

Range Management Notes

1938-39

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- INTRODUCTION -

The need for more adequate information on various phases of range management has prompted these mimeographed notes. These notes were developed to assist the student in Range Management and allied fields to obtain a better understanding of the subject.

It seems desirable to offer the following explanations concerning the various sections in the pamphlet. During the past two years, several installments of the pamphlet have been issued as a single pamphlet.

The pamphlet consists of the following sections:

Section I. MAJOR RANGE REGIONS (pp. 1-24)

The vegetation on western range lands at best, is very complex and species occurrence diversified, consisting of all proportions of grasses, weeds and browse. To assist the student and create order out of almost chaos, the vegetation has been divided into an orderly and logical classification. Moreover, since the vegetation of a region is the product of the sum of the environmental factors, a brief summary of the more important factors: climate, soil, and topography is included. Other pertinent facts as to season of use, class of animals grazed, and the grazing capacity are also combined from various sources to acquaint the student with the relative regional values of the forage for grazing purposes.

Because the Pacific Northwest forested region is economically unimportant for grazing purposes, Juniors in Range Management are not required to study this region.

The divisions by range regions do not follow Weaver and Clements classification of associations, formations and climaxes. The grassland and desert shrub climaxes follow Shantz' classification in the Atlas of American Agriculture. The forest regions have been divided to correspond to the regional distribution of Forest Service experiment stations, whose publications have furnished much of the information used. The Western Range has been invaluable in providing season of use, original and present grazing capacities, and the class of livestock grazed. The student should have access to all the sections of the Atlas of American Agriculture as its intensive treatment of all the habitat factors by sections will further depict the necessary details involved in producing each range region.

Suggestions and criticisms of this section are welcomed. The material is believed to be essentially correct.

Section II. NATIVE AND INTRODUCED RANGE GRASSES (pp. 3-39)

Since these notes were compiled, the Range Plant Handbook has been issued by the U. S. Forest Service. The Handbook is a very valuable publication and should be used freely as a reference. It is now required of all seniors in the technical Range Management course.

The following explanation is made concerning various points for each species in this section:

Distribution: The occurrence of each grass species is shown for the seventeen western range states which includes, Washington, Oregon, California, Nevada, Idaho, Utah, Arizona, New Mexico, Colorado, Wyoming, Montana, Texas, Oklahoma, North and South Dakota, Nebraska and Kansas.

Habitat: Particular attention was given to typical localities, moisture requirements, soil types and approximate elevations. It should not be inferred that a species may not occur in situations other than those described.

Associates: Since the described species generally occupy a wide range and are associated with a great number of vegetative species, only the most outstanding associates could be given.

Flowering period and seed dissemination: Due to the varied latitudinal and altitudinal occurrence of the majority of the species there is an apparent wide range in the date of flowering and seed dissemination. The dates usually include the earliest and latest dates of flowering and seed dissemination for any given species.

Season of Use: Certain species are used at different times of the year in different areas of the western range. The season of most general use was indicated in each case.

Relative forage value: The following palatability values are indicated: Excellent (81 to 90%); high (61 to 80%); moderate (41 to 60%); low (21 to 40%); and poor (20% and below). These are empirical rather than absolute.

The material included in these notes was mostly compiled from the following publications:

1. Hitchcock, A. S. Manual of the Grasses of the United States.
2. National Forest Range Plants. Office of Grazing Studies.
3. Sampson, A. W. Native American Forage Plants. John Wiley & Sons, Inc. New York. 1924.

Section III. SOME BROWSE SPECIES THAT OCCUR ON WESTERN RANGES (pp. 1-25)

The purpose of these notes is to assist the students to become better acquainted with the western browse plants. Dayton's publication on Important Western Browse Plants (Misc. Publ. No. 101) is an invaluable aid for study and reference. It has been used rather freely in the compilation of data for many of the browse species. Several U. S. Forest Service palatability lists were referred to for information. The data on some species are rather meager. It is hoped to make these notes more complete as additional information is secured.

Section IV. GRAZING CAPACITY OF RANGE LANDS (pp.1-22)

Information on the four main classes of vegetation, definitions of each class and methods of determining grazing capacity are discussed. The classification of forage types as outlined by the Inter-Agency Committee, April 24, 1937, at Salt Lake City, is given. Each student should study each type description carefully. An example of each range survey method is worked out in detail for your information. An analysis of the Inter-Agency Palatability Tables for Colorado and Wyoming groups, places the various range species into three main classes.

Section V. SOME IMPORTANT POISONOUS PLANTS ON WESTERN RANGES (pp.1-9)

A brief resume of some important poisonous plants on Western Ranges is given. Information on the outstanding plant characteristics and effects of the more important poisonous plants is outlined. A list of some important publications on the subject is given.

Much credit is due the former members of the Senior Range Management classes of 1937 and 1938 for compilation of the notes on the important range grasses and browse species. Much credit is also due former Professor Stevens and Professor Wasser for their painstaking care in compiling the information on various sections of the pamphlet.

November 2, 1938

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Professor of Range Management

SECTION I
MAJOR RANGE REGIONS

MAJOR RANGE REGIONS

The continental United States consists primarily of a large number of vegetative regions. Because of such a wide range of climatic, physiographic and soil differences, it, therefore, presents a very great diversity in natural vegetation. The type of natural vegetation ranges from the splendid deciduous forests of the East; to the sparse grasslands of the Great Plains; to the coniferous forests and the alpine meadows of the Rocky Mountain system; to the great sagebrush areas of the Great Basin; to the great pinery of the South; to the great coniferous forests of the Pacific States and to the vast semi-arid desert regions of the Southwest. Each in itself prevents a diversified climate and soil.

Before there is a discussion of any range region, a statement as to the relative acreage of pasture and range land in the United States compared with forest and croplands should be given ⁽¹⁾.

<u>Type of Land</u>	<u>Acres</u> <u>(1000)</u>	<u>Percent</u> <u>of total</u>
Forest land	515,000	34.4
Cropland in farms	413,000	21.7
Pasture and Range		
in farms	379,000	
Not in farms	<u>317,000</u>	36.6
Farmsteads, roads, etc.	<u>179,000</u>	7.3
Total all land	1,905,000	

In the study of range management we are primarily concerned with the western range lands, that is, the range lands extending west from the 101st meridian. It is estimated that this range area consists of almost 728 million acres, 38 percent of the total land area of the continental United States. About half of this vast area or 376 million acres is in private ownership and one-third or 239 million acres is Federal range - national forests, grazing districts, public domain, withdrawals and reservations.

It is interesting to note that precipitation in this vast area averages less than one-third that of the middle west and east. One to four drought years out of ten typifies most all of the area.

In table 1 is given the distribution of the present western range area into various range regions (2).

Range Region	Area	
	Acres (1,000)	Percent of total
1. Tall grass	18,513	2.5
2. Short grass	198,092	27.2
3. Pacific bunchgrass	42,534	5.8
4. Semidesert grass	89,274	12.3
5. Sagebrush grass	96,528	13.3
6. Southern desert shrub	26,896	3.7
7. Salt-desert shrub	40,858	5.6
8. Pinon-juniper	75,728	10.4
9. Woodland-chaparral	13,406	1.8
10. Open forests	126,367	17.4
Total	728,196	100.0

Table 2 records the percent of each range region as to ownership

Range Region	Type of Ownership		
	Federal %	State & County %	Private %
1. Tall grass	2.5	4.2	93.3
2. Short grass	12.9	12.3	74.8
3. Pacific bunchgrass	11.1	4.5	84.4
4. Semidesert grass	27.3	18.4	54.3
5. Sagebrush grass	57.2	6.8	36.0
6. Southern desert shrub	33.9	21.5	39.6
7. Salt desert shrub	84.9	2.3	12.8
8. Pinon-juniper	67.4	5.0	27.6
9. Woodland chaparral	19.4	1.2	79.4
10. Open forests	61.8	3.7	34.5

The complexity of the range vegetation is evident when it is estimated that about 10,000 species of grasses and other flowering plants occur on these western ranges. About one-third of these species are sufficiently abundant to have some economic significance. From 500 to 1,000 species rank as important forage plants. Nearly 600 species of grasses are known to grow naturally on western ranges, of these 170 are considered important. The personnel of the U. S. Forest Service during the past 25 years has

collected about 1000 species of shrubs, undershrubs and woody vines on National Forests. The better browse species do not equal grasses in forage value but are of great importance to the livestock industry, especially in drought periods. Many of our important western watersheds are entirely dependent upon a shrubby cover for protection. It is estimated that of the browse species, one out of eighteen possesses considerable forage value. Many browse species, however, are grazed to some extent. A considerable number of browse species are invaluable forage for big game. Many weeds (forbs) that occur on these ranges are very important from a grazing standpoint. They furnish excellent feed for sheep.

The western range area may be conveniently subdivided into ten main range vegetative regions of which, four are important and distinct grass regions.

- (1) National Resources Board, Part II, Report of the Land Planning Committee, November 1934.
- (2) U. S. Forest Service, Senate Document No. 199, U. S. 74th Congress 2nd Sess. 1936.

MAJOR RANGE REGIONS

I. GRASSLANDS

A. Tall Grass Region (13)

1. General Aspect: Tall grasses, mostly bunch with showy herbaceous plants interspersed. Now mostly in crops.
 - a. Extent: Mostly east of 100th meridian, includes eastern half of Dakotas, Nebraska, Kansas, Oklahoma and coastal Texas.
 - b. Topography: Gently rolling plains and river valleys.
 - c. Soils: ⁽⁴⁾ Mostly alluvial; richest agricultural soil in United States; calcareous subsoils, dark soils. Chernozem and prairie soils.
2. Precipitation: ⁽⁵⁾Varies from 20-40" annually, about 60-75% occurs in the form of rain during the growing season. Late summer and fall - dry periods.
3. Growing Season: Late April to September. Big and little bluestem grow until September; weed growth starts early.
4. Characteristic Plants:

Grasses

Big Blue Stem (*Andropogon furcatus*)
Little Blue Stem (*Andropogon scoparius*)
Needle grass (*Stipa spartea*)
Slender wheatgrass (*Agropyron pauciflorum*)
Wire grass (*Aristida* spp.)

Grass-like Plants

Bullrushes (*Eleocharis* spp.)
Reeds (*Typha* spp.)
Rushes (*Juncus* spp.)
Sedges (*Carex* spp.)

Woods

Aster (*Aster* spp.)
Blazing star (*Liatris* spp.)
Blue Foxglove (*Pentstemon* spp.)
Phlox (*Phlox* spp.)

5. Principal Forage Plants: ⁽¹⁵⁾ Big bluestem, Little bluestem, Needle grass and Slender wheatgrass.
6. Season of Use: ⁽¹⁴⁾ Summer- May to late September.
7. Class of Livestock: Cattle, mostly steers.
8. Grazing Capacity: ⁽¹⁴⁾ 2.4 acres per cow month now compared with 1.9 acres per cow on virgin range. About 20 acres per C.Y.L.

B. Short Grass Region

1. General Aspect: Mostly turf grasses interspersed with mid-grasses (Medium height) and showy herbs.
 - a. Extent: East of the Rocky Mountains and west of 100th meridian, Saskatchewan to Edwards Plateau, Texas and east central New Mexico.
 - b. Topography: Gently rolling plains with occasional uplifted plains, "breaks", bluffs and plateaus.
 - c. Soils: Mostly alluvial, quite variable in texture, sand-clay, mostly loams, medium to shallow depth, tendency toward alkalinity, calcareous subsoils, pedocals mostly.
2. Precipitation: 12-22", about 75% occurs in the form of rain during the growing season.
3. Growing Season: March - October.

Plant Associations:

Galleta
Grama grass
Grama - buffalo grass
Grama - muhlenbergia
Grama - western needle grass
Grama - mountain sage
Western wheatgrass
Wire grass

4. Characteristic Plants:

Grasses

Blue grama (*Bouteloua gracilis*)
Buffalo grass (*Buchloe dactyloides*)
Red three-awn grass (*Aristida longiseta*)
Ring muhly grass (*Muhlenbergia torreyi*)
Western needle or needle and thread grass (*Stipa comata*)
Western wheatgrass (*Agropyron smithii*)

Grass-like Plants

Nigger wool (*Carex filifolia*)

Weeds

Beggar's tick (*Lappula occidentalis*)
Phlox (*Phlox hoodii*)
Plains plantain (*Plantago purshii*)
Psoralea (*Psoralea tenuiflora*)
Sand lily (*Leuccocrinum montanum*)
Wild onion (*Allium textile*)

Browse

Fringed sage (*Artemisia frigida*)
Snake weed (*Gutierrezia sarothrae*)

5. Principal Forage Plants: Blue grama, Buffalo grass and Western needle grass.
6. Season of Use: Yearlong as a rule; some supplemental feeding during the three winter months.
7. Class of Livestock: Cattle and horses, some hogs.
8. Grazing Capacity: 4.1 acres per animal month, 2.1 acres required per animal month under virgin conditions.

(17)

C. Pacific Bunchgrass Region

1. General Aspect: Tufted clumps of mid to tall grasses interspersed with herbs, overgrazing and disturbance has left annual grasses and many weeds.
 - a. Extent: Eastern Washington, eastern Oregon, northern Idaho, western Montana, Nevada and central California.
 - b. Topography: Upland plains, plateaus and valleys.
 - c. Soils: Quite variable from coarse gravelly upland brown soils to fine black bottom soils.
2. Precipitation: Varies from 10-25", most of the rain falling during the winter and spring months and only about 25% during the growing season. Very little falls as snow because of the mild coastal winters, in California, particularly.
3. Growing Season: Grows after winter rains come, December-June with sometimes a short secondary growth period in the fall in the California region. Early spring and extremely dry summer - Montana.

Plant Associations:

Stipa-Poa-bunchgrass - California region
 Wheatgrass-sod) Eastern Oregon and eastern
 Wheatgrass-bunch) Washington and western Montana

4. Characteristic Plants:

Grasses

Bluestem bunch wheatgrass (*Agropyron spicatum*)
 California bluegrass (*Poa scaberrima*)
 California Needlegrass (*Stipa pulchra*)
 Cheatgrass (*Bromus tectorum*)
 Foxtail (*Bromus hordeaceus*)
 Idaho fescue (*Festuca idahoensis*)
 Sandberg's bluegrass (*Poa sandbergii*)

Weeds

Alfalfa (Erodium cicutarium)
 Bur clover (*Medicago hispida*)
 California poppy (*Eschscholtzia* spp)
 Numerous annual weeds

5. Principal Forage Plants: Alfilarree, Blue bunch wheatgrass, California needle grass, Foxtail and Idaho fescue.
6. Season of Use: Spring-Fall-Winter. From time of fall rains, usually late October to late May or June - California. Spring, summer and fall - Washington, Oregon and Montana.
7. Class of Livestock: Cattle and sheep; many spring lambs.
8. Grazing Capacity: 4.5 acres are required per cow month; 2.2 acres were required under virgin conditions.

D. Semi-Desert Grassland (7),(8)

1. General aspect: Appearance more open than in short-grass plains with few areas of pure grass stands; many desert shrubs present.
 - a. Extent: From the Edwards Plateau in Texas through southern New Mexico and southeastern Arizona.
 - b. Topography: More small hills and sand washes than in other types; almost hilly in spots and broad mesas.
 - c. Soils: Gray to brown desert soils, adobe flats to sands; calcareous sub-soils.
2. Precipitation: 12-18", almost wholly as rain. High evaporation.
3. Growing Season: Some early spring growth, February-May, usually shrubs; main growing season; July-September.
4. Characteristic Plants:

Grasses

Black grama (*Bouteloua eriopoda*)
 Crow foot grama (*Bouteloua rothrockii*)
 Curly mesquite (*Hilaria belangeri*)
 Six weeks grama (*Bouteloua aristidoides*)
 Spruce top grama (*Bouteloua chondrosioides*)
 Three Awn grass (*Aristida longiseta*)
 Three Awn grass (*Aristida adscensionis*)
 Tobosa grass (*Hilaria mutica*)

Shrubs

Black brush (*Coleogyne* spp.)
 Catclaw (*Acacia* spp.)
 Creosote (*Covillea tridentata*)
 Emory's Oak (*Quercus emoryi*)
 Mesquite (*Prosopis juliflora*)
 Yucca (*Yucca elata*)

5. Principal Forage Plants: Black grama, Curly mesquite, Mesquite tree, Rothrocks grama, Tobosa grass.

6. Season of Use: Yearlong.
7. Class of Livestock: Cattle and some goats.
8. Grazing Capacity: 6.4 acres per cow month are required, formerly 2.9 in virgin state.

II. DESERT SHRUB VEGETATION⁽³⁾

A. Sagebrush-grass (Northern desert shrub) Region

1. General Aspect: Evenly spaced scrubby shrubs of low straggling appearance with little to no grass between shrubs at present; formerly much more grass. Some smaller woody species are found under or mixed with sage.
 - a. Extent: Occupies much of the desert country of Great Basin including portions of northern New Mexico, Arizona, and California; western and northwestern Colorado, Utah, Oregon, Montana and Idaho.
 - b. Topography: Sagebrush occupies a variety of topographical areas but primarily upland and outwash plains that are good deep soil, and well drained. The region varies from almost level to rolling; to mountainous and rough in places.
 - c. Soils: Brown to gray desert soils.
2. Precipitation: Varies from 7-15" of rainfall. Only about 1/4-1/3 of this amount falls during the growing season and for the most part the precipitation is in the form of rain, percentage of snow increases northward.
3. Growing Season: May-October 1, possible, but actually, growth limited to period of ample soil moisture. Usually dry summers prevail.
4. Characteristic Plants:

Grasses

Blue bunch wheatgrass (*Agropyron spicatum*)
 Downy brome (*Bromus tectorum*)
 Idaho fescue (*Festuca idahoensis*)
 Western wheatgrass (*Agropyron smithii*)

Browse

Big rabbitbrush (*Chrysothamnus nauseosus*)
 Big sage (*Artemisia tridentata*)
 Bud sage (*Artemisia spinoscens*)
 Little rabbitbrush (*Chrysothamnus stenophylla*)
 Salt sage (*Atriplex corrugata* and *Nuttallii*)
 Shadscale (*Atriplex confertifolia*)
 Small sage (*Artemisia nova*)
 Winterfat (*Eurotia lanata*)
 White sage (*Kochia americana vestita*)

4. Characteristic Plants (continued)

Weeds

Alfilaree (*Erodium cicutarium*)

5. Principal Forage Plants: Downy chess, Saltbushes, Winterfat, Sagebrush, Big sagebrush, Bitterbrush, Chamiso, Salt sage.
6. Season of Use: Spring-fall mostly. Some winter use.
7. Class of Livestock: Sheep - some cattle and goats.
8. Grazing Capacity: 8.9 acres per animal month - formerly 2.9 under virgin conditions.

B. Southern Desert Shrub (Creosote Bush)⁽⁸⁾

1. General Aspect: Uniformly spaced shrubs and scrubby trees with very little leafage - some half shrubs, cactus, and annual weeds and grasses forming a sparse cover in the spaces.
 - a. Extent: From the Gulf of Mexico along the Rio Grande and Pecos River valleys into southern New Mexico along the Rio Grande drainage, into southwestern Arizona along the Gila River, southeastern California, southern Nevada into the southwest corner of Utah.
 - b. Topography: Level drainages and undulating desert hills and washes - gives way to semi-desert grassland and chaparral in rougher topography.
 - c. Soils: Mostly gray desert soils; Horizon A covered with "desert pavement" (small pebbles); B horizon often known as caliche a Calcium hardpan, zone of lime accumulation.
2. Precipitation: Exceedingly variable from 2-20" but for the most part less than 10". All of this falls as rain in the West (Mohave Desert) mostly during the winter; farther east, mostly in the summer time. There are two rainy periods, one, January-March, the other July-August, characterized by drought 4-5 years out of 10.
3. Growing Season: Temperatures permit almost year long growth but precipitation is the limiting factor. For the area as a whole growth takes place from February-early May; July-September with some late season growth in October-November if rains permit.

4. Characteristic Plants:

Plant Associations:

California sagebrush (*Artemisia californica*)
Creosote bush (*Covillea tridentata*)
Desert saltbush (*Atriplex polycarpa*)
Mesquite (*Prosopis juliflora*)
Yucca - Cactus (*Yucca* - *Opuntia*)

4. Characteristic Plants (continued)

Grasses

Arizona cotton grass (*Tricachne californica*)
Big Galleta (*Hilaria rigida*)
Burrow grass (*Scleropogon brevifolius*)
Curly mesquite (*Hilaria belangeri*)
Fluff grass (*Triodia pulchella*)
Porter's muhly (*Muhlenbergia porteri*)
Tobosa grass (*Hilaria mutica*)

Annual grasses

Annual three awn grass (*Aristida adscensionis*)
Poverty three awn (*Aristida divaricata*)
Six weeks grama (*Bouteloua aristidoides*)
Six weeks grama (*Bouteloua barbata*)

Weeds

Alfileria (*Erodium cicutarium*)
Brittle bush (*Encelia farinosa*)
Indian wheat (*Plantago ignota*)
Annual borages and other weeds

Browse

Cats claw (*Acacia gregii*)
Chamiso (*Atriplex canescens*)
Cholla (*Opuntia bigelovii*)
Creosote bush (*Covillea tridentata*)
Desert saltbush (*Atriplex polycarpa*)
Joshua tree (*Clistoyucca brevifolia*)
Mesquite (*Prosopis juliflora*)
Narrow leaved saltbush (*Atriplex linearis*)
Palo-verde (*Cercidium torreyanum*)
Sagebrush (*Artemisia californica*)

5. Principal Forage Plants

Grasses: Arizona cotton grass, Curly mesquite, Porter's muhly,
Six weeks grama, Tobosa grass.

Weeds: Alfileria.

Browse: California sagebrush, Chamiso, Mesquite, Saltbushes.

6. Season of Use: Occasionally yearlong - where near mountains used
in fall-winter-spring.

7. Class of Livestock: Mostly cattle, some goats and wintering of sheep.

8. Grazing capacity: 11.5 acres per cow month, formerly 4.4 acres needed.

C. Greasewood (Salt Desert Shrub) (10)

1. General Aspect: In appearance quite variable, from almost bare flats covered with a few small shrubs and an undercover of pickleweed to a dense shrub with an undercover of salt grass. Ordinarily rather sparsely vegetated with scrubby plants (shrubs or weeds) which are almost devoid of any leafage.
 - a. Extent: West central Nevada, west central and southeast Utah, drainages of western slope of Colorado and San Luis Valley.
 - b. Topography: Lowlands; poorly drained flats, basins and river valleys.
 - c. Soils: Gray-brown arid soils of somewhat heavy alluvial nature.
2. Precipitation: Mostly under 10 inches, falling mostly in the form of rain, slightly more rain falling in the winter time in the Western areas and in the summer time in the Eastern areas.
3. Growing Season: Temperatures favorable for about 8 months growth but alkali and available soil moisture limits this period. Spring - late summer growth is common with a dormant period during early summer and fall drought periods.
4. Characteristic Plants:

Grasses

Alkali sacaton (*Sporobolus airoides*)
Salt grass (*Distichlis spicata*)

Weeds

Pickleweed (*Allenrolfea occidentalis*)
Salicornia (*Salicornia* spp.)
Seepweed (*Dondia torreyana*)

Shrubs

Alkali heath (*Frankonia grandiflora campestris*)
Greasewood (*Sarcobatus vermiculatus*)
Rabbitbrush (*Chrysothamnus graveolens*)
Shadscale (*Atriplex confertifolia*)

5. Principal Forage Plants:

Grasses: Alkali sacaton, Salt grass.
Shrubs: Greasewood, Shadscale

6. Season of Use: Variable usage; in Nevada year long range; in Utah winter range; in Colorado fall-winter-spring range.
7. Classes of Livestock: Cattle, but mostly sheep, very few goats.
8. Grazing capacity: 17.8 acres were required per animal unit; 5.2 acres formerly under virgin conditions.

III. FOREST LANDS

A. Woodland Types

1. Chaparral (17)

- (1) General Aspect: Dense thickets of scrubby broad leaved trees and shrubs with little to no grass in the interspaces.
- (a) Extent: Mostly confined to the coastal foothills and areas below the pine in southern California. Small limited areas too small to be mapped occur below the ponderosa pine and pinon-juniper areas in Arizona, New Mexico, Colorado, Utah and Nevada, often alternating with the pinon-juniper type.
- (b) Topography: Usually rough - varying from rolling to rough foothills and fringes on steep mountain slopes below pine-clad summits. Occurs from sea level to 6000 feet mostly.
- (c) Soils: Shallow, stony to almost barren rocks.
- (2) Precipitation: From 10-20" falling in the form of rain in the winter time - less than 20% ordinarily falls in the summer time.
- (3) Growing Season: From fall rains in October to May. Yearlong possible in southern California if moisture permitted.
- (4) Characteristic Plants:

Grasses:

Blue grama (*Bouteloua gracilis*)
Cheatgrass (*Bromus tectorum*)
Indian rice grass (*Oryzopsis hymenoides*)
Side oats grama (*Bouteloua curtipendula*)
Western wheatgrass (*Agropyron smithii*)

Browse: In southern California

Chamise (*Adenostema fasciculata*) Dominant. Chaparral
Deer brush (*Ceanothus hirsutus*) indicator.
Scrub oaks (*Quercus agrifolia*)
(*Q. dumosa*)
(*Q. wislizeni*)
Sumac (*Rhus lauriana*)

Browse: In Rocky Mountains

Deer brush (*Ceanothus* spp.)
Gambels oak (*Quercus gambelii*)
Mountain mahogany (*Cercocarpus* spp.)
Service berry (*Amelanchier* spp.)
Sumac (*Rhus trilobata*)
Turbinella oak (*Quercus turbinella*)

- (5) Principal Forage Plants: Deer brush, Grama grasses, Mt. mahogany and Sumacs.
- (6) Season of Use: Chiefly spring-fall; some fall-winter-spring.
- (7) Class of Livestock: Excellent goat type; cattle and sheep in less dense areas.
- (8) Grazing Capacity: 9.8 acres per animal month, formerly 4.9 under virgin conditions.

2. Pinyon-Juniper (9)

- (1) General Aspect: Grove-like stands of short-stunted trees - evenly spaced with fair to good stands of grass between and occasional shrubs.
 - (a) Extent: Southern Rocky Mountain region from western Texas through New Mexico, Arizona, Nevada, Utah, Colorado and southwestern Idaho and north along the eastern Sierra slopes to Oregon. In places it alternates with the chaparral type.
 - (b) Topography: Foothills and mountain slopes with some plateau and mesa types.
 - (c) Soils: Generally shallow, rough to broken country and low in productivity; subject to erosion.
- (2) Precipitation: Ordinarily below 20 inches and for the most part above fifteen inches, equally distributed throughout the year - slightly higher in July and August than fall, winter or spring.
- (3) Growing Season: May - October.
- (4) Characteristic Plants:

Plant Associations:

Pinyon-juniper
Pinyon-oak
Juniper-oak

Grasses:

Blue bunch wheatgrass (*Agropyron spicatum*)
Blue grama (*Bouteloua gracilis*)
Galleta grass (*Hilaria jamesii*)
Indian rice grass (*Oryzopsis hymenoides*)
June grass (*Koeleria cristata*)
Mutton grass (*Poa fendleriana*)
Western wheatgrass (*Agropyron smithii*)

Weeds:

Blue foxglove (*Pentstemon* spp.)
Tin piute (*Gilia* spp.)

Browse:

Apache plume (*Fallugia paradoxa*)
Bitterbrush (*Purshia tridentata*)
Cliff rose (*Cowania stansburiana Mexicana*)
Mt. mahogany (*Cercocarpus montanus*)
Scrub oak (*Quercus turbinella*)
Skunk bush (*Rhus trilobata*)
Stiff leaf bush (*Fendlera rupicola*)

- (5) Important Forage Plants: Bitterbrush, Blue grama, Gallata Grass, Indian rice grass, Mt. mahogany, Skunk bush, Western wheatgrass.
- (6) Season of Use: Variable, spring-fall, with some yearlong, summer, and fall-winter-spring grazing.
- (7) Class of Livestock: Cattle and sheep, few goats.
- (8) Carrying Capacity: 8.4 acres, formerly 3.4 acres.

B. Timber Types

1. Southern Rocky Mountain Region⁽⁹⁾

- (1) General Aspect: Medium height trees rather evenly spaced on plateaus and mesas but denser in drainages and moister areas, particularly on north exposures. Undercover varies from sparse cover and heavy litter to open timber with some buckbrush, snowberry and bunch grasses.
 - (a) Extent: This type occurs at an elevation of 6500 feet and up to 11,500 timber line from west Texas through the White Mountains and Sangre de Cristo ranges of New Mexico and other smaller ranges into eastern and northern Arizona by way of the Mogollon and Tonto rims to the Grand Canyon and, on the north includes the Kaibab Plateau. Many desert island ranges are found in southern New Mexico and Arizona.
 - (b) Topography: Mountainous and rough on the slopes and higher ranges (but on Kaibab and Coconino Plateaus of Arizona rather level table land) cut by deep canyons and form the Colorado and Rio Grande watersheds.
 - (c) Soils: Vary with timber type.

Timber type

Ponderosa pine
(Colorado zone)

Soil type

Soil layers from surface as follows:

- 1. Neutral or very slightly calcareous pale-chestnut brown surface soils with humus of several inches.
- 2. Heavier-yellow, brown and reddish oxidation colors.
- 3. Same as two, more friable, some CaCO_3 .
- 4. Substratum.

Douglas fir type
(Datil Zone)
8,500-10,000 ft.

Soil layers from surface:

1. Mild humus - some thin moulds, not acid.
2. Dark brown loam with some humus and organic matter.
3. Heavier than 2 - no cementation.
4. Substratum.

Engelmann Spruce type
(Agassiz Zone)
10,000-11,500 ft.

1. Thick layers of mould, little acidity or humification.
2. Underlying humus layer, acid in reaction, little lime.
3. Very thin layer of low concentration of clay, low in lime content.
4. Substratum.

North Slope -
(9,000-11,500 ft.)

(2) Precipitation:

<u>Ponderosa pine type</u>	18-25"	50%	snow, May-June drought period
<u>Douglas fir type</u>	25-30"	60%	snow, May-June drought period
<u>Engelmann Spruce</u>	30-35"	65%	snow, May-June drought period

(3) Growing Season: Variable and although related somewhat to frost, is still independent of frost depending upon the species:

<u>Timber Type</u>	<u>Probable growing season</u>	<u>Frostless period</u>	<u>Frost free days</u>
Ponderosa pine	May 10-Oct. 1	June 1-October 1	120
Douglas fir	May 20-September 15	June 1-October 1	120
Engelmann spruce	June 1-September 1	June 5-September 25	110

(4) Characteristic Plants:

Grasses:

Arizona fescue (*Festuca arizonica*)
 Black dropseed (*Sporobolus interruptus*) (Kaibab & Coconino Plateaus)
 Blue grama (*Bouteloua gracilis*)
 Mountain muhly (*Muhlenbergia montana*)
 Mutton grass (*Poa fenderliana*)
 Nodding brome (*Bromus anomalus, ciliatus*)
 Pine dropseed (*Blepharoneuron tricholepis*)
 Squirrel tail (*Stianion hystrix*)

Grass-like Plants

Dryland sedge (*Carex geophila*)

Weeds

Asters (*Aster* spp.)
 Daisies (*Erigeron* spp.)
 False carrot (*Pseudocymopterus* spp.)
 False dandelion (*Agoseris* spp.)
 Lotus (*Lotus wrightii*)
 Lupine (*Lupinus* spp.)
 Trailing daisy (*Erigeron flagellaris*)
 Yarrow (*Achillea lanulosa*)

Poisonous Plants

Lupine (*Lupinus*)
Pingue (*Actinea richardsonii*)
Sneezeweed (*Helonium hoopesii*)
Tall larkspur (*Delphinium*)

Shrubs

Buckbrush (*Ceanothus fendleri*)
Currant (*Ribes* spp.)
Gambel's oak (*Quercus gambelli*)
Mt. mahogany (*Cercocarpus montanus*)
New Mexico Locust (*Robinia neo-Mexicana*)
Rose (*Rosa fendleri*)
Serviceberry (*Amelanchier* spp.)
Snowberry (*Symphoricarpos oreophilus*)

- (5) Principal Forage Plants: (Occur in Ponderosa Pine and wet cienega meadows of Douglas Fir types).
Grasses: Arizona fescue, Blue grama, Mountain muhly, Nodding bromes.
Grass-like: Dryland sedge.
Weeds: Dandelion, False dandelion, False carrot, Peas, Red and Yellow Pea, Yarrow.
- (6) Season of Use: Summer-June 1-October 31.
- (7) Class of Livestock: Mostly cattle on lower Ponderosa pine areas; sheep in high mountain meadows and Douglas fir types.
- (8) Grazing Capacity: 4-8 acres per animal unit, depending upon density of undercover; few mountain meadows, 1-2 acres per animal unit per month.

2. Central Rocky Mountain Region (2)

- (1) General Aspect: Moderately dense to dense timber with a fair density of bunch grasses and shrubs to almost no under cover on north slopes and in lodgepole timber - considerable rocky inaccessible topography is encountered. Parks and meadows in ponderosa and limber pine areas afford excellent forage, at present, considerable sneezeweed and larkspur have decreased the values of such parks and meadows.
- (a) Extent: This area includes the forest lands of Colorado, Utah and Wyoming.
- (b) Topography: As the name Rockies would indicate these areas are mountainous and rough in topography. They are found on the upper elevations of mountain ranges such as the Rampart Range of Colorado, the Wasatch and Uintah Ranges of Utah and the Big Horn Range of Wyoming.
- (c) Soils: Shallow virgin soils, low in organic matter, neutral to acid soils - somewhat comparable to southern Rocky Mountain region.

(2) Precipitation: Varying with elevations:

Ponderosa pine	15-25"
Douglas fir	25-30"
Lodgepole pine	18-25"
Spruce fir	25-40"

(3) Growing Season: Bates⁽²⁾ considers these as being from June 1 - September 1, 100 days, for all types.

(4) Characteristic Plants:

Associations:⁽¹⁰⁾

- Ponderosa pine - Douglas fir zone - 6000-8000 ft.
- Lodgepole pine zone - 8000-10,000 ft.
- Engelman spruce - balsam fir zone - 10,000-11,500 ft.

Grasses:

- Arizona fescue (*Festuca arizonica*)
- Blue grama (*Bouteloua gracilis*)
- June grass (*Koeleria cristata*)
- Mountain muhly (*Muhlenbergia montana*)
- Mutton grass (*Poa fendleriana*)
- Nodding brome (*Bromus anomalus*)
- Nodding (fringed) brome (*Bromus ciliatus*)
- Slender wheatgrass (*Agropyron pauciflorum*)
- Tall mountain brome (*Bromus carinatus*)
- Thurber's fescue (*Festuca thurberi*)
- Trisetum (*Trisetum spicatum*)

Grass-like Plants:

- Baltic rush (*Juncus balticus*)
- Bull rush (*Scirpus* spp.)
- Dryland sedge (*Carex stenophylla*)

Woods:

- Dandelion (*Leontodon taraxacum*)
- False dandelion (*Agoseris* spp.)
- Lupine (*Lupinus* spp.)
- Pea (*Lathyrus* spp.)
- Vetch (*Vicia* spp.)
- Wild geranium (*Geranium viscosissimum*)

Browse:

- Alder (*Alnus tenuifolia*)
- Aspen (*Populus tremuloides*)
- Bear-berry (*Arctostaphylos uva-ursi*)
- Buck brush (*Ceanothus fendleri*)
- Chokecherry (*Prunus melanocarpa*)
- Gambel's oak (*Quercus gambelii*)
- Mountain mahogany (*Cercocarpus montanus*)
- Oregon grape (*Berberis repens*)
- Service berry (*Amelanchier* spp.)
- Skunk bush (*Rhus trilobata*)
- Snowberry (*Symphoricarpos* spp.)

(12)
(5) Principal Forage Plants:

Grasses: Arizona fescue, Blue grama, Mountain brome,
Nodding brome, Thurber's fescue.

Grasslike Plants: Dryland sedge.

Weeds: Dandelion, Geranium, Peas & vetches, Yarrow.

Browse: Buckbrush, Mountain mahogany, Service berry,
Snowberry.

(6) Season of Use: Summer - June 1 - October 31.

(7) Class of Livestock: Sheep and cattle, mostly sheep in upper
zones.

(8) Grazing capacity: Variable.

3. Northern Rocky Mountain Region (16)

(1) General Aspect: Similar to southern and central Rocky
Mountain aspects - perhaps in Spruce-fir and zones above
ponderosa pine somewhat denser with a corresponding drop in
undercover quality.

(a) Extent: Includes montane forests of northwestern Wyoming,
Idaho, western Montana, with a little extension into eastern
Oregon and Washington.

(b) Topography: Mountainous, hilly to rough and broken to
steep and rocky.

(c) Soils: Better formed in ponderosa pine types; shallow to
duff only in upper types, podsollic soils.

(2) Precipitation: Varying from 15-40"; increasing with
elevation-mostly in the form of snow.

(3) Growing Season: Three months in ponderosa pine - slightly
less in Douglas fir and Lodgepole pine types - 8 weeks in
upper limits of Engelmann Spruce - Alpine fir type.

(4) Characteristic Plants:

Ponderosa Pine

Grasses

Bluebunch fescue (*Festuca idahoensis*)

Bluebunch wheatgrass (*Agropyron spicatum*)

Canby's blue grass (*Poa canbyi*)

Pinegrass (*Calamagrostis suksdorfii*)

Western wheatgrass (*Agropyron smithii*)

Grass-like Plants

Elk grass (*Carex geyeri*)
Niggerwool (*Carex filifolia*)

Weeds

Arnica (*Arnica cordifolia*)
Lupine (*Lupinus* spp.)

Browse

Ninebark (*Opulaster pauciflorus*)
Snowberry (*Symphoricarpos racemosus*)

Lodgepole Pine and Douglas fir

Grasses

Bluegrasses (*Poa* spp.)
Pine grass (*Calamagrostis suksdorfii*)

Grass-like Plants

Elk's grass (*Carex geyeri*)

Weeds

Arnica (*Arnica cordifolia*)
Aster (*Aster* conspicuous)

Browse

Big huckleberry (*Vaccinium membranaceum*)
Low huckleberry (*Vaccinium scoparium*)
Spireas (*Spirea lucida*)
(*S. rosa*)
Twinberry (*Lonicera utahensis*)

White pine, cedar, hemlock, white fir

No grazing, game only.

Larch and Douglas fir

Many shrubs and herbs - used for wildlife only.

Subalpine Forest (Alpine fir - Whitebark pine)

Grasses

Bentgrass (*Agrostis* spp.)
Big Mt. brome (*Bromus marginatus*)
Bluebunch fescue (*Festuca idahoensis*)

Grass-like Plants

Elk grass (*Carex geyeri*)
Wire grass (*Juncoides* spp)

Weeds

Asters (*Aster* spp)
Beargrass (*Xerophyllum tenax*)
Bluebells (*Mertensia* spp)
Lupine (*Lupinus* spp.)
Monkey flowers (*Mimulus* spp.)

Shrubs

Labrador tea (*Ledum glandulosum*)
Mountain heath (*Phyllodoce empetrifomis*)

Meadows - in Forest Types

Grasses

Bluebunch fescue (*Festuca idahoensis*)
Porcupine grass (*Stipa* spp.)
Redtop (*Agrostis idahoensis*)
Sedges (*Carex* spp.)
Timber oatgrass (*Danthonia intermedia*)
Wheatgrass (*Agropyron* spp.)

(5) Principal Forage Plants

Grasses: Blue grasses, Bluebunch fescue, Bluebunch wheatgrass, Pine grass, Western wheatgrass.

Grass-like: Sedges.

Weeds: Lupine

Browse: Snowberry

(6) Season of Use - Summer - June 1-October 1.

(7) Class of Livestock: Mostly sheep, cattle on lower ranges.

(8) Grazing Capacity: Variable.

4. Pacific Northwest (1), (17)

(1) General Aspect: Much more hydrophytic conditions exist because of the closeness to the ocean. Timber is exceedingly dense especially around Puget Sound and the Douglas fir types with an undercover of less value because of the light interception by tree species. Ferns and mosses and shrubs and herbs that are shade tolerant are more prevalent and grasses decreased.

(a) Extent: Coastal Washington, Oregon and northern California including the Columbia basin.

(b) Topography: From comparatively level at or near sea level to rough and mountainous at higher elevations.

(c) Soils: Coast ranges and plains are largely sedimentary in origin; sandstone, limestones, shales or more recent alluvial deposits. Some of peaks are volcanic in origin - quite often basaltic.

(2) Precipitation: From 50-120", most of it falling during the winter time - as rain at lower elevations, snow at upper limits of range. Fogs prevalent - evaporation low. Humid conditions are conducive to a fairly deep rich humus and much mold over the soil base.

(3) Growing Season: Along the coast and lower transition region - comparatively long growing season - extending perhaps as much as 6-8 months because of the uniform annual temperatures. The upper Canadian and Hudsonian life zones characterized by Alpine firs, larches, hemlock, juniper and mountain ashes is distinctly a summer growing season - June-September.

(4) Characteristic Plants:

Tree species (6) - Transition zone - sea level 3,000-5,000 ft. depending upon slope

Douglas fir (*Pseudotsuga taxifolia*)
Lowland white fir (*Abies concolor*)
Sitka willow (*Salix* spp.)
Western hemlock (*Tsuga heterophylla*)
Western yew (*Taxus brevifolia*)

Shrubs

Evergreen blueberry (*Vaccinium* sp.)
California rhododendron (*Rhododendron californicum*)
Kidney wort (*Baccharis pillularis*)
Salal (*Gaultheria shallon*)
Salmonberry (*Rubus spectabilis*)

Mosses - Lichens

Weeds

Chiloe strawberry (*Fragaria chiloensis*)
Knotweed (*Polygonum paronychia*)
Lupine (*Lupinus littoralis*)
Shore morning glory (*Convolvulus soldanella*)
Yellow sand verbena (*Abronia latifolia*)

Canadian zone - 3,000 - 6,000, - 7,000 ft. depending upon slope.

Tree species

Aspen (*Populus tremuloides aurea*)
Engelman spruce (*Picea engelmannii*)
Grand fir (*Abies nobilis*)
Lodgepole pine (*Pinus murrayana*)
Mountain ash (*Fraxinus oregona*)
Mountain maple (*Acer douglasii*)
Shasta fir (*Abies shastensis*)
Silver fir (*Abies grandis*)
Western white pine (*Pinus monticola*)

Shrubs

Beargrass (*Xerophyllum tenax*)
Blueberry (*Vaccinium erythrococcum*)
Myrtle boxleaf (*Pachistima myrsinites*)
Russet buffaloberry (*Shepherdia canadensis*)

Hudsonian zone - 6,000-7,000 ft. - 8,000-8,500 ft.

Tree species

Alpine fir (*Abies lasiocarpa*)
Alpine hemlock (*Tsuga mertensiana*)
Alpine juniper (*Juniperus communis siberica*)
Alpine larch (*Larix lyalii*)
Alpine mountain ash (*Pyrus sitchensis*)
White stemmed pine (*P. albicaulis*)

Shrubs

Little blueberry (*Vaccinium scoparium*)
Little wintergreen (*Gaultheria ovata* - *G. humifusa*)
Mountain mat (*Lutkea pectinata*)
Mountain lily (*Erythronium montanum*)
Pink heather (*Phyllodoce empetrifolia*)
White heather (*P. glanduliflora*)

Weeds

Grass of Parnassus
Lousewort (*Pedicularis surrecta*)
Stonecrop (*Sedum divergens*)
Twisted polygonum (*Polygonum spp.*)

- (5) Principal Forage Plants: All are rather inferior.
- (6) Season of Use: Summer
- (7) Class of Livestock: Sheep
- (8) Grazing Capacity: Low - figures not available. Because of heavy timber growth is not important as range.

5. Sierra Nevada - Cascade Ranges⁽¹¹⁾

- (1) General Aspect: Timbered mountainous slopes with a fair undercover in lower open stands - in higher elevations, dense timber stands little to no undercover.
 - (a) Extent: From north central Washington down through Oregon and to South central California - relict ranges extending into lower California.
 - (b) Topography: Rough and mountainous.
 - (c) Soils: Many are volcanic in origin - soil depth decreasing northward and upward - podsollic soils not well differentiated. Accumulation of mulch increasing northward and upward.
- (2) Precipitation: From 20-80" falling mostly during the winter as rain at lower elevations as snow in upper limits.

- (3) Growing season: Transition zone - about 6 months,
April 15 - October 15. Boreal zone- Canadian
- Hudsonian zones about
4 months.

- (4) Characteristic Plants: Transition zone.

Coniferous species:

Douglas fir (*Pseudotsuga taxifolia*)
Ponderosa pine (*Pinus ponderosa*)
Redwood (*Sequoia gigantea*)
Sugar pine (*Pinus lambertiana*)
White fir (*Abies concolor*)

Grasses

Blue grasses (*Poa* spp.)
Fescue grasses (*Festuca* spp.)
Melic grasses (*Melica* spp.)
Rye grasses (*Elymus* spp.)
Wheatgrasses (*Agropyron* spp.)

Deciduous species:

Arbutus (*Arbutus menziesii*)
Oaks (*Quercus californica*)
(*Q. garryana*)

Boreal zone:

Foxtail pine (*Pinus balfouriana*)
Jeffrey pine (*Pinus jeffreyi*)
Lamber pine (*Pinus flexilis*)
Lodgepole pine (*P. murrayana*)
Red fir (*Abies magnifica*)
Western hemlock (*Tsuga heterophylla*)
Western white pine (*Pinus monticola*)
White bark pine (*P. albicaulis*)

Poisonous Plants

Death camas (*Zygadenus* spp.)
Larkspur (*Delphinium* spp.)

- (5) Principal Forage Plants:

Grasses: Blue grasses, Fescue grasses, Melic grasses,
Rye grasses, Tall mountain brome, Wheatgrasses.

- (6) Season of Use: Transition (Ponderosa pine) May - Nov.
Boreal zone - June - October.

- (7) Class of Livestock: Sheep and cattle.

- (8) Grazing Capacity: Averages about 10 A. per A. unit month.

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SECTION II

SOME NATIVE AND INTRODUCED RANGE GRASSES

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Agropyron dasystachyum - Thickspike Wheatgrass

Distribution - Washington, Oregon, Idaho, Nevada, Utah, Arizona, Montana, Wyoming, Colorado, the Dakotas and Nebraska.

Habitat - Plains, benchlands, and well-drained meadows, usually in sandy soils at medium elevation.

Associates - *Agropyron smithii*, *Bouteloua gracilis*, *Stipa comata*, *Koeleria cristata*.

Botanical description - Often glaucous; culms mostly 40 to 80 cm. tall with creeping rhizomes; blades flat to involute, 1 to 3 mm. wide; spikes 6 to 12 cm. long; lemmas densely to sparsely pubescent, awnless or mucronate.

Flowering period - July to August.

Seed dissemination - August to September.

Manner of revegetation - Natural reseeding to a limited extent but reproduces mainly by rhizomes.

Seasons of use - Late spring, summer and fall.

Relative forage value - Highly palatable to cattle and moderately palatable to sheep, however, its occurrence is limited and its value, therefore, as a native forage species is rather localized.

Agropyron pauciflorum - Slender Wheatgrass

Distribution - All of the 17 western range states with the exception of Oklahoma and Texas.

Habitat - Common in dry mountain meadows, river bottoms, mountain valleys, and medium-moist, well-drained sites throughout the ponderosa pine, most of the lodgepole pine belts and higher vegetative zones. Commonly found at elevations of 4000 ft.-8000 ft. and up to 10,300 feet in the western range states on a great variety of soils.

Associates - *Bouteloua gracilis*, *Stipa comata*, *Muhlenbergia montana*, *Bromus carinatus* and *Stipa lettermanii*.

Botanical description - Greenish-colored bunchgrass with rootstocks; culms 50-100 cm. tall; blades 2 to 4 mm. wide; spike slender, 10 to 25 cm. long; glumes and lemmas awnless or nearly so.

Agropyron pauciflorum (continued)

Flowering period - May to August 15.

Seed dissemination - July to September 15.

Manner of revegetation - Reseeds naturally at higher elevations.

Seasons of use - Late spring, summer and fall.

Relative forage value - Highly palatable to cattle, and moderately palatable to sheep. Its value as a range grass is due to its wide distribution, early growth, early maturity, and usually produces a good crop of viable seed. When cultivated and irrigated it produces good native hay.

Remarks: Agropyron tenerum and A. violaceum are both combined under Agropyron pauciflorum, according to A. S. Hitchcock's Manual of Grasses of the United States.

Agropyron smithii - Bluestem. (Western wheatgrass)

Distribution - Occurs in all of the 17 western range states as well as the eastern portion of the United States with the exception of the South.

Habitat - Often on alkali sites, though it occurs on a great variety of soils; most common in fairly moist bottomlands; dry plains region of Montana; may extend to elevations as high as 9000 feet in Colorado.

Associates - Aristida longiseta, Bouteloua gracilis, Buchloe dactyloides, Bromus anamolus, Stipa comata, Agropyron pauciflorum and Stipa lettermanii.

Botanical description - Usually glaucous, culms 30 to 60 cm. tall with creeping rhizomes; sheaths glabrous; blades firm, stiff and flat when green, strongly nerved; inflorescence an erect spike, 7 to 15 cm. long.

Flowering period - July to August 15.

Seed dissemination - Late August to September 15.

Manner of revegetation - Reproduces by seed to a limited extent. It reproduces rapidly by rhizomes.

Seasons of use - Spring, early summer and fall.

A. smithii (continued)

Relative forage value - Of high palatability to cattle, moderately palatable to sheep. Its wide distribution, drought resistance, palatable foliage, long period of green growth, adaptability to alkaline soils, and its growth from rootstocks all contribute to its value as a range forage plant. Disadvantages are late seed maturity and its failure to produce dense stands. It is an important hay species in native hay meadows of Montana.

Agropyron spicatum - Blue Bunch Wheatgrass.

Distribution - Washington, Oregon, California, Idaho, Nevada, Montana, Wyoming, Utah, Colorado, Arizona, New Mexico and S. Dakota.

Habitat - Plains, dry slopes, canyons and dry open forests at elevations of 3000-8000 feet in western United States; prefers dry sandy loam soils; not found in wet areas or in dense timber.

Associates - Festuca idahoensis, Festuca scabrella, Bromus anomalus, Melica bulbosa, Stipa viridula, Koeleria cristata, Poa fendleriana and Stipa lettermanii.

Botanical description - Green or glaucous; culms tufted, often in large bunches, erect, 60 to 100 cm. tall; sheaths glabrous; blades flat, glabrous beneath, pubescent above; spike slender, mostly 8-15 cm. long; lemma with a strongly divergent awn, 1-2 cm. long.

Flowering period - Late June to mid August.

Seed dissemination - July 10 to late September.

Manner of revegetation - Heavy producer of viable seed.

Seasons of use - Primarily in spring, fall, and early winter; summer forage in ponderosa pine belt.

Relative forage value - Highly palatable to cattle, and moderately palatable to sheep; of greatest economic importance in Oregon, Washington, Montana and Idaho; remains green until late in the season, and is palatable and nutritious after growth ceases.

Agrostis exarata - Spike Redtop.

Distribution - Utah, Washington, Oregon, California, Idaho, Nevada, Montana, Wyoming, Colorado, Nebraska, Arizona, New Mexico and western Texas.

Habitat - Moist or rather dry open ground, at low and medium elevations on a great variety of soils.

Botanical description - Erect, tufted perennial; culms 20 to 120 cm. tall; ligule prominent; blades flat; panicle narrow, 1 to 25 cm. long; glumes scabrous on the keel.

Flowering period - June to September depending on locality and elevation.

Seed dissemination - July to October.

Manner of revegetation - Seed

Seasons of use - Spring, summer and early fall.

Relative forage value - Highly palatable to cattle and moderately palatable to sheep; remains green until late in the season; one of the most important of the native species of *Agrostis*.

Andropogon furcatus - Blue Joint Turkeyfoot.

Distribution - The Dakotas, Nebraska, Kansas, Oklahoma, Texas, Utah, New Mexico, Arizona, Colorado, Wyoming and Montana.

Habitat - Dry sandy or rocky soils, dry bottoms, prairies and open woods; common associate in the tall prairie association and in the sandhills of Nebraska and Kansas.

Associates - *Andropogon scoparius*, *Stipa comata*, *Stipa spartea*, *Koeleria cristata*, *Calamovilfa longifolia*, *Phalaris arundinacea*.

Botanical description - Tall tufted perennial with culms 80-120 cm. tall, sometimes with creeping rootstocks; blades flat, elongate, 5-10 mm. wide with scabrous margins; racemes 3 to 6 on a long exerted terminal peduncle; first glume of the sessile spikelet with a geniculate awn 1 to 2 cm. long.

Flowering period - June and July.

Seed dissemination - August and September.

Andropogon furcatus (continued)

Manner of revegetation - Seed, and rhizomes to some extent.

Seasons of use - Spring and early summer.

Relative forage value - Moderately palatable to cattle and sheep early in the season; becomes tough and relatively unpalatable after maturity; valued as hay in some parts of the West.

Andropogon scoparius - Prairie Beardgrass.

Distribution - The Dakotas, Nebraska, Kansas, Oklahoma, Texas, New Mexico, Arizona, Colorado, Wyoming, Montana, Idaho and southeastern Utah.

Habitat - Dry sandy to sandy loam soils on prairies, in open woods, dry hills, and fields at low to medium elevations.

Associates - *Andropogon furcatus*, *Bouteloua gracilis*, *Bouteloua curtipendula*, *Stipa comata*, *Calamovilfa longifolia* and *Panicum virgatum*.

Botanical description - Plants green or glaucous, often purplish; culms tufted, 50 to 150 cm. tall; blades 3 to 6 mm. wide flat; raceme 3 to 6 mm. long; sessile spikelet 6 to 8 mm. long, pedicellate spikelet reduced, short awned.

Flowering period - July to September.

Seed dissemination - August to October.

Manner of revegetation - Seed.

Seasons of use - Spring and early summer.

Relative forage values - Fairly palatable to cattle but of low palatability to sheep early in the season; after the appearance of flower stalks, the foliage toughens and becomes rather unpalatable; sometimes cut for hay.

Aristida longiseta - Red Three-Awn.

Distribution - All of the 17 western range states with the exception of California and Nevada.

Aristida longiseta (continued)

Habitat - Dry sandy to loamy soils on plains and mesas, generally below the ponderosa pine zone; in Colorado it is found at elevations as high as 8500 feet.

Associates - Agropyron smithii, Bouteloua gracilis, Bouteloua curtipendula, Buchloe dactyloides, Hilaria Jamesii, Muhlenbergia racemosa, Oryzopsis hymenoides and Stipa comata. In southern New Mexico occurs with Bouteloua eriopoda.

Botanical description - Perennial, often in large bunches; culms 20-30 cm tall; blades involute, curved or flexuous; panicle narrow, erect, but not stiff, few flowered; awns about equal, divergent, 6 to 8 cm. long.

Flowering period - June to July.

Seed dissemination - Middle July to September.

Manner of revegetation - Seed.

Seasons of use - Spring and early summer.

Relative forage value - Low palatability for sheep and cattle; provides some forage prior to maturity.

Remarks - This is one of the first perennial grasses coming into abandoned fields on the short grass plains in Colorado.

Bouteloua curtipendula - Side-Oats-Grama.

Distribution - The Dakotas, Nebraska, Kansas, Oklahoma, Texas, New Mexico, Arizona, Colorado, Utah, Wyoming, Montana and southern California.

Habitat - Plains, prairies, and dry rocky hills on a great variety of soils at elevations as high as 7000 feet.

Associates - Bouteloua gracilis, Muhlenbergia montana, Agropyron pauciflorum, Stipa comata, Buchloe dactyloides and Koeleria cristata.

Botanical description - Rhizomatous perennial with erect tufted culms, 50 to 80 cm. tall; blades flat and scabrous; spikes 35 to 50, each spike with 5 to 8 spikelets, these on a long, erect raceme.

Flowering period - May to October.

Bouteloua curtipendula (continued)

Seed dissemination - July to November.

Manner of revegetation - Seeds and rhizomes.

Seasons of use - Yearlong.

Relative forage value - Excellent feed for both sheep and cattle even after growth ceases; it is an important forage species in the arid and semi-arid regions of the West; occasionally cut for hay in the Plains and Southwest.

Bouteloua ericpoda - Black Grama.

Distribution - Arizona, New Mexico, Utah and western Texas.

Habitat - Mesas, hills and dry open ground on the sandier soils.

Associates - *Aristida longiseta*, *Sporobolus cryptandrus* and *Aristida purpurea*.

Botanical description - Tufted perennial with slender, wiry, arching stolons; spikes commonly 4 to 5, spikelets 12 to 20 not crowded or pectinate; fertile lemma with a short terminal awn.

Flowering period - August and September.

Seed dissemination - September and October.

Manner of revegetation - Stolons; seed usually of low viability.

Seasons of use - Winter and spring.

Relative forage value - Highly palatable to cattle and sheep; wherever it grows in abundance it forms fairly dense and excellent pasture; the cured forage is nutritious and palatable; grazing during the summer growing season is inadvisable as it results in eventually killing out the black grama.

Bouteloua gracilis - Blue Grama

Distribution - The Dakotas, Nebraska, Kansas, Oklahoma, Texas, Arizona, New Mexico, Utah, Colorado, Wyoming, Montana, Nevada and southern California.

Habitat - Primarily on the plains and prairies on clay loam to sandy loam soil although it extends into the ponderosa pine zone to an elevation of 8000 feet in Colorado. Reaches maximum growth in southcentral New Mexico.

Associates - *Buchloe dactyloides*, *Aristida longiseta*, *Sporobolus cryptandrus*, *Koeleria cristata*, *Agropyron smithii*, *Bouteloua hirsuta*, *Agropyron dasytachyum* and *Sporobolus airoides*.

Botanical description - A densely tufted perennial with erect culms 20 to 50 cm. tall; blades flat or loosely involute; spikes usually 2, pectinate; spikelets as many as 80; fertile lemma pilose with slender, short awns.

Flowering period - August 15 to early September.

Seed dissemination - August to October.

Manner of revegetation - Seeds fairly well; also spreads vegetatively.

Seasons of use - Yearlong

Relative forage value - Excellent feed for both sheep and cattle; undoubtedly the most important grass of the Great Plains and Southwest; growth in the Plains region starts in late May, while in the Southwest growth starts with the advent of summer rains in July; it retains its nutritive value after curing and, therefore, makes excellent winter feed; it is drought resistant and withstands trampling well. Its wide distribution, abundance, palatability, nutritive value even after growth stops, ability to withstand grazing and reproductive powers rank it as one of the most important of the native forage grasses.

Bouteloua hirsuta - Hairy grama.

Distribution - South Dakota, Nebraska, Kansas, Oklahoma, Texas, New Mexico, Colorado, southern Nevada and southern California.

Habitat - Dry prairies, sandy plains and gravelly rolling slopes of high mesas; reaches its best development upon stable sandy loam soils; extends up to elevations of 7000 feet in Colorado.

Bouteloua hirsuta - (continued)

Associates - *Bouteloua gracilis*, *Buchloe dactyloides* and *Hilaria Jamesii*,

Botanical description - Densely tufted perennial with erect culms 20 to 60 cm. tall, leafy at base; blades flat, flexuous; spikes 1 to 4, the rachis extending beyond the spikelets as a slender point 5 to 8 mm. long; spikelets 35 to 45.

Flowering period - July 15 to September.

Seed dissemination - September and October.

Manner of revegetation - Seed.

Seasons of use - Yearlong.

Relative forage value - Comparable to blue grama with the exception that it is not as abundant, and not as widely distributed.

Bouteloua rothrockii - Rothrock Grama.

Distribution - Arizona, southern Utah and southern California.

Habitat - Foothills, mesas, canyons, open ground or among brush on a great variety of soils, often in pure stands at elevations up to 5000 feet.

Associates - *Bouteloua eriopoda*, *Sporobolus cryptandrus* and *Aristida longiseta*.

Botanical description - Perennial with tufted erect culms 25 to 50 cm. tall; spikes pectinate, 4 to 12 with a total of 40 to 50 spikelets; glumes scabrous, awn 1 to 2 mm. long.

Flowering period - August and September.

Seed dissemination - September and October.

Manner of revegetation - Seed.

Seasons of use - Yearlong.

Relative forage value - Excellent feed for cattle and sheep, however the distribution of this species is limited, where it does occur in sufficient abundance, it supplies good forage; does not withstand drought or close grazing.

Bromus anomalus - Nodding Brome

Distribution - North Dakota, S. Dakota, Montana, Idaho, Wyoming, Utah, Colorado, Nevada, California, Arizona, New Mexico and Texas.

Habitat - Open hillsides, meadows and in open forest, on sandy loam, clay and gravelly soils at medium elevations.

Associates - Agropyron spicatum, Koeleria cristata, Festuca idahoensis and Stipa viridula.

Botanical description - Tufted, short-lived, deeply rooted perennial; culms slender, 30 to 60 cm. tall, with pubescent nodes; ligule about 1 mm. long; blades scabrous; panicle 10 cm. long, few flowered, dropping; awn of lemma 2 to 4 mm. long.

Flowering period - July 15 to August 15.

Seed dissemination - August and September.

Manner of revegetation - Seed.

Seasons of use - Spring and summer.

Relative forage value - Excellent feed for cattle and of good palatability for sheep; it has a wide distribution, but generally does not occur in great abundance.

Remarks - This species was formerly known as Bromus porteri.

Bromus carinatus - California Brome.

Distribution - All of the 17 western range states with the exception of Oklahoma and North Dakota.

Habitat - Open ground, open woods and waste places on a great variety of soils, at low to middle elevations.

Associates - Bromus anomalus, Bromus pumpellianus, Agrostis hiemalis, Stipa lettermanii, Poa canbyi, Phleum alpinum and Aropyron pauciflorum.

Botanical description - Annual or biennial, culms 50 to 100 cm. tall; blades flat, 3 to 8 mm. wide; panicle as much as 20 cm. long with spreading, often deflexed; spikelets 2 to 3 cm. long, 5 to 10 flowered; awn of lemma 7 to 15 mm. long.

Flowering-period - May to July

Seed dissemination - June to August 20.

Bromus carinatus - (continued)

Manner of revegetation - Excellent seed producer.

Seasons of use - Throughout the summer.

Relative forage value - Highly palatable to cattle and moderately palatable to sheep early in the season; later it becomes rather coarse and of lower palatability. Sheep prefer seed heads.

Remarks - *Bromus marginatus* and *B. polyanthus* are variable and integrated forms of *Bromus carinatus*; the former has a range similar to *Bromus carinatus*, but is mostly a perennial; the latter is found in Montana, Idaho, Washington, Wyoming, Colorado and Arizona and is a stout perennial.

Buchloe dactyloides - Buffalo Grass.

Distribution - North Dakota, South Dakota, Kansas, Nebraska, Oklahoma, Texas, Arizona, New Mexico, Colorado, Wyoming and Montana.

Habitat - Plains, prairies and river bottoms on clay loam and loamy soils at low elevations.

Associates - *Bouteloua gracilis*, *Aristida longiseta*, *Sporobolus cryptandrus*, *Agropyron smithii* and *Koeleria cristata*.

Botanical description - Dioecious, staminate spikelets 2-flowered, sessile; pistillate spikelets 4 to 5 in a short spike, or head; perennial, sod forming, with numerous stolons; generally not more than 4 to 6 inches in height.

Flowering period - April to August, depending upon latitude.

Seed dissemination - May to September.

Manner of revegetation - Stolons and seed, the seedlings have both staminate and pistillate flowers. Extremely poor seeder.

Seasons of use - Yearlong.

Relative forage value - Excellent feed for cattle and sheep; withstands grazing and trampling; makes excellent winter forage; dominant over a large area of the uplands of the Great Plains.

Calamagrostis rubescens - Pinegrass

Distribution - Washington, Oregon, northern California, Idaho, Montana, Wyoming and northern Colorado.

Habitat - Common in low pine woods or on moist mountain slopes up to 10,000 feet, also on prairies and in meadows.

Associates - Carex spp; often in pure stands.

Botanical description - Tufted perennial with creeping rhizomes and slender culms, 60 to 100 cm. tall; sheaths pubescent at collar; blades erect and scabrous; panicle narrow, often purple; callus hairy; awn of lemma arising from near the base, short, geniculate.

Flowering period - July and August.

Seed dissemination - August and September.

Manner of reproduction - Mainly rhizomes; seeds of low viability.

Seasons of use - Spring mainly, lightly in fall.

Relative forage value - Moderately palatable to cattle and sheep; becomes tough in summer, but softens in fall to some extent and may be grazed at this time; withstands early grazing well because of its sod forming habit; it is rather common in the ponderosa pine type.

Calamovilfa longifolia - Sand Grass

Distribution - North Dakota, South Dakota, Nebraska, Montana, Idaho, Wyoming and Colorado.

Habitat - Sandhills and sandy prairies or open woods on sandy to sandy loam soils.

Associates - The Andropogons, Stipa spartea, Stipa comata, Sporobolus cryptandrus and Bouteloua gracilis.

Botanical description - Tall rigid perennial with strong scaly rhizomes; sheaths appressed villous; blades firm, long, tapering to a fine point; panicle 15 to 35 cm. long, narrow or contracted; callus with copious hairs.

Flowering period - June to August.

Seed dissemination - July to September.

Calamovilfa longifolia (continued)

Manner of revegetation - Rhizomes and seed.

Seasons of use - Primarily in spring and summer.

Relative forage value - Medium to low palatability for cattle and sheep; sometimes of value on sandy hillsides where other grasses are scarce; the cured forage is sometimes used for hay; an excellent grass for binding drifting sand.

Danthonia californica - California Oatgrass.

Distribution - Washington, Oregon, California, Idaho, Nevada, Montana, Wyoming, Utah, Colorado and New Mexico.

Habitat - Meadows and open woods, sometimes on dry hills, but usually in well drained park areas on various soil types; in Colorado it extends up to an elevation of 10,000 feet.

Associates - Melica imperfecta, Avena fatua, Agropyron spicatum and Stipa pulchra.

Botanical description - Perennial, with culms 30 to 80 cm. tall; sheaths pilose at throat; blades 10 to 20 cm. long; panicle bearing 2 to 5 spikelets; awn of lemma from bifid apex.

Flowering period - May to July.

Seed dissemination - June to August.

Manner of revegetation - Seed.

Seasons of use - Late spring and summer.

Relative forage value - Moderately palatable to sheep and cattle; produces a large amount of fine, leafy foliage; occurrence is scattered, and abundance rarely sufficient to produce large amounts of forage.

Deschampsia caespitosa - Tufted Hairgrass.

Distribution - Washington, Oregon, California, Nevada, Idaho, Utah, Montana, North Dakota, Wyoming, Colorado, Arizona and New Mexico.

Deschampsia caespitosa (continued)

Habitat - Moist bottomlands, canyons and meadows on a great variety of soils and from low to high elevations.

Associates - *Agrostis alba*, *Poa pratensis*, *Poa compressa*, *Phleum alpinum* and *Carex* spp.

Botanical description - Tufted perennial with smooth, erect, unbranched culms, 60 to 120 cm. tall; blades scabrous above; panicle loose, open, nodding, with capillary branches and branchlets, spike-bearing toward the ends; lemma smooth with awn arising from near the base, short, straight, or weakly geniculate.

Flowering period - July to September.

Seed dissemination - August to September.

Manner of revegetation - Seed

Seasons of use - Late spring and summer.

Relative forage value - Moderately palatable to cattle, fair for sheep; becomes somewhat rank as the season advances; often the predominating grass in mountain meadows in which case it furnishes the bulk of the forage; withstands grazing well; sometimes cut for hay.

Distichlis stricta - Saltgrass.

Distribution - Occurs in all of the 17 western range states.

Habitat - On alkaline soils, often on areas where other species will not grow; generally at lower elevations.

Associates - *Stipa comata*, *Hordeum jubatum* and *Hordeum nodosum*.

Botanical description - Dioecious; low perennials, with extensively creeping scaly rhizomes; sheaths overlapping; blades rather short and rigid; panicles congested; spikelets with 5 to 9 flowers, awnless.

Flowering period - May to August.

Seed dissemination - July to September.

Manner of revegetation - Primarily by rhizomes.

Seasons of use - Primarily in spring and early summer.

Distichlis stricta (continued)

Relative forage value - Low palatability for cattle and sheep; if stock eat it before it becomes dry they will continue to eat it as new growth forms; in the Great Basin, where it reaches its greatest abundance, it will be taken if other grasses are not available; provides some rather poor, wiry hay in parts of the middle West.

Elymus condensatus - Giant Wild Rye.

Distribution - Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, Montana, Wyoming, South Dakota, Colorado and New Mexico.

Habitat - Dry plains, slopes, sandhills, and in gullies to medium elevations on a great variety of soils.

Associates - Agropyron spicatum, Festuca scabrella, Bromus tectorum, Stipa comata, Stipa viridula and Agropyron smithii.

Botanical description - Large tufted perennial; rhizomes when present short and thick; culms 1 to 3 m. tall; ligule 2 to 5 mm. long; spike erect, dense, 15 to 30 cm. long; spikelets often 3 to 5, awnless or mucronate.

Flowering period - June to July.

Seed dissemination - July to September.

Manner of revegetation - Seed, and to some extent, rhizomes.

Seasons of use - Spring and early summer; and winter to a limited extent.

Relative forage value - Low palatability for cattle, and sheep; becomes tough and coarse in mid-summer; supplies some winter forage when left standing; used for hay in some localities.

Festuca arizonica - Arizona Fescue.

Distribution - Nevada, Arizona, New Mexico and Colorado.

Habitat - In ponderosa pine, on rocky slopes, and in open parks at elevations of 6000 to 8500 feet on a great variety of soils.

Associates - Bouteloua gracilis, Muhlenbergia montana, Bromus anomalus and Koeleria cristata.

Festuca arizonica - Arizona Fescue (continued)

Botanical description - An erect tufted perennial with culms 10 to 90 cm. tall; leaves tufted at base, stiff and glaucous; panicle narrow, long, and erect; spikelets 4 to 5 flowered, lemma short awned or nearly awnless.

Flowering period - June 15 to July 15.

Seed dissemination - July to September.

Manner of revegetation - Seed.

Seasons of use - Spring and early summer.

Relative forage value - Highly palatable to cattle and sheep early in the season, but becomes somewhat tough after summer rains are over; forms dense stands in the higher mountains of northern Arizona, and withstands grazing well.

Festuca idahoensis - Bluebunch Fescue.

Distribution - Washington, Oregon, California, Idaho, Nevada, Arizona, New Mexico, Colorado, Wyoming and Montana.

Habitat - Open forests, dry slopes and hillsides at low or medium elevations on a great variety of soils; sometimes found on moderately moist sites.

Associates - Agropyron spicatum, Festuca scabrella, Bromus anomalus, Melica bulbosa and Stipa viridula.

Botanical description - Culms densely tufted in large bunches, 30 to 100 cm. tall; blades numerous, elongate, scabrous, filiform and involute; panicle narrow, 10 to 20 cm. long, the branches ascending or appressed; spikelets 5 to 7 flowered; awn of lemma 2 to 4 mm. long.

Flowering period - June 15 to August.

Seed dissemination - August to September.

Manner of revegetation - Seed.

Seasons of use - Spring and summer.

Relative forage value - Of excellent palatability for cattle and high palatability for sheep; one of the most important forage grasses in the Northwest.

Festuca ovina - Sheep Fescue

Distribution - Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, New Mexico, Colorado, Wyoming, Montana, the Dakotas and Nebraska.

Habitat - Widely distributed on various types of soil; common in dry open areas on sagebrush types at medium elevations; intolerant of shade and drought resistant.

Botanical description - Densely tufted culms, 20 to 40 cm. tall; blades slender, involute, 5 to 10 cm. long; panicle narrow, spikelets 4 to 5 flowered, lemma short awned.

Flowering period - June to September.

Seed dissemination - August to October..

Manner of revegetation - Seed.

Seasons of use - Summer and fall primarily.

Relative forage value - Palatability for cattle and sheep is high; the numerous basal leaves remain green until fall; considered one of the 3 most important forage grasses in the Northwest.

Remarks - Festuca ovina var. brachyphylla is an alpine form of F. ovina, and is characterized by its smaller size and smooth, short, lax blades. Its range is similar to that of F. ovina.

Festuca rubra - Red Fescue.

Distribution - Washington, Oregon, California, Nevada, Idaho, Montana, Wyoming, Utah, Colorado and Arizona.

Habitat - Varies greatly, from open dry sites or in sandy soil to meadows, usually at low elevations.

Botanical description - Loosely tufted perennial with creeping rootstocks; culms 40 to 100 cm; blades smooth, soft, folded or involute; panicle contracted and narrow; spikelets 4 to 6 flowered, awn of lemma about 3 mm. long.

Flowering period - June to August.

Seed dissemination - August to September.

Manner of revegetation - Seed and rhizomes.

Festuca rubra (continued)

Seasons of use - Late spring, summer and fall.

Relative forage value - This widely distributed species is abundant enough in many places to be important; it is moderately palatable to all classes of stock.

Hilaria belangeri - Curly Mesquite.

Distribution - Texas, New Mexico and Arizona.

Habitat - Dry mesas and plains on sandy to loamy soils.

Associates - Bouteloua gracilis, Aristida longiseta, Hilaria Jamesii, and Buchloe dactyloides.

Botanical description - Tufted perennial with slender stolons; culms erect, slender 10 to 15 cm. long, villous at the nodes; blades, flat, short, curly; spike 2 to 3 cm. long with 4 to 8 clusters of spikelets.

Flowering period ----

Seed dissemination ----

Manner of revegetation - Stolons and seed.

Seasons of use - Yearlong.

Relative forage value - Excellent palatability for cattle and sheep; produces an abundance of fine herbage; second to none as winter forage.

Hilaria Jamesii - Galleta.

Distribution - Colorado, Wyoming, Utah, Nevada, southern California, Arizona, New Mexico and Texas.

Habitat - Deserts, canyons, and dry plains; varies from dry to moist sites in the southwest, and is common in the lower limits of the ponderosa pine type.

Associates - Bouteloua gracilis, Hilaria belangeri, Sporobolus cryptandrus.

Hilaria Jamesii - (continued)

Botanical description - Perennial; base often decumbent or rhizomatous; culms glabrous, nodes villous; blades short and rigid, the upper reduced; groups of spikelets 6 to 8 mm. long; lemmas and glumes with short plumose awns, with the exception of the second glume of each lateral spikelet.

Flowering period - March to July

Seed dissemination - April to August

Manner of revegetation - Seeds and rhizomes.

Seasons of use - Spring, summer and fall.

Relative forage value - High to moderate palatability for cattle and sheep; produces large quantities of forage and often occurs abundantly over large areas; resistant to trampling and drought; makes up a large part of the forage in some parts of the Southwest

Hilaria mutica - Tobosa Grass

Distribution - Texas, New Mexico and Arizona.

Habitat - Dry plains and low hills of the southwest in clay and clay loam swales and depressions at low elevations.

Associates - *Distichlis stricta* and *Scleropogon brevifolius*.

Botanical description - Perennial; culms from a tough rhizomatous base, 30 to 60 cm. tall; nodes pubescent; blades flat, rather rigid; spike 4 to 6 cm. long; groups of spikelets about 7 mm. long, bearded at base; spikes white or straw colored.

Flowering period - Generally July and August.

Seed dissemination - August to October.

Manner of revegetation - Mainly from rhizomes.

Seasons of use - Summer and fall.

Relative forage value - Of high palatability for cattle and sheep during the growing season; of little value as forage after drying up due to its coarseness.

Koeleria cristata - June Grass.

Distribution - All of the 17 western range states.

Habitat - Dry to moist soils, on prairies and mountains, usually at lower elevations.

Associates - *Agropyron spicatum*, *Stipa viridula*, *Bromus anomalus*,
Bouteloua gracilis, *Buchloe dactyloides* and *Poa secund.*

Botanical description - Tufted perennial with erect culms, 30 to 60 cm. tall; sheaths pubescent on lower half; blades flat or involute, 1 to 3 mm. wide; panicle erect, spikelike, dense, 4 to 5 mm. long, glumes and lemmas scaberulous, sometimes short awned.

Flowering period - June 15 to July.

Seed dissemination - July to September.

Manner of revegetation - Seed; seed production fairly abundant but of low viability.

Seasons of use - Spring and summer.

Relative forage value - Palatability for cattle high, for sheep moderate; grazed primarily in the earlier part of the season prior to maturity; it is quite common in a number of foothill and low mountain types, however, it is seldom found in any great abundance.

Melica bulbosa - Onion Grass.

Distribution - Washington, Oregon, California, Nevada, Idaho, Utah, western Montana, Wyoming, Colorado and southwestern Texas.

Habitat - Rocky woods, hills, and mountain meadows on a variety of soils.

Associates - *Festuca idahoensis*, *Agropyron spicatum*, *Bromus anomalus*,
Stipa viridula, *Koeleria cristata* and *Agropyron pauciflorum*

Botanical description - Tufted perennial; culms 30 to 60 cm. tall, bulbous at base; panicle narrow, densely flowered, with rather stiff, short, appressed branches, spikelets become papery with age, and are 7 to 15 mm. long.

Melica bulbosa (continued)

Flowering period - June to July.

Seed dissemination - August to September.

Manner of revegetation - Seed.

Seasons of use - Late spring and summer.

Relative forage value - Highly palatable to cattle and moderately palatable to sheep; generally does not occur in sufficient abundance to be an important forage constituent.

Muhlenbergia montana - Mountain Muhly.

Distribution - Montana, Wyoming, Colorado, Utah, New Mexico, Arizona, California and southwestern Texas.

Habitat - Gravelly, rocky or sandy soil at middle elevations (extends up to 10,000 feet in Colorado); in the Southwest it occurs primarily in open ponderosa pine stands.

Associates - Bouteloua gracilis, Koeleria cristata, Stipa comata, and Stipa viridula.

Botanical description - Perennial; culms densely tufted: erect 30 to 60 cm. tall; blades flat to involute, 1 to 2 mm. wide; panicle narrow, loose, 5 to 15 cm. long; awn of lemma slender, flexuous, 1 to 1.5 cm. long.

Flowering period - August and September.

Seed dissemination - September and October.

Manner of revegetation - Seed.

Seasons of use - Primarily spring and summer.

Relative forage value - Moderately palatable to sheep and cattle while young and tender; it produces an abundance of foliage, is quite resistant to grazing, widely distributed and often fairly abundant.

Oryzopsis hymenoides - Indian Ricegrass

Distribution - Occurs in all of the western range states with the exception of Oklahoma.

Habitat - Prefers sandy soils.

Associates - *Aristida longiseta*, *Stipa comata*, *Stipa viridula* and *Bouteloua gracilis*.

Botanical description - Densely tufted perennial; culms 30 to 60 cm. tall; ligule about 6 mm. long; blades long, slender, involute; panicle diffuse, 7 to 15 cm. long, the slender branches in pairs; the single spikelets are terminal with a deciduous awn about 4 mm. long; the mature caryopsis is hard, rounded and dark.

Flowering period - April to July.

Seed dissemination - May to September.

Manner of revegetation - Produces fair amount of seed. Extremely hard coat and must be scarified before sowing.

Season of use - Spring and summer.

Relative forage value - Moderately palatable to sheep and cattle; the foliage is taken early in the season, and the seeds later in the season; although widely distributed this grass is seldom of sufficient abundance to provide an appreciable amount of forage.

Panicum obtusum - Vine Mesquite

Distribution - Texas, New Mexico, Arizona, Colorado, Oklahoma and Kansas.

Habitat - Sandy or gravelly soil along river banks and arroyas; often in low damp valleys; may extend up to 6000 ft. in New Mexico.

Associates - *Bouteloua eriopoda* and *Hilaria mutica*.

Botanical description - Tufted perennial from a somewhat knotted rhizome, and producing long wiry stolons; culms compressed, 20 to 80 cm. tall; panicle 3 to 12 cm. long; spikelets obovoid, brownish, and obtuse.

Flowering period - May to July.

Seed dissemination - July to September.

Panicum obtusum (continued)

Manner of revegetation - Rhizomes and stolons.

Seasons of use - Spring and early summer.

Relative forage value - Moderate to low palatability for cattle and sheep; becomes tough and coarse as the season advances; its value as a soil binder probably exceeds its value as forage.

Phleum alpinum - Alpine Timothy.

Distribution - Washington, Oregon, California, Nevada, Montana, Wyoming, Black Hills of South Dakota, Colorado, Utah, Arizona and New Mexico.

Habitat - Moist meadow, marshes, bogs, stream banks, and wet places at higher elevations.

Associates - *Poa pratense*, *Poa secunda*, *Deschampsia caespitosa*, and *Agrostis hiemalis*.

Botanical description - Densely tufted perennial, with culms sometimes decumbent or creeping, and 20 to 50 cm. tall; blades usually less than 10 cm. long; panicle mostly ellipsoid or short cylindrical, bristly; glumes with awns 2 mm. long.

Flowering period - June to September.

Seed dissemination - August to October.

Manner of revegetation - Seed.

Season of use - Summer and fall.

Relative forage value - Excellent palatability for cattle, and high palatability for sheep; remains green until late in the fall and therefore, is valuable as a late summer sheep feed.

Poa canbyi - Canby Bluegrass.

Distribution - Washington, Oregon, California, Nevada, Utah, Idaho, Montana, Wyoming, Colorado, New Mexico, Nebraska and the Dakotas.

Poa canbyi (continued)

Habitat - Dry, rocky places, moist brooksides and meadows at elevations of 500 to 10,000 feet on sandy or sandy loam soils.

Associates - *Agropyron smithii*, *Bouteloua gracilis*, *Carex* sp.; higher elevations, *Bromus carinatus*, *Agropyron pauciflorum* and *Stipa lettermanii*.

Botanical description - Slender, tufted, perennial; green or glaucous; culms 50 to 120 cm. tall; ligule 2 to 5 mm. long; blades flat or folded; panicle narrow, 10 to 15 cm. long; spikelets 3 to 5 flowered.

Flowering period - June 15 to September.

Seed dissemination - July to October.

Manner of revegetation - Seed.

Seasons of use - Spring, summer and fall.

Relative forage value - Of excellent palatability for cattle and highly palatable to sheep; sometimes abundant as a meadow grass in the central Rockies.

Remarks - This species includes a form known as *Poa lucida*, which heretofore was known as a separate species.

Poa fendleriana - Mutton Grass.

Distribution - Montana, Idaho, Utah, Nevada, California, Arizona, New Mexico, Colorado, Wyoming, South Dakota and western Texas.

Habitat - On dry hills, mesas, and rocky slopes generally at medium elevations up, may extend up to 11,500 feet.

Associates - *Muhlenbergia montana*, *Bouteloua gracilis*, *Bromus anomalus*, *Bromus carinatus*, also in oakbrush in Utah.

Botanical description - Tufted perennial, imperfectly dioecious; culms, erect, scabrous, 30 to 50 cm. tall; ligule less than 1 mm. long; blades basal; panicle long exerted, oblong, contracted, pale, 2 to 7 cm. long; spikelets with 5 to 6 flowers.

Flowering period - April to June.

Seed dissemination - May to July.

Manner of revegetation - Seed.

Season of use - Spring, summer and fall.

Poa fendleriana (continued)

Relative forage value - Of excellent palatability for cattle, and highly palatable to sheep; growth starts early in the spring and therefore, provides early feed.

Poa nevadensis - Nevada Bluegrass.

Distribution - Washington, Oregon, California, Nevada, Idaho, Montana, Utah, Colorado and Arizona.

Habitat - Low meadows and wet places, generally on moist, loose, sandy loam soil.

Associates - Agropyron pauciflorum, Bromus carinatus, Stipa columbiana, and Stipa lettermanii.

Botanical description - Tufted perennial with erect culms, 50 to 100 cm. tall; sheaths scabrous; ligule 4 mm. long; blades long, narrow and rather stiff; panicle narrow, 10 to 15 cm. long, rather loose; spikelets 3 to 5 flowered.

Flowering period - May to August.

Seed dissemination - July to September.

Manner of revegetation - Seed.

Seasons of use - Spring and early summer.

Relative forage value - Excellent feed for cattle; highly palatable to sheep; grazed mostly early in the season as it becomes somewhat coarse later in the season; although widely distributed it rarely is found in great abundance.

Poa secunda - Sandberg's Bluegrass.

Distribution - Washington, Oregon, California, Idaho, Nevada, Montana, Wyoming, Colorado, Utah, New Mexico, the Dakotas and western Nebraska.

Habitat - Widely distributed in sagebrush, open timber and well drained park areas; while it does well on rich, clay loam soils, it is commonly found on poor dry rocky or sandy soils, at medium and upper elevations.

Associates - Stipa comata, Stipa viridula, Agropyron spicatum, Bouteloua gracilis and Koeleria cristata.

Poa secunda (continued)

Botanical description - Tufted perennial with erect culms 30 to 60 cm. tall, and short basal foliage; ligule acute and prominent; blade soft, flat; panicle narrow, 2 to 10 cm. long, with short appressed branches.

Flowering period - June to September.

Seed dissemination - July to October.

Manner of revegetation - Seed.

Season of use - Primarily spring and summer.

Relative forage value - Excellent feed for cattle and sheep; readily grazed by all classes of stock early in the season; grazed to some extent after curing.

Remarks - This species was formerly known as *Poa sandbergii*.

Sporobolus airoides - Alkali sacaton.

Distribution - All of the 17 western range states with the exception of North Dakota.

Habitat - Bottomlands, valleys, prairies, and rocky sites, often in alkaline soils up to elevations of 11,000 feet.

Associates - *Distichlis stricta*, *Bouteloua gracilis*, *Agropyron smithii*, *Buchloe dactyloides* and *Stipa comata*.

Botanical description - Perennial in large tough bunches; culms erect to spreading, 50 to 100 cm. tall; sheath pilose at throat; ligule pilose; blades elongate, flat, becoming involute; panicle nearly one-half the length of the plant, diffuse, and slender branched; caryopsis falling toward maturity.

Flowering period - July to September.

Seed dissemination - August to September.

Manner of revegetation - Seed.

Seasons of use - Spring and early summer.

Relative forage value - Moderately palatable to cattle, but rarely eaten by sheep due to its coarseness; becomes relatively tough and unpalatable in mid-season; the species is persistent and withstands close grazing and trampling well.

Sporobolus cryptandrus - Sand Dropseed

Distribution - All of the 17 western range states.

Habitat - Sandy plains and ridges, open ground up to elevations of 8,000 feet.

Associates - *Bouteloua gracilis*, *Bouteloua eriopoda*, *Stipa comata*, *Andropogon scoparius*, *Calamovilfa longifolia*.

Botanical description - Perennial, often in small tufts; culms erect or spreading, sometimes prostrate, 30 to 100 cm. tall; sheaths with a conspicuous tuft of long white hairs at summit; blades flat, tapering to a fine point; panicles terminal, axillary, included at base, open; caryopsis falling at maturity.

Flowering period - July to September.

Seed dissemination - August to October.

Manner of revegetation - Seed.

Seasons of use - Late spring and summer.

Relative forage value - Moderately palatable to cattle, of low palatability for sheep; it has wide distribution and where abundant supplies forage of fair quality, especially is this so in the Southwest.

Stipa columbiana - Columbia needlegrass

Distribution - North Dakota, Montana, Wyoming, Colorado, New Mexico, western Texas, Arizona, Utah, Idaho, Washington, Oregon, Nevada and California.

Habitat - Dry plains, meadow and open woods at medium and high elevations, on a variety of soils.

Associates - *Stipa lettermanii*, *Stipa viridula*, *Bromus anomalus*, *Agropyron pauciflorum* and *Bromus carinatus*.

Botanical description - Culms 30 to 60 cm. tall; sheaths naked at throat; ligule 1 to 2 mm. long; blades 10 to 25 cm. long, 1 to 3 mm. wide, mostly involute; panicle 5 to 15 cm. long, narrow, rather dense; awn 2 to 2.5 cm. long, twice-geniculate.

Flowering period - July and August 15.

Stipa columbiana (continued)

Seed dissemination - September.

Manner of revegetation - Seed.

Seasons of use - Spring, summer, and fall.

Relative forage value - Moderately palatable to cattle and sheep, especially to cattle; the awns are of no great hindrance to grazing.

Stipa comata - Needle and Thread.

Distribution - All of the 17 western range states with the exception of Oklahoma.

Habitat - Dry sandy or gravelly soils on plains or hills; occurs at elevations of 4000 feet to 8500 feet in Colorado.

Associates - Agropyron smithii, Agropyron spicatum, Agropyron pauciflorum, Bouteloua gracilis and Andropogon scoparius.

Botanical description - Culms 30 to 60 cm. tall, ligule thin 3 to 4 mm. long; blades 10 to 30 cm. long, flat or involute; panicle included at base, narrow, 10 to 20 cm. long; awn 10 to 15 cm. long, indistinctly twice geniculate, slender, twisted below, flexuous above.

Flowering period - May to July.

Seed dissemination - July to September.

Manner of revegetation - Seed.

Seasons of use - Early spring and summer prior to the maturity of the awns although it is often grazed after the awns have fallen.

Relative forage value - Highly palatable to cattle and moderately palatable to sheep prior to the maturity of the awn; often cut as hay in parts of Wyoming, Nebraska and the Dakotas.

Stipa lettermanii - Letterman Needlegrass.

Distribution - Wyoming, Colorado, New Mexico, Arizona, Utah, Montana, Idaho, Nevada, Washington, Oregon and California.

Stipa lettermanii (continued)

Habitat - Dry soils, in canyons, and on hillsides, plains and open woods at middle elevations and up to an elevation of 10,000 feet on a variety of soils.

Associates - Lower elevations - *Agropyron spicatum* and *Artemisia tridentata*.
Higher elevations - *Agropyron pauciflorum* and *Bromus carinatus*.

Botanical description - Culms often in large tufts, 30 to 60 cm. tall; blades slender, involute; panicle slender, narrow-
loose, 10 to 15 cm. long; awn 1.5 to 2 cm. long.

Flowering period - June 15 to August.

Seed dissemination - July 31 to September 30.

Manner of revegetation - Seed.

Seasons of use - Late spring, summer and early fall.

Relative forage value - Highly palatable to cattle and moderately palatable to sheep; remains green until snow comes; awns are short and fine and cause mechanical injury to stock.

Remarks - This species resembles *Stipa columbiana*, but is somewhat smaller.

Stipa spartea - Porcupine Grass.

Distribution - Wyoming, New Mexico, North Dakota, South Dakota, Kansas, Oklahoma and the upper Mississippi Valley.

Habitat - Plains and prairies, extending into the sandhills of Nebraska and Kansas; occurs on sandy to loam soils.

Associates - *Andropogon scoparius*, *Andropogon furcatus*, *Sorghastrum nutans* and *Panicum virgatum*.

Botanical description - Culms 1 m. tall; ligule 4 to 5 mm. long; blades 20 to 30 cm. long; panicle 15 to 20 cm. long, narrow, nodding; awn stout 12 to 20 cm. long twice geniculate.

Flowering period - May to July.

Seed dissemination - July to September.

Manner of revegetation - Seed.

Seasons of use - Spring and early summer.

Stipa spartea (continued)

Relative forage value - Moderately palatable to cattle and sheep in spring and early summer prior to the maturity of the awns.

Remarks - This grass does not extend west in sufficient abundance to be of major forage value. It is of importance in the Nebraska sandhills and in the tame pastures of the middle West.

Stipa viridula - Green Needlegrass.

Distribution - Montana, the Dakotas, Wyoming, Nebraska, Colorado, western Kansas, and New Mexico.

Habitat - From plains and dry slopes to elevations up to 9000 feet; on a great variety of soils.

Associates - *Agropyron pauciflorum*, *A. spicatum*, *Bouteloua gracilis*, *B. curtipendula*, *Bromus anomalus* and *Stipa comata*.

Botanical description - Culms 60 to 100 cm. tall; sheaths, villous at throat; ligule about 1 mm. long; blades 10 to 30 cm. long; panicle 10 to 20 cm. long, closely flowered; awn 2 to 3 cm. long, twice geniculate.

Flowering period - May to August depending on elevation.

Seed dissemination - July to September.

Manner of revegetation - Seed.

Seasons of use - Spring, summer and fall.

Relative forage value - Moderate to high palatability for cattle, low palatability for sheep; remains green until late in the season; awns of no great hindrance to grazing.

Trisetum spicatum - Spike Trisetum.

Distribution - Washington, Oregon, California, Idaho, Nevada, Montana, Wyoming, Colorado, Utah, Arizona and New Mexico.

Habitat - Mountains and on rocky banks; frequent in moist places at higher elevations, in Colorado and New Mexico it extends up to 13,000 feet; it is typically a high mountain forage species, although it may extend down to 7000 feet in Montana.

Trisetum spicatum (continued)

Associates - *Poa alpinum*, *Agrostis hiemalis*, *Agropyron pauciflorum*,
Bromus carinatus, *Deschampsia caespitosa*, *Carex* spp.

Botanical description - Densely tufted perennial; culms erect 15 to 20 cm. tall; panicle dense, usually spikelike, pale or often dark purple, 5 to 15 cm. long; one-third below the tip, and 5 to 6 mm. long, geniculate.

Flowering period - May to August.

Seed dissemination - July to September.

Manner of revegetation - Seed; viability rather low.

Seasons of use - Summer and early fall.

Relative forage value - Moderately palatable to sheep and cattle; begins growth early, withstands trampling well, and the leaves remain green throughout the season; generally not found in great abundance.

Introduced Grasses

Agropyron cristatum - Crested Wheat Grass

Distribution - Introduced from Eurasia into various parts of the United States, primarily in the Dakotas, Wyoming, and Colorado in early 1900's.

Habitat - Dry plains and prairies and low foothills on sandy loam to clay loam soils at elevations up to 8000 feet.

Associates - ----

Botanical description - Tufted perennial with erect culms 60 to 100 cm. long; blades flat; spike dense, 4 to 6 cm. long; spikelets compressed, closely imbricate; lemmas abruptly narrowed into an awn 2 to 4 mm. long.

Flowering period - June 15 to July 15.

Seed dissemination - July 15 to August 15.

Manner of revegetation - Spreads readily by natural reseeding.

Seasons of use - Early spring, summer and late fall.

Relative forage value - Highly palatable to cattle and moderately palatable to sheep; this is not a true range grass; it is well adapted for hay and pasture in various portions of the West; its ability to withstand drought the viability of its seed, its early and late growth, and palatability make it an important species for reseeding under dry land conditions.

Agrostis alba - Redtop.

Distribution - Introduced from Eurasia; extensively escaped in all the cooler parts of the United States; rare in southern states.

Habitat - Wet meadows and pastures; endures acid soils better than any other well-known forage plant; extends up to elevations of 8500 feet in Colorado.

Associates - *Poa pratensis*, *Poa compressa*, *Agrostis hiemalis*, and *Carex spp.*

Botanical description - Perennial with creeping rhizomes; culms robust 1 to 1.5 m. tall, the base erect or decumbent; blades flat and wide; panicle pyramidal-oblong, reddish, as much as 20 cm. long spreading in anthesis, contracting later on.

Agrostis alba - Redtop. (continued)

Flowering period - July to September.

Seed dissemination - August to October.

Manner of reproduction - Seed and rootstocks.

Season of use - Late spring and summer.

Relative forage value - Highly palatable to cattle, moderately palatable to sheep; of sufficient abundance to produce considerable forage in some areas; common in hay meadows and cultivated pastures.

Bromus inermis - Smooth Brome

Distribution - A native of Europe, introduced into the United States and now found throughout most of the states with the exception of the Southwest.

Habitat - Cultivated fields, waste places, and open woods on medium moist lands on a great variety of soil at low to high elevations.

Associates - *Bromus carinatus*, and *Agropyron pauciflorum*.

Botanical description - Perennial with creeping rhizomes and erect culms, 50 to 100 cm. tall; ligule about 2 mm. long; panicle 10 to 20 cm. long, erect, the branches whorled, spreading in flower, contracting at maturity; lemmas mucronate or with a short awn.

Flowering period - June to early August.

Seed dissemination - July to September.

Manner of reproduction - Seed and rhizomes.

Seasons of use - Primarily in spring and summer, although it may be eaten at all times of the year.

Relative forage value - Excellent palatability for cattle and of high palatability for sheep; withstands grazing, generally it does not exist in sufficient abundance naturally to provide a large volume of forage, however, its ability to withstand drought, to grow on poor soils and to establish and maintain itself under these conditions make it an ideal species for reseeding purposes in various parts of the West. Becomes sod bound after several years.

Dactylis glomerata - Orchard Grass

Distribution - Native of Europe and Asia; now found throughout the United States.

Habitat - Fields, meadows and waste places on a great variety of soils: not found on arid or wet soils.

Associates - -----

Botanical description - Perennial bunchgrass with smooth erect stems, 60 to 120 cm. tall; panicle 5 to 20 cm. long, the few distant stiff solitary branches ascending or spreading at anthesis; appressed at maturity; lemmas mucronate or short awned.

Flowering period - May to July.

Seed dissemination - July to September.

Manner of revegetation - Seed.

Seasons of use - Spring, summer and fall.

Relative forage value - Moderately palatable to sheep and cattle; remains green throughout the season; it generally is not very abundant on the range; commonly cultivated as a meadow or pasture grass.

Poa compressa - Canada Bluegrass

Distribution - Introduced from Europe and now distributed in most of the United States.

Habitat - Will grow on a great variety of soils, even upon those too poor for other species; common in wet and moist meadows, woodlands, and in well drained grassy parks up to 9500 feet.

Associates - *Agrostis alba*, *A. hiemalis*, *Bromus pumpellianus*, *Poa pratensis*, and *Carex* spp.

Botanical description - Bluish-green, smooth perennial from extensive, creeping rootstocks, 50 cm. tall; blades short, narrow, 3 to 7 cm. long; spikelets crowded, subsessile, 3 to 6 flowered.

Flowering period - May to September.

Seed dissemination - July to October.

Manner of revegetation - Seed and rootstocks.

Poa compressa (continued)

Season of use - Spring, summer and fall.

Relative forage value - Excellent palatability for cattle and sheep; often occurs in sufficient abundance to supply considerable forage; cultivated for pastures in poor soil.

Poa pratensis - Kentucky Blue Grass.

Distribution - Widely distributed throughout the United States, Europe and Asia.

Habitat - Common in fields, meadows and on high mountain slopes in rich moist loam soils; prefers soils of limestone origin.

Associates - *Agrostis alba*, *Agrostis hiemalis*, *Bromus carinatus*, *Phleum alpinum*.

Botanical description - Slender, erect, rhizomatous perennial; culms slightly compressed, 30 to 100 cm. tall; ligule about 2 mm. long; blades soft, flat or folded; panicle somewhat pyramidal, open, lowermost branches in whorls of 5; spikelets crowded, 3 to 5 flowered; lemma webbed at base.

Flowering period - May to August.

Seed dissemination - July to September.

Manner of revegetation - Rootstocks and seed.

Seasons of use - Excellent palatability for cattle and sheep; produces an abundance of leafy foliage; while generally not found in great abundance, its wide range and ability to withstand grazing make it an important forage species; it is an important cultivated meadow grass.

SECTION III

SOME BROWSE SPECIES THAT
OCCUR ON WESTERN RANGES

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DEPARTMENT OF RANGE AND PASTURE MANAGEMENT
Colorado State College, August 25, 1938

IMPORTANT WESTERN BROWSE SPECIES

Acacia greggii - Catclaw. Family - Mimosaceae.

Distribution - Western Texas to southern Nevada, North. Lower Calif.
and N. Chihuahua, Mexico.

Elevation - 2500' - 5000'.

Associates - Creosote Bush - Mesquite.

Habitat Requirements - Deserts to semi-deserts on sandy to gravelly
soils.

Natural Revegetation - Seed.

Season of Use - Spring.

Relative Forage Value - Poor forage in late spring for cattle.
R 3, (S.W. Region) 10-10.

Miscellaneous - Much of the forage is unavailable due to thorns.

Adenostoma fasciculatum - Chamise. Family - Rosaceae.

Distribution - California south to lower California.

Elevations - 500' - 5000'.

Associates - Pure or other chaparral species.

Habitat Requirements - Hot dry slopes.

Natural Revegetation - Seeds and rootstalks.

Season of Use - Winter.

Relative Forage Value - Practically worthless.

Miscellaneous - Good for watershed protection - serious fire hazard
in dry summers. Most characteristic plant of
chaparral type in southern California.

Alnus tenuifolia - Mt. Alder or Thin Leaf Alder. Family - Betulaceae.

Distribution - Rocky Mountains, Canada to Mexico. West to Oregon and Washington, Colorado, Wyoming, Utah and Nevada.

Elevations - 0 - subalpine. Frequently timberline.

Associates - Salix, Mt. Birch, Douglas Fir, Mt. Mahogany, Serviceberry and scrub oaks.

Habitat Requirements - Prefers moist situations, usually in thickets, sometimes sparsely scattered.

Natural Revegetation - Underground rhizomes or suckers, forms thickets, hindering use by stock.

Season of Use - Fall-winter and spring. (Game use heavy).

Relative Forage Value - Generally not high. Important because of abundance. Fair for sheep. Used to appreciable extent by cattle.

Miscellaneous - Legume properties yield high nitrogen content which indicates high protein content of herbage. Significant in watershed protection.

Amelanchier alnifolia - Serviceberry. Family - Malaceae.

Distribution - From Alaska south and east to west. Ontario, Michigan, the Dakotas, N. Mexico and California.

Elevation - Near sea level to 9000'.

Associates - Manzanita, thimble berry, Gambel Oak and cherries.

Habitat requirements - Variety of conditions. Dry rocky slopes in full sunlight or shade of coniferous timber.

Natural Revegetation - Seed.

Season of Use - Chiefly after mid summer. On browse range - spring-summer. R3, 40-50; R2, 20-40

Relative Forage Value - Fair to good for cattle and good for sheep.

Miscellaneous - Deer and elk are particularly fond of serviceberry twigs and leaves. Berries relished by birds, rodents and bears.

Artemisia cana - Gray, hoary, silvery or white sage. Family - Compositae.

Distribution - Southern Alberta, Saskatchewan to Western Nebraska, Northern New Mexico, California (east to Sierras), Eastern Oregon.

Elevations - 2500' - 11,500'.

Associates - Other sages, yarrow, rabbitbrush, blue grama, buffalo grass, and June grass.

Habitat Requirements - Dry sandy or gravelly loams; sage-brush plains to Spruce-fir zone; foothills and mountains.

Natural Revegetation - Lateral spreading roots.

Season of Use - Fall-winter.

Relative Forage Value - Cattle 10-20; sheep 10-20. R3, 20-20; R2, 10-20.

Miscellaneous - Height - 1-10 ft.; greatest altitude range of the genus; grayish appearance.

Artemisia dracunculoides - False tarragon. Family - Compositae.

Distribution - Widely distributed throughout the West.

Elevations - Wide range.

Associates - Artemisia frigida, and A. gnaphalodes, blue grama, wheatgrasses, Pine drop seed, Mt. Muhly, Arizona Fescue, Pinyon and Snakeweed

Habitat Requirements - Sand loams, loams and clays in plains, foothills and ponderosa pine types.

Natural Revegetation - Lateral spreading roots.

Season of Use - Fall-winter.

Relative Forage Value - Cattle 10-20; sheep 10-20. R3, 0-10; 40-50. R2, 10-20. One of principal sheep forage weeds of S.W. Idaho.

Artemisia filifolia - Sand sage or Thread leaf sage. Family - Compositae.

Distribution - Relative low elevations from Nebraska to Wyoming and New Mexico.

Elevations - Relatively low.

Associates - Sandhill cherry, Stipas, Andropogons, Calamovilfa longifolia, Redfieldia flexuosa, Sporobolus spp.

Artemisia filifolia (continued)

Habitat requirements -- Sandy soils, sandhills in plains and foothill areas.

Natural Revegetation -- Lateral spreading roots.

Season of Use -- Fall-winter.

Relative Forage Value -- Cattle 0-10; sheep 0-10. R3, 20-40; R2, 0-10. Palatable in southern Utah especially.

Miscellaneous -- One of the few shrubs growing in sandhills of eastern Colorado.

Artemisia frigida -- Fringed sage. Estafiata in S.W. Family -- Compositae.

Distribution -- From Mexico northward over most of western U. S. to Alaska. Most widely distributed sage.

Elevations -- Low semi-desert valleys to 11,000'.

Associates -- Winter fat, shadscale, rabbitbrush, big sage, wheatgrasses, bluegrass.

Habitat requirements -- Full sunlight on dry porous coarse-gravelly, sandy or shallow loam soils.

Natural Revegetation -- Root stocks; seed viability low.

Season of Use -- Winter and spring.

Relative Forage Value -- Cattle 50; sheep 70. R3, 80-90; R2, 10-20.

Miscellaneous -- Used in old world as source of medicinal oil and an intoxicating liquor, antiseptic and celluloid. Causes hay fever.

Artemisia nova -- Curly sage. Family -- Compositae.

Distribution -- From Montana, south to New Mexico, east to Arizona, Nevada and Oregon, North and Central Utah.

Elevations -- 3,000' - 6,000'.

Associates -- White sage, wheatgrasses, blue grass, curly grass, brown sage, bromes.

Habitat Requirements -- Well drained soils, rocky and of low fertility, dry exposures; plains.

Natural Revegetation -- Seed.

Season of Use -- Winter-Spring.

Relative Forage Value - Cattle 0; sheep 40. R3, 20-20.

Miscellaneous - One of the most valuable of desert shrubs, highly relished by sheep on winter range.

Artemisia spinescens - Bud sage. Family - Compositae.

Distribution - Montana, southern Idaho and Oregon, southward to New Mexico and California.

Elevations - Low valleys to 9,000'.

Associates - Eriogonums, blue grass, wheatgrasses, festucas, Kochia, shadscale.

Habitat Requirements - Deserts on better sites, sometimes on alkaline soils.

Natural Revegetation - Seed abundant.

Season of Use - Winter-spring.

Relative Forage Value - R2, cattle 10; sheep 40.

Miscellaneous - 4 inches to 1 foot in height, fern-like appearance, leaves dry and turn brown in mid-summer. Twigs are sharp and often injure animals. Believed to cause abortion.

Artemisia tridentata - Blue sage, big sage or sagebrush. Family - Compositae.

Distribution - Formerly confined to Great Basin, but recently spread from Canada to Mexico, and from Nebraska to California.

Elevations - 3,000' - 9,000'.

Associates - Brigham tea, brown sage, curly grass, salt bush, match weed, rabbitbrush, Gambel oak, Stipas, wheatgrasses, etc.

Habitat Requirements - Dry plains, mesas and hill sides on deep well drained soils of medium rainfall.

Natural Revegetation - Seed.

Season of Use - Late fall, winter and early spring.

Relative Forage Value - Cattle 10; sheep 20. R3, 20-30.

Miscellaneous - Large shrubs 3-5 feet tall sometimes 10 ft. Used locally as a tea substitute, general tonic, a hair and eye wash, treating colds and diarrhea and as an antiseptic for wounds.

Aster parryi - Parry Aster, Woody aster. Family - Compositae.

Distribution - Confined almost entirely to Wyoming, some in No. Colorado.

Elevations - Lower elevations up to 6,000'.

Associates - Sages, grama, buffalo grass, etc.

Habitat Requirements - Denuded and saline soils near water; favors
gumbo-clay soils.

Natural Revegetation - Seed.

Season of Use - Grazed early spring and summer.

Relative Forage Value - None.

Miscellaneous - Poisonous throughout growing season. Probably the major
sheep-poisoning plant in Wyoming, especially in early
spring and summer.

Atriplex canescens - Four winged salt bush, (Chamiza). Family - Chenopodiaceae.

Distribution - From South Dakota to W. Texas, California and Nevada,
Utah and Wyoming.

Elevations - Up to 8500'.

Associates - Creosote Bushes, sagebrush, Pinyon.

Habitat Requirements - Dry, moderately saline, in plains and valleys.

Natural Revegetation - Seed.

Season of Use - Winter.

Relative Forage Value - High nutritive value. R3, 50-60; R2, 20-40.

Miscellaneous - Occasionally causes bloat in cattle.

Atriplex confertifolia - Shadscale. Family - Chenopodiaceae.

Distribution - Southern Idaho to Wyoming, Utah, New Mexico, Southern
California and S.E. Oregon.

Elevations - 6,000' - 8,000'.

Associates - Sagebrush and rabbitbrush, winterfat, and semi-desert
bunch grasses.

Habitat Requirements - Common in alkaline valleys.

Natural Revegetation - Seed.

Atriplex confertifolia (continued)

Season of Use - Winter

Relative Forage Value - Good. R3, 30-40; R2, 20-40.

Miscellaneous - Spiniest of the saltbushes.

Calliandra eriophylla - False Mesquite. Family - Mimosaceae.

Distribution - Western Texas to Central Arizona. Most of Mexico.

Elevations - 3,000' to 5,000'.

Associates - Catclaw, Mesquite, Paloverde, Curly mesquite, Three-awns,
low range gramas.

Habitat Requirements - Sandy soils of granitic origin - sunny dry mesas.

Natural Revegetation - Seed.

Season of Use - Yearlong.

Relative Forage Value - Fairly good to good. May be higher in some
localities. R3, 40-50.

Miscellaneous - Greens up early in spring and makes good second growth;
will withstand heavy grazing and will recover rapidly
under protection.

Ceanothus cordulatus - Whitethorn. Family - Rhamnaceae (Buckthorn).

Distribution - Sierra Nevadas to Southwest Oregon.

Elevation - 2,000' - 6,000'.

Associates - Greenleaf Manzanita, Service berry, Oaks, Snowbrush,
Huckleberry.

Habitat Requirements - Wide variety of well drained sites, usually
in open but thrives in shade.

Natural Revegetation - Abundant seed.

Season of Use - Spring and summer.

Relative Forage Value - Poor to fair or fairly good for cattle and sheep.

Miscellaneous - Use limited by habit of growth in brush fields or
dense patches. Slow growing plants, thorny.

Ceanothus cuneatus - Wedge-leaf ceanothus. Family - Rhamnaceae.

Distribution - Oregon and California to western Nevada.

Elevation - Indicator of Upper Sonoran Zone in Oregon.

Associates - Manzanita and Oaks.

Habitat Requirements - Dry gravelly ridges and open rocky slopes.

Natural Revegetation - Seed.

Season of Use - Spring and Summer.

Relative Forage Value - Low except for goats.

Miscellaneous - Injurious to kidneys to male livestock if grazed extensively.

C. fendleri - Fendler ceanothus. Family - Rhamnaceae.

Distribution - South Dakota and Wyoming to Arizona and western Texas.

Elevation - 4500' - 11,000'.

Associates - Manzanita, Mt. mahogany and Oaks.

Habitat Requirements - Open slopes, well drained soil.

Natural Revegetation - Seed.

Season of Use - Spring and summer.

Relative Forage Value - Fair to good for cattle and fairly good to good for sheep. Fairly good to very good for goats. Also eaten by horses. R3, 30-30; R2, 20-40.

Miscellaneous - In northern part of range is of inferior value - worthless to poor to fair for cattle and sheep. Important deer feed throughout range. Somewhat spiny twigged.

C. greggii - Desert ceanothus. Family - Rhamnaceae.

Distribution - West Texas to central Nevada and Southeastern California and Mexico.

Elevation - 3500' - 7000'.

Associates - Manzanita, Mimosa and Oaks.

Habitat Requirements - Open slopes in dry clay or sandy soils.

Natural Revegetation - Seed.

C. greggii (continued)

Season of Use - Yearlong - especially fall, winter and spring.

Relative Forage Value - Fair or fairly good for cattle, fair to good for sheep and good for goats. R3, 50-40.

C. integerrimus - Deerbrush, Nevada Bluebrush. Family - Rhamnaceae.

Distribution - Washington through California and West. Nevada to Ariz.

Elevation - 5,000' - 6,000'.

Associates - Whitethorn, manzanita, Oaks, currants and Lupine.

Habitat Requirements - Well drained moderately fertile soil in open and half-shade.

Natural Revegetation - Seed (very viable) and rootstocks.

Season of Use - Late spring and summer. Some winter.

Relative Forage Value - Good to excellent for sheep, cattle, goats and deer. Fair to good for horses.

Miscellaneous - Better utilization by cattle because of size of bush. Palatability lower before leaves are out and after seed maturity.

C. sanguineus - Red stem ceanothus. Family - Rhamnaceae.

Distribution - British Columbia and Montana to California.

Elevation - 3,000' - 6,000'.

Associates - Serviceberry, snowbrush, deer brush and cream bush.

Habitat Requirements - Moist northern slopes in open or part shade.

Natural Revegetation - Seed.

Season of Use - Spring and summer.

Relative Forage Value - Fair to fairly good for cattle and sheep.

Miscellaneous - In favorable sites often too tall to be browsed by stock.

Ceanothus velutinus - Snowbrush. Family - Rhamnaceae.

Distribution - British Columbia and Saskatchewan to Colorado and Calif.

Elevations - 4500' - 10,000'.

Associates - Very "gregarious" in brush fields. Serviceberry,
deer brush and oaks.

Habitat Requirements - All exposures in well drained soil.

Natural Revegetation - Seed (very viable) and sprouts.

Season of Use - Spring and summer.

Relative Forage Value - Poor for cattle and horses. Poor to fair
for sheep, goats and deer.

Celtis douglassi - Douglas Hackberry. Family - Ulmaceae.

Distribution - Utah and Idaho to Oregon, Washington and British Columbia.

Elevation - Lower areas of the N.W. forest.

Associates - Variable.

Habitat Requirements - Found on both moist and dry soils, along streams,
ravines and cliffs.

Natural Revegetation - Seed.

Season of Use - Winter and early spring.

Relative Forage Value - A secondary forage plant of considerable
importance. R3, 10-10.

Cercocarpus breviflorus - (none). Family - Rosaceae.

Distribution - Generally New Mexico only.

Elevation - In New Mexico up to 9500'.

Associates - Juniper, Gambel Oak, Pinon, Ponderosa Pines, Bitterbrush,
Sagebrush, etc.

Habitat Requirements - Does best in moist, heavy soils; can withstand
poor and dry soil.

Natural Revegetation - Seed, shoots, roots.

Season of Use - Fall, winter and spring.

Relative Forage Value - Good for all classes, especially sheep and goats.
R3, 60-60.

Cercocarpus ledifolius - Curl leaf Mt. Mahogany or Desert Mt. Mahogany.
Family - Rosaceae.

Distribution - South Dakota and Montana, south to New Mexico west to California and Oregon. None south of Grand Canyon.

Elevation - North 2000'. South 9000'. Lower on north slopes.

Associates - Same as above plus Serviceberry, Rabbitbrush and Manzanita, Bunchgrass, Aspen, Lodge Pole Pine, Spruce and Fir.

Habitat Requirement - Can withstand shallow, dry, coarse or poor soils; does well in canyon bottoms and warm dry slopes.

Natural Revegetation - Heavy use makes plant bushy and produces spreading by shoots; seeds.

Season of Use - Late summer, fall, and some in early winter - twigs yearlong.

Relative Forage Value - For all classes low to fair, twigs and leaves all year. R3, 75-70; R2, 40-60.

Miscellaneous - Shrub 3' - 10', rarely a tree 40'; often dominant in type, can stand heavy use, leaves rolled and leathery; allied to C. arizonicus, important in California.

Cercocarpus montana syn. parvifolius - True Mt. Mahogany. Family - Rosaceae.

Distribution - South Dakota and Montana, south to New Mexico, Northeastern California and Oregon.

Elevation - 4000' - 10,000'.

Associates - Same as above, except not generally in Lodgepole, Spruce or Fir.

Habitat Requirements - Same as above - prefers canyon bottoms.

Natural Revegetation - Same as above.

Season of Use - Late summer, fall and some in early winter - twigs year long.

Relative Forage Value - Good to excellent for all classes. R3, 75-70; R2, 40-60.

Miscellaneous - Shrub 2' - 10', rarely tree 20'; can stand fairly heavy use.

Chrysothamnus lanceolatus (and allied species) Rabbitbrush. Family - Compositae.

Distribution - Canada to Texas and Old Mexico; South Dakota and Nebraska to coast range of California.

Elevation - Sea level to 10,000'.

Associates - Saltgrass, greasewood, poverty weed on alkaline soils; almost all range plant species.

Habitat Requirement - Alkaline and fresh soils; stream banks to arid lands; gravel to clay.

Natural Revegetation - Seed.

Season of Use - Grazed in fall by sheep and cattle; by elk in winter; by deer both summer and winter.

Relative Forage Value - Very low for the genus. *C. lanceolatus* alone is moderately good where it occurs in quantity.
R3, 0-0; R2, 0-30.

Miscellaneous - Some species (*C. nauscosus*, *C. stenophyllus*, etc.) are indicators of overgrazing.

Cowania stansburiana - Cliffrose. Family - Rosaceae.

Distribution - Southern Colorado and Utah to California (E. of Sierra Nev.) Sonora, Chihuahua, and New Mexico.

Elevation - 4000' - 8000'.

Associates - Juniper, Pinyon, Mt. Mahogany, Serviceberry, Sagebrush, Live Oak.

Habitat Requirement - Most characteristic on limestone areas, but also on granitic, volcanic and other igneous formations, often on eastern and southern slopes.

Natural Revegetation - Seed.

Season of Use - Winter.

Relative Forage Value - Important and valuable. R3, 60-60.

Miscellaneous - Leafy evergreen shrub. Valuable deer browse in Kaibab N. F. and in forested areas of Arizona.

Dasiphora fruticosa - Shrubby Cinquefoil. Family - Rosaceae.

Distribution - In Europe and Asia; in North America from Greenland and Labrador to Alaska and south to California, N. Mexico, Minnesota, Illinois and N. Dakota.

Elevation - 5,000' - 11,000'. Upper Ponderosa Pine to above timberline.

Associates - Geranium, yarrow.

Habitat Requirement - Open exposures, especially moist subalpine meadows and near cold springs and seeps, also in open timber.

Natural Revegetation - Seed.

Season of Use - Summer, (however it is adapted to winter use when possible).

Relative Forage Value - Fair forage. R3, 20-20; R2, 10-10.

Miscellaneous - Evergreen,-produces a profusion of attractive flowers.

Ephedra nevadensis - Nevada joint-fir (Mormon tea). Family - Gnetacea.

Distribution - Ranges from Utah, to California, Sonora, Chihuahua and greater portion of southwest ranges.

Elevation - 6000' - 8000'.

Associates - Gramas, Mt. Mahogany, Shadscale, Saltbushes, Junipers, and Creosote bush.

Habitat Requirement - Dry plains and foothills, frequently in gravelly or rocky soils. Favors canyons, arroyos, and dry water courses (good drainage).

Natural Revegetation - Conservatively, if at all, naturally. Is easily reproduced by cuttings.

Season of Use - Used mainly on winter range. Cropped small percent year around. Used as fall-winter browse in Great Basin.

Relative Forage Value - Cropped by cattle, sheep and goats. Palatable for cattle in winter, has been placed as high as 40%. R3, 30-40.

Miscellaneous - Has been held by Indians, in high local repute, as a specific in acute urethritis. Analysis are said to reveal a high percent of tannin in the seed.

Eurotia lanata - Winter fat. Family - Chenopodiaceae.

Distribution - Saskatchewan and Manitoba to western Nebraska, Colorado, Texas to California and Washington.

Elevation - 2000' - 10,000'.

Associates - Saltbushes, semidesert bunchgrasses, rabbitbrush and greasewood.

Habitat Requirements - Grows on dry, sandy or shallow clay loams in open grass-weed parks and on ridges.

Natural Revegetation - Branches from base and reproduces by seeds.

Season of Use - Winter and spring.

Relative Forage Value - High. R3, 50-60; R2, 40-60.

Fallugia paradoxa - Apache Plume. Family - Rosaceae.

Distribution - Western Texas and southwestern Colorado to southern Nevada, southeastern California and south into Mexico.

Elevations - 5000' - 7500'. Sometimes 8500'.

Associates - Pinyon-juniper, ponderosa pine and brush within its range.

Habitat Requirements - Sandy or clay loams, dry rocky ridges, open canyons. Prefers deep moist rich sites.

Natural Revegetation - Seed.

Season of Use - Winter.

Relative Forage Value - Poor to fair (good on some ranges). R3, 50-50.

Miscellaneous - Evergreen, endures close grazing, excellent recuperative powers. Valuable in erosion control.

Grossularia inermis - White Stem Gooseberry. Family - Grossulariaceae.

Distribution - British Columbia east to Montana, south to California and New Mexico.

Elevation - 6000' - 9000'. Higher in south, lower in north.

Associates - Aspen and open coniferous timber.

Habitat Requirements - Parks and meadows, occasionally dry gravelly or rocky sites but does best in rich soil.

Grossularia inermis (continued)

Natural Revegetation - Seeds and sprouts.

Seasons of Use - Probably yearlong if accessible.

Relative Forage Value - Good for all types, low palatability for cattle but used widely. R 3, 10-20; R 2, 10-20.

Miscellaneous - Relatively free from spines, 1-6 ft. high. Alternate host for white pine blister rust.

Grossularia roezli - Sierra Gooseberry. Family - Grossulariaceae.

Distribution - California only.

Elevation - Occurs at all elevations.

Associates - Warm dry sandy soil, throughout the State of California. Typical of woodland chaparral.

Habitat Requirements - Warm dry, sandy soil; can stand heat, does well in good soil.

Natural Revegetation - Seeds and some shoots.

Seasons of Use - Probably yearlong.

Relative Forage Value - Fair for sheep and cattle. R3, 10-20; R2, 10-20.

Grossularia watsoniana - Watson Gooseberry. Family - Grossulariaceae.

Distribution - Cascade Mountains of Washington.

Elevation - Confined to Cascade elevations (lower).

Associates - Cascade coniferous timber and browse of open parks.

Habitat Requirements - Can stand dry conditions, prefers moist and good soil.

Natural Revegetation - Seed and some shoots.

Seasons of Use - Fall use best.

Relative Forage Value - High for all classes. R3, 10-20; R2, 10-20.

Gutierrezia longifolia (sarothrae) - Snakeweed. Family - Compositae.

Distribution - Manitoba to western Nebraska, Kansas and Texas;
southern California and Idaho.

Elevation - 3000' - 7000'.

Associates - Shadscale, black sage, dropseeds, gramas, Indian ricegrass;
big sage, rabbitbrush, mesquite, soapwood, downy choss and
buffalo grass.

Habitat Requirements - Dry, well-drained sandy or gravelly clay loams;
can live on heavy adobe and clay soils. Cannot
grow on alkaline or saline soils. Disturbed soils.

Natural Revegetation - Seed.

Seasons of Use - Winter.

Relative Forage Value - Very seldom used.

Miscellaneous - An indicator of overgrazing. In quantity, poisons sheep
and horses, affecting kidneys.

Odostemon aquifolium - Oregon grape. Family - Berberidaceae.

Distribution - British Columbia to California other species all over
Western range.

Elevation - Sea level to top Cascade Range.

Associates - Most species that are associated with coniferous forest.

Habitat Requirements - Moderately moist rich humus soils, also common
on rocky slopes and canyon bottoms in shade.

Natural Revegetation - Seed.

Seasons of Use - Fall and winter.

Relative Forage Value - Practically worthless for livestock, moderate
for deer and elk.

Miscellaneous - Sharp pointed, tough leaves, berries edible for humans
after frost.

Peraphyllum ramosissimum - Squaw apple. Family - Malaceae.

Distribution - From eastern California to eastern Oregon, western Wyoming, New Mexico and Nevada.

Elevation - 3000' - 9000'.

Associates - Mt. Mahogany, Service Berry, Buckbrush, Pine and Juniper.

Habitat Requirements - Dry foothills and mountain slopes, especially in sandy loam soils.

Natural Revegetation - Seed.

Seasons of Use - Spring - fall.

Relative Forage Value - Much disputed. Colorado poor to fair, sometimes practically worthless.

Miscellaneous - Much branched rigid twigged shrub, 2' - 6' high. Leaves appear with flowers May 10 to June 10. Fruits ripen in July.

Populus tremuloides aurea - Quaking aspen. Family - Salicaceae.

Distribution - Labrador and Newfoundland to New Jersey, Penn. and in Appalachian Mountains, western Kansas to California and Mexico.

Elevation - North - sea level - 3500' and in Rockies 6000'-10,500'.

Associates - Understory of weeds and browse. Bearberry, snowbrush, Mt. alder, etc. Narrowleaf Poplar, Ponderosa Pine and Balsam.

Habitat Requirements - Grows in great variety of soils; best in deep moist, rich, but well-drained soils.

Natural Revegetation - Vegetative reproduction abundant. Vigorously by root shoots. Small seeds reproduced, practically none.

Seasons of Use - More palatable to cattle than sheep during July and August. Equally palatable during Sept. and Oct.

Relative Forage Value - When not beyond reach is very palatable.
R 3, 30-50; R 2, 0-0.

Miscellaneous - Commonly considered a temporary type, but when it becomes established on fire-denuded areas thick stands may dominate for many years.

Prosopis glandulosa - Honey Mesquite. Family - Mimosaceae.

Distribution - Eastern Texas. Southern Kansas to lower California and south into Mexico.

Elevation - 2500' - 5000'.

Associates - Soapwood, black grama.

Habitat Requirements - Dry sandy, gravelly plains.

Natural Revegetation - Very good by seed. Invades grass areas. Birds and animals help to revegetate.

Season of Use - Spring.

Relative Forage Value - Pods very good - green leaves only slightly used. Dry stems - fair in drought. R3, 20-20.

Miscellaneous - Honey Mesquite is a valuable soil binder, hard to kill out.

Prunus demissa - Western chokecherry. Family - Prunaceae.

Distribution - British Columbia to western Montana, Great Basin Region and California.

Elevation - 2000' - 9000'.

Associates - Willows, Alders, Aspen and Dogwood.

Habitat Requirements - Grows in sunny, moist or relatively dry situations. Also grows around springs, seeps and other moist places. Pure bushy stands limited to moist or well drained sites, warm slopes.

Natural Revegetation - Seed.

Seasons of use - Late fall or winter only. Very poisonous to all classes of stock until late fall when they become harmless.

Relative Forage Value - Poor to fair (all classes). Very poisonous to cattle and sheep in spring and continues to be poisonous until late fall.

Miscellaneous - Generally a dangerous poisonous plant, only on over-grazed ranges where practically no other forage is available. Used extensively by deer and elk with no apparent ill affect.

Prunus melanocarpa - Black Chokecherry. Family - Prunaceae.

Distribution - British Columbia to N. Dakota, Kansas, New Mexico and California.

Elevation - 2000' - 9000'

Associates - Willows, Alders, Aspen and Dogwood.

Habitat Requirements - Grows in sunny, moist or relatively dry situations, also grows around springs, seeps, and other moist places. Pure bushy stands limited to moist or well drained sites, warm slopes.

Natural Revegetation - Seed.

Seasons of Use - Late fall or winter only. Very poisonous to all classes of stock until late fall when they become harmless.

Relative Forage Value - Poor to fair (all classes). Very poisonous to cattle and sheep in spring and continues to be poisonous until late fall. R3, 20-40; R2, 10-10.

Miscellaneous - Generally a dangerous poisonous plant only on overgrazed ranges where practically no other forage is available. Used extensively by deer and elk with no apparent ill affect.

Purshia tridentata - Bitterbrush. Family - Rosaceae.

Distribution - Montana to New Mexico, California and British Columbia. In the N.W. not west of Cascade Mountains.

Elevation - 0 - 9000'.

Associates - Sagebrush, mountain mahogany, oakbrush, Ponderosa pine, Pinon, Serviceberry, and wheatgrass or pure.

Habitat Requirements - Well drained, sandy, gravelly or rocky soils on open southerly exposures.

Natural Revegetation - Seed.

Seasons of Use - Yearlong (especially palatable in spring, winter and late fall).

Relative Forage Value - Good to very good. R3, 60-60; R2, 40-50.

Miscellaneous - Longlived, exceptionally drought resistant, thrives under rigorous conditions.

Quercus gambelii - Gambel Oak. Family - Fagaceae.

Distribution - West Texas to Wyoming, Utah, southern Nevada, Arizona and south into Mexico.

Elevation - 6000' - 8000'.

Associates - Chokecherries, Mt. Mahogany, serviceberry, and Ponderosa Pine.

Habitat Requirements - Moderate moisture requirement, sandy, gravelly, or rocky sites.

Natural Revegetation - Acorn nuts.

Seasons of Use - Spring-fall.

Relative Forage Value - Moderate to poor.

Miscellaneous - A straight diet of oak leaves may be poisonous to cattle or sheep early in spring (tannic acid). R3, 25-30; R2, 20-10.

Ribes cereum - Wax current. Family - Grossulariaceae.

Distribution - British Columbia to California, Arizona to Montana.

Elevation - Approximately 2000' to 9000' - often varies.

Associates - Pinon, Juniper, Ponderosa Pine, Lodgepole, Aspen, Sagebrush, Bitterbrush, Serviceberry, Chokecherry.

Habitat Requirements - Dry open slopes and ridges in partial shade.

Natural Revegetation - Seeds.

Season of Use - Summer and fall, winter when accessible.

Relative Forage Value - Poor to fair for all classes but very important because of extent. R3, 10-10; R2, 0-10.

Miscellaneous - Unarmed, much branched, less than five feet high, usually shorter in open stands, widely utilized.

Ribes montigenum - Gooseberry. Family - Grossulariaceae.

Distribution - High mountains of British Columbia to Montana, New Mexico and California.

Elevation - 2000' or lower up to subalpine region.

Associates - Spruce-fir, widely scattered.

Ribes montigenum (continued)

Habitat Requirements - Prefers moist situations up to edge of sub-alpine, meadows and parks.

Natural Revegetation - Seed.

Season of Use - Summer and if available, in fall.

Relative Forage Value - More than average, fair for sheep, less for cattle. R2, 0-10.

Miscellaneous - 1-2 ft. high, straggling, more or less spiny.

Ribes petiolare - Black Currant. Family - Grossulariaceae.

Distribution - British Columbia to Oregon and California, Nevada, Utah, east to Northern Colorado and Montana.

Elevation - 4000' - 8500'.

Associates - Aspen, spruce, willows, alders and coniferous timbers.

Habitat Requirements - Prefers moist sites but will grow in dry, rocky sites.

Natural Revegetation - Seed.

Season of Use - Mostly fall, late summer at higher elevations.

Relative Forage Value - Poor for cattle, fair for sheep, good for game.

Miscellaneous - Widely distributed as scattered individuals or in small patches.

Ribes viscosissimum - Sticky currant. Family - Grossulariaceae.

Distribution - British Columbia to California, east to Northern Colorado, and Montana.

Elevation - 1400' to 5000' up to 9500' in Colorado.

Associates - Ponderosa pine, lodgepole, spruce, fir, aspen, and brush types.

Habitat Requirements - Prefers moist sites but will grow in dry rocky sites.

Natural Revegetation - Seed.

Ribes viscosissimum - (continued)

Season of Use - Spring, summer and fall, summer only in high mountains.

Relative Forage Value - Low or poor, better in Utah, varies with location.

Miscellaneous - Seldom over five feet high, rounded foliage easily accessible.

Rosa fendleri - Fendler Rose. Family - Rosaceae.

Distribution - Montana and South Dakota to Western Texas and Arizona and south in Mexico.

Elevation - 5000' - 8000'.

Associates - Willows, aspen, serviceberry and various oaks.

Habitat Requirements - Open woods, fertile and moist soils.

Natural Revegetation - Seed.

Season of Use - Late summer and fall, occasionally yearlong.

Relative Forage Value - Cattle, poor to fair; sheep good. R3, 10-25; R2, 10-20.

Miscellaneous - Thorny but does not interfere with use.

Rosa gymnocarpa - Bald hip rose. Family - Rosaceae.

Distribution - Vancouver Island and S. British Columbia to Western Montana, Idaho and Central California.

Elevation - 3500' - 7000'.

Associates - Holly grape, salal, ocean spray, ferns.

Habitat Requirements - Shaded woods and brushy slopes, fertile soil.

Natural Revegetation - Seed.

Season of Use - Late summer and fall.

Relative Forage Value - Cattle, fair to fairly good; sheep, good.

Miscellaneous - Most palatable rose in the northwest.

Sambucus caerulea - Blueberry Elder. Family - Caprifoliaceae.

Distribution - British Columbia and Alberta to Arizona and California.

Elevation - On coast, 0 - 8000'; Inland, 5500' - 10,000'.

Associates - Chokecherry, serviceberry, wheatgrasses, and bromes.

Habitat Requirements - Along streams and canyons, on moist flats and slopes in sandy or clayey loam soils.

Natural Revegetation - Seed.

Season of Use - Summer and fall.

Relative Forage Value - Fair in summer for sheep. After frost good for cattle to very good for sheep. R3, 50-50.

Miscellaneous - Not abundant. Much of foliage beyond reach of stock where it attains tree form.

Sambucus melanocarpa - Blackhead Elder. Family - Caprifoliaceae.

Distribution - British Columbia and Alberta to Colorado, New Mexico and California.

Elevation - 5000' - 8000'.

Associates - Mountain brome, wheatgrass, snowberry, chokecherry and serviceberry.

Habitat Requirements - Moist sites, streambanks, shaded areas and gulches where snow lays late. Rich moist loams.

Natural Revegetation - Abundant Seed.

Season of Use - Summer and fall.

Relative Forage Value - Fair in summer. After frost fairly good to good for cattle to very good for sheep. R3, 50-50; R2, 50-70.

Sambucus microbotrys - Bunchberry Elder. Family - Caprifoliaceae.

Distribution - Southwest Montana to South Dakota, New Mexico, Arizona, Nevada, and Northeast California.

Elevation - 8500' - 10,000'.

Associates - Chokecherry, serviceberry, brome and wheatgrasses.

Habitat Requirements - Moist sites, streams and canyons, meadows and parks. Occasionally in open aspen stands.

Natural Revegetation - Abundant seed.

Season of Use - Summer and Fall.

Relative Forage Value - Fair in summer. After frost fairly good to good for cattle to very good for sheep.
R2, 50-70.

Sarcobatus vermiculatus - Greasewood. Family - Chenopodiaceae.

Distribution - Washington to Montana from California to Texas.

Elevation - Low elevations to 6000'.

Associates - Salt bushes, Rabbitbrush, Sagebrush and semi-desert grass.

Habit Requirements - Alkaline soils entirely.

Natural Revegetation - Seed.

Season of Use - Winter.

Relative Forage Value - Fairly high. R3, 20-40; R2, 20-20.

Miscellaneous - Has been known to poison sheep occasionally.

Simmondsia Californica - Coffee Berry. Family - Buxaccac.

Distribution - Arizona, California, lower California.

Elevation - 2500' - 4000'.

Associates - Covillea, Creosote bush, Desert willow, Chilopsis, Acacia.

Habitat Requirements - Low dry, foothills - sandy soil.

Natural Revegetation - Seeds carried by rock squirrels.

Season of Use - Summer-winter.

Relative Forage Value - Good to very good in winter, fair summer forage.
R3, 50-40.

Miscellaneous - Withstands heavy grazing and recovers rapidly.
Nutritious but is more fattening than muscle building.
Free from spines.

Symphoricarpus albus. - Common Snowberry. Family - Caprifoliaceae.

Distribution - Nova Scotia to Alaska and south to California.

Elevation - 1' - 10,000'.

Associates - Mt. snowberry, oaks, aspen, serviceberry.

Habitat Requirements - Dry or moist soils along drainages or in parks.

Natural Revegetation - Seeds, shoots.

Season of Use - Summer and fall.

Relative Forage Value - Poor to fair for cattle, fairly good to good for sheep. R5, 20-50.

Miscellaneous - Saponin is known to occur in leaves but not in fruit. However, occurs in too small amounts in western snowberries to be important physiologically. No cases of sickness known, even when fed forcibly.

Symphoricarpus oreophilus - Mountain snowberry. Family - Caprifoliaceae.

Distribution - Colorado and New Mexico to California, Utah, Idaho and eastern Oregon.

Elevation - 4500' - 5000', North; 5000' - 10,000', South.

Associates - Aspen, Oaks, Spruce-fir, Serviceberry, and Chokecherry and Lupine.

Habitat Requirements - All slopes, hot to moist and fairly dry sites. Usually on sandy or clayey soil. Sometimes on wet, black alluvial bottoms. Seldom in shade.

Natural Revegetation - Excellent seed and underground shoots.

Season of Use - Late summer and fall.

Relative Forage Value - Poor to fair for cattle. Fairly good to good for sheep. R3, 20-50.

Miscellaneous - Somewhat greater palatability in Intermountain and southwest regions than in the North and West.

SECTION IV

GRAZING CAPACITY OF RANGE LANDS

DEPARTMENT OF RANGE AND PASTURE MANAGEMENT
Colorado State College, November 15, 1937

THE SUBJECT OF GRAZING CAPACITY OF RANGE LANDS

The problem of grazing capacity of range lands is a large one because of such varied existing conditions. Practically all types of grazing lands support a large variety of plant species of which only a small percent may be important from a grazing capacity standpoint. If grazing capacity was always uniform over any considerable area, then the problem would not be exceedingly difficult. Variation in grazing capacity is frequent and great because of differences in vegetative personnel, latitude, altitude, slope, exposure, soil and climate.

Grazing capacity means the number of stock of a given class or classes which a range unit will support in good condition for the period of grazing allowed. The rate of stocking should be on a basis that will perpetuate the more desirable range plants.

It is thought advisable to again state the four main classes of vegetation, and a definition of each before methods are discussed.

(1) Grasses (Gramineae or Poaceae) (Perennial and Annual)

Herbs with fibrous roots and nearly always round, jointed stems, (culms) often hollow except at the nodes which are solid, culms may be simple (not branching) a potential branch at every node, if the main culm is cut off as in grazing, one of the latent branches will develop. Leaves 2 ranked and of two parts, - blade extending away; - sheaths, usually open, inclosing the stem; with a fine membrane, the ligule, at the point where the blade leaves the stem.

Definitions: Annual and perennial grasses.

(1) Annuals - germinate seed, grow, mature seed and die in a single season - usually the cycle of growth is about six weeks. Example: cheat-grass (Bromus tectorum). Increases by seed only.

(2) Perennials - individual plants living from two to several years. Accurate records on black grama (Bouteloua eriopoda) in southern New Mexico show individual plants living through a period of thirteen years. Perennial grasses increase by seed and vegetatively.

(a) Revegetation by seed: Grass seeds may be broadly grouped into two classes; (1) soft rather chaffy seeds; examples, smooth brome (Bromus inermis) and blue grama (Bouteloua gracilis) and (2) hard seeds; Indian rice grass (Oryzopsis hymenoides) and sand dropseed (Sporobolus cryptandrus).

The softer, rather chaffy seeds germinate readily - that is in 5 to 15 days, while the hard seeds require scarification and remain in the soil sometimes one to two years before they germinate.

(b) Revegetation by vegetative means:

- (1) Lateral spread by tillering - the growth from the transition region of new shoots which spread, partly under, partly above ground comparatively short distances. Typical of bunch forming grasses.
- (2) Modified seed stalks - a process in which the seed stalk arches over and takes root where its nodes touch the ground. Widespreading. Typical of Black grama (Bouteloua eriopoda).
- (3) Stolons (surface runners) a stem, decumbent, wide-spreading, which propagates the plant above ground by taking root at the nodes. Typical of buffalo grass (Buchloe dactyloides)
- (4) Rhizomes - modified, underground stems, often thickened, which spread the plant laterally. At the nodes are produced shoots which come above ground. The tips are often sharp, and can spread many feet. Typical of sod forming grasses, Western wheatgrass (Agropyron smithii).

(2) Grass-like Plants (Cyperaceae, Sedges) (Perennial)

Stockmen call them the water grasses. Plants that resemble the true grasses superficially but do not belong to that family and as a general rule are inferior in forage value. Herbs; fibrous roots; jointed stems, 3 angled and usually solid; simple or branching; leaves in 3 ranks, sheaths closed, no ligule, blades usually coarse. Niggerwool (dryland sedge), (Carex filifolia) (is also a dry land plant).

(3) Weeds (Forbs and non-grasslike herbs) (Annual, biennial and perennial).

A weed is a broad-leaved herbaceous plant.

Annual - example: Russian thistle (Salsola pestifer)

Biennial - example: Yellow sweet clover (Molilotus officinalis)

Perennial - example: Wild geranium (Geranium caespitosum)

(4) Browse: Twigs and shoots, with their leaves that are cropped by livestock from browse plants, trees and woody vines. Example: Mountain mahogany (Cercocarpus montanus).

Methods of determining grazing capacity.

The following methods are used to determine grazing capacity. The procedure may appear somewhat intricate but by careful study one should be able to work it out satisfactorily.

Donsity concept. The determination of grazing capacity is primarily based upon the density concept. The density methods of studying plant populations have been used in the West by range investigators more extensively than have those of the frequency type. The density methods are

based upon the concept of ground cover. This group embraces a number of systems of plant measurements based on ocular estimates. These estimate methods depend for their accuracy upon the trained judgment of examiners and careful and constant checking of judgment.

The dominant vegetative cover is the governing factor in the type classification of range vegetation. Standardized numerical numbers are established as a simple means of classifying and designating the various types. Naturally, a change in type of vegetation means subtyping which gives more accurate data for determining grazing capacity. Some of the factors that necessitate subtyping within a major type are (1) changes in plant density, (2) plant composition, (3) type of soil, (4) elevation, (5) topography, etc.

Two methods are in common use at the present time to determine the density of the vegetation, (1) Reconnaissance methods and the (2) Square foot density method.

1. Reconnaissance Methods

- (1) Method A. (Quoted from Instructions formulated by Inter-agency Committee, April 24, 1937.)

Density

In estimating density the spread of the vegetation above the ground must be carefully considered. The density of more or less upright weeds should be based on the amount of ground that appears covered when the vegetation is viewed from directly above. In estimating the density of spreading weeds or browse or open clumps of grass this forage should be pressed together or raised at an angle so that all of the normal interstices between the leaves are completely filled without compressing or unduly crowding the vegetation. The forage is then so compacted that it will represent a 10/10 density. All density should be judged on the basis of growth during a normal year. The density of browse should be determined by the portion of ground covered by that part of the browse that is accessible to stock. This may exclude from the estimate the interior of dense clumps. Any oak or other brush that forms an upper story beyond the reach of stock does not enter into the density estimate. Where a double story of available vegetation exists, such as browse over grass, judge the density of each story separately. Both stories are included in the density estimates. Care must be exercised that the density estimate represents a true average for the type as a whole. Especially is this important in composite types which cannot be divided into separate types.

In passing through the type the examiner will mentally calculate and carry with him a moving average of plant density and composition. In large types the examiner should jot down notes on density and composition changes in order to better analyze type averages and aid his mental calculations.

Composition:

Type composition estimates are based on the relative density abundance of each available vegetation species in the type. The examiner should not write up his type until he has seen a fair sample of the total type area. Preferably he should complete his write-up while still in a representative part of the type. Type composition is itemized on Form 764a expressed in terms of percentage. The sum of the percentage ratings for individual species should always total 100%. In determining composition the examiner should rate each species in accordance with his best judgment as to its individual abundance with relation to the total cover.

In the interests of obtaining uniformity between examiners it is generally desirable to estimate composition by rating the species in accordance with their relative abundance in the type, starting with the most abundant species and rating each lesser species in turn. Such a rating scheme results in a definite expression of relative abundance. Afterward the individual initial ratings may all be slightly adjusted to total 100% without destroying the established ratio.

Field Computation

After the composition rating for each individual species has been recorded, that rating is multiplied by the accepted palatability rating for the species, and the sum of all the individual products yields the weighted average palatability of the type. This last figure multiplied by the estimated density yields the forage factor or palatable density of the type. The forage factor is carried onto the camp map for type "jibing" purposes and otherwise used in compilation of the data but should no longer be placed on the final map or used in grazing capacity summaries.

(2) Method B. Modified reconnaissance method.

Density

A closer check is made on the density of the vegetation than by Method A. The examiner goes through a section twice selecting a sample plot at ten chain intervals on two transects. Each sample plot is 100 square feet in area.

Composition:

The total density of each sample plot is ascertained and then the plot is broken down into species giving each a percentage value. The sum of the species percentages should always total 100%.

Vegetative types:

All vegetative types 20 acres or more are located on map sheets. The types are then transferred to a camp map at night so that vegetative types are jibed between sections and other land subdivisions.

Office Computation:

See sample form for procedure in office computation.

2. Square Foot Density Method

(Quoted from Instructions formulated by Inter-agency Committee April 24, 1937)

Definition of Method:

The square foot density method is a system of sampling vegetation by randomized and replicated plots. It differs from the reconnaissance method in the manner of estimating density and of obtaining average species composition and density on plant types of varying acreage. The procedure for computing grazing capacity following the determination of the forage factor is identical for the two methods.

Procedure:

How to lay out a plot: The plot used in this method is a circle 100 square feet in area, with a radius of 5.64 feet (or 5 feet 7.8 inches). Two systems of describing the boundary of this circle have been found to be most convenient:

1. Compass system. --Two stakes connected by a light chain equal to the radius (5.64') of the circle constitute the apparatus. In laying out the plot one stake is struck in the center of the sample plot and the other stake is used as a compass to circumscribe the plot. Care must be exercised to keep both stakes erect and the chain tight and horizontal.

2. Radius rod system. -- The apparatus consists of a stick equal to the radius (5.64') of the circle. By holding one end of the rod at the center of the plot, and using the other end as a marker, the boundary of the circular plot may be scratched in the soil. In marking out the circle, hold the rod horizontal, close to the ground and scratch short segments at intervals to indicate the plot boundary.

Care must be exercised in marking the plot boundary. For example, a 6-inch mistake on the radius of a 100 sq. ft. circle introduces an error of 13.4 sq. feet in the area of the circle. Any method of describing the circle accurately and quickly is acceptable and should be left largely to the discretion of the estimator as influenced by the character of the vegetation to be sampled.

How to estimate density: In the square foot method the density of each species occurring on a particular plot is estimated individually. No attempt is made to estimate the percentage each species comprises of the total plot density.

A square foot of ground completely covered by vegetation when viewed from above is the standard for estimation of density. The vegetation is never viewed obliquely because this tends to increase the estimate by allowing plant height to hide the ground surface. It is essential that the estimator have a clear conception of a square foot area in his mind and that he constantly refresh his memory by means of a wire frame one foot square, divided into quarters, which he should carry at all times.

In estimating weeds or grasses, if the herbage is spreading or prostrate, it should mentally be compacted so that all the normal interstices are completely filled without compressing or unduly crowding the vegetation. Density of upright weeds or grass should be based on the amount of ground that appears covered when the vegetation is viewed from directly above. Density estimates of shrubby species should consist only of the current year's twig growth and the leafage present on the plant; trunks, or heavy branches being excluded. In estimating for different classes of livestock, shrubby material within 30 inches from the ground should be taken as available for sheep and within 60 inches for cattle. Any vegetation unavailable to livestock owing to height or to other factors should be excluded from the density estimate.

Density for each species should be based on the appearance of the plants when they have attained their full normal growth. In other words the plants should mentally be reconstructed to compensate for one or all of the following conditions; (1) for growth still to be attained; (2) for portions already eaten; and (3) for abnormal total forage production.

In considering a double story of vegetation the density of each layer should be estimated.

Using the square foot as a unit of measure with the foregoing principles in mind, mentally amass individual plants of a species into square-foot units of total density and do this progressively until the total number of square foot units of that species has been counted for the plot. As an aid to counting square foot, the unit of estimation may be $1/4$, $1/2$, or 1 square foot depending on the density, abundance and growth character of the species. This procedure should be continued by species.

The number of square feet of 10/10 density recorded for a given species represents the percentage of total ground area covered by that species because a square foot is one percent of the total plot area.

Individuals should check their density concept at least once a day by picking the plants on a plot and placing them within the wire frame or on a square foot area that has been marked out on the ground. Plants should be so placed within the square-foot area that they constitute a 10/10 density without crushing plant parts together. This check preferably should be made by all members of the field party on the same plots to afford uniformity of results and also to evaluate the personal error of estimate. Each new species should be checked when encountered. The accuracy of this method depends to a great extent on the density estimate. Therefore, utmost care is essential in making this simple measurement.

How to record estimates

1. On the form to be used for recording density estimates, list all species occurring in density on the plot, either by name or by standard plant symbol. Species should be listed by the three common vegetative groups: grasses, weeds, and browse.

2. Density of species should be recorded directly in square foot or fractions thereof.

3. Before leaving each plot, make an estimate of total density and check the sum of the species estimates to see that it equals the total density of the plot. This is necessary to avoid the omission of important species.

4. All plots within a particular type or sub-type should be recorded on the same sheet or sheets. No plots in other types should be included. If the survey is by land lines set up a new set of sheets for each section. In any case, whether the survey is by land lines, topographic units or types it is essential to record on each and every sheet (1) the section, township and range or reference to aerial photograph where these are used in lieu of a base map; (2) examiner's name; (3) date; (4) plot numbers; (5) type and sub-type; (6) number of the plot series (transect or type number).

5. Locate each plot of a series or transect within each type by a dot on the field map. In every case show route of travel by progressive plot numbers or directional arrow. Also identify each transect on the map by its number.

Field Application

The square foot method is based on the premise that average values obtained from several definitely defined and impersonally selected small plots is more accurate, uniform, and representative of the type to be sampled than is a general opinion formulated in the estimator's mind as he walks through the type. By varying the procedure in sampling, increasing or decreasing the number of plots, or by a combination of the two, the method is sufficiently flexible to meet all ordinary field conditions.

Six general conditions may be encountered in the field. These are: (1) a mixture of small vegetative types and sub-types with widely different grazing capacities; (2) a mixture of large types; (3) a mixture of small type with similar grazing capacities; (4) one or more large types with high grazing capacity, interspersed with small types of low grazing capacity; (5) a single, large, homogenous type, and (6) a mixture of large types relatively low in grazing capacity, interspersed with small distinct types of high grazing capacity. The procedure in sampling these conditions should be varied to obtain uniformly dependable data most economically.

Three variations in sampling procedure are: (A) sampling within types (B) stripping or gridironing, and (C) a combination of the two whereby the major sample is obtained by the strip or gridiron method but is augmented by additional sampling where needed within specific types. A fourth procedure of sampling, whereby a so-called "typical" area is selected and sampled as being representative of a larger surrounding area, is not recommended because a reliable average is not always obtained and because such data may not be applicable to the development of management plans.

Procedure A should be used under condition 1 described above. It consists of first determining the location and extent of the type; secondly, of an estimation of the approximate acreage and the number of plots necessary to sample the type. The center of the first plot should be determined at random by throwing a stone into the type. The estimator ordinarily should proceed along the longitudinal axis of the type estimating plots at a pre-determined sampling interval until the necessary number of plots has been completed. All of the series should be well within the type boundaries. The minimum number of plots to sample various acreage is as follows:

10 - 20 acres	3 plots
20 - 80 acres	5 plots
80 - 640 acres	10 plots

It is not contended that 3 plots will give an adequate sample of a small type from a statistical viewpoint. However, in any management unit, the same type may occur many times. Therefore, it is believed that with the minimum per-acre set up, a dependable estimate of plant cover may be obtained.

Procedure B should be used under conditions 2, 3, 4, and 5. It consists of a uniform spacing of plots on a line or lines within a section, township or other arbitrarily bounded area. It may also be used within a definite topographic unit if conditions 2, 3, 4, or 5 are present. If the minimum sample is to be used, one line of 10 plots spaced at 3 chain intervals through the middle of each section is preferable. If greater intensity is desired in the survey two parallel lines of 10 plots each one half mile apart may be used. If still greater intensity is desired, 25, 36, etc., equidistant plots within the section necessitating 5, 6, etc., lines through each section should be used. In either the strip or grid system the type lines are indicated when crossed by or seen from the survey line and the estimated plots are segregated both according to the type in which they fall and by the section being surveyed. The estimator should leave his line of plots whenever necessary to close a type boundary or to indicate its extension to the next line of survey.

Procedure C should be used when condition number 6 exists. This procedure is a combination of A and B, and consists of sampling the large low value type in a similar manner and with the minimum requirements stated under procedure B, and digressing from the survey line to sample the small important types as outlined in procedure A.

With the foregoing suggestions as a guide it is left to the discretion of the chief of party to use the three procedures in a manner best suited to meet local needs and conditions. If, for example, rugged topography makes procedure B exceedingly laborious, procedure A may be used.

Supplemental Instructions

1. Reconstruction of vegetation: The density of vegetation should be based on the spread of the plants as they would appear when they have attained their full growth in a normal year in an ungrazed condition.

2. Elimination of unimportant species: Non-poisonous species of zero palatability when not important from a soil-conservation standpoint may be omitted from the density estimate, unless a full plant inventory is desired.

3. Minimum limit of estimation: In general, densities should not be counted that will not make $1/2$ square foot unless in sparse vegetation it seems advisable to reduce the limit of estimation to $1/4$ square foot. If a complete record of plant occurrence is desired, species present on the plot but not abundant enough to reach the lower limit of density should be recorded as a trace (T).

4. If species unimportant to grazing and individually not estimated are present, an estimate of total plant cover may be made if desired for erosion studies.

5. In addition to the forage inventory, the examiner should make field notes by types or topographic units which will enable him to prepare the unit descriptions.

Field Computation:

In the determination of the forage factor, the following order of computation should be observed:

1. Add the species densities for each plot and record the total estimated density in the space provided on the field sheet (764b).

2. Add the densities for each species horizontally across the form for all plots within the type and record the sums in the total density column.

3. Add the total densities of species. This sum should equal the total of the plot densities.

4. Divide each total species density by the number of plots in the type and record the quotients in the average density column.

5. Sum the average densities. This sum should equal the average total density.

6. Multiply the average density of each species by its percentage palatability.

7. Add the products thus obtained to secure the forage factor. This is expressed as forage acres per hundred surface acres and two decimal places should be pointed off to the left to obtain values expressed in terms of one surface acre.

GRAZING CAPACITY COMPUTATIONS (ALL METHODS)

(Quoted from Instructions formulated by Inter-Agency Committee
April 24, 1937)

Forage Acre Factor:

Forage acre factor is determined for each species by multiplying the density of each species by its palatability. The total of all species is the forage acre factor for a plot or type or palatable density of the plot or type. (See footnote at bottom of page 27, U.S.D.A. Bul. 790).

Forage Acre Requirement:

Determination of the forage acre requirement base by means of which the forage acre data are converted to terms of grazing capacity is as important as any phase of the range survey work.

Ordinarily the most satisfactory method of determining this base is to select for forage acre requirement studies those allotments, pastures or ranges that have every appearance of having been properly used for a period of years and that have been surveyed in the course of the season's work. These areas should be as representative of large portions of the range as it is possible to find. Figures for controlled ranges, whenever obtainable, should be used. At the close of the season the chief of party will make utilization and range condition studies of these ranges and will obtain the most accurate and detailed information possible on the rate of stocking and seasonal use that has been obtained on such areas for the past several years. Supplied with this information he is able to determine, as soon as compilation of the current survey data is complete, the number of forage acres per animal unit that have been used in the past, following up this determination with slight adjustments to correlate actual use with previously determined range conditions on the selected areas should yield a satisfactory base from which to determine approximate grazing capacity. Preferably these figures should be based on a slightly below indicated requirement pending actual trial of the recommended stocking. If actual use on the basis of recommended stocking indicates that the forage acre requirement determined is uniformly high or low, it should be adjusted to permit increase or reduced stocking.

When the forage acre requirement proves unsatisfactory under general application, owing to important differences in forage composition or range conditions, there should be no hesitation in making additional studies to determine the appropriate requirement for different localities. There is a distinct danger in applying a predetermined forage acre requirement to a new project or to a new series of types without determining, first, that the two ranges are similar in the main characteristics, and second, that the bases for estimating density, composition, palatability and utilization are directly comparable. In the absence of these requisites a new test to determine the requirement should be made.

The forage acre has erroneously been accepted as a constant. Actually it is a variable. This is evident because of the continual need of applying different forage acre requirements to obtain grazing capacity in different localities or in the same locality with different methods of estimation. Consequently, the forage acre has been misleading to stockmen, to economists who have attempted to capitalize it, and to agencies

who have attempted to correlate grazing capacity on different ranges.

In the future, forage acres will be omitted on all range maps and Graphic plans and grazing capacity in terms of animal months substituted therefor. This will bring all maps and plans to the same basis.

To compute the grazing capacity, multiply the surface acreage of a type by its forage factor, and divide the result by the proper forage acre requirement. The forage acre requirement may be in terms of sheep or cow months, or years. Grazing capacity is, therefore, expressed in sheep or cow months, or years, according to the forage acre requirement used.

Thus, the final maps will always show for each type the following:

Surface acreage

Grazing capacity (in sheep or cow months or years)

Other converting factors or pertinent information may be added if desired.

CLASSIFICATION OF FORAGE TYPES

Type designations

Types will be indicated by the proper type number followed by standard symbols to indicate the dominant species. Types containing a timber overstory will carry the principal timber species symbol after the type numbers. The governing rule should be that the number and symbols will give an accurate picture of the principal species.

Types will be designated according to aspect. For instance, if the type is predominantly a grass type with scattering timber, it will be shown as a 1 type, followed by the timber symbol. The conspicuous or most important species or genus symbol will be shown first, followed by minor species. Ordinarily, unless exceptional conditions prevail not more than three symbols will be shown in a designation. If less than three species are prominent the number of symbols should be reduced accordingly.

Symbols

Symbol lists for trees, shrubs, and herbaceous vegetation should be devised and standardized for regions. Standardization of symbols for all common and widely distributed genera and species should preferably be standardized for the entire range area.

The governing principle will be a three letter symbol; all capitals for the genus symbol and one capital and two lower-case letters for species. The genus symbol should, except for trees, consist of the first three letters of the genus name. In case of conflict the most common genus will carry the second or third letter changed to remove the conflict.

Species symbols will consist of the first letter of the Latin generic name, followed by the first two letters of the specific name. In case of conflicts, the same rule will be applied as for removing conflicts in genus symbols. Where the species determination is unimportant and where the species cannot be readily identified the genus symbol may be used. When there is a difference in forage value or general characteristics between species in the same genus, the species symbol should always be used.

Color Legend:

Standard colors are shown for each type by crayon numbers.

The use of crayons contemplates a medium - light application of crayon, smoothed out through the use of a stomp dipped in gasoline.

Type Descriptions

Type No.	Standard (Mongol Color crayon guides)	<u>Grassland</u>
1. (S)	Short grass Light yellow Mongol - 817	Includes grassland other than meadow and secondary meadow. Perennial grasses predominate and determine the aspect, although weeds and browse may be present.
1. (T)	Tall grass Dark yellow Mongol - 867	Examples of types are: grama-buffalo grass, bunch grass, wheatgrass-sedge, alpine grassland, blue stem.
		<u>Meadow</u>
2.	Cadmium Orange (Mongol 862)	Includes areas where sedges, rushes and moisture-enduring grasses predominate. Two classes of meadows are recognized: wet meadows and dry meadows. Wet meadows are characterized principally by sedges and remain wet or moist throughout the summer. These shall be designated as 2W-Wet Meadow or Marsh. Dry meadows are dominated by grasses rather than sedges and occur as moist meadowlike areas in open timber or intermittent meadows, both of which become moderately dry by midsummer. These shall be designated as 2-D Dry Meadow or Flood Plain.

Perennial forbs (Weeds)
(Not desert weeds)

3. Lake Red
Mongol - 866

Includes all untimbered areas where perennial weeds predominate over other classes of vegetation. There is very little true weed type, as a weed cover is usually more or less temporary in character and is soon replaced by a more permanent type if the disturbing factor is removed. If there is no great predominance of the weeds over the grass or brush vegetation, and if it is possible to judge that the weed predominance is due to some unnatural factor, the weeds should be disregarded in designating the type and the more stable vegetation should be used as an index. The weeds will then be cared for in the sub-type.

Sagebrush

4. Stone Brown
Mongol - 893

This type includes all untimbered lands where sagebrush or shrubby species of similar appearance predominate. The sagebrush lands are usually of different range values and different in season of grazing from the areas which are listed below under browse. Areas dominated by shrubby species of sagebrush, including big sagebrush (*Artemisia tridentata*), shall be classed as sub-types, as for example: Artemisia filifolia, A. cana, and A. tripartita. Other shrubby species such as Chrysothamnus should be designated as subtypes when they become dominant in sagebrush areas.

This and the browse type which follows are sometimes difficult to distinguish from the grass and weed types if aspect rather than the dominant class of forage is used as the distinguishing characteristic. Sagebrush may form only 15 percent of the total vegetation of a type and still its aspect may be that of a sagebrush type.

It may prove desirable, in a given region, to decide on a certain percentage of all the vegetation in the type, say 20 percent, as the minimum proportion of sagebrush that may be present if the area is still to be classified as a 4 type, providing, of course, it does not already have the aspect of some other type. The same will hold true of the browse type.

Browse-Shrub

5. Olive Green
Mongol 888

This type includes all untimbered lands where browse, except sagebrush or its subtypes, gives the main aspect to the type or is the predominant vegetation. Characteristically it occupies the transition zone of the lower mountain slopes, foothill, and plateau areas. Examples of subtypes are mountain mahogany, bitter brush, willows, Oeanothus-Manzanita, California Chaparral, etc.

Conifer

6. Dark Green
Mongol 858

This type includes all range in coniferous timber supporting grasses, weeds, browse, either singly or in combination, except as provided under Type 7 and 9. The forage may vary from a pure stand of pine grass, or some other grass, to a pure stand of weeds or browse. It usually, however, consists of grasses, weeds, and browse, and the proportion of each species varies so widely that it is not thought advisable to attempt a division into types with distinct colors. These variations can best be represented by sub-types.

Waste

7. Blue Green
Mongol 898

This type includes all areas of dense timber and brush which have no value for grazing or have such slight value that they cannot be used economically, owing either to denseness of standing or down timber or sparseness of forage growth. Large areas of very sparse forage, unless within easy reach of a better type, shall be classified as waste because of the impracticability of running stock over so large an area to get such a small amount of feed.

This type also includes other waste areas not strictly in timber or brush and not barren which are so rough or inaccessible as to make their future use improbable.

The sub-type designations generally encountered in this type are as follows: 7T- Waste in Dense Timber; 7D- Waste in Down Timber; 7B - Waste in Brush; 7R - Waste Areas where Rocky Character Prevents Use; and 7 I - Permanently Inaccessible Areas. Principal species of timber should be shown by symbols.

Barron

8. (blank) This type includes all areas on which there is naturally no vegetation, or practically none, including intermittent lake beds, saline flats, active sand dunes, shale, rock slides, lava flows, etc. Areas which have been denuded by overgrazing should not be confused with areas naturally barren, nor should areas containing only annuals for a part of the year be shown under 8, although these may be without vegetation for the remainder of the year.

Pinon-Juniper

9. Light green
Mongol 848 This type includes pinon, juniper, pinon-juniper, and digger pine. The character of the range in this type as regards location, grazing capacity, and management is sufficiently distinct from the conifer type to justify a separate color. The forage may vary from a pure stand of grasses, weeds, or browse to a combination of any two or all. This variation can best be shown by sub-type designations.

Broad Leaf Trees

10. Pink
Mongol 846 This type includes all range in deciduous timber. The combination of grasses, weeds, and browse, and the proportion of individual species, will vary as in other types.
- The principal sub-types which will be encountered are: aspen, cottonwood, oak, birch, alder, ash-cdm, etc., when they occur in tree form.

Creosote

11. Bottle Green
Mongol 855 This type includes areas where creosote bush (*Covillea*) constitutes the predominant vegetation.

Mesquite

12. Yellow Earth
Mongol 853 This type includes areas where various species of the Mesquite (*Prosopis*) give the characteristic aspect or constitute the predominant vegetation.

Saltbush

13. Slate
Mongol 819

This type includes areas where the various salt desert shrubs of the Atriplex family form the predominant vegetation, or give the characteristic aspect. There is sufficient significant difference in the range value and the use of salt bush areas to justify their separation from other desert or semi-desert shrub types.

Greasewood

14. Royal Purple
Mongol 864

This type includes areas where greasewood (Sarcobatus) is the predominant vegetation or gives a characteristic aspect. Characteristically this type occupies valley floors subject to overflow during flood periods or areas underlain with ground-water at shallow depths where the soil is more or less saline. It is sufficiently differentiated from other desert shrubs to justify an exclusive type.

Winterfat

15. Light Tan
Mongol 813

This type includes areas where winterfat (Eurotia) gives a characteristic aspect or constitutes the predominant vegetation. Though commonly associated with other semi-desert shrubs, the occurrence of this plant in Utah and Nevada as a type character is of sufficient extent to justify a separate type.

Desert Shrub

16. Dark Tan
Mongol 863

This is a general type which includes areas where other desert shrubs aside from those separated into individual types, constitute the predominant vegetation or give the characteristic aspect. This type includes several genera which are quite distinctive in type habit such as black brush (Coleogyne), coffee berry (Simmondsia), Catclaw (Acacia, Mimosa), gray molly (Kochia), hopsage (Grayia spinosa), spiny horsebrush (Tetradymia spinescens), and little rabbitbrush (Chrysothamnus stenophyllus) but pure types of each are so limited in extent as to not justify separate type. The plant symbols used will be sufficient to indicate the predominant species present.

Half Shrub

17. Wisteria
 Mongol 844

This type includes areas where half shrubs constitute the dominant vegetation or give the characteristic aspect.

Half shrubs are semi-woody perennials of low stature such as Aplepappus, Gutierrezia, Artemisia frigida, Eriogonum wrightii, etc. They commonly consist of a woody caudex from which herbaceous stems are produced that die back annually. These genera are sufficiently distinctive in habitat and of wide enough extent in certain localities to justify a separate type designation.

Annuals (Weeds or Grasses)

18. Red Terre Cotta
 Mongol 876

This type includes areas in which annual weeds or annual grasses constitute the dominant vegetation. Both transitory stages and semi-permanent conditions should be included in this type as for example: Russian thistle, downy chess (Bromus tectorum) desert weeds. The plant symbols used will be sufficient to indicate the predominant species present.

Abandoned Lands

Abandoned lands should be classified according to aspect. In mapping, the boundaries should be hatched.

RANGE RESOURCE FIELD DATA
Colorado State College
Experiment Station
Department of Range and Pasture Management

SAMPLE

Examiner's Sheet No. 2

Examiner Hiram Drylander

(Reconnaissance - Method B)

Sample Plot -- Vegetative Type Write-ups

County Larimer Date Sept. 22, 1937
Sec. T R (College Pasture 1)
Vegetative Type 1 (Bgr-Bda)
Soil Type Heavy clay
Vegetation in %: Grasses _____ Weeds _____ Browse _____

Plot No.	1	2	3	4	5	6	7	8	9	10	Density	
DENSITY	.12	.13	.09	.08	.07	.08	.08	.07	.08	.10	.90 Total	.09 Average

Species												
Blue grama	39	29	75	58	52	50	32	9	50	40	434	.434
Buffalo grass	30	59	-	-	13	27	26	12	43	48	255	.255
West. Wheatgrass	16	8	21	6	20	15	31	62	-	-	179	.179
Other species omitted for lack of space	15	3	2	34	14	7	11	16	9	11	122	.122
Totals	100	99	98	98	99	99	100	99	99	99	990	.990

Examiner's Sheet No. 2

Examiner Hiram Drylander

Vegetative Type Write-up

County Larimer Date Sept. 22, 1937
Sec T R _____
Vegetative type 1 (Bgr-Bda)
Soil type Heavy clay
Elevation 5000 Degree of slope _____ Exposure _____
Forage Acre Factor for Cattle _____ Sheep _____
VEGETATION Density .09

Plant Species (Symbols)	Composition %	Comp. % X Veg. Den.	X Palat. %	Cattle	Sheep	= F. A. F.	Cattle	Sheep
Blue grama	.434	.039		80		.031		
Buffalo grass	.255	.022		80		.018		
West. Wheatgrass	.179	.016		70		.012		
All others	.122	.013				.002		
Totals	.990	.090				.063		

Forage acre requirement .2 forage acre per cow per month
.2 + .063 = 3.2 surface acres per cow month

Form 764a (back)

Type Comments

Current Forage Utilization: (check one) ~~over~~-proper-~~under~~
 Plant Vigor (check one) poor-fair-good

Range Condition: (check one) poor-fair-good

Relative productiveness of Site (check one) low-av.-high

Watering Places _____

(Kind-Lake, spring, tank, etc.) (distance) (adequacy) (Permanent-Temporary)

Poisonous plants _____

(Kinds)

(Recommendations)

Kind of stock best suited to range: (check one or more) Cattle-horses-sheep-goats.

Proper Grazing Period: (check one or more) Spring-Summer-Fall-Winter-Year Long.

Wildlife _____

(Game, Predators, Rodents - Species and abundance)

Soil Erosion (check one or more)

Soil Texture (To six inches deep)

Sheet Erosion Evident

Check in appropriate blocks

*Gully Erosion

Occasional gullies-shallow

Occasional gullies - deep

Frequent gullies - shallow

Frequent gullies - deep

Light

Medium

Heavy

Check in appropriate blocks				
:	:	Gravelly	: Stony	:
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:

Wind Erosion

Alkali (check if evident)

Deposition Evident

Removal evident

Slope in percent (circle appropriate classification) 0 to 5, 6 to 10, 11 to 20,
 21 to 40, 41 to 60,
 61 to 80, 81 +

*Explanation of Gully Terms: Occasional gullies are gullies more than 100 feet apart. Frequent gullies are gullies less than 100 feet apart. Shallow gullies are those easily crossable by stock. Deep gullies are those deep enough to interfere with stock movement.

Additional Type Comments _____

Note:

The information contained on this sheet is primarily a forage inventory. When and if further data are secured on timber, water, soils, erosion, wild life, etc., by experts along these lines, such information should be further correlated to best serve range management.

Analysis of Inter-Agency Palatability Tables

For Colorado and Wyoming

CLASSIFICATION FOR CATTLE

1. Grasses - 47 genera, 143 species.
2. Grass-like plants - 6 genera, 18 species.
3. Weeds - 100 genera, 291 species.
4. Browse - 19 genera, 47 species.

Good to very good 55-85%	Fairly good 40-50%	Poor to fair 5-35%
-----------------------------	-----------------------	-----------------------

GRASSES

No. Species - 63

Selected genera

1. Blue grasses
2. Wheat grasses
3. Bromes
4. Gramas
5. Buffalo grass
6. Timothy
7. Needle grasses

37

Selected genera

1. Oat grasses
2. Fescues
3. Indian rice grass
4. Tobosa grass
5. Sand dropseed
6. Blue stems

43

Selected genera

1. Annual grasses
2. Rye grass
3. Barley grasses
4. Three awn grasses

GRASS-LIKE PLANTS

Selected Species

No. Species - 8

1. Thread loaf sedge
2. Mountain Meadow
sedge

6

1. Spikerush
2. Wood rush
3. Rush

4

1. Cyperus

WEEDS

Selected species

No. Species - 14

1. Alfilaria
2. Clovers
3. Dandelion
4. Vetch

29

1. Mountain dandelion
2. Wild onion
3. Angelica
4. Cow parsnip
5. Bluebell

248

1. Yarrow
2. Aster
3. Lambs quarter
4. Balsam root
5. Fireweed

BROWSE

Selected species

No. Species - 0

1. Mountain mahogany
2. Winter fat
3. Bitterbrush
4. Elderberry

6

1. Serviceberry
2. Rose
3. Willow
4. Snowberry
5. Oak

41

CLASSIFICATION FOR SHEEP

1. Grasses - 46 genera, 139 species.
2. Grass-like - 6 genera, 16 species.
3. Weeds - 136 genera, 438 species.
4. Browse - 24 genera, 59 species.

Good to very good 55-85%	Fairly good 40-50%	Poor to fair 5-35%
-----------------------------	-----------------------	-----------------------

Selected genera and species

GRASSES

<u>No. Species - 27</u>	<u>42</u>	<u>70</u>
1. Blue and Hairy Grama	1. Wheat grasses	1. Beard grass or Blue stem
2. Buffalo	2. Bromes	2. Three awn grasses
3. Timothy	3. Bent Grass	3. Reed grass
4. Blue grasses	4. Gramas (other)	4. Oat grasses
	5. Tufted Hairgrass	5. Rye grasses
		6. Barley grasses
		7. Panic grasses

GRASS-LIKE PLANTS

<u>No. Species - 4</u>	<u>7</u>	<u>5</u>
1. Thread leaf sedge	1. Mountain meadow sedge	1. Spike rush
	2. Dryland sedge	2. Rush
	3. Wood rush	3. Wire grass

WEEDS

<u>No. Species - 69</u>	<u>72</u>	<u>297</u>
1. Cogswellia	1. American vetch	1. Indian paint brush
2. Alfilaria	2. Yellow sweet clover	2. Chickweed
3. False carrot	3. Balsam root	3. Draba
4. White clover	4. Peavine	4. Erigeron
	5. Dandelion	5. Gentian
	6. Cow parsnip	6. Gilia
		7. Phlox
		8. Groundsel

BROWSE

<u>No. Species - 5</u>	<u>7</u>	<u>47</u>
1. Winter fat	1. Serviceberry	1. Rabbit brush
	2. Sagebrush	2. Oak
	3. Bitterbrush	3. Willow
		4. Wild currant
		5. Wild plum
		6. Snowberry

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SECTION V

SOME IMPORTANT POISONOUS
PLANTS ON WESTERN RANGES

January 8, 1937

DEPARTMENT OF RANGE AND PASTURE MANAGEMENT
COLORADO STATE COLLEGE

POISONOUS PLANT NOTES

The purpose of these notes is to give a brief resume of the outstanding characteristics and affects of the more important poisonous plants from a range management standpoint. These notes are intended for use in the classroom at Colorado State College.

The information has been compiled from U. S. D. A., and state experiment station bulletins. Inasmuch as the various authors disagree on some of the factors considered, the information should not be considered complete and entirely authentic.

The following species were considered:

1. Low larkspurs - *Delphinium menziesii*, *D. bicolor*, *D. andersonii*, *D. virescens* and *D. Nelsonii*.
2. Tall larkspurs - *D. barbeyi*, *D. cucullatum* and *D. trolliifolium*.
3. Death camas - *Zygadenus venenosus*, *Z. gramineus*, *Z. paniculatus*, *Z. elegans* and *Z. nuttallii*.
4. Locos - *Oxytropis lambertii*, *Astragalus mollissimus*, *A. diphysus*, *A. wooloni*, *A. Nothoxys*, *A. thurberi* and *A. bisulcatus*.
5. Lupines - *Lupinus sericeus*, *L. lexiflorus*, and *L. alpestris*.
6. Milkweed - *Asclepias galioides*, *A. mexicana*, *A. pumila*, *A. eriocarpa* and *A. verticillata*.
7. Arrow grass - *Triglochin maritima*
8. Water hemlock - *Cicuta occidentalis*
9. Chokecherry - *Prunus demissa*
10. Pingue - *Hymenoxys floribunda*
11. Western sneezeweed - *Helenium hoopesii*.
12. Sleepy grass - *Stipa robusta*
13. St. Johnswort - *Hypericum perforatum*
14. Oak - *Quercus gambellii* and *Q. havardi*
15. Cocklebur - *Xanthium echinatum*

A bibliography of some of the more important poisonous plant publications is included for those students desirous of obtaining more detailed information.

Low larkspur - Delphinium menziesii, D. bicolor, D. andersonii, D. virescens
D. Nelsonii. Family Ranunculaceae.

Distribution and habitat - open hillsides and parks, 4000-8000 ft.

Classes of stock - Cattle and horses

Season of poisoning - Throughout the life of the plant, but especially in
early spring before grasses appear.

Poisonous parts - All parts are poisonous.

Poisonous principle - Delphinin

Condition under which poisoning occurs - .5% of body weight eating in
few minutes

Symptoms - Staggering, weakness, trembling, falling, constipation,
convulsions at death, bloating; death due to respiratory
paralysis.

Treatment - Hypodermic injection of:

Physostigmine salicylate - 1 grain

Pilocarpine hydrochloride - 2 grains

Strychnine sulphate - $\frac{1}{2}$ grain

Keep animal quiet, turn head uphill.

Control -

1. Delay grazing until palatable forage is developed.
2. Grubbing.
3. Change class of stock to sheep
4. Chlorate sprays

Remarks - Low larkspurs may furnish desirable forage for sheep.

Tall larkspurs - Delphinium barbeyi, D. cucullatum and D. troliiifolium.
Family Ranunculaceae.

Distribution and habitat - D. barbeyi - Colorado and Utah

D. cucullatum - Montana, Wyoming and Idaho

D. troliiifolium - Pacific Coast

All at altitudes of 8000-10,000 ft. in Colorado
and adjoining states.

Classes of stock - Primarily cattle, horses to some extent

Season of poisoning - Late spring and summer until blossoming is complete.

Poisonous parts - All parts.

Poisonous principle - Delphinin

Condition resulting in poisoning - .5% of body weight eating in few minutes

Symptoms - Staggering, falling, trembling, constipation, convulsions, death.

Control -

1. Change class of stock to sheep
2. Grubbing
3. Avoidance
4. Defer grazing until after blossoming

Remedy - Same as for low larkspur

Remarks - Leaves of larkspur are especially poisonous after dew or rain

Death camas - *Zygadenus venenosus* (Meadow), *Z. gramineus* (Grassy), *Z. paniculatus* (foothill), *Z. elegans* (mountain), *Z. nuttallii* (Nuttalls).

Family Liliaceae.

Distribution and habitat - *Z. venenosus* - damp meadows - Pacific Coast
Z. gramineus - low altitudes - Wyoming, Montana and adjoining states.
Z. paniculatus - foothills on gravelly ridges and dry areas throughout the intermountain region
Z. elegans - damp places above 8000 ft.
Z. nuttallii - Kansas, Oklahoma and Texas

Rated on basis of number of losses caused.

1. Grassy, 2. Nuttalls', 3. Meadow, 4. Foothill, 5. Mountain

Classes of stock - Primarily sheep, although cattle may be poisoned, and horses made sick by eating death camas.

Season of poisoning - Poisonous throughout life of plant, but primarily in spring while forage is scarce.

Poisonous parts - All parts are poisonous.

Poisonous principle - Zygadenine

Condition resulting in poisoning - Eating .5% of animal's weight in a day.

Symptoms - Frothing, nausea, weakness, collapse, death.

Treatment - No medicinal remedies although caffeine sodio benzoate has been recommended; also atropine sulfate and bicrotoxin.

Control -

1. Delay grazing until forage is well developed
2. Graze sheep in morning on areas free of death camas
3. Avoid permanent bad grounds
4. Fence off heavily infested areas.

Remarks - Death camas is easily confused with wild onion - Camas has no odor, the bulb of the plant is dark in color.

Locos

Oxytropis lambertii (White loco)

Astragalus mollissimus (Purple loco)

Astragalus diphysus (Blue loco)

Astragalus wootoni (Wooton loco)

Astragalus nothoxys (Sheep loco)

Astragalus thurberi (Thurber loco)

Astragalus bisulcatus (Two-grooved Vetch). Family Leguminosae

Distribution and habitat - White loco - plains, east of the Rockies - most important because of its abundance.
Purple loco - Texas, Colorado, Kansas, New Mexico, Nebraska.
Blue loco - New Mexico, Arizona and Nevada, appearing in January and February.
Wooton loco - Texas, New Mexico, Arizona.
Sheep loco - Arizona and New Mexico
Thurber loco - same as wooton loco
Two-grooved Vetch - Great Plains

Classes of stock - Cattle, horses, sheep and goats.

Season of poisoning - Throughout the season

Poisonous parts - All parts are poisonous

Loco - continued

Poisonous principle - not known

Conditions resulting in poisoning - Feeding on locos for several days or weeks.

Symptoms - In order of appearance

1. Loss of condition
2. Partial paralysis
3. Lack of coordination
4. Craving for loco
5. Peculiar actions
6. May result in death

Treatment -

1. Remove animals from infected area to alfalfa pasture if possible.
2. Treat with Fowler's solution if so desired.

Control -

1. Abundance of forage other than loco
2. Fencing
3. Grubbing
4. Avoidance

Lupines - *Lupinus sericeus* (silky lupine), *L. laxiflorus*, *L. alpestris*.

Family Leguminosae

Distribution and habitat - Lower altitudes along streams, ditches and hillsides throughout western United States.

Classes of stock - Primarily sheep; cattle to a limited extent.

Season of poisoning - Summer - from time green pods appear until plant dries up in fall.

Poisonous parts - Primarily seeds and pods.

Poisonous principle - Lupinin, lupinidin and lupinotoxin.

Conditions resulting in poisoning - Eating 0.5% of animal's weight in a day.

Symptoms -

Sheep - nervousness, depression, butting, death.

Cattle - weakness and trembling.

Treatment - No medicinal treatment

Control -

1. Avoid infested areas during poisonous period.
2. Cut down or mow plants when in bloom.
3. Fence off infested areas.

Remarks - Under range conditions, lupine may be regarded almost exclusively as a sheep poison.

Milkweed -

Asclepias galioides (horsetail milkweed)

A. Mexicana (Mexican milkweed)

A. pumila (Little green milkweed)

A. eriocarpa (Wooly pod milkweed)

A. verticillata (Whorled milkweed)

Of these *A. galioides* is most poisonous, followed by *A. verticillata* and *A. mexicana*.

Milkweed - continued

Family Asclepiadaceae

Distribution and habitat

- A. galileides - Colorado, Utah, Arizona, New Mexico, Texas.
- A. mexicana - Pacific Coast
- A. pumila - Great plains
- A. eriocarpa - California
- A. verticillata - Rocky Mountain region.

Classes of stock - Cattle and sheep

Season of poisoning - Throughout the life of the plant

Poisonous parts - Leaves and stems

Poisonous principle - Glucoside

Conditions resulting in poisoning - 0.1% to 0.2% of the animal's weight in a day.

Symptoms - Dullness, weakness, staggering, spasms.

Treatment - No specific antidote.

Control -

1. Avoidance
2. Grubbing
3. Chlorates

Remarks - All species are unpalatable and are eaten only when forage is scarce.

Arrow Grass - Triglochin maritima and T. palustris. Family Juncaginaceae.

Distribution and habitat - Salt and alkaline marshes and wet places throughout the United States.

Classes of stock - Cattle and sheep.

Season of poisoning - Plant appears in May and is poisonous throughout its period of active growth.

Poisonous parts - Leaves and stems

Poisonous principle - Prussic acid

Conditions under which poisoning occurs - Eating 1% of animal's weight in a few minutes.

Symptoms - Labored respiration, spasms, coma, death due to respiratory failure.

Treatment - Poison acts rapidly and little reliance can be placed on remedies. Hydrogen peroxide, potassium permanganate, cobalt nitrate, and glucose have been used.

Control - Avoidance.

Remarks - There is a difference of opinion as to whether or not dried arrow grass in cured hay is poisonous, if so the toxic effect is relatively weak.

Water Hemlock -- *Cicuta occidentalis*. Family Umbelliferae

Distribution and habitat -- Throughout North America -- restricted to moist localities, stream, banks, ditches, swamps, etc., elevations of 3000-8000 ft. in western U.S.

Classes of stock -- All higher animals, including man.

Season of poisoning -- Primarily in spring when roots are easily pulled up.

Poisonous parts -- All parts are poisonous, roots most toxic.

Poisonous principle -- Cicutoxin

Conditions under which poisoning occurs -- Eating .2% animal's weight in a day.

Symptoms -- Convulsions, staggering, dilated pupils, sudden death.

Treatment -- No remedial measures

Control -- Grubbing, fencing

Remarks -- European hemlock, *Conium maculatum*, has been introduced into the Holy Cross National Forest of Colorado.

Chokecherry -- *Prunus demissa* (or *melanocarpus*) Family Drupaceae

Distribution and habitat -- Throughout the western range especially along streams and in bottoms.

Classes of stock -- Sheep and cattle

Season of poisoning -- Throughout the season but especially when driving to summer range

Poisonous parts -- Leaves

Poisonous principle -- Prussic acid

Conditions resulting in poisoning -- Eating 1% of the animal's weight in a few minutes.

Symptoms -- Spasms, labored respiration, sudden death.

Treatment -- No practical treatment

Control -- Most losses result along driveways when animals graze heavily on chokecherry, therefore: 1. avoid chokecherry infested driveways
2. feed animals well before driving.

Remarks -- Chokecherry are browsed with injury when other forage is consumed at the same time.

Pingue or Colorado Rubber Plant -- *Hymenoxys floribunda*. Family Compositae

Distribution and habitat -- New Mexico, Colorado and Utah on gravelly hills and flats 4000-10,000 ft.

Class of stock -- Sheep

Season of poisoning -- Spring and late fall when palatable forage is scarce.

Poisonous parts -- All above ground parts.

Poisonous principle -- Not definitely known; may be due to impaction.

Conditions resulting in poisoning -- Eating small quantities daily for several days.

Symptoms -- Vomiting, weakness.

Treatment -- Remove mildly infected animals from pingue infested areas.

Control --

1. Delay grazing until forage is well developed
2. Avoid overgrazing and forage depletion.
3. Digging or grubbing.

Remarks -- Under proper range management conditions there is no danger of pingue poisoning.

Western Sneezeweed - *Helenium hoopesii*. Family Compositae

Distribution and habitat - Heavily grazed areas at 7000-10,500 ft. elevations in Wyoming, New Mexico, Utah, Nevada and California.

Classes of stock - Primarily sheep, although cattle may be affected.

Season of poisoning - Throughout the active life of the plant.

Poisonous parts - All parts are poisonous.

Poisonous principle - Dugalin

Conditions resulting in poisoning - 2 lbs. for 20 days necessary to produce symptoms.

Symptoms - Depression, coughing, spewing, weakness, vomiting.

Treatment - No medicinal remedy known.

Control - Proper range management preventing range depleting, inasmuch as the plant is most common on overgrazed sheep ranges; if heavily infested areas are utilized, sheep must be herded away from congested patches of the plant.

Remarks - This plant is most destructive on Utah sheep ranges where it caused the so called "spewing sickness."

Sleepy Grass - *Stipa robusta*. Family Gramineae

Distribution and habitat - Dry plains, hills and open woods, Colorado, New Mexico, Texas and Arizona.

Classes of Stock - Horses

Season of poisoning - Throughout the life of the plant.

Poisonous parts - All above ground parts.

Poisonous principle - Thought to have a narcotic effect on horses.

Conditions resulting in poisoning - One full meal of the grass has produced symptoms of poisoning.

Symptoms - Stupor, dejection, drooping of head; no cases of death are known, the resulting illness being temporary.

Treatment - No definite remedy known.

Control - As this grass comes in under overgrazed conditions, proper management will reduce its abundance.

Remarks - Horses and cattle will not graze sleepy grass except under stress of hunger. Considerable quantities of the grass must be grazed at one time to produce the narcotic effect. Cases of poisoning are localized in occurrence.

St. Johnswort - *Hypericum perforatum*. Family Hypericaceae

Distribution and habitat - Fields, waste places and hills across northern half of the United States and the Pacific Coast (introduced from Europe)

Classes of stock - Cattle and sheep, affecting primarily those animals having white areas on the body.

Season of poisoning - Presumably throughout the year.

Poisonous parts - Leaves

Poisonous principle - Not definitely known.

Conditions resulting in poisoning - Feeding on the plant and being in the bright sunlight; considerable quantities must be consumed.

Symptoms - High temperature and pulse, rapid respiration; sore scabby areas on white skin, death rarely results.

Treatment - No definite medicinal remedy.

St. Johnswort - continued

Control - No practical control of the plant on the range is known; it is a possible source of forage on the Pacific Coast, inasmuch as relatively large amounts can be eaten without producing toxic effects.

Remarks - Definite information as to the importance and danger of St. Johnswort as a poisonous plant is not available.

Oak - *Quercus gambellii* and *Q. havardi*. Family Fagaceae

Distribution and habitat - *Q. gambellii* - Gambel Oak - foothills of Colorado, Utah, and New Mexico.

Q. havardi - Shinnery Oak - plains of eastern New Mexico and Western Texas.

Classes of stock - Cattle

Season of poisoning - Primarily in spring

Poisonous parts - Buds and young leaves

Poisonous principle - Not known

Conditions resulting in poisoning - Heavy grazing of tender buds and leaves

Symptoms - Constipation, bloody feces, emaciation, surface swellings; death uncommon.

Treatment - None definitely known.

Control - Delay grazing until forage is fully developed.

Remarks - Oak can well be utilized as forage if other species are eaten at the same time; only an exclusive diet of oak will cause sickness.

Cocklebur - *Xanthium echinatum* and related spp. Family Compositae.

Distribution and habitat - Low, wet and waste places throughout the U.S.

Classes of stock - Primarily pigs and cattle, sheep to a limited extent.

Season of poisoning - Spring when the first leaves appear.

Poisonous parts - First leaves of seedlings.

Poisonous principle - Glucoside

Conditions under which poisoning occurs - Eating .75% of animal's weight in a few minutes.

Symptoms - Prostration, inflamed stomach, labored respiration.

Treatment - No specific antidote; milk, fat, or oil may partially alleviate condition.

Control - Mow before seed is formed.

Remarks - There is no evidence of poisoning from mature plants or burs.

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