is a Sandy range site (Sedimentary Plains).

Soil depths vary on top of the Butte from very shallow on the wind-swept edges to deep on the rest of the area.

Study area #2 represents the Ryegate soil which is moderately deep, well drained and formed in weathered sandstone. It is underlain by sandstone at a depth of about 36 inches. It is on uplands at an elevation of about 3800 feet. The exposure is east and the slope is 2 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 120 to 140 days. The annual precipitation is about 13 inches.

The soil profile at this site has a grayish-brown sandy loam surface layer about 4 inches thick, The subsoil is yellowish-brown light sandy clay loam about 12 inches thick. The underlying material is light yellowish-brown sandy loam.

Permeability is moderate to a depth of 36 inches and moderately slow below that depth. The available water capacity to a depth of two feet is about 4 inches.

A comparative study was also made of the grazed bench located $\frac{1}{2}$ mile west of Square Butte. Soil, slope, elevation and precipitation are the same for both areas. Vegetation of the relict area is dominated (composition by weight) by bluebunch wheatgrass, threadleaf sedge and needleand-thread with only a few scattered plants of big sagebrush. In contrast, the grazed area has a dense stand of big sagebrush resulting from years of grazing pressure.

Study area #3 is representative of the very shallow range site on the south and west edges of the relict area. The Butte's edges, especially on the south and west, receive a considerable amount of soil disturbances from wind action.

The Travessilla soil at this site is shallow, well drained and formed in weathered sandstone. It is underlain by hard sandstone at a depth of about 8 inches. It is on uplands at an elevation of about 3800 feet. The exposure is west and the slope is 5 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 120 to 140 days. The annual precipitation is about 13 inches.

The soil profile at this site has a light brownish-gray sandy loam surface layer about 4 inches thick. The underlying material is pale brown stony loam.

Permeability is moderate to a depth of 8 inches and slow below that depth. The available water capacity to a depth of two feet is about 1 inch.

Big Timber Airport

#4

The study area is located due east of the airport administration building which is one mile southwest of Big Timber. The range site is Silty (Foothill Area).

The Sweetgrass soil at this site is deep, well drained and formed in alluvium. It is on a stream terrace at an elevation of about 4100 feet. The exposure is east and the slope is 1 percent. The mean annual air temperature is 45 degrees F, and the frost-free season is 120 to 130 days. The annual precipitation is about 14 inches.

The soil profile at this site has a grayish-brown gravelly clay loam surface layer about 4 inches thick. The subsoil is dark yellowish-brown gravelly light clay about 14 inches thick. The underlying material is very pale brown gravelly loam.

Permeability is moderately slow to a depth of 18 inches and moderate below that depth. The available water capacity to a depth of two feet is about 3 inches.

The area has been fenced from livestock since about 1940. It was burned in the late 1960's which may account for the high percentage of perennial forbs.

Bluebunch wheatgrass is the dominant species with lesser amounts of prairie junegrass and blue grama associated.

Benton Lake Refuge

#5

The study area is a Clayey range site (Glaciated Plains Area) on the Benton Lake Wildlife Refuge located between the Refuge's headquarters and the lake.

The Pendroy soil at this site is deep, well drained and formed in clay glacial till. It is on uplands at an elevation of about 3630 feet. The exposure is south and the slope is 1 percent. The mean annual air temperature is 44 degrees F, and the frost-free season is 120 to 140 days. The annual precipitation is about 14 inches.

The soil profile at this site has a grayish-brown clay surface layer about 7 inches thick. The underlying material is grayish-brown clay.

Permeability is very slow and the available water capacity to a depth of two feet is about 3 inches.

Major vegetation on this site is western wheatgrass and green needlegrass. Associated grass species are prairie junegrass and dryland sedges. Fringed sagewort makes up 6 percent of the vegetation while perennial and annual forbs make up 7 percent.

Square Butte
North of Cascade
#6

"Square Butte" is the local name given to the prominent volcanic core remnant located approximately 10 miles north of Cascade and 20 miles southwest of Great Falls. The Butte is a vertical rock which rises above the floor of the valley about 1000 feet. The top of the Butte is 1200 acres in size.

Access to the top of the Butte is available through a dissecting canyon on the south side. For many years the Butte was grazed only occasionally, due to lack of stockwater. About 1968, water was pumped to the top of the Butte; and since then, the majority of the top has been grazed by cattle.

A portion of the top of the Butte has been fenced and protected from livestock grazing to preserve the vegetation as a permanent relict area.

The Ess soil at this site is moderately deep, well drained and formed in weathered igneous rock. It is underlain by hard rock at a depth of about 30 inches. It is at an elevation of about 4600 feet. The exposure is south and the slope is 5 percent. The mean annual air temperature is 42 degrees F, and the frost-free season is 105 to 120 days. The annual precipitation is about 15 inches.

The soil profile at this site has a dark gray loam surface layer about 8 inches thick. The subsoil is dark brown stony clay loam about 22 inches thick.

Permeability is moderate and the available water capacity to a depth of two feet is about 4 inches.

Rough fescue makes up about 60 percent of the species' composition on the study area with lesser amounts of Idaho fescue, bluebunch wheatgrass, fringed sagewort and forbs.

Rough fescue is steadily being grazed out on the rest of the Butte. As it decreases, bluebunch wheatgrass is filling the voids.

Bowman's Corner
#7

The study area is located 2 miles southwest of Bowman's Corner (intersection of Highways 200 and 287) along the highway right-of-way. The range site is Clayey (Foothill Area).

The Gerber soil at this site is deep, well drained and formed in alluvium. It is on a terrace in the uplands at an elevation of about 4300 feet. The exposure is north and the slope is 4 percent. The mean annual air temperature is 41 degrees F, and the frost-free season is 90 to 120 days. The annual precipitation is about 16 inches.

The soil profile at this site has a dark grayish-brown clay surface layer about 7 inches thick. The subsoil is brown clay about 30 inches thick. The underlying material is grayish-brown clay.

Permeability is slow and the available water capacity to a depth of two feet is about 3 inches.

Rough fescue makes up about 70% of the vegetation, Idaho fescue 20%, bluebunch wheatgrass 5% and perennial forbs 5%.

Shaw Butte #8

This site is located approximately 15 miles southwest of Wibaux, Montana at the west edge of the rolling soft shale plains. The range site is Silty (Sedimentary Plains).

The Farnuf soil at this site is deep, well drained and formed in alluvium. It is on a footslope at an elevation of about 2600 feet. The exposure is east and the slope is 3 percent. The mean annual air temperature is 44 degrees F, and the frost-free season is 120 to 130 days. The annual precipitation is about 13 inches.

The soil profile at this site has a dark grayish-brown loam surface layer about 7 inches thick. The subsoil is brown clay loam about 15 inches thick. The underlying material is light gray heavy loam.

Permeability is moderate and the available water capacity to a depth of two feet is about 4 inches.

The area is a high butte inaccessible to livestock. Deer may occasionally graze on the area and some small rodents are evident. The top of the Butte is about 3 acres in size.

The dominant vegetation is western wheatgrass and bluebunch wheatgrass with lesser amounts of threadleaf sedge, needleandthread, prairie junegrass, forbs, etc.

Clearwater Junction #9 & #10

This study area is 1 mile north of Clearwater Junction or 14 miles west of Ovando on the east side of Highway 287. It is a slightly rolling, rather typical Palouse Prairie landscape. The area is part of the winter game range commonly referred to as the Old Boyd Ranch. The area has received no livestock grazing and only occasional winter elk grazing since 1948.

The range site is Silty (Rocky Mountain Area). The concave and convex relief of the rolling landscape are composed of two different soil series. Rough fescue and Idaho fescue total about the same on both reliefs but make up inverse proportions on each.

#9
(Concave)

The Lolo soil at this site is deep, well drained and formed in gravelly alluvium. It is in a swale at an elevation of about 4300 feet. The exposure is west and the slope is 1 percent. The mean annual air temperature is 40 degrees F, and the frost-free season is 60 to 90 days. The annual precipitation is about 16 inches.

The soil profile at this site has a gray gravelly loam surface layer about 18 inches thick. The subsoil is yellowish-brown very gravelly loam about 10 inches thick. The underlying material is pale brown very gravelly loam.

Permeability is moderately rapid and the available water capacity to a depth of two feet is about 3 inches.

#10
(Convex)

The Rattler soil at this site is deep, well drained and formed in gravelly alluvium. It is on stream terraces at an elevation of about 4300 feet. The exposure is west and the slope is 1 percent. The mean annual air temperature is 40 degrees F, and the frost-free season is 60 to 90 days. The annual precipitation is about 16 inches.

The soil profile at this site has a dark gray loam surface layer about 7 inches thick. The subsoil is reddish-brown light clay about 24 inches thick. The underlying material is reddish-yellow very gravelly clay.

Permeability is moderately slow to a depth of 30 inches and slow below that depth. The available water capacity to a depth of two feet is about 4 inches.

Dominant species is Idaho fescue with lesser amounts of rough fescue, bluebunch wheatgrass and forbs.

Belgrade Railroad Right-of-Way
#11

The area of study is a small block of land comprising about 1½ acres between U.S. Highway No. 10 and the Burlington Northern Railway. The site is located approximately one mile east of Belgrade, Montana; and eight miles west of Bozeman, Montana. It is a Shallow range site (Foothills Area).

The Beaverton soil at this site is deep, well drained and formed in alluvium. It is underlain by sand and gravel at a depth of about 15 inches. It is on a stream terrace at an elevation of about 4400 feet. The exposure is north and the slope is 1 percent. The mean annual air temperature is 41 degrees F, and the frost-free season is 105 to 115 days. The annual

precipitation is about 13 inches.

The soil profile at this site has a dark gray loam surface layer about 6 inches thick. The subsoil is brown clay loam about 7 inches thick. The underlying material is very gravelly sand.

Permeability is moderate to a depth of 13 inches and very rapid below that depth. The available water capacity to a depth of two feet is about 2.5 inches.

The area seems to be relatively free of disturbance with the exception of an occasional fire and possibly some traffic at times from railroad-affiliated vehicles. There is evidence of an old trail passing through the site at some time in the distant past.

The dominant vegetation on the site is bluebunch wheatgrass. Associated grasses include western wheatgrass and prairie junegrass with lesser amounts of Sandberg bluegrass, needleandthread, and blue grama. The forb producing the highest lbs./acre was western yarrow.

Cooper Pasture #12

The area of study is a small block of about 2 acres located approximately 13 miles southwest of Three Forks, Montana on the Chan Cooper Ranch. This is a Silty range site (Foothills Area).

The Turner soil at this site is deep, well drained and formed in alluvium. It is underlain by gneiss and schist at a depth of about 60 inches. It is on a footslope at an elevation of about 5100 feet. The exposure is north and the slope is 3 percent. The mean annual air temperature 41 degrees F, and the frost-free season is 90 to 105 days. The annual precipitation is about 14 inches.

The soil profile at this site has a dark grayish-brown loam surface layer about 4 inches thick. The subsoil is grayish-brown clay loam about 12 inches thick. The underlying material is white loam.

Permeability is moderate to a depth of 60 inches and slow below that depth. The available water capacity to a depth of two feet is about 4 inches.

The pasture in which this site is located is grazed in the late fall by cattle. The only other disturbance would be antelope or an occasional jackrabbit or cottontail.

The major vegetation on this site is bluebunch wheatgrass. Associated grasses include prairie junegrass and western wheatgrass with lesser amounts of Sandberg bluegrass, needleandthread, and blue grama.

North Belgrade
#13

The area of study is a narrow ridge point about $1\frac{1}{2}$ acres in area. It is located about ten miles north of Belgrade, Montana. The range site is Silty (Foothills Area).

The Amsterdam soil at this site is deep, well drained and formed in alluvium. It is on a lake terrace at an elevation of about 4600 feet. The exposure is southeast and the slope is 2 percent. The mean annual air temperature is 41 degrees F, and the frost-free season is 90 to 115 days. The annual precipitation is about 13 inches.

The soil profile at this site has a dark gray very fine sandy loam surface layer about 2 inches thick. The subsoil is dark grayish-brown silt loam about 10 inches thick. The underlying material is very pale brown silt loam and very fine sandy loam stratified.

Permeability is moderate and the available water capacity to a depth of two feet is about 4 inches.

The area shows signs of previously heavy use and is now in a stage of secondary plant secession. The site was used lightly prior to 1954, probably as late fall pasture, and has not been used since that time. This site was studied by the Range Department at Montana State University located in Bozeman in 1970.

The primary vegetational component on this site is bluebunch wheatgrass. Associated grasses include prairie junegrass and Sandberg bluegrass with lesser amounts of western wheatgrass and needleandthread. The major forbs on the site include pale bastard toadflax, western yarrow, and oyster salsify.

Chico Cemetery
#14

This study area is the Chico Cemetery located about $1\frac{1}{2}$ miles west of the town of Chico and approximately 30 miles southwest of Livingston, Montana. The plots were set up on the westernmost $\frac{1}{5}$ of the cemetery. The range site is Silty (Foothills Area).

The Windham soil at this site is deep, well drained and formed in glacial till. It is an upland ridge at an elevation of about 5200 feet. The exposure is west and the slope is 4 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 90 to 105 days. The annual precipitation is about 14 inches.

The soil profile at this site has a dark brown cobbly and gravelly loam surface layer about 3 inches thick. The subsoil is brown cobbly and gravelly loam about 9 inches thick. The underlying material is light gray cobbly and gravelly loam.

Permeability is moderately slow to a depth of 30 inches and moderately rapid below that depth. The available water capacity to a depth of two feet is about 2.5 inches.

The cemetery was fenced in 1911 and shows signs of abuse prior to that time. Areas of disturbance within the cemetery are gravesites and a road into the cemetery.

The major vegetation on this site is bluebunch wheatgrass. Associated grasses include prairie junegrass and needleandthread. Lesser amounts of Sandberg bluegrass, Cusick bluegrass and western wheatgrass are also found on the site.

Among the forbs found on the site, the highest producer was milk-vetch.

Antelope Range #15

This study area is located about seven miles northwest of Townsend, Montana and one-half mile southwest of U.S. Highway 12 and 287 along the Kimber Gulch Road. Plots were set up about 200 to 500 feet north of the road. This is a Stony range site (Foothills Area).

The Radersberg soil at this site is deep, well drained and formed in cobbly alluvium. It is on a stream terrace at an elevation of about 4100 feet. The exposure is east and the slope is 4 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 105 to 120 days. The annual precipitation is about 12 inches.

The soil profile at this site has a grayish-brown very cobbly loam surface layer about 4 inches thick. The subsoil is cobbly and gravelly light clay about 10 inches thick. The underlying material is light gray cobbly and gravelly loam.

Permeability is moderately slow to a depth of 30 inches and moderately rapid below that depth. The available water capacity to a depth of two feet is about 2.5 inches.

LaHood Canyon Flat #16

The area of study lies adjacent to the Jefferson River 11 miles southeast of Whitehall. The area comprises about 13 acres. The range site is Stony (Foothills Area).

The Radersberg soil at this site is deep, well drained and formed in stony alluvium. It is on a stream terrace at an elevation of about 4300 feet. The exposure is south and the slope is 1 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 105 to 120 days. The annual precipitation is about 11 inches.

The soil profile at this site has a dark grayish-brown stony loam surface layer about 6 inches thick. The subsoil is dark brown stony clay loam about 14 inches thick. The underlying material is light gray stony sandy loam.

Permeability is moderately slow to a depth of 30 inches and moderate below that depth. The available water capacity to a depth of two feet is about 2.5 inches.

The site has been protected from grazing for as long as anyone can remember, but the area is subjected to periodic burning by the Burlington Northern Railroad which passes along the north side of the area.

The major vegetation on the site is bluebunch wheatgrass. Associated grasses include Sandberg bluegrass and blue grama with lesser amounts of needleandthread.

The most abundant forb was green or falsetarragon sagewort.

Winston Cemetery

#17

The study area is the Winston Cemetery located about $1\frac{1}{2}$ miles northwest of Winston, Montana and about 16 miles northwest of Townsend, Montana. The range is Silty (Foothills Area).

The Martinsdale soil at this site is deep, well drained and formed in alluvium. It is on a stream terrace at an elevation of about 4200 feet. The exposure is north and the slope is 2 percent. The mean annual air temperature is 42 degrees F, and the frost-free season is 90 to 115 days. The annual precipitation is about 12 inches.

The soil profile at this site has a dark grayish-brown loam surface layer about 6 inches thick. The subsoil is grayish-brown clay loam about 6 inches thick. The underlying material is very pale brown loam.

Permeability is moderate and the available water capacity to a depth of two feet is about 4 inches.

The cemetery was fenced in the early 1900's. Early grave stones date back to 1889. Areas of disturbance are limited to gravesites and a road into the cemetery. Some parts were burned about 1961. Plots were set up parallel to the fenceline in the north $\frac{1}{6}$ of the cemetery.

Bluebunch wheatgrass is the dominant vegetation found on this site. Grasses associated in lesser amounts are prairie junegrass and Sandberg bluegrass.

Laurin Cemetery

#18

The area of study is the Laurin Cemetery located about 9 miles south-

east of Sheridan, Montana and about one mile east of Laurin, Montana. The range site is Silty (Foothills Area).

The Avalanche soil at this site is moderately deep, well drained and formed in alluvium. It is underlain by weathering granite at a depth of about 30 inches. It is on a terrace at an elevation of about 5100 feet. The exposure is west and the slope is 3 percent. The mean annual air temperature is 42 degrees F, and the frost-free season is 90 to 105 days. The annual precipitation is about 11 inches.

The soil profile at this site has a light brownish-gray very fine sandy loam surface layer about 4 inches thick. The subsoil is pale brown silt loam about 5 inches thick. The underlying material is white very fine sandy loam.

Permeability is moderate to a depth of 30 inches and slow below that depth. The available water capacity to a depth of two feet is about 4 inches.

The dominant vegetation in the area of study is bluebunch wheatgrass. Associated is needleandthread with lesser amounts of western wheatgrass and Sandberg bluegrass.

Poison Patch #19

This study area is a pasture approximately 12 miles north of Jackson, Montana on the Jack Hirschy Ranch. The range site is Silty (Rocky Mountain Area).

The Mord soil at this site is deep, well drained and formed in glacial till. It is on glacial uplands at an elevation of about 7200 feet. The exposure is northwest and the slope is 10 percent. The mean annual air temperature is 35 degrees F, and the frost-free season is 60 to 90 days. The annual precipitation is about 19 inches.

The soil profile at this site has a very dark gray gravelly loam surface layer about 14 inches thick. The subsurface layer is light gray gravelly loam about 20 inches thick. The subsoil material is reddish-brown gravelly clay.

Permeability is moderate to a depth of 34 inches and moderately slow below that depth. The available water capacity to a depth of two feet is about 4 inches.

The area is quite a distance from water, but horse droppings indicate recent grazing. Elk and deer also make some use of the site. Grazing by cattle on this pasture has been deferred until fall for many years because of tall larkspur.

The dominant vegetation is rough fescue. Associated grasses include Idaho fescue and prairie junegrass with lesser amounts of bluebunch wheatgrass, slender wheatgrass, purple oniongrass and mountain brome.

The two dominant forbs, among a whole host of species, were sticky geranium and mule-ear wyethia.

Grass Valley, Missoula
#21

This study area is a knoll about 3 acres in size located approximately 10 miles west of Missoula, Montana. It is within the county roadway where the road jogs east around the point of a ridge. It is a Silty range site (Rocky Mountain Area).

The Brockway soil at this site is deep, well drained and formed in lake sediments. It is on a terrace at an elevation of about 3100 feet. The exposure is northeast and the slope is 10 percent. The mean annual air temperature is 45 degrees F, and the frost-free season is 120 to 130 days. The annual precipitation is about 14 inches.

The soil profile at this site has a light gray silt loam surface layer about 2 inches thick. The subsoil is reddish-brown silty clay loam about 5 inches thick. The underlying material is light gray silty clay loam.

Permeability is moderately slow and the available water capacity to a depth of two feet is about 4 inches.

The area has been void of grazing for as long as anyone can remember. The only animal disturbance is from rabbits, rodents, or an occasional deer; however, the area is being frequented by motorbike enthusiasts who are making trails and runways all over the site. This may render the site useless for future studies.

The dominant vegetation is bluebunch wheatgrass. Associated grasses are Sandberg bluegrass and prairie junegrass. The lower northeast slope, not part of the area in which the plots were set up, maintains a good stand of rough fescue.

Spokane Y, Missoula
#22

The study site is a small knoll that is located approximately 10½ miles northwest of Missoula. The site lies adjacent to the west side of U.S. Highway 93 (the road to Kalispell) about ¾ mile from the "Spokane Y" where Interstate 90 and U.S. Highway 93 intersect. The range site is Silty (Rocky Mountain Area).

This unnamed soil at this site is deep, well drained and formed in alluvium. It is on a terrace at an elevation of about 3200 feet. The exposure is north and the slope is 8 percent. The mean annual air temperature is 45 degrees F, and the frost-free season is 120 to 130 days. The annual precipitation is about 14 inches.

The soil profile at this site has a dark gray cobbly loam surface layer about 12 inches thick. The upper subsoil is reddish-gray gravelly sandy clay loam about 14 inches thick. The lower subsoil is pale brown very gravelly and cobbly sandy loam.

Permeability is moderate to a depth of 26 inches and moderately rapid below that depth. The available water capacity to a depth of two feet is about 3.5 inches.

The site is perimetered by farmland on three sides with the highway on its eastern border. Badgers have been digging in the area and there is some evidence of other rodent activity. The only other disturbance by animals would be by deer or rabbits. The site is being heavily invaded by spotted knapweed. The southern exposure of the knoll seems to have been plowed at one time and the knapweed infestation is intense. It seems to be spreading into the grassland by establishing itself in the disturbed areas (i.e., rodent diggings) and between loosely spaced grass clumps.

The primary vegetation is rough fescue. Associated grasses include bluebunch wheatgrass with lesser amounts of prairie junegrass and Sandberg bluegrass. Oddly enough there is a marked absence of Idaho fescue which is usually associated with rough fescue and increases under grazing.

Helmville Cemetery #23

The study area is in the western half of the Helmville Cemetery located about one mile southwest of Helmville, Montana. The range site is Silty (Rocky Mountain Area).

The Rattler soil at this site is deep, well drained and formed in glacial till. It is on ground moraine at an elevation of about 4400 feet. The exposure is west and the slope is 3 percent. The mean annual air temperature is 40 degrees F, and the frost-free season is 80 to 100 days. The annual precipitation is about 15 inches.

The soil profile at this site has a dark grayish-brown loam surface layer about 7 inches thick. The subsoil is grayish-brown cobbly light clay about 14 inches thick. The underlying material is pinkish-gray cobbly clay loam.

Permeability is moderately slow and the available water capacity to a depth of two feet is about 4 inches.

The dominant vegetation is rough fescue. Associated in lesser amounts are prairie junegrass, Sandberg bluegrass, Idaho fescue, and bluebunch wheatgrass. Among the many forbs on the site, ballhead sandwort is the most abundant.

Young plants of threetip sagebrush were scattered among the plots. The burning of the cemetery may have induced establishment of this species.

Grace Railroad Right-of-Way

#24

This site is an area in the Milwaukee Railroad right-of-way located approximately 16 miles southwest of Whitehall, Montana. It is approximately $\frac{1}{2}$ mile northwest of the Grace Station. The range site is Silty (Rocky Mountain Area).

The Martinsdale soil at this site is deep, well drained and formed in alluvium. It is on a terrace at an elevation of about 5700 feet. The exposure is north and the slope is 2 percent. The mean annual air temperature is 40 degrees F, and the frost-free season is 80 to 105 days. The annual precipitation is about 15 inches.

The soil profile at this site has a very dark grayish-brown cobbly loam surface layer about 2 inches thick. The subsoil is dark grayish-brown sandy clay loam about 11 inches thick. The underlying material is white gravelly loam.

Permeability is moderate and the available water capacity to a depth of two feet is about 4 inches.

The area has been free from grazing since the railroad was established in about 1912 but is subjected to occasional burning. A few deer and rabbits may make some use of the site. Apparently rough fescue, which would normally be the dominant species, has been destroyed by repeated burning.

The primary vegetation is Idaho fescue, and bluebunch wheatgrass makes up a good share of the composition. Associated grasses include prairie junegrass, needleandthread, blue grama, and Sandberg bluegrass.

Rochester Cemetery

#25

The study site is the cemetery of Rochester, an old mining town of earlier years. It is located approximately 20 miles west of Twin Bridges, Montana. The range site is Sandy (Foothills Area).

The Chinook soil at this site is deep, well drained and formed in alluvium. It is on a terrace at an elevation of about 5900 feet. The exposure is northeast and the slope is 4 percent. The mean annual air temperature is 42 degrees F, and the frost-free season is 80 to 105 days. The annual precipitation is about 13 inches.

The soil profile at this site has a grayish-brown cobbly sandy loam surface layer about 4 inches thick. The subsoil is brown cobbly sandy loam about 6 inches thick. The underlying material is white and light gray sandy loam and sand.

Permeability is moderately rapid to a depth of 20 inches and rapid below that depth. The available water capacity to a depth of two feet is about 2.5 inches.

The area has been fenced and protected from grazing for a number of years; but prior to fencing, it was subjected to heavy abuse. A great deal of the site seems to have been disturbed by a tunneling rodent, possibly moles.

The dominance in vegetational type is shared by bluebunch wheatgrass and needleandthread. Associated grasses are Sandberg bluegrass and blue grama.

Fringed sagewort was the highest producing forb.

LaHood Canyon Fan
#26

The study site is a small alluvial fan just north of U.S. Highway No. 10 approximately 13 miles southeast of Whitehall, Montana. The range site is Silty (Foothills Area).

The Crago soil at this site is deep, well drained and formed in alluvium. It is on an alluvial fan at an elevation of about 4200 feet. The exposure is south and the slope is 8 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 105 to 120 days. The annual precipitation is about 11 inches.

The soil profile at this site has a grayish-brown gravelly loam surface layer about 9 inches thick. The underlying material is light gray gravelly loam and sandy loam.

Permeability is slow to a depth of 15 inches and moderate below that depth. The available water capacity to a depth of two feet is about 2.5 inches.

This site has been relatively free of grazing influence for quite a number of years. Deer and rabbits make some use of the site.

The dominant vegetation is bluebunch wheatgrass. Associate grasses include needleandthread with lesser amounts of Sandberg bluegrass and blue grama.

Basin Cemetery
#27

The site of study is the Basin Cemetery located about $\frac{1}{2}$ mile northeast of Basin, Montana. The range site is Silty (Rocky Mountain Area).

This unnamed soil at this site is deep, well drained and formed in local alluvium. It is on a footslope at an elevation of about 5300 feet. The exposure is northeast and the slope is 5 percent. The mean annual air temperature is 40 degrees F, and the frost-free season is 60 to 90 days. The annual precipitation is about 15 inches.

The soil profile at this site has a very dark gray fine sandy loam surface layer about 9 inches thick. The subsoil is dark grayish brown sandy clay loam about 17 inches thick. The underlying material is pale brown sandy loam.

Permeability is moderate and the available water capacity to a depth of two feet is about 3.5 inches.

The cemetery was fenced in 1920 and has had no grazing since that time. The cemetery was burned about 3 years' ago as evidenced by charred plant centers. There are elk droppings in the cemetery and a few deer and rabbits are most likely making some use of the site.

The dominant vegetation is rough fescue. Associated grasses are Idaho fescue with lesser amounts of bluebunch wheatgrass, prairie junegrass, and needleandthread.

Copper Creek Allotment Exclosure
#28

The site of study is a U.S. Forest Service exclosure located about 25 miles north of White Sulphur Springs, Montana. The range site is Silty (Rocky Mountain Area).

The Passcreek soil at this site is moderately deep, well drained, and formed in weathered slate. It is underlain by hard slate at a depth of about 38 inches. It is on footslopes at an elevation of about 6000 feet. The exposure is south and the slope is 6 percent. The mean annual air temperature is 38 degrees F, and the frost-free season is 60 to 90 days. The annual precipitation is about 20 inches.

The soil profile at this site has a very dark grayish-brown loam surface layer about 6 inches thick. The subsoil is dark grayish-brown clay loam about 9 inches thick. The underlying material is light gray clay loam.

Permeability is moderate and the available water capacity to a depth of two feet is about 4 inches.

The enclosure was fenced in 1936 and has received no livestock grazing since that time. The only disturbance since the time it was fenced would have been an occasional elk, deer, rabbit or perhaps tunneling rodents.

The dominant vegetation is rough fescue. Associated grasses include Idaho fescue with lesser amounts of prairie junegrass, thickpike wheatgrass. The highest producing forb on the site is cudweed sagewort. This forb is quite abundant in areas of rodent tunneling.

Flat Iron Ridge Exclosure #29

This site is an exclosure that has been used as a study site by range specialists at Montana State University, Bozeman, Montana. The site is approximately 3 miles southeast of White Sulphur Springs, Montana. It is site No. 5 in Willis Vogle's masters thesis report (1960). The range site is Shallow (Rocky Mountain Area).

It receives about 18 inches annual precipitation. The elevation is approximately 5500 feet. The mean annual temperature is about 41 degrees F and the frost-free period is about 90 days. The exposure is southwest on a 10 percent slope. The site is open to the wind.

The soil at the site is shallow-to-hard factured slate. The surface layer is non-calcareous grayish-brown loam containing many fine slate fragments. The volume of slate fragments increases with depth and there is little root penetration below 18 to 20 inches.

The exclosure was fenced in 1953 from sheep range and has received no grazing since that time; however, prior to that time it is evidenced that the site was subjected to heavy grazing use. The site appears to be in the early stages of secondary plant succession.

The dominant vegetation is bluebunch wheatgrass. Associated grasses include Idaho fescue with lesser amounts of prairie junegrass, needleand-thread, Sandberg bluegrass, and rough fescue.

LaHood Canyon Slope #30

This study site is a small slope approximately 15 miles southeast of Whitehall, Montana and one mile west of the Lewis and Clark State Park information booth. The range site is Silty (Foothills Area).

The unnamed soil at this site is moderately deep, excessively drained and formed in weathered shale. It is underlain by clay loam shale at a depth of about 40 inches. It is on a footslope at an elevation of about 4400 feet. The exposure is south and the slope is 15 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 105 to 120 days. The annual precipitation is about 11 inches.

The soil profile at this site has a pinkish-gray gravelly loam surface layer about 2 inches thick. The subsoil is reddish-gray gravelly clay loam about 14 inches thick. The underlying material is pinkish-gray very gravelly clay loam.

Permeability is moderate to a depth of 40 inches and slow below that depth. The available water capacity to a depth of two feet is about 3 inches.

The dominant vegetation is bluebunch wheatgrass. Associated grasses include green needlegrass with lesser amounts of western wheatgrass and red threeawn.

Fort Harrison Entrance #31

The study site is a 40-acre block of land that lies immediately north of the entrance road to Fort Harrison. The Fort stands on the west edge of Helena, Montana. The range site is Silty (Foothills Area).

The Sappington soil at this site is deep, well drained and formed in mixed alluvium. It is on a fan terrace at an elevation of about 4000 feet. The exposure is northeast and the slope is 2 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 100 to 120 days. The annual precipitation is about 11 inches.

The soil profile at this site has a dark grayish-brown loam surface layer about 8 inches thick. The subsoil is grayish-brown loam about 6 inches thick. The underlying material is light gray loam and sandy loam.

Permeability is moderate to a depth of 40 inches and moderately rapid below that depth. The available water capacity to a depth of two feet is about 3.5 inches.

The area seems to be relatively free of disturbance other than tunneling rodents in a few places. The Fort was quite active from 1894 until World War I, and the site was probably subjected to intense grazing use during that period. At the present time, the area is protected from grazing or any other form of disturbance and should serve as a good reference point in years to come.

Bluebunch wheatgrass is the dominant vegetation on the site. Sandberg bluegrass and needleandthread are associated grasses with lesser amounts of western wheatgrass, blue grama, prairie junegrass, cheatgrass, and six-weeks fescue.

Fort Harrison Ballpark #32

The site of study is a strip of land approximately 1320 feet by 250 feet located on the grounds of Fort Harrison, Helena, Montana. The site lies adjacent to the Fort Harrison entrance study area. The range site is

Limy (Foothills Area).

The Musselshell soil at this site is deep, well drained and formed in alluvium. It is on a fan terrace at an elevation of about 4000 feet. The exposure is northeast and the slope is 1 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 100 to 120 days. The annual precipitation is about 11 inches.

The soil profile at this site has a grayish-brown loam surface layer about 9 inches thick. The underlying material is white and light gray gravelly loam.

Permeability is moderate to a depth of 40 inches and moderately rapid below that depth. The available water capacity to a depth of two feet is about 3.5 inches.

The site appears to be free of disturbance; however, a prairie dog colony is located within 300 feet of the site and the possibility of invasion exists. As occurred with the Fort Harrison entrance site, this area was undoubtedly subjected to heavy grazing by government-owned livestock from 1894 to World War I.

The dominant vegetation is bluebunch wheatgrass. Prairie junegrass was the highest producer among the associated grasses with lesser amounts of Sandberg bluegrass, western wheatgrass, blue grama, and needleandthread.

Old Airport at Roundup #33 & #029

The study area is the old airport at Roundup, Montana located approximately 3 miles northeast of town. The range site is Silty (Foothills Area).

It receives about 12 inches of annual precipitation. The elevation is 3500 feet. The mean annual temperature is 47 degrees F, and the frost-free season is 120 to 140 days. The exposure is not significant and the slope is one percent.

The soil at this site is moderately deep over interbedded sandstone and shale. The surface layer is dark grayish-brown loam about 3 inches thick. The subsoil is friable clay loam about 10 inches thick with a gradual boundary to calcareous clay loam substratum. Roots are effectively stopped by sandstone at 36 inches.

The area was fenced in 1935 to prevent livestock from entering the airport grounds. There has been no disturbance since that time, and the site is still protected from grazing influence.

The dominant vegetation is bluebunch wheatgrass. Associated grasses include western wheatgrass and needleandthread with lesser amounts of blue grama, Sandberg bluegrass, and cheatgrass brome.

Bearcreek Cemetery

#34

The study was made in the west 1/3 of the Bearcreek, Montana cemetery. The cemetery is located approximately ½ mile east of Bearcreek. The range site is Clayey (Foothills Area).

The Heldt soil at this site is deep, well drained and formed in weathered shale. It is an upland at an elevation of about 4500 feet. The exposure is north and the slope is 14 percent. The mean annual air temperature is 38 degrees F, and the frost-free season is 100 to 120 days. The annual precipitation is about 14 inches.

The soil profile at this site has a grayish-brown clay loam surface layer about 8 inches thick. The subsoil is grayish-brown silty clay loam about 15 inches thick. The underlying material is gray silty clay loam.

Permeability is slow and the available water capacity to a depth of two feet is about 4 inches.

Disturbance on the site is limited mainly to the gravesite area. The cemetery is still used for interment, but rapid encroachment onto the study area is not expected.

Bluebunch wheatgrass is the dominant vegetation on the site. Associated grasses include Sandberg bluegrass, prairie junegrass, western wheatgrass, and cusick bluegrass. Among the non-grass species, the half-shrub winterfat was the highest producer.

Carbonado Cemetery

#35

The study was conducted in the Carbonado Cemetery, located approximately 3½ miles southwest of Joliet, Montana. The range site is Silty (Sedimentary Plains Area).

The Yegen soil at this site is deep, well drained and formed in local alluvium. It is on a footslope at an elevation about 4000 feet. The exposure is west and the slope is 6 percent. The mean annual air temperature is 44 degrees F, and the frost-free season is 100 to 120 days. The annual precipitation is about 12 inches.

The soil profile at this site has a light brownish-gray loam surface layer about 3 inches thick. The subsoil is dark grayish-brown clay loam about 20 inches thick. The underlying material is light brownish-gray sandy loam.

Permeability is moderate to a depth of 24 inches and moderately rapid below that depth. The available water capacity to a depth of two feet is about 4 inches.

The cemetery is the last remains of an old mining town that existed in the late 1800's and early 1900's. Since that time, the fence around

the cemetery has been maintained. There have been no burials for quite some time and the site should remain free of disturbance in the years to come.

The dominant vegetation on the site is bluebunch wheatgrass. Associated grasses include needleandthread, prairie junegrass, and western wheatgrass with lesser amounts of Sandberg bluegrass and blue grama. The shrub silver sagebrush was the highest producer among the non-grass species.

Custer Battlefield #36 & #015

The study area is located on the Custer Battlefield National Monument 15 miles south of Hardin, Montana. The range site is Shallow Clay (Sedimentary Plains Area).

The Kyle soil at this site is deep, well drained and formed in weathered shale. It is underlain by shale at a depth of about 18 inches. It is on upland at an elevation of about 3400 feet. The exposure is east and the slope is 9 percent. The mean annual air temperature is 44 degrees F, and the frost-free season is 120 to 130 days. The annual precipitation is about 14 inches.

The soil profile at this site has a grayish-clay loam surface layer about 6 inches thick. The subsoil is light gray clay with white spots of segregated lime below 7 inches.

The Custer Battlefield was fenced off in 1891 to preserve the site as a National Monument. There are about 500 acres that are included in this enclosure. The area was probably subjected to heavy grazing by horses in the distant past and was undoubtedly disturbed by the Battle that occurred in 1876, burials, reburials, and artifact hunters in the succeeding years.

The major vegetation on this site is bluebunch wheatgrass. There was also quite a bit of western wheatgrass. Associated grasses include prairie junegrass and Sandberg bluegrass with lesser amounts of needleandthread and blue grama. The major forbs on the site were oyster salsify and pale bastard toadflax.

Reno-Benteen Battlefield #37

The study area is located at the north end of the Reno-Benteen Battlefield. The site is approximately 300 yards east of the entrance to the Battlefield and about 200 yards south of the fenceline. The range site is Clayey (Sedimentary Plains Area).

The Kyle soil at this site is deep, well drained and formed in weathered shale. It is underlain by shale at a depth of about 42 inches. It is on upland at an elevation of about 3300 feet. The exposure is west and the slope is 7 percent. The mean annual air temperature is 44 degrees F, and

the frost-free season is 120 to 130 days. The annual precipitation is about 14 inches.

The soil profile at this site has a grayish-brown clay surface layer about 4 inches thick. The subsoil is light brownish-gray clay about 24 inches thick. The underlying material is light gray clay.

Permeability is very slow and the available water capacity to a depth of two feet is about 3.5 inches.

The Reno-Benteen Battlefield was fenced off in 1954 as an addition to the Custer Battlefield National Monument. There are 160 acres in this enclosure. The area was subjected to heavy grazing in the early days but has been protected from grazing since 1954.

The major grass on the site is bluebunch wheatgrass with a lesser amount of western wheatgrass. Associated grasses include prairie junegrass, blue grama, green needlegrass and sideoats grama.

The forb oyster salsify is the highest-producing vegetational component on the site. This is unusual and it can only be speculated that 1972 was a good year for this particular forb. Prairie milkvetch is also a high producer on this site.

Chalk Buttes #38

The study site is located on the largest of three buttes that comprise the landmark known as Chalk Buttes. These Buttes are about 15 miles southwest of Ekalaka, Montana. The study area is a Sandy range site located on the western 1/3 of the butte, which is about 400 acres in size.

The Vegar soil at this site is moderately deep, well drained and formed in weathered sandstone. It is underlain by soft sandstone at a depth of about 32 inches. It is on uplands at an elevation of about 4100 feet. The exposure is east and the slope is 8 percent. The mean annual air temperature is 44 degrees F, and the frost-free season is 120 to 130 days. The annual precipitation is about 14 inches.

The soil profile at this site has a dark grayish-brown fine sandy loam surface layer about 5 inches thick. The subsoil is brown fine sandy loam about 20 inches thick. The underlying material is light yellowish-brown fine sandy loam.

Permeability is moderately rapid to a depth of 32 inches and slow below that depth. The available water capacity to a depth of two feet is about 3.5 inches.

The Butte is not readily accessible to livestock and there is no water available; however, some livestock were seen at various places atop the Butte, so the site may receive infrequent use.

Prairie sandreed is the dominant vegetation on the site and is followed

closely by sun sedge. Associated grasses include little bluestem, needle-andthread, and thickspike wheatgrass with lesser amounts of blue grama, prairie junegrass, green needlegrass, Sandberg bluegrass, red threeawn, plains reedgrass, and cheatgrass brome.

Among a host of forb species, the highest producer by far was cudweed sagewort. This species produced 17 percent of the total vegetation.

Miller Butte

#39

The area of study is the top of a butte about 50 acres in size that is located about 4½ miles northwest of Park City, Montana. The range site is Silty (Foothill Area).

The Cushman soil at this site is moderately deep, well drained and formed in weathered shale and sandstone. It is underlain by hard sandstone at a depth of about 40 inches. It is on upland at an elevation of about 4000 feet. The exposure is northwest and the slope is 2 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 120 to 140 days. The annual precipitation is about 13 inches.

The soil profile at this site has a light brownish-gray fine sandy loam surface layer about 3 inches thick. The subsoil is brown very fine sandy loam about 3 inches thick. The underlying material is very pale brown silt loam and very fine sandy loam.

Permeability is moderate to a depth of 40 inches and slow below that depth. The available water capacity to a depth of two feet is about 3.5 inches.

The site has been void of grazing influence by other than deer and antelope for a number of years. The top of the Butte seems inaccessible to domestic livestock, and the site is free of any disturbance with the exception of natural fires and rodents. A small patch of about one acre appeared to have been struck by lightning and the resultant fire was extinguished by a rainstorm.

Bluebunch wheatgrass is the dominant vegetation. Prairie junegrass in association made up a surprising 21 percent of the total vegetation. Found in lesser amounts is Sandberg bluegrass, blue grama, and needleandthread.

U. L. Bend Wildlife Refuge

#40

The study site is part of the U. L. Bend Wildlife Refuge located about 70 miles south of Malta, Montana on the Missouri River. The plots were set up on a slope about 300 yards above the river in the west end of the Bend region. The range site is Thin Hilly (Glaciated Plains Area).

The Bercail soil at this site is deep, well drained and formed in alluvium. It is on terrace edges at an elevation of about 2400 feet. The exposure is north and the slope is 45 percent. The mean annual air temperature is 44 degrees F, and the frost-free season is 100 to 120 days. The annual precipitation is about 12 inches.

The soil profile at this site has a grayish-brown silty clay surface layer about 5 inches thick. The underlying material is light brownish-gray silty clay.

Permeability is slow and the available water capacity to a depth of two feet is about 3.5 inches.

The range was used primarily as a winter bull pasture before it was acquired by the U.S. Department of the Interior as a wildlife refuge in 1967. The area was used for some light grazing until 1969 when all use by domestic livestock was terminated. Mule deer are abundant in the area and use the site occasionally.

Bluebunch wheatgrass is the dominant vegetation. Associated grasses include prairie junegrass, prairie sandreed, and plains muhly with a trace of blue grama.

Of the non-grass species, prairie milkvetch was by far the highest producer making up 21 percent of the total vegetation.

Elliston #41

The study site is the highway right-of-way just south of U.S. Highway 12 one-half mile east of Elliston, Montana. The range site is Silty (Rocky Mountain Area).

The Lolon soil at this site is deep, well drained and formed in glacial till. It is on a terminal moraine at an elevation of about 5000 feet. The exposure is east and the slope is 1 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 90 to 110 days. The annual precipitation is about 15 inches.

The soil profile at this site has a very dark grayish-brown cobbly loam surface layer about 8 inches thick. The subsoil is dark brown, very cobbly sandy clay loam about 20 inches thick. The underlying material is dark brown very cobbly sandy loam and loamy sand.

Permeability is moderately rapid and the available water capacity to a depth of two feet is about 2.5 inches.

The site has had no grazing influence since U.S. Highway 12 was constructed in the mid-1930's; however, the highway is presently under construction to be included as part of Interstate 90 and the site will be destroyed. Some disturbance occurred when a telephone pole was placed on the site and has resulted in the invasion of spotted knapweed.

Rough fescue is the dominant vegetation on the site. Associated grasses include Idaho fescue and bluebunch wheatgrass with lesser amounts of prairie junegrass, Sandberg bluegrass, timothy and needleleaf sedge.

The highest forb producers are spotted knapweed and sulfer eriogonum.

Sun River Game Range

#42

The study site is part of the Sun River Game Range located 17 miles northwest of Augusta, Montana. The plots were set up on the north side of the road about $\frac{1}{4}$ mile from the entrance to the game range. The range site is Silty (Foothills Area).

The Judith soil at this site is deep, well drained and formed in gravelly glacial outwash. It is on a fan terrace at an elevation of about 4500 feet. The exposure is east and the slope is 1 percent. The mean annual air temperature is 42 degrees F, and the frost-free season is 90 to 115 days. The annual precipitation is about 18 inches.

The soil profile at this site has a grayish-brown clay loam surface layer about 6 inches thick. The subsoil is light grayish brown clay loam about 7 inches thick. The underlying material is light gray gravelly and very gravelly clay loam.

Permeability is moderate and the available water capacity to a depth of two feet is about 3.5 inches.

The area has been protected from domestic livestock grazing since the establishment of the game range in 1948. It receives only occasional winter use by deer and elk.

Rough fescue is the dominant vegetation on the site. The vigor was excellent and numerous seed stalks on each plant accounted for a productive seed crop. Associated grasses include bluebunch wheatgrass, prairie junegrass and Sandberg bluegrass.

Rimini Turnoff, Helena

#43

The area studied is located 7 miles west of Helena, Montana about 80 yards south of U.S. Highway 12 at the Ten Mile Creek turnoff. The turnoff, which leads to the old mining town of Rimini, cuts through a 40-acre tract of land adjacent to the highway. The range site is Silty (Foothills Area).

The Blain soil at this site is moderately deep, well drained and formed in weathered granite. It is underlain by granite at a depth of about 38 inches. It is on upland at an elevation of about 4600 feet. The exposure is east and the slope is 1 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 100 to 120 days. The annual precipitation is about 16 inches.

The soil profile at this site has a dark grayish-brown gravelly loam

surface layer about 6 inches thick. The subsoil is brown gravelly clay loam about 5 inches thick. The underlying material is light gray gravelly clay loam.

Permeability is moderate to a depth of 38 inches and slow below that depth. The available water capacity to a depth of two feet is about 3.0 inches.

This area has been fenced from livestock for many years. However, the area blows bare some in the winter and the absence of rough fescue may be accounted for by winter grazing of elk and deer. Rodents have caused some disturbance.

The dominant vegetation is rough fescue. Associated grasses include Idaho fescue and bluebunch wheatgrass with lesser amounts of cusick bluegrass, western wheatgrass, green needlegrass, and Sandberg bluegrass.

Rimini Turnoff Slope #44

The study area is located 7 miles west of Helena, Montana and south of U.S. Highway 12 at the Ten mile turnoff. The range site is Silty (Foothills Area).

The Martinsdale soil at this site is deep, well drained and formed in alluvium. It is on fan terrace at an elevation of about 4600 feet. The exposure is northeast and the slope is 15 percent. The mean annual air temperature is 43 degrees F, and the frost-free season is 100 to 120 days. The annual precipitation is about 16 inches.

The soil profile at this site has a dark grayish-brown gravelly loam surface layer about 7 inches thick. The subsoil is brown gravelly clay loam about 7 inches thick. The underlying material is light gray gravelly loam.

Permeability is moderate and the available water capacity to a depth of two feet is about 3.5 inches.

This site is in the same fenced-off area as #43 and has had no grazing influence that anyone can recall. Motorized vehicles have crossed the area and have caused some disturbance. Rodents have also done some burrowing.

The dominant vegetation is rough fescue. Associated grasses include Idaho fescue and bluebunch wheatgrass with lesser amounts of cusick bluegrass, western wheatgrass, green needlegrass, and Sandberg bluegrass.

Chick's Tits, Big Butte #45

The study site is the top of a butte about 2½ acres in size located about 20 miles southwest of Wibaux, Montana. The range site is Silty

(Sedimentary Plains).

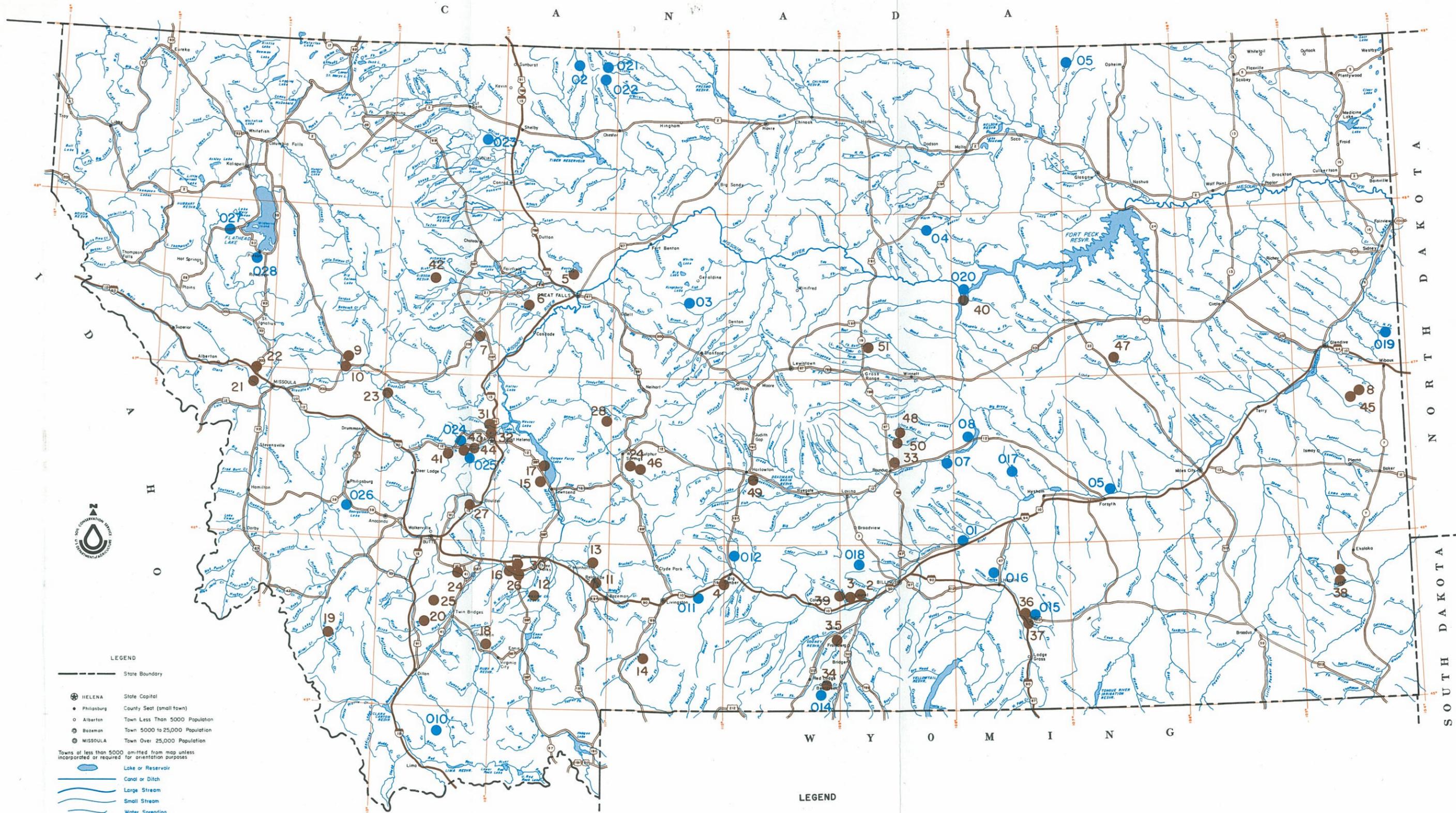
The Flasher soil at this site is moderately deep, somewhat excessively drained and formed in weathered sandstone. It is underlain by soft sandstone at a depth of about 24 inches. It is on upland at an elevation of about 2600 feet. The exposure is south and the slope is 1 percent. The mean annual air temperature is 45 degrees F, and the frost-free season is 120 to 140 days. The annual precipitation is about 13 inches.

The soil profile at this site has a dark grayish-brown fine sandy loam surface layer about 6 inches thick. The underlying material is light olive brown loamy fine sand.

Permeability is moderately rapid and the available water capacity to a depth of two feet is about 3.0 inches.

The Butte has never been grazed by domestic livestock; only rodents, rabbits and an occasional deer have made use of the site.

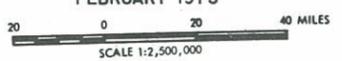
The dominant vegetation is needleandthread. Associated in high percentages are western wheatgrass and threadleaf sedge. Lesser amounts of blue grama and cheatgrass brome are also present. The highest non-grass producer is big sagebrush.



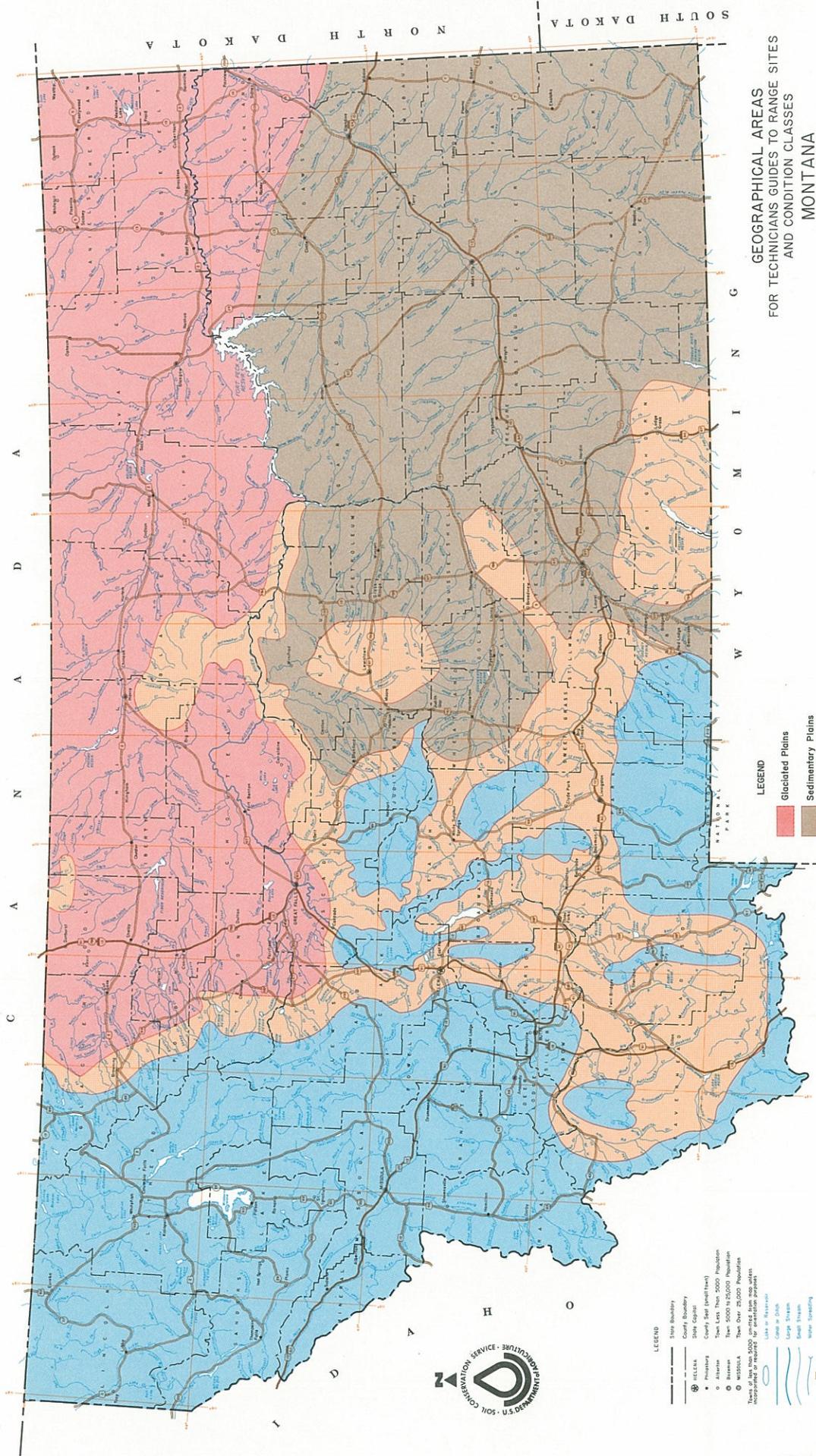
- LEGEND**
- State Boundary
 - HELENA State Capital
 - Phillipsburg County Seat (small town)
 - Town Less Than 5000 Population
 - Bozeman Town 5000 to 25,000 Population
 - MISSOULA Town Over 25,000 Population
 - Towns of less than 5000 omitted from map unless incorporated or required for orientation purposes
 - Lake or Reservoir
 - Canal or Ditch
 - Large Stream
 - Small Stream
 - Water Spreading
 - Interstate Highway
 - Federal Highway
 - State Highway

- LEGEND**
- Clipped Plots
 - Ocular Estimates

NEAR PRISTINE VEGETATION
MONTANA
 FEBRUARY 1973
 SCALE 1:2,500,000



USGS National Atlas 1:1,000,000 Albers Equal-Area projection (1967) used as source for base map and adapted for SCS use.



**GEOGRAPHICAL AREAS
FOR TECHNICIANS GUIDES TO RANGE SITES
AND CONDITION CLASSES
MONTANA**

NOVEMBER 1970
SCALE 1:1,000,000
ALBERS EQUAL-AREA PROJECTION

- LEGEND**
- Glaciated Plains
 - Sedimentary Plains
 - Foothills
 - Rocky Mountain Area

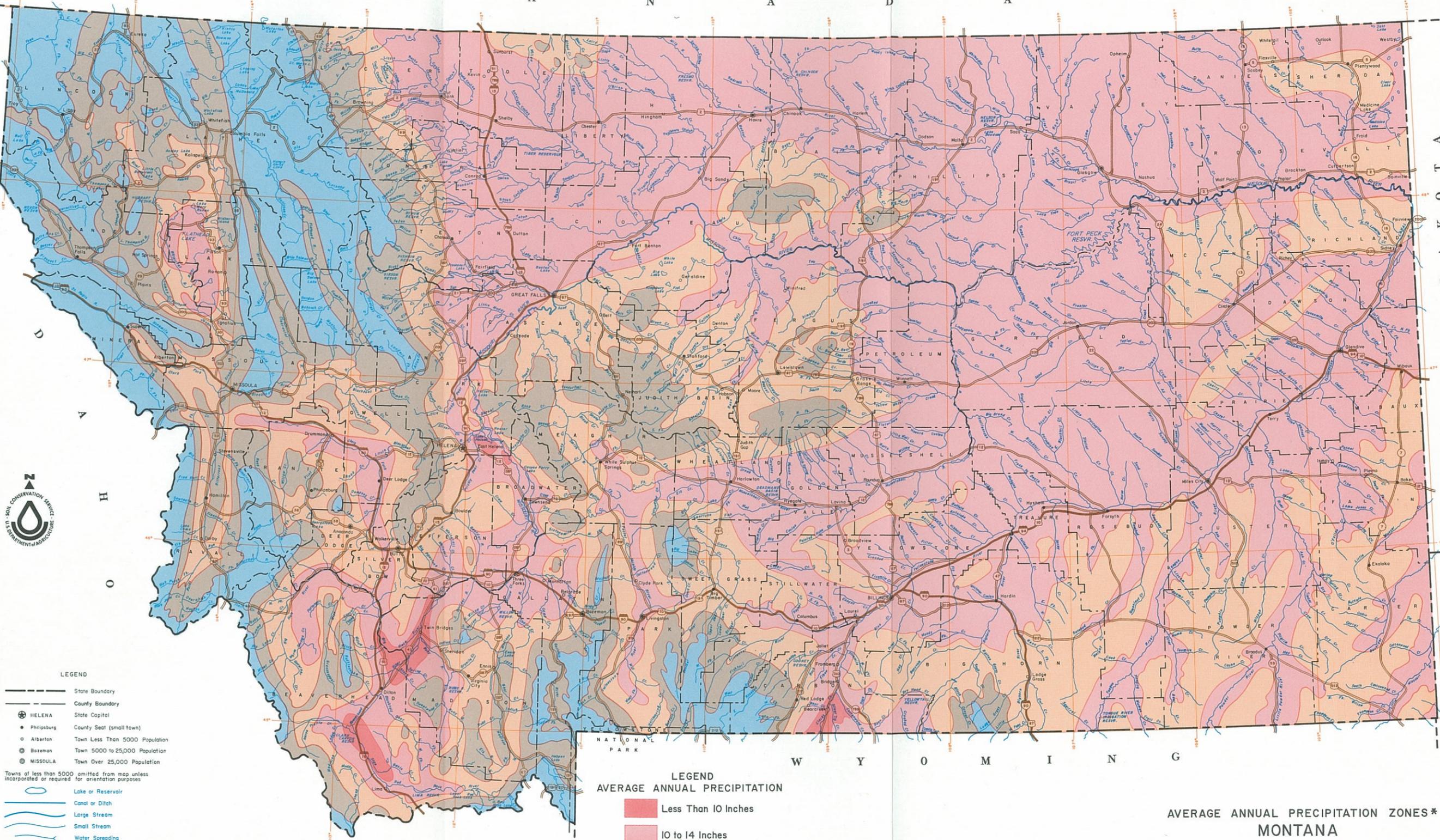
- LEGEND**
- State Boundary
 - County Boundary
 - State Capital
 - County Seat (small town)
 - City
 - Town Less Than 5000 Population
 - Village 5000 to 25,000 Population
 - Metropolitan Area Over 25,000 Population
 - Metropolitan Area
 - Lake or Reservoir
 - Canal or Ditch
 - Large Stream
 - Small Stream
 - Road
 - Interstate Highway
 - State Highway



C A N A D A

N O R T H D A K O T A
S O U T H D A K O T A

W Y O M I N G



- LEGEND**
- State Boundary
 - - - County Boundary
 - HELENA State Capital
 - Phillipsburg County Seat (small town)
 - Alberton Town Less Than 5000 Population
 - Bozeman Town 5000 to 25,000 Population
 - Missoula Town Over 25,000 Population
 - Towns of less than 5000 omitted from map unless incorporated or required for orientation purposes
 - Lake or Reservoir
 - Canal or Ditch
 - Large Stream
 - Small Stream
 - Water Spreading
 - Interstate Highway
 - Federal Highway
 - State Highway

- LEGEND**
AVERAGE ANNUAL PRECIPITATION
- Less Than 10 Inches
 - 10 to 14 Inches
 - 14 to 20 Inches
 - 20 to 30 Inches
 - More Than 30 Inches

AVERAGE ANNUAL PRECIPITATION ZONES*
MONTANA

*Based on 1953-67 period and obtained from SCS Snow Survey, Soil Survey and Weather Bureau data.

NOVEMBER 1970
SCALE 1:2,500,000
ALBERS EQUAL-AREA PROJECTION

RANGE SITE CRITERIA

Range sites are kinds of rangeland that differ from each other in their ability to produce a significantly different kind or amount of climax or original vegetation. Only natural grasslands are classified as range sites. In order to fully designate a range site, a soil-group name is combined with the precipitation zone and geographic location; e.g., Sandy, 10-14" p.z., Glaciated Plains, Montana.

The following range soil-groups are listed in presumed order of natural productivity, considering total air-dry weight of all herbage produced through the entire year by all seed plants per unit of area, in ordinary years under climax plant cover.

- I. Soil-groups that can produce more herbage than ordinary range uplands because of plainly superior soil moisture availability.

WL - WET LAND: Lands where seepage, ponding, etc. raises the water table to above the surface during only a part of the growing season. Too wet for cultivated crops but too dry for common reed, cattails, or true aquatics.

Sb - SUBIRRIGATED: Lands with an effective subsurface ground water table and water rarely over the surface during the growing season.

SL - SALINE LOWLAND: Subirrigated and overflow lands where salt and/or alkali accumulations are apparent and salt tolerant plants occur over a major part of the area.

Ov - OVERFLOW: Areas regularly receiving more than normal soil moisture because of run-in or stream overflow.

- II. Soil-groups with no obvious soil or moisture limiting factors. The vegetation can make a normal response to climate.

Sa - SANDS: Sands and loamy sands more than 20 inches deep.

Sy - SANDY: Coarse to fine sandy loams more than 20 inches deep.

Si - SILTY: Soils more than 20 inches deep of very fine sandy loam, loam, or silt loam. This includes soils with two inches or more loam or silt loam over clayey subsoils.

Cy - CLAYEY: Granular clay loam, silty clay loam, silty clay, sandy clay or clay more than 20 inches deep.

- III. Soil-groups with characteristics or topographic features that limit moisture-holding capacity or affect infiltration rates.

TH - THIN HILLY: Loamy or clayey soils on steep or hilly landscapes with a thin A horizon and weak or no structure in the subsoil,

but with significant root penetration deeper than 20 inches. It is usually calcareous but contains less than 15 percent calcium carbonate.

- St - STONY: Soils more than 20 inches deep with cobbles or stones occupying 40 to 80 percent of the surface.
- Ly - LIMY: Soils more than 20 inches deep that are nearly white and very limy (15 percent or more calcium carbonate) within four inches of the surface.
- SwC - SHALLOW CLAY: Shallow granular clay soils that are 10 to 20 inches deep to underlying shale or nearly impervious clays.
- SwG - SHALLOW TO GRAVEL: Soils that are 10 to 20 inches deep to sandy gravel. Few roots penetrate deeper than 20 inches.
- Sw - SHALLOW: Soils 10 to 20 inches deep to hard rock or soft beds of decomposed granite, siltstone or sandstone. Few roots penetrate deeper than 20 inches.
- Ps - PANSPOTS: Areas of silty, clayey or sandy soils in complex with shallow depressions of hard clays or other nearly impervious materials at or near the surface. The shallow depressions occupy 20 to 50 percent of the site.
- DC - DENSE CLAY: Relatively impervious deep nongranular clays--may be overlain by thin ineffectual layers of other materials. The dispersed layer is very hard to extremely hard when dry and very sticky when wet.
- TB - THIN BREAKS: Mixed soils of various depths with hard rock or other resistant bed outcroppings at different levels on steep irregular slopes. Trees may occur locally above outcrops.
- Gr - GRAVEL: Coarse textured soils with more than 50 percent gravel and cobbles underlain by loose sand and gravel at less than 20 inches.
- VS - VERY SHALLOW: Areas where few roots can penetrate deeper than 10 inches. Outcropping of gravel or bedrock is characteristic. Joints in bedrock may develop deep soil pockets usually marked by tall grasses, shrubs, or stunted trees.
- SU - SALINE UPLAND: Soils more than 20 inches deep with salt and/or alkali accumulations. Salt tolerant plants occur over a major part of the area.
- Sh - SHALE: Readily puddled uplands where some unweathered angular raw shale fragments are exposed at the surface and little, if any, soil profile development is evident.
- B1 - BADLANDS: Nearly barren lands broken by drainages intermingled with small grazable areas.

LIST OF PLANT SPECIES

<u>Botanical Name</u>	<u>Common Name</u>
Grasses & Grass-Like Plants	
Agropyron dasystachyum	Thickspike wheatgrass
" smithii	Western "
" spicatum	Bluebunch "
" subsecundum	Bearded "
" trachycaulum	Slender "
Agrostis scabra	Ticklegrass
Andropogon scoparius (Schizachurium scoparium)	Little bluestem
Andropogon hallii	Sand bluestem
Aristida fendleri	Fendler threeawn
Aristida longiseta	Red threeawn
Bouteloua curtipendula	Sideoats grama
Bouteloua gracilis	Blue grama
Bromus marginatus	Mountain brome
Bromus pumpellianus	Pumpelly brome
Calamagrostis montanensis	Plains reedgrass
Calimovilfa longifolia	Prairie sandreed
Carex filifolia	Threadleaf sedge
Danthonia intermedia	Timber Danthonia
Elymus cinereus	Basin wildrye
Festuca idahoensis	Idaho fescue
" scabrella	Rough fescue
" octiflora	Six-weeks fescue
Koeleria cristata	Prairie junegrass
Melica spectabilis	Purple oniongrass
Muhlenbergia cuspidata	Plains muhly
" montana	Mountain muhly
Oryzopsis hymenoides	Indian ricegrass
Phleum alpinum	Alpine timothy
" pratense	Common timothy
Poa ampla	Big bluegrass
" cusickii	Cusick bluegrass
" secunda	Sandberg bluegrass
Sitanian histrix	Bottlebrush squirreltail
Sporobolus cryptandrus	Sand dropseed
Stipa columbiana	Columbia needlegrass
" comata	Needleandthread
" richardsonii	Richardson needlegrass
" viridula	Green needlegrass

Botanical NameCommon Name

Shrubs & Half-shrubs

<i>Artemisia tridentata</i>	Big sagebrush
" <i>tripartita</i>	Threetip sagebrush
" <i>frigida</i>	Fringed sagewort
" <i>cana</i>	Silver sagebrush
" <i>ludoviciana</i>	Cudweed sagewort
<i>Atriplex confertifolia</i>	Shadscale saltbush
<i>Chrysothamnus nauseosus</i>	Rubber rabbitbrush
" <i>viscidiflorus</i>	Green rabbitbrush
<i>Eurotia lanata</i>	Winterfat
<i>Gutierrezia sarothrae</i>	Broom snakeweed
<i>Juniperus scopulorum</i>	Rocky Mountain juniper
Phlox species	Phlox
<i>Potentilla fruiticosa</i>	Shrubby cinquefoil
<i>Rhus trilobata</i>	Skunkbrush sumac
<i>Ribes cereum</i>	Squaw current
<i>Rosa arkansana</i>	Arkansas rose
<i>Sarcobatus vermiculatus</i>	Greasewood
<i>Tetradymia canescens</i>	Grey horsebrush
<i>Yucca glauca</i>	Yucca

Succulents

<i>Opuntia polykantha</i>	Cactus (prickly pear)
<i>Mammillaria missouriensis</i>	Yellow pincussion cactus
" <i>viviparia</i>	Pink pincussion cactus

Mosses & Clubmosses

<i>Selaginella densa</i>	Clubmoss
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