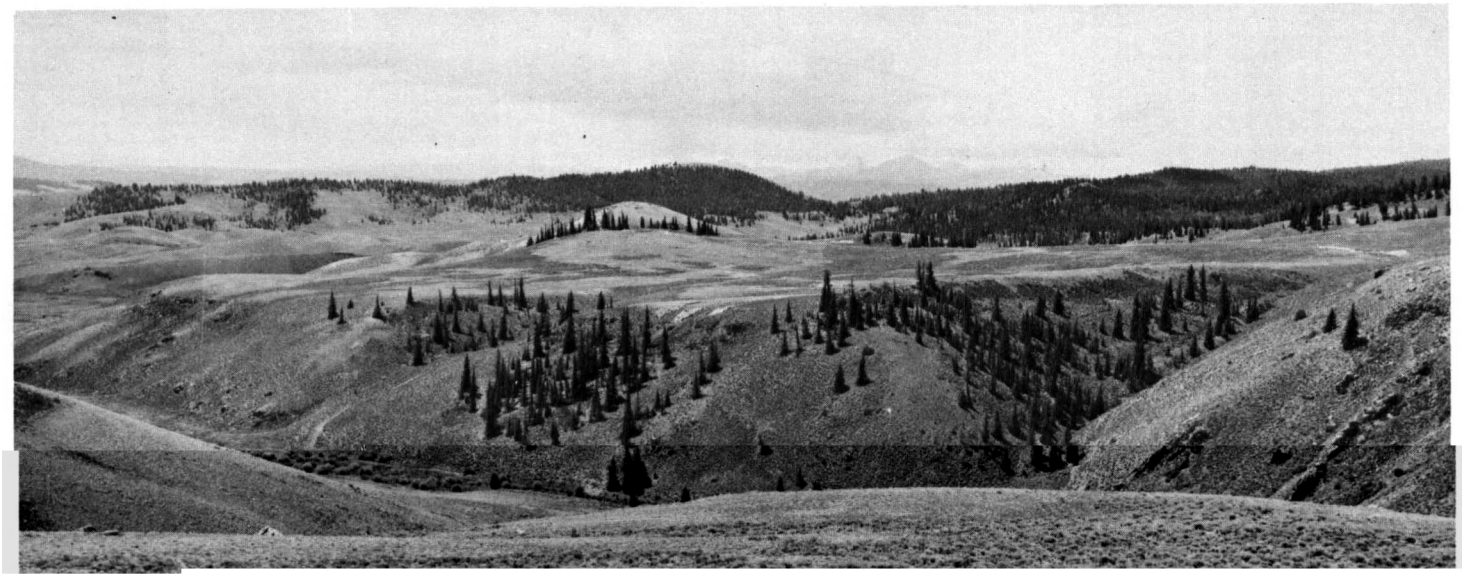
SOIL SURVEY OF

Gunnison Area, Colorado

Parts of Gunnison, Hinsdale, and Saguache Counties



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Colorado Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1958–64. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the Area in 1964. This survey was made cooperatively by the Soil Conservation Service and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the Gunnison Soil Conservation District.

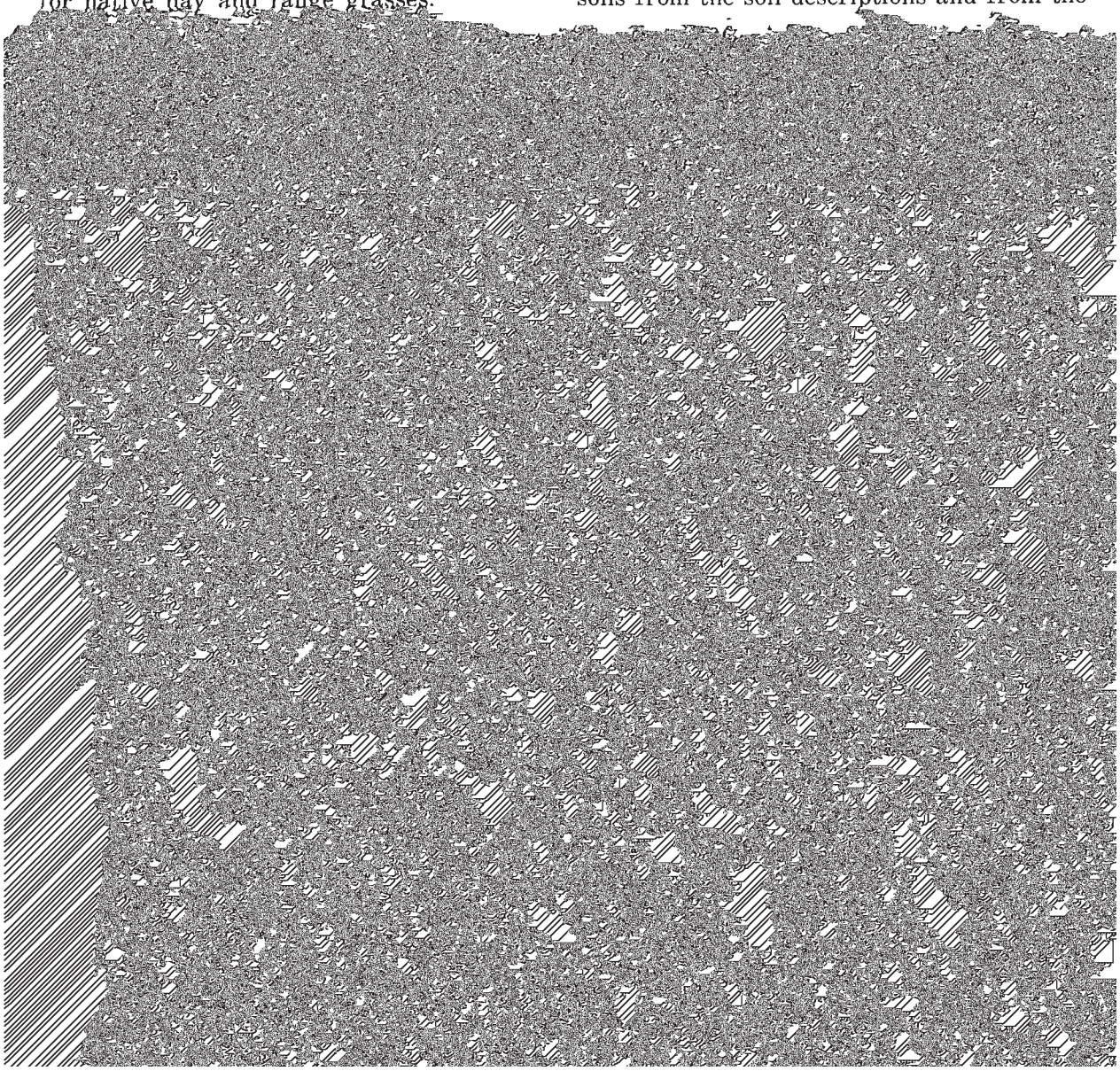
Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing ranches and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for native hay and range grasses.

can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the



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SOIL SURVEY OF THE GUNNISON AREA, COLORADO

PARTS OF GUNNISON, HINSDALE, AND SAGUACHE COUNTIES

BY WILLIAM R. HUNTER AND CLAYTON F. SPEARS, SOIL CONSERVATION SERVICE

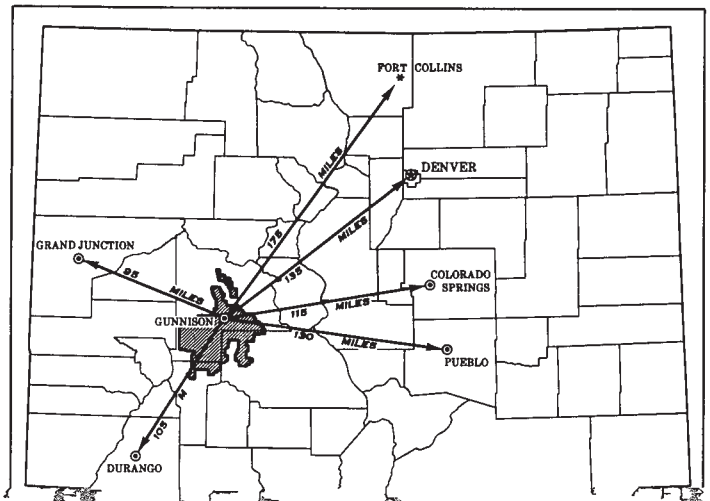
FIELDWORK BY WILLIAM R. HUNTER, CLAYTON F. SPEARS, EVAN V. KLEVEN, RODNEY E. PREATOR, AND DONALD E. BOYER, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE COLORADO AGRICULTURAL EXPERIMENT STATION

THE GUNNISON AREA is in the west-central part of Colorado, just west of the Continental Divide (fig. 1). Most of the survey area is in the southwestern part of Gunnison County. Part of it extends into Hinsdale and Saguache Counties. The total area is 803,000 acres, or 1,256 square miles. It is about 42 miles wide from east to west, and about 30 miles long from north to south. Gunnison is the county seat of Gunnison County.

Topographic differences and the resulting wide extremes of climate are typical both locally and throughout the survey area. Gunnison, for example, has an average frost-free season of about 71 days and about 11 inches of precipitation. Crested Butte has an average frost-free season of about 51 days and about 30 inches of precipitation. Frost, however, can occur at either location at any time during the year.

The Gunnison Area is drained by the Gunnison River and its tributaries. Elevations range from 7,100 feet at the western edge, where the Gunnison River leaves the survey area, to 12,700 feet on the Cannibal Plateau in the extreme southern part. Nearly level flood plains, low terraces, and fans are along major streams and side drainageways. Interstream areas consist of moderately rolling to steeply rolling uplands dissected by long narrow ridges, mesas, and benches that slope toward the main valley of the Gunnison River.



Low rainfall, short frost-free periods, and low winter temperatures limit the survey area mostly to the production of native hay, range grasses, and woodland products. Irrigation is needed for hay and pasture grasses. About 40,000 acres in the Gunnison Area is irrigated.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Gunnison Area, where they are located, and how they can be used. The soil scientists went into the Area knowing they likely would find many soils they had already seen, and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are

and Parlin, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

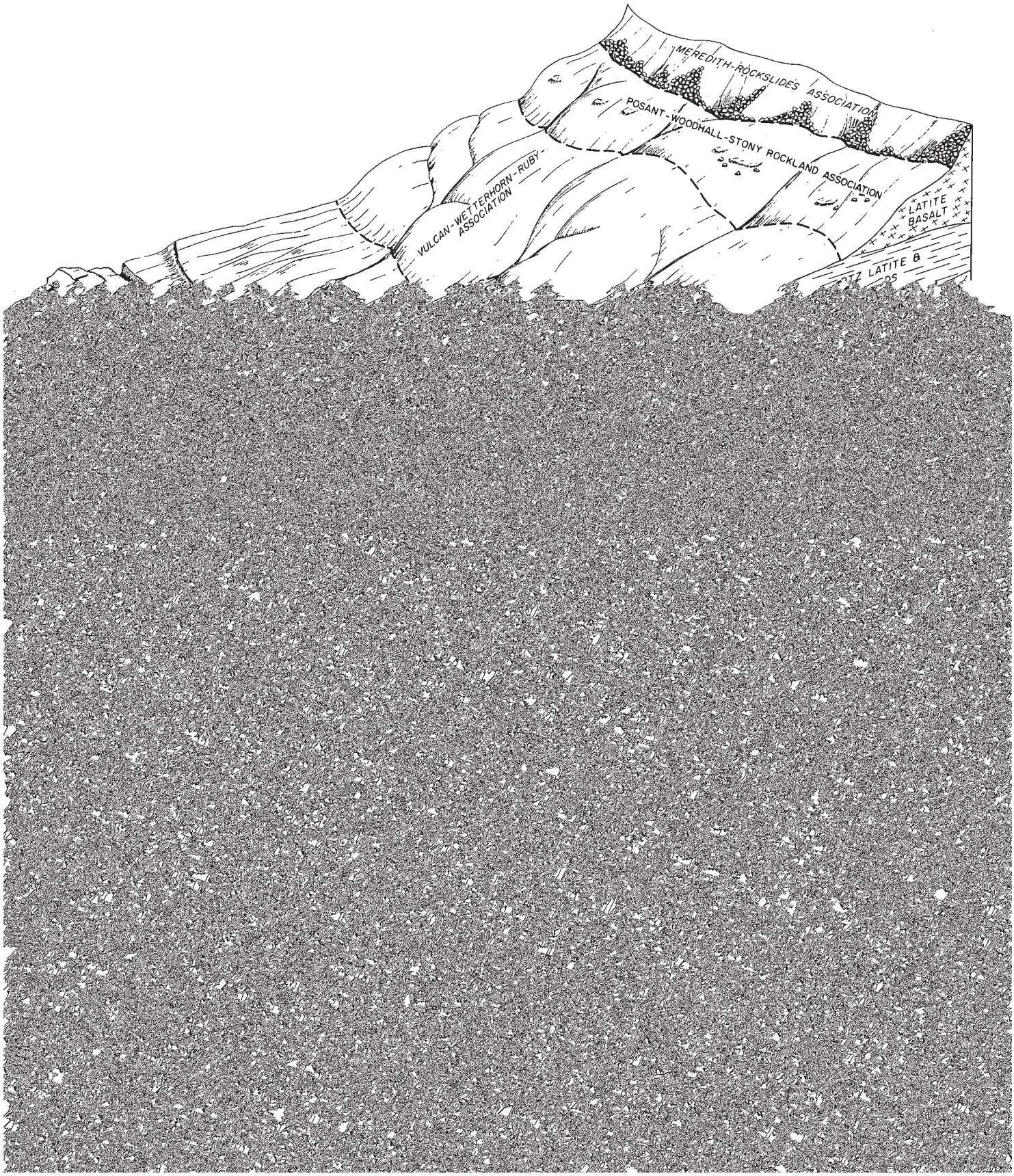
Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Irim loam, 0 to 1 percent slopes, is one of two phases within the Irim series.

After a guide for classifying and naming the soils

on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and range, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation


MEREDITH-ROCKSLIDES ASSOCIATION
POSANT-WOODHALL-STONY ROCKLAND ASSOCIATION
VULCAN-WETTERHORN-RUBY ASSOCIATION
LATITE BASALT

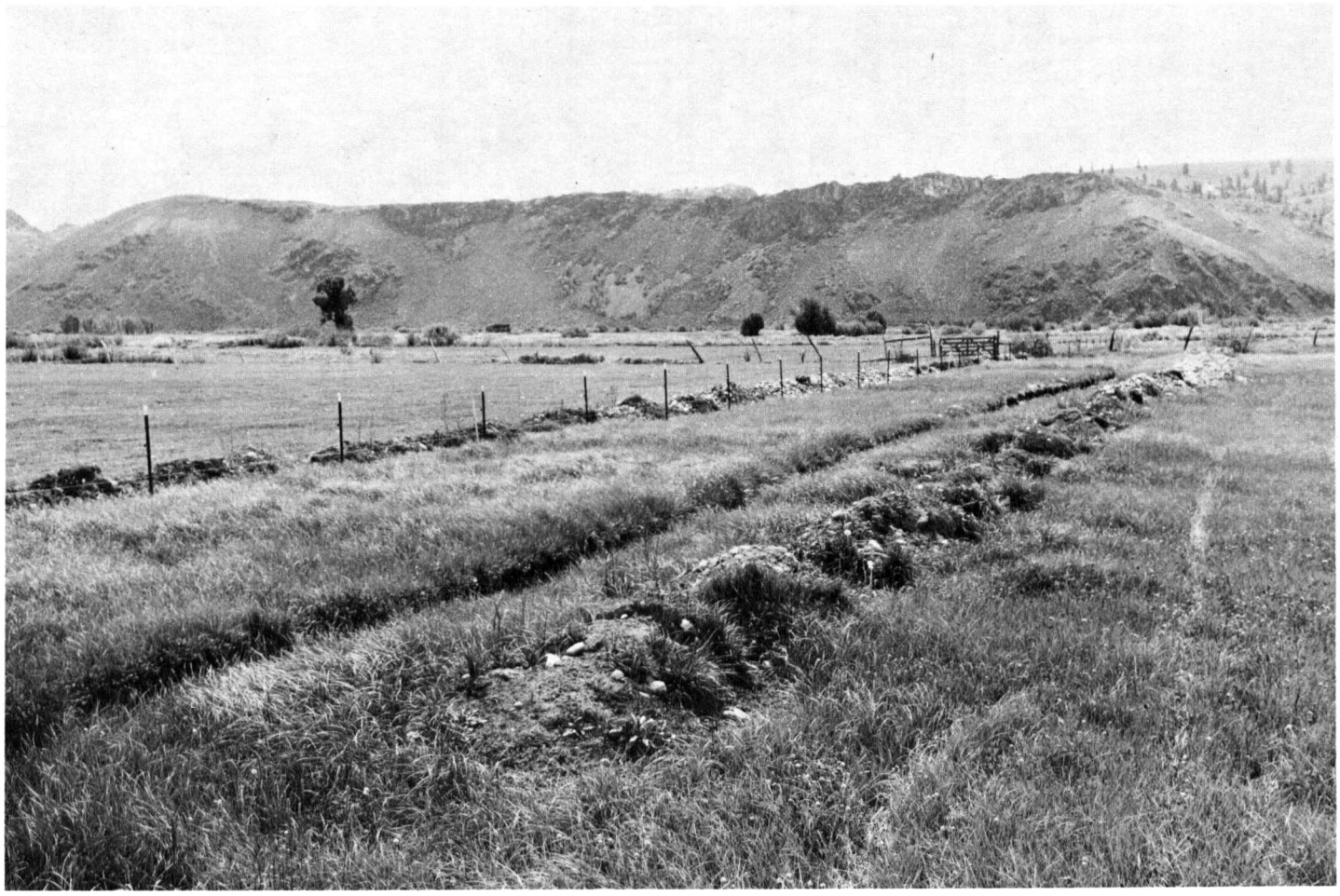


Figure 3.—**Meadow hay on poorly drained Gas Creek and Irim soils on flood plains.**

45° F., and the frost-free season is less than 75 days.

This association makes up about 45 percent of the survey area. It is about 30 percent Parlin soils, 20 percent Lucky soils, 10 percent Hopkins soils, 30 percent about equal parts Cheadle, Corpening, Duffson, Kezar, Redcloud, and Spring Creek soils and Stony rock land, and 10 percent less extensive soils and miscellaneous land types.

Parlin soils are deep and well drained. Their surface layer is channery loam. The subsoil is channery clay loam that grades to calcareous very stony loam at a depth of about 30 inches.

Lucky soils are moderately deep and well drained. Their surface layer is gravelly sandy loam. The subsoil is gravelly sandy clay loam that is underlain by gneiss or schist bedrock at a depth of about 28 inches.

Hopkins soils are deep and well drained. Their surface layer is channery loam. The underlying material is channery loam that grades to overlapping rhyolite flagstone.

Nearly all of this association is in range vegetation and is used for livestock and wildlife. Parlin and Lucky soils, on northern and eastern exposures, produce good forage. The dominant grasses are Arizona fescue, wheatgrass, mountain muhly, Idaho fescue, and native bluegrass. Big sagebrush is the dominant shrub. Hopkins soils are on dry southern and western exposures. The dominant vegetation in most areas is fringed sage, slimstem muhly, phlox, and bluegrass.

This association provides good habitat for mule deer, elk, cottontail rabbits, jackrabbits, and snowshoe hare, and for such upland birds as mourning dove, sage grouse, blue grouse, sharp-tailed grouse, and band-tailed pigeon.

3. Vulcan-Wetterhorn-Ruby Association

Deep and moderately deep, moderately sloping to steep, well-drained gravelly sandy loams and stony loams on mountains, ridges, and mesas

This association is on uplands, mostly in the southern part of the survey area. Small areas are in the extreme northern part. The soils formed in material that was derived from fine-grained igneous rock. The vegetation is mainly Engelmann spruce on Vulcan and Wetterhorn soils and cool-season grasses on Ruby soils. Elevations range from 8,500 to 11,000 feet. The average annual precipitation is about 20 to 25 inches. The average annual soil temperature at a depth of 20 inches is 38° F. to 46° F. Frost can occur during any month.

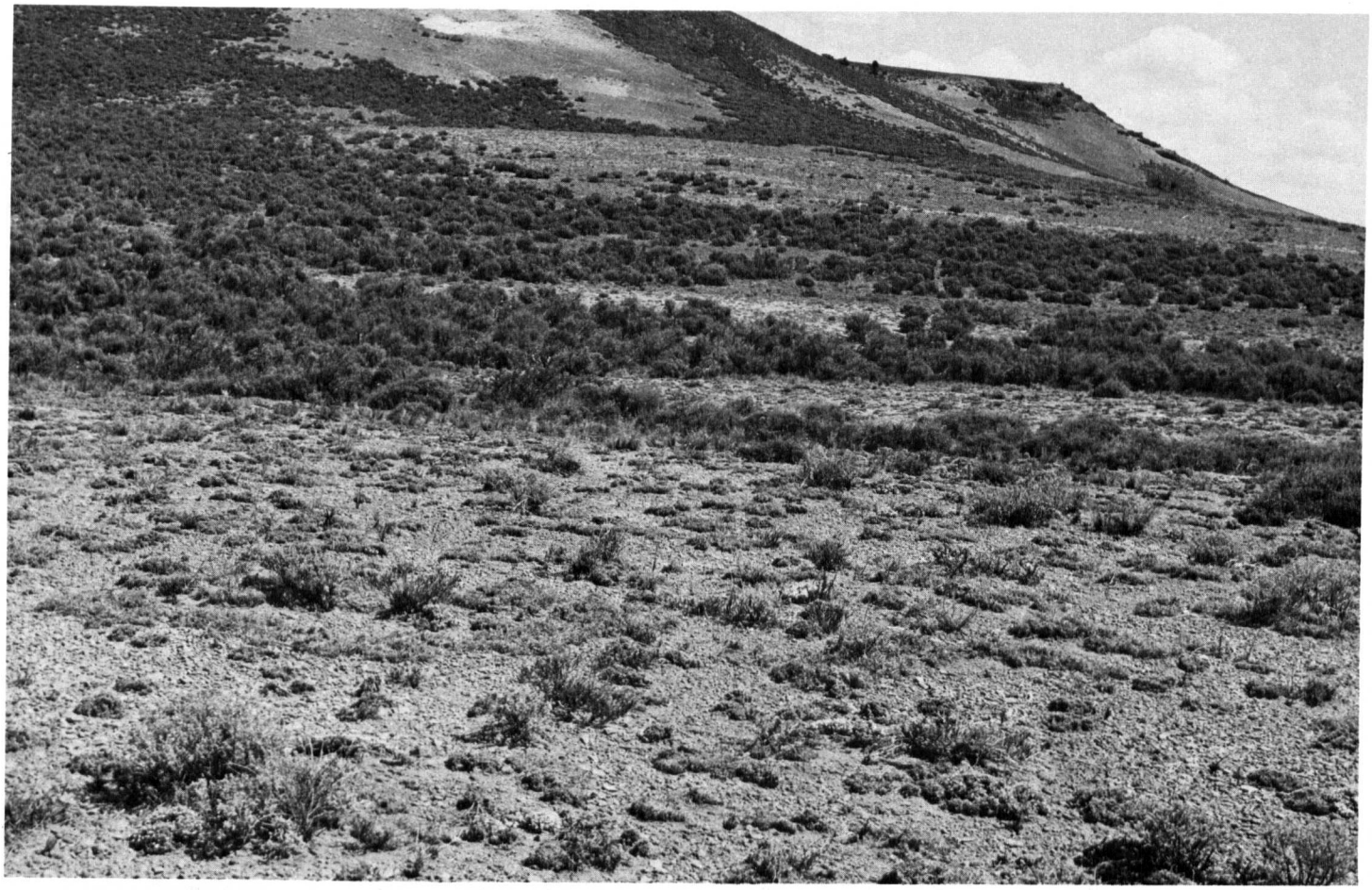


***Figure 4.*—Sparse cover of fringed sage and slimstem muhly on Hopkins soils in foreground. Dense cover of big sagebrush and grasses on Parlin soils in background.**

This association makes up about 24 percent of the survey area. It is about 30 percent Vulcan soils, 15 percent Wetterhorn soils, 10 percent Ruby soils, 35 percent about equal parts Nutras, Bead, Cebolia, Cochetopa, Sunshine, Uinta, Mord, and Powderhorn soils and Stony rock land, and 10 percent less extensive soils and miscellaneous land types.

Vulcan soils are deep and well drained. They have

lumbia needlegrass, bluegrass, and big sagebrush. Logging is common on Vulcan and Wetterhorn soils. The trees are Engelmann spruce, Douglas-fir, and aspen. Most of the area is covered with deep snow all winter and until late in spring. Snowmelt, which is a source of water for springs and streams, is slower on northern exposures and in timbered areas.

This association provides good habitat for mule d

annual soil temperature at a depth of 20 inches is 42° to 44° F. Frost can occur during any month.

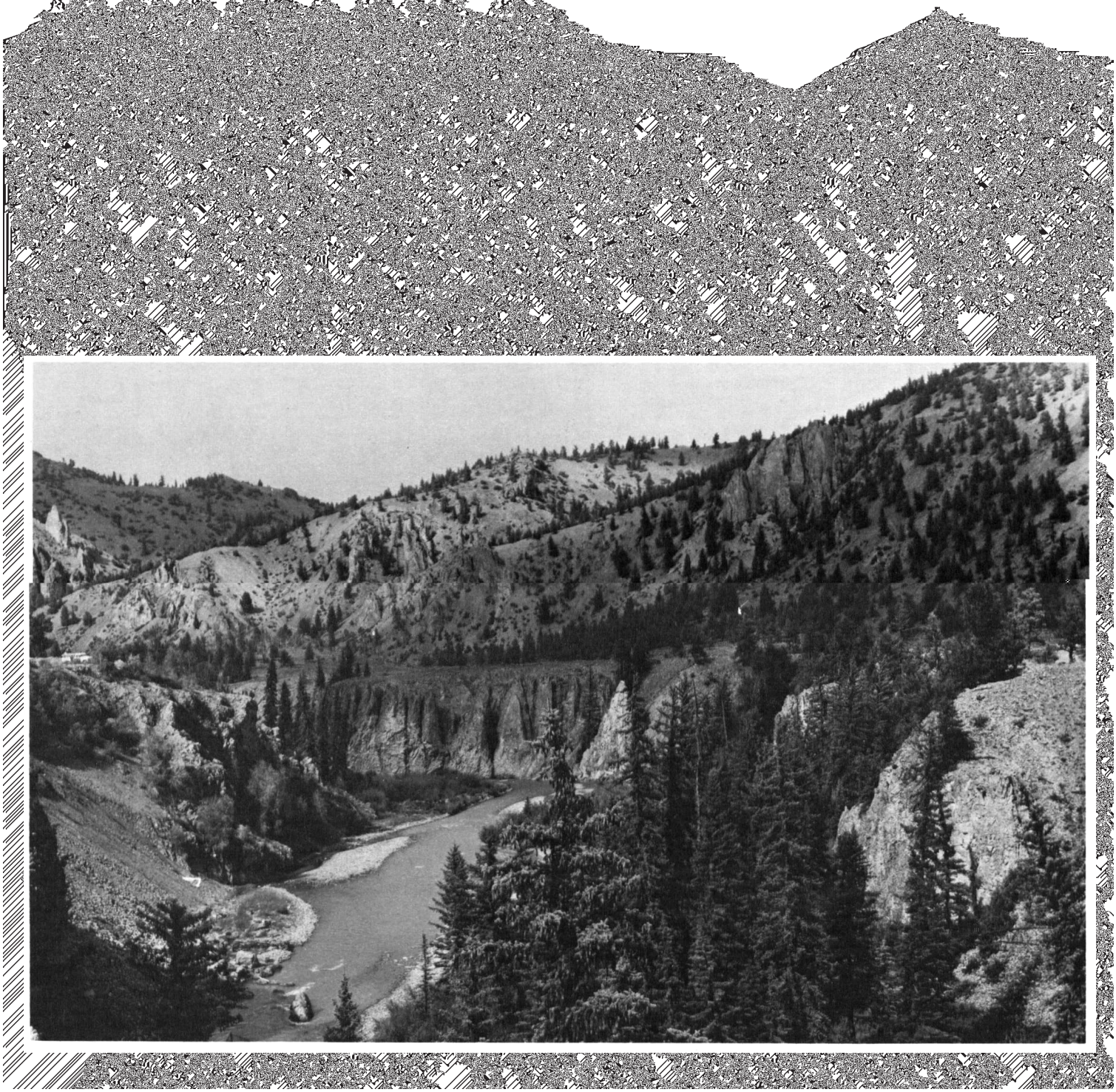
This association makes up 9 percent of the survey area. It is 30 percent Posant soils, 25 percent Woodhall soils, 20 percent Stony rock land, 20 percent about equal parts Wetterhorn, Nutras, Ruby, and Woosley soils, and 5 percent less extensive soils and miscellaneous land types. Rock outcrop is common in areas of Posant and Woodhall soils.

Posant soils are shallow and well drained. Their

snowshoe hare, mourning dove, sharp-tailed grouse, blue grouse, and band-tailed pigeon. Deer and elk often graze the sunny slopes during the winter. Elk, however, utilize the area mainly for cover.

5. Shule-Youman-Passar Association

Moderately deep and deep, strongly sloping to steep, well-drained loams on alluvial fans, hills, ridges and mountains



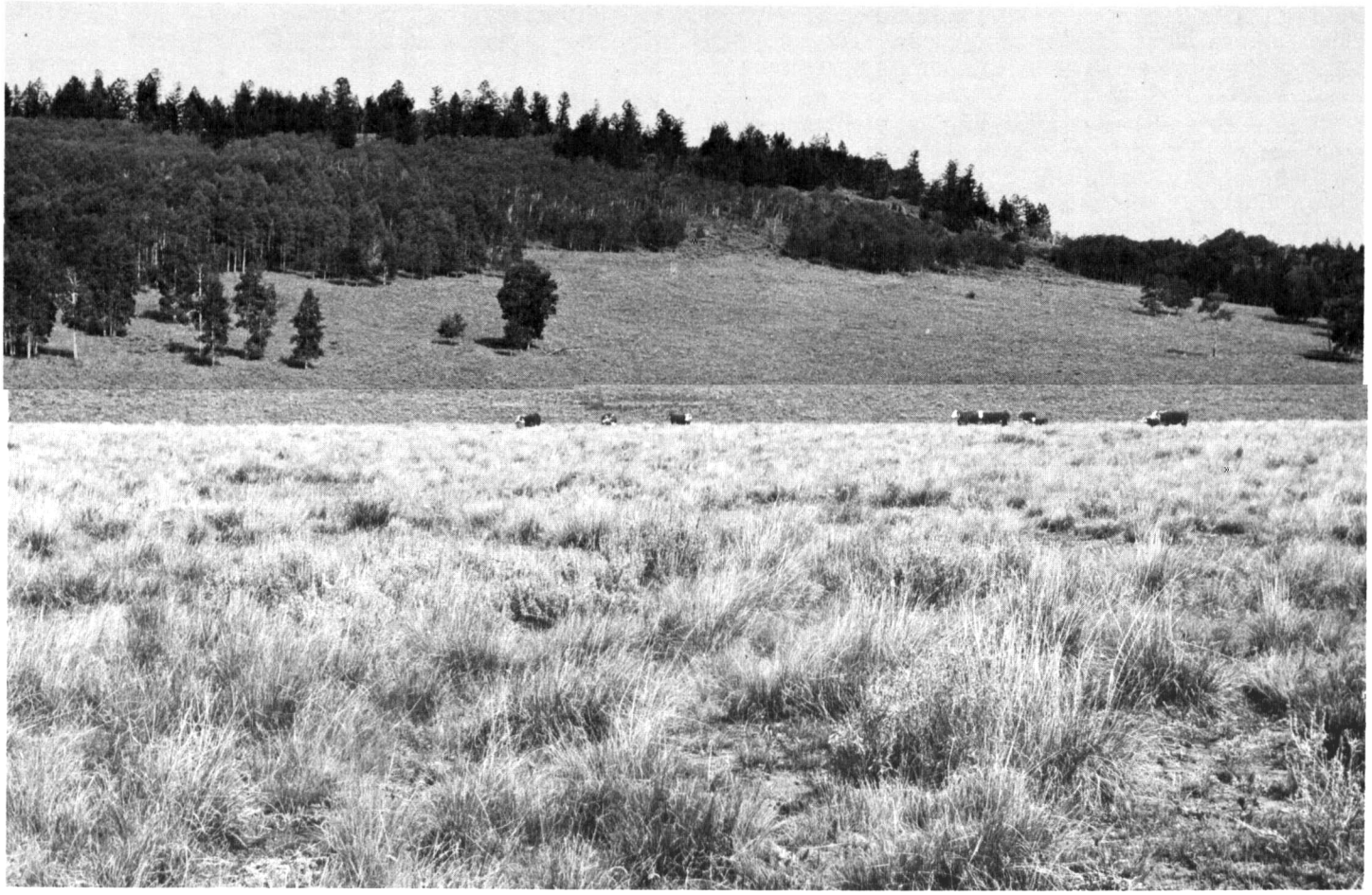


***Figure 6.*—Youman and Passar soils in foreground provide good summer grazing for livestock. Trees in background are on Shule soils.**

cent Youman soils, 20 percent Passar soils, 15 percent Kubler and Sapinero soils, and 10 percent Stony rock land.

Shule soils are moderately deep and well drained. They have a mat of needles, leaves, and twigs on the surface. The mineral surface layer is loam. The subsoil is clay loam that is underlain by rhyolite at a depth of about 34 inches.

Youman soils are deep and well drained. Their surface layer is loam. The subsoil is heavy clay loam, and the substratum is heavy clay loam.

Passar soils are deep and well drained. Their surface layer is loam. The subsoil is extremely stony clay. The substratum is very stony clay loam.

Most of this association is in native vegetation and is used for timber, grazing, recreation, and wildlife. Forage production is high on Youman and Passar soils.

This association provides good habitat for mule deer, elk, black bear, mountain lion, snowshoe hare, mourning dove, sage grouse, sharp-tailed grouse, and blue grouse. Wild turkey can find good cover for roosting and concealment. Deer and elk inhabit the areas throughout the summer.

6. Meredith-Rockslides Association

Deep, stony, well-drained, strongly sloping to very steep soils and rockslides on mountain and alpine rimland

This association is in the extreme south-central part of the survey area. The landscape is one of long uniform slopes, ridges, and rimlands above timberline. The soils formed in stony colluvium that was derived from latite-basalt. The vegetation is alpine grasses, shrubs, and forbs. Elevations range from 11,000 to 12,600 feet

mat of partly decomposed plant material on the surface. The surface layer is very stony loam. The subsoil is very stony silt loam. The substratum is very stony silt loam several feet thick.

Rockslides consists of loose, angular stone fragments that range in size from gravel to boulders many feet in diameter. It is commonly on very steep upland slopes below Rock outcrop and rimland.

This association is used mostly for grazing sheep. The grazing season is short, commonly no longer than 2 months. The native vegetation is low-growing sedges, alpine bluegrass, moss campion, silver cinquefoil, and alpine willow. Rockslides provides water for lower areas. Winter snow accumulates in crevices between the stones and is slower to melt during spring thaw. Slower melting allows a more even distribution of water to springs and streams.

This association has good potential as habitat for elk, black bear, mountain sheep, ptarmigan, and snowshoe hare. It has good potential as cover for deer and mourning dove, but only fair potential for food.

Descriptions of the Soils

This section describes the soil series and mapping units in the Gunnison Area. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make [illegible] the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*4*).[1]

Alluvial Land

Alluvial land (Ad) is in narrow, winding valleys and on small fans and mountain toe slopes. It consists of an accumulation of valley-fill sediment that was derived from many kinds of rocks and upland soils. Some sediment has been carried for only short distances and has been sorted only slightly. Other sediment has been carried for considerable distances and has been well sorted and stratified. This land is subject to flooding and deposition of new sediment. Slopes are dominantly 0 to 5 percent, but they range to 15 percent.

Little or no soil formation has occurred in most areas. In some areas a thin, dark-colored, generally loamy surface layer has formed. The underlying material is highly stratified. Drainageways that are not protected by adequate plant cover are subject to entrenchment and headcutting. The water table in most areas has been lowered by the entrenchment of drainageways.

Alluvial land is used mainly for range, wildlife, and recreation. The vegetation is commonly grass and mixed stands of big sagebrush and grass. Areas above an elevation of 9,000 feet are forested. Capability unit VIw-3 nonirrigated; Mountain Swale range site.

Alluvial Land, Occasionally Flooded

Alluvial land, occasionally flooded (Ao) is on flood plains along streams and side drainageways. It consists of material recently deposited by streams. It varies widely in texture and commonly has very cobbly or stony areas interspersed throughout. It is subject to erosion from floods and changes in stream channels. Slopes are 0 to 5 percent.

Alluvial land, occasionally flooded, is suited to limited grazing and to wildlife and recreation. In most areas the vegetation is narrowleaf cottonwood, willows, grasses, sedges, and rushes. Small areas are flooded annually and support little or no vegetation. Capability

TABLE 1.—*Approximate acreage and proportionate extent of the soils* [1]

Soil	Area	Extent
	Acres	*Percent*
Alluvial land	7,000	0.9
Alluvial land, occasionally flooded	4,800	.6
Alluvial land, wet	7,200	.9
Bead fine sandy loam, 10 to 50 percent slopes	13,300	1.7
Big Blue loam, 0 to 1 percent slopes	1,100	.1
Big Blue loam, 1 to 5 percent slopes	900	.1
Bogan silt loam, 5 to 30 percent slopes	2,500	.3
Bosler sandy loam, 1 to 8 percent slopes	3,700	.5
Carbol very rocky sandy loam, 15 to 60 percent slopes	2,800	.4
Cebolia loam, 5 to 30 percent slopes	11,000	1.4
Cochetopa loam, 5 to 30 percent slopes	8,300	1.0
Corpening fine sandy loam, 5 to 40 percent slopes	2,500	.3
Curecanti gravelly loam, 1 to 8 percent slopes	4,900	.6
Dewville loam, 1 to 5 percent slopes	1,400	.2
Dewville loam, 5 to 15 percent slopes	2,700	.3
Dollard silty clay loam, 5 to 30 percent slopes	3,100	.4
Duffson-Corpening loams, 5 to 35 percent slopes	36,600	4.6
Duffson-Spring Creek stony loams, 5 to 40 percent slopes	30,600	3.8
Evanston loam, 1 to 5 percent slopes	6,300	.8
Evanston loam, 5 to 20 percent slopes	9,200	1.1
[illegible]	[illegible]	[illegible]
Lucky-Cheadle gravelly sandy loams, 5 to 45 percent slopes	76,700	9.6
Meredith very stony loam, 8 to 50 percent slopes	6,200	.8
Mord loam, 5 to 30 percent slopes	6,800	.8
Morop stony loam, 5 to 40 percent slopes	1,100	.1
Nutras stony loam, 10 to 50 percent slopes	18,500	2.3
Parlin-Hopkins channery loams, 5 to 45 percent slopes	111,600	13.9
Parlin-Mergel gravelly loams, 5 to 45 percent slopes	14,500	1.8
Posant very rocky loam, 10 to 60 percent slopes	19,900	2.5
Powderhorn loam, 5 to 30 percent slopes	5,000	.6
Redcloud channery loam, 3 to 30 percent slopes	14,400	1.8
Rock outcrop	1,900	.2
Rockslides	5,200	.6
Ruby gravelly sandy loam, 5 to 30 percent slopes	14,800	1.8
Ruby extremely rocky sandy loam, 5 to 40 percent slopes	6,300	.8
Shule and Sapinero loams, 10 to 50 percent slopes	48,000	6.0
Stony rock land	62,300	7.8
[illegible]	[illegible]	[illegible]

percent sandstone fragments; pH 5.5; gradual, smooth boundary.

C—40 to 60 inches +, light reddish-brown (5YR 6/4) very stony clay, reddish brown (5YR 5/4) moist; massive; extremely hard, firm; 40 percent angular sandstone; pH 6.0.

In places this soil has a dark-colored surface layer. The A2 horizon ranges from 4 to 12 inches in thickness. The B2t horizon generally is stony clay, but ranges to clay loam or stony clay loam. The content of rock fragments, mostly stones, in the A2 and B2t horizons ranges from 5 to 35 percent and increases with increasing depth.

Bead fine sandy loam, 10 to 50 percent slopes (BaF).—This soil is in the southern part of the survey area and near Crested Butte. In old burned areas under a cover of aspen, a 2- to 3-inch dark-colored surface layer is common.

Included with this soil in mapping are areas of Cebolia soils and small areas where slopes are either steeper or less steep. Also included in the Crested Butte area are soils that have a stony clay loam subsoil and sandstone at a depth of 30 to 40 inches, but are otherwise similar to Bead soils. Included soils make up less than 10 percent of the total acreage.

Almost all the acreage is wooded, mainly with Engelmann spruce and subalpine fir at higher elevations and Douglas-fir at lower elevations. Mixed aspen and conifers grow at all elevations where the original cover has been destroyed by fire or logging. Runoff is rapid, and the erosion hazard is moderate to high. Capability unit VIIe-2 nonirrigated; woodland group 3.

Big Blue Series

The Big Blue series consists of deep, poorly drained soils on flood plains and low terraces. Slopes are 0 to 5 percent. These soils formed mainly in fine-textured alluvium of mixed origin.

Typically, these soils are stratified and have a 3-inch

structure parting to moderate, fine, granular; slightly hard, friable; slightly calcareous; pH 8.2; clear, wavy boundary.

B21g—21 to 32 inches, gray (5Y 5/1) heavy clay loam, dark gray (5Y 4/1) moist; many medium and large, prominent, olive (5Y 5/6) mottles; massive; hard, friable; pH 8.1; gradual, smooth boundary.

B22g—32 to 40 inches, gray (5Y 6/1) heavy clay loam, dark gray (5Y 4/1) moist; many, medium and large, prominent, olive (5Y 5/6) mottles; massive; very hard, firm; pH 7.8; gradual, smooth boundary.

B23g—40 to 52 inches, light greenish-gray (5BG 7/1) clay loam, greenish gray (5BG 5/1) moist; many, medium and coarse, prominent, olive (5Y 5/6) mottles; massive; extremely hard, very firm; 10 percent gravel; pH 8.4; gradual, wavy boundary.

IIC—52 to 60 inches, gravel, sand, and cobblestones; single grained; loose.

In undisturbed areas the O1 horizon is typically 2 to 4 inches thick. The A11 horizon is typically loam, but ranges to light clay loam. It ranges from dark gray to very dark gray. Depth to the IIC horizon ranges from 40 to more than 60 inches.

Big Blue loam, 0 to 1 percent slopes (BbA).—This soil is ordinarily in old oxbows and slack water areas, away from the main stream channel. It is saturated about 8 months out of the year. Small areas are sometimes flooded.

Included with this soil in mapping are small areas of Gas Creek, Gold Creek, and Irim soils. Excessively wet areas are identified by spot symbols on the map. Included soils make up about 10 percent of the total acreage.

Most of the acreage is used for native hay and pasture. Runoff is very slow, and the erosion hazard is slight. Capability unit Vw-1 irrigated.

Big Blue loam, 1 to 5 percent slopes (BbB).—This soil is along streams and tributaries. It has the profile described as representative of the series. It is saturated throughout for short periods.

Included with this soil in mapping are a few areas

Permeability is moderate. The root zone is 20 to 40 inches deep. Available water capacity is low.

Bogan soils are important for range, and they provide habitat for wildlife.

Representative profile of Bogan silt loam, 5 to 30 percent slopes, three-fourths of a mile east of Baldwin; NE1/4 sec. 7, T. 15 S., R. 86 W., Gunnison County:

A1—0 to 8 inches, dark-brown (10YR 3/3) silt loam, very dark brown (10YR 2/3) moist; weak, very fine, granular structure; soft, very friable; pH 6.6; clear, smooth boundary.

B1—8 to 16 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; hard, firm; thin continuous clay films on ped faces; pH 7.0; clear, smooth boundary.

B2t—16 to 24 inches, pale-brown (10YR 6/3) light silty clay loam, dark grayish brown (10 YR 4/2) moist; moderate and strong, fine, subangular blocky structure; hard, firm; moderate continuous clay films on ped faces; pH 6.7; clear, smooth boundary.

R—24 inches +, yellowish-brown shale interbedded with fine-grained sandstone.

The A1 horizon is dominantly silt loam, but ranges to fine sandy loam and loam. It ranges from dark brown to brown. The B2t horizon is typically light silty clay loam, but in places is clay loam. It ranges from 6 to 12 inches in thickness. Sandstone or interbedded sandstone and sandy shale is at a depth of 20 to 40 inches. Bogan soils are commonly noncalcareous, but limy horizons occur in places.

Bogan silt loam, 5 to 30 percent slopes (BoE).—This soil is on uplands in the northwestern part of the [illegible]

depth of 60 inches or more, but available water capacity is low.

If irrigated, these are important soils for hay and pasture.

Representative profile of Bosler sandy loam, 1 to 8 percent slopes, one-fourth mile north of Gunnison; NW1/4 sec. 36, T. 50 N., R. 1 W., Gunnison County:

A1—0 to 10 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; slightly hard, very friable; about 5 percent gravel; pH 7.2; clear, smooth boundary.

B1—10 to 22 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak, coarse, subangular blocky structure; slightly hard, very friable; about 5 percent gravel; pH 7.4; clear, wavy boundary.

B2t—22 to 26 inches, brown (7.5YR 5/3) gravelly sandy clay loam, dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable; thin continuous clay films on ped faces; about 40 percent gravel and cobblestones; clear, irregular boundary.

B3ca—26 to 32 inches, grayish-brown (10YR 5/2) gravelly sandy clay loam, dark grayish brown (10 YR 4/2) moist; weak, medium, subangular blocky structure; hard, very friable; thin patchy clay films; about 40 percent gravel and cobblestones; strongly calcareous; pH 7.6; gradual, wavy boundary.

IIC1ca—32 to 48 inches, white (10YR 8/2) very cobbly loamy sand, very pale brown (10YR 7/3) moist; massive; hard, very friable; strongly calcareous; pH 8.0; clear, wavy boundary.

IIC2—48 to 72 inches, cobbly sand.

The A horizon is typically sandy loam, but in places is [illegible]

Permeability is moderately rapid. Roots can penetrate to a depth of only 10 to 20 inches, and available water capacity is low.

These are important soils for timber production and range, and they provide habitat for wildlife.

Representative profile of Carbol very rocky sandy loam, 15 to 60 percent slopes, in a road cut on a south-facing slope of 28 percent; sec. 26, T. 46 N., R. 1½ W., Gunnison County:

A1—0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; weak to moderate, medium, granular structure; soft, very friable; 20 percent small angular gravel; pH 6.8; gradual, smooth boundary.

B2t—8 to 16 inches, dark-brown (7.5YR 4/3) gravelly sandy clay loam, dark brown (7.5YR 3/3) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky; hard, friable; thin continuous clay films on ped faces; 30 percent fine angular gravel; pH 6.6; clear, wavy boundary.

R—16 inches, hard, unweathered granite.

The Cathedral soils in this survey area are mapped only with Kezar soils.

Representative profile of Cathedral gravelly sandy loam, 5 to 35 percent slopes; SE1/4 sec. 20, T. 49 N., R. 3 E., Gunnison County:

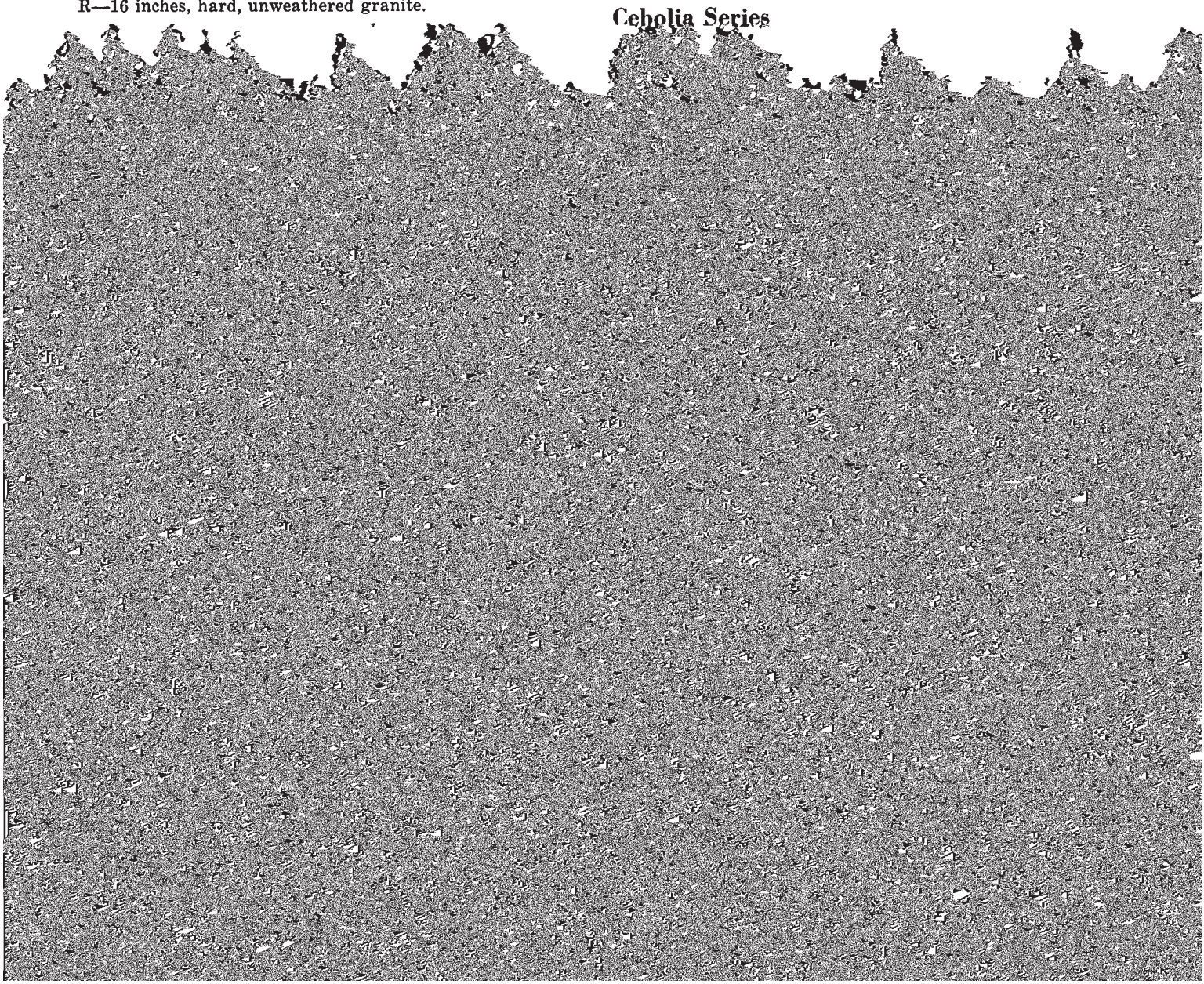
A1—0 to 7 inches, dark-brown (7.5YR 4/3) gravelly sandy loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure parting to weak, very fine, granular; soft, very friable; 40 percent angular granite gravel; pH 6.6; clear, smooth boundary.

C—7 to 15 inches, brown (7.5YR 5/4) very gravelly sandy loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure parting to weak, fine, subangular blocky; slightly hard, friable; 80 percent gravel; pH 6.6; abrupt, smooth boundary.

R—15 inches, slightly weathered granite.

The A1 horizon is typically gravelly sandy loam, but ranges to gravelly loam. Depth to bedrock ranges from 10 to 20 inches. The content of coarse fragments ranges from 50 to 70 percent.

Cebolia Series



loam. The A2 horizon ranges from pinkish gray to gray. The B2t horizon is reddish brown to brown and ranges from clay to heavy clay loam. The content of coarse fragments ranges from less than 5 to 30 percent.

Cochetopa Series

The Cochetopa series consists of deep, well-drained soils on uplands. Slopes are 5 to 30 percent. These soils

Included soils make up about 10 percent of the total acreage.

Nearly all the acreage is native range and is used for grazing in summer and fall. Runoff is medium to rapid, depending on slope. The erosion hazard is moderate. Capability units VIe-1 irrigated, VIe-4 nonirrigated; Subalpine Loam range site.

Corpening Series

The Corpening series consists of shallow, well-drained soils on upland hills, ridges, and benches. Slopes are 5 to 40 percent. These soils formed in material derived in place from calcareous sandstone or limestone.

In a representative profile the surface layer is brown fine sandy loam about 7 inches thick. Below this is about 7 inches of calcareous, pink gravelly sandy loam. Calcareous sandstone is at a depth of 14 inches.

Corpening soils are at an elevation of about 8,400 feet. The average annual soil temperature is 42° F., and the annual precipitation is 14 inches. The native vegetation is commonly fringed sage, cactus, winterfat,

In a representative profile the surface layer is brown gravelly loam about 7 inches thick. The subsoil is brown very cobbly sandy clay loam about 12 inches thick. The substratum to a depth of 60 inches is light-brown very cobbly loam.

Curecanti soils are at elevations of 7,700 to 8,500 feet. They receive about 18 inches of annual precipitation. The average annual soil temperature is about 42° F. The native vegetation is commonly black sagebrush, winterfat, phlox, squirreltail, and blue grama.

Permeability is moderate. Roots can penetrate to a depth of 60 inches or more, but available water capacity is low.

Curecanti soils are used for range and hay and provide habitat for wildlife.

Representative profile of Curecanti gravelly loam, 1 to 8 percent slopes; NE1/4 sec. 20, T. 48 N., R. 4 E., Saguache County:

A1—0 to 7 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; slightly hard, very friable; about 15 percent gravel; pH 7.0; clear, smooth boundary.

In a representative profile the surface layer is grayish-brown loam 10 inches thick. The subsoil is brown sandy clay loam about 12 inches thick. The substratum to a depth of 60 inches is grayish-brown and very pale brown sandy loam. It is calcareous below a depth of 22 inches.

Dewville soils are at elevations of about 9,000 to 10,000 feet. The average annual soil temperature is 40° F. The average annual precipitation is 15 inches. The native vegetation is commonly big sagebrush, needle-and-thread, Arizona fescue, and Indian ricegrass.

Permeability is moderate. Roots can penetrate to a depth of 60 inches or more. Available water capacity is moderate.

These soils are used mostly for irrigated hay and pasture.

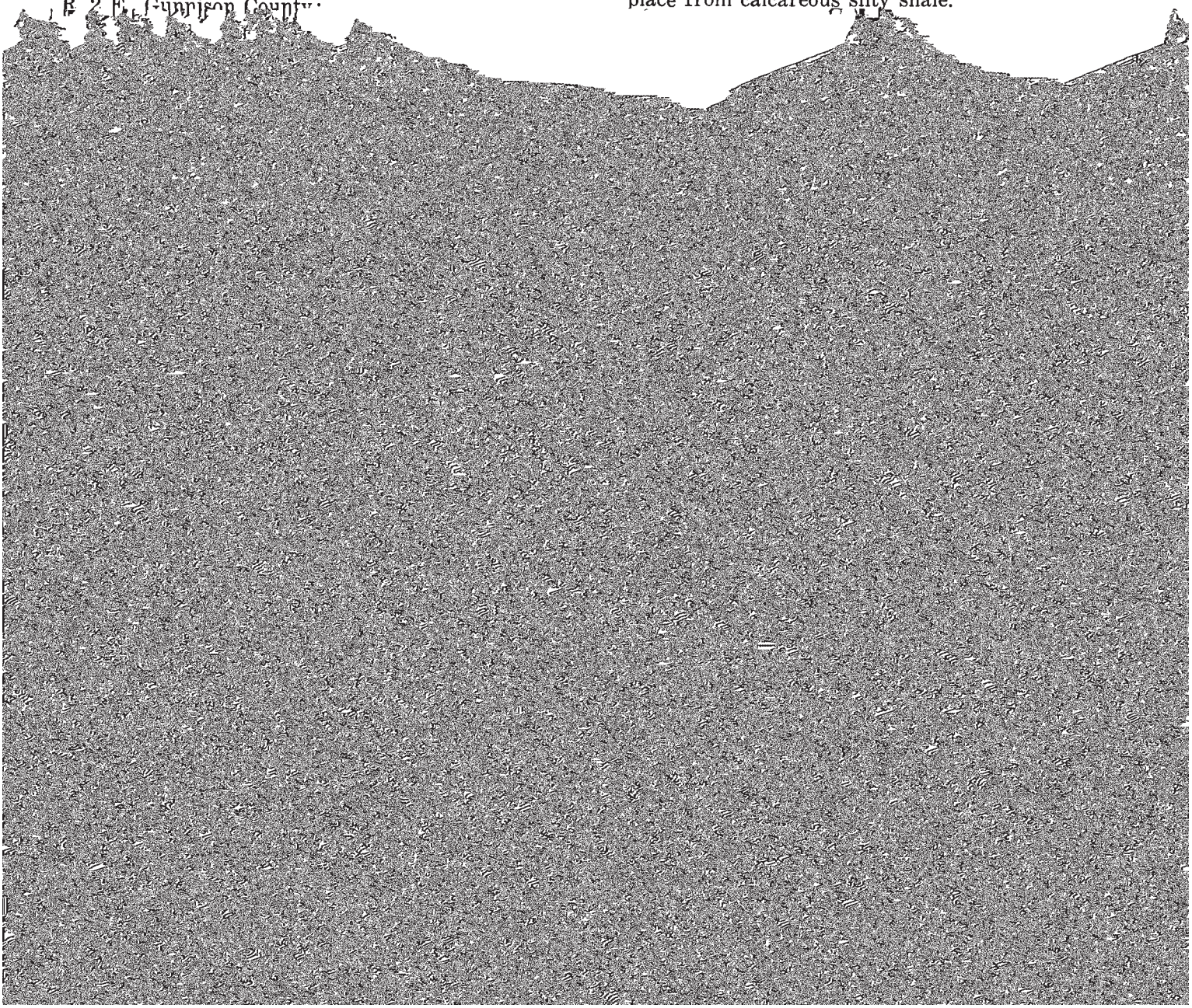
Representative profile of Dewville loam, 5 to 15 percent slopes, 1½ miles west of Parlin; sec. 15, T. 49 N., R. 2 E., Gunnison County:

Included with this soil in mapping are areas of Corpening and Hopkins soils and Rock outcrop. Also included are wet areas and saline spots, which are identified by spot symbols on the soil map. Included soils make up less than 10 percent of the total acreage.

Most of the acreage is used for irrigated hay and pasture. Small areas are used for range. Runoff is medium to rapid, and the erosion hazard is moderate. Shallow gullies are common. Capability units VIe-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Dollard Series

The Dollard series consists of moderately deep, well-drained soils on upland hills and ridges. Slopes are 5 to 30 percent. These soils formed in material derived in place from calcareous silty shale.



cent. Leaps and Morop soils make up about 10 percent of some mapped areas.

This soil is used mostly for grazing. Small areas are used for irrigated hay and pasture. Runoff is medium to rapid, and the erosion hazard is slight to moderate. Capability units VIe-1 irrigated, VIIe-1 nonirrigated; Deep Clay Loam range site.

Duffson Series

The Duffson series consists of moderately deep, well-drained, calcareous soils on hills, ridges, and benches. Slopes are 5 to 40 percent. These soils formed in locally transported alluvium that was derived from calcareous, interbedded sandstone and shale.

In a representative profile the surface layer is grayish-brown loam about 5 inches thick. The subsoil is brown and light yellowish-brown loam and clay loam about 15 inches thick. It is calcareous in the lower part. The substratum is about 10 inches of strongly calcareous

Depth to bedrock ranges from 20 to 40 inches. The content of gravel ranges from 5 to 15 percent.

Duffson-Corpening loams, 5 to 35 percent slopes (DrE).—This mapping unit is mainly in the central part of the survey area. The largest acreage is between Razor and Cochetopa Creeks. The unit is about 50 percent Duffson loam and 30 percent Corpening loam. The Duffson soil is generally on northern and eastern exposures. The Corpening soil is commonly on windswept, southern and western exposures. In some eroded areas of these soils, the surface layer is thinner and stonier than that in the profiles described as representative of the series.

Included with these soils in mapping are small areas of Lucky and Parlin soils, areas of severely eroded Duffson and Corpening soils, and areas of Rock outcrop and Stony rock land. Also included are areas of Alluvial land and Alluvial land, wet, commonly along small drainageways and toe slopes. Included soils make up less than 20 percent of the total acreage.

ous in the lower 4 inches. The substratum is strongly calcareous, light-brown loam that extends to a depth of 60 inches.

Evanston soils are at elevations of about 8,000 to 10,000 feet. Summers are cool, and winters are cold. The average annual soil temperature is less than 45° F. The average annual precipitation is about 14 inches. The native vegetation is commonly Arizona fescue, mountain muhly, and needlegrass. Big sagebrush and

Evanston loam, 5 to 20 percent slopes (EvD).—This soil is on alluvial fans and valley sides throughout the central part of the survey area. It is commonly in areas at the outlets of streams and side drainageways.

Included with this soil in mapping are steep cobbly terrace edges and small areas of Dewville and Mergel soils and Alluvial land. Included soils make up 15 percent of the total acreage.

Most of the acreage is native range and is used for

Included soils make up less than 10 percent of the total acreage.

Much of the acreage is irrigated and is used mainly for hay and pasture. Runoff is slow, and the erosion hazard is none to slight. Capability units VIs-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

soil is subject to occasional overflow during periods of runoff in spring. During periods of overflowing, sand and gravel are deposited on the surface.

Included with this soil in mapping are areas of Irim soils and areas of Alluvial land, occasionally flooded, adjacent to creek channels. Excessively wet areas are identified by spot symbols on the soil map. Included

hard, very friable; 60 percent gravel and cobblestones; pH 7.0.

The A11 horizon is typically cobbly loam, but in places is cobbly sandy loam. The A horizon ranges from 16 to 25 inches in thickness. The content of gravel and cobblestones below a depth of about 10 inches is 35 to 70 percent.

Gateview cobbly loam, 2 to 8 percent slopes (GeB).—This soil is mainly in the Crested Butte area on outwash fans. It has the profile described as representative of the series. In irrigated areas it has an organic mat 1 to 2 inches thick at the surface.

Included with this soil in mapping are small areas of Fola and Curecanti soils and small areas of Youman soils along margins of the uplands. Included soils make up about 10 percent of the total acreage.

Most of the acreage is irrigated and is used for hay and pasture. The rest is used for range. Runoff is slow. Erosion is a moderate hazard during periods of snowmelt, but is not a hazard in areas under irrigated pasture cover. Capability units VIs-1 irrigated, VIe-2 non-

0 to 5 percent slopes, west of Doyleville along Tomichi Creek; SW1/4 sec. 34, T. 49 N., R. 3 E., Gunnison County:

O1—2 inches to 0, organic mat of plant roots.

A11—0 to 9 inches, gray (10YR 5/1) silty clay loam, black (10YR 2/1) moist; moderate, fine, granular structure; very hard, firm; calcareous in spots; few, fine and medium, white (10YR 8/2) lime streaks; pH 9.2; gradual, wavy boundary.

A12g—9 to 20 inches, dark-gray (2.5Y 4/1) silty clay, black (10YR 2/1) moist; common, medium, distinct, olive-brown (2.5Y 4/6) mottles; weak, coarse, subangular blocky structure parting to moderate, fine, granular; very hard, firm; calcareous; 10 percent white (10YR 8/1) lime streaks; pH 9.5; gradual, wavy boundary.

B2g—20 to 41 inches, light-gray (10YR 7/2) silty clay, light brownish gray (10YR 6/2) moist; common, medium, distinct, olive-brown (2.5Y 4/6) mottles; massive; very hard, firm; calcareous; pH 9.6; abrupt, wavy boundary.

IIC—41 to 60 inches, strongly mottled very gravelly and cobbly sand; single grained; loose; pH 9.0.

percent angular gravel; pH 6.8; clear, wavy boundary.

B1t—6 to 11 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark brown (10YR 2/2) moist; weak, medium, subangular blocky structure parting to moderate, medium, granular; slightly hard, friable; thin patchy clay films on ped faces; 10 percent angular gravel; pH 6.8; clear, wavy boundary.

B21t—11 to 24 inches, brown (7.5YR 5/3) gravelly heavy clay loam, dark brown (7.5YR 4/3) moist; weak, medium, prismatic structure parting to moderate to strong, medium, subangular blocky; very hard, firm; medium continuous clay films on ped faces; 20 percent angular gravel; pH 6.8; clear, wavy boundary.

B22t—24 to 35 inches, light-brown (7.5YR 6/4) gravelly heavy clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure

The Kezar soils in the Gunnison Area are mapped only with Cathedral soils.

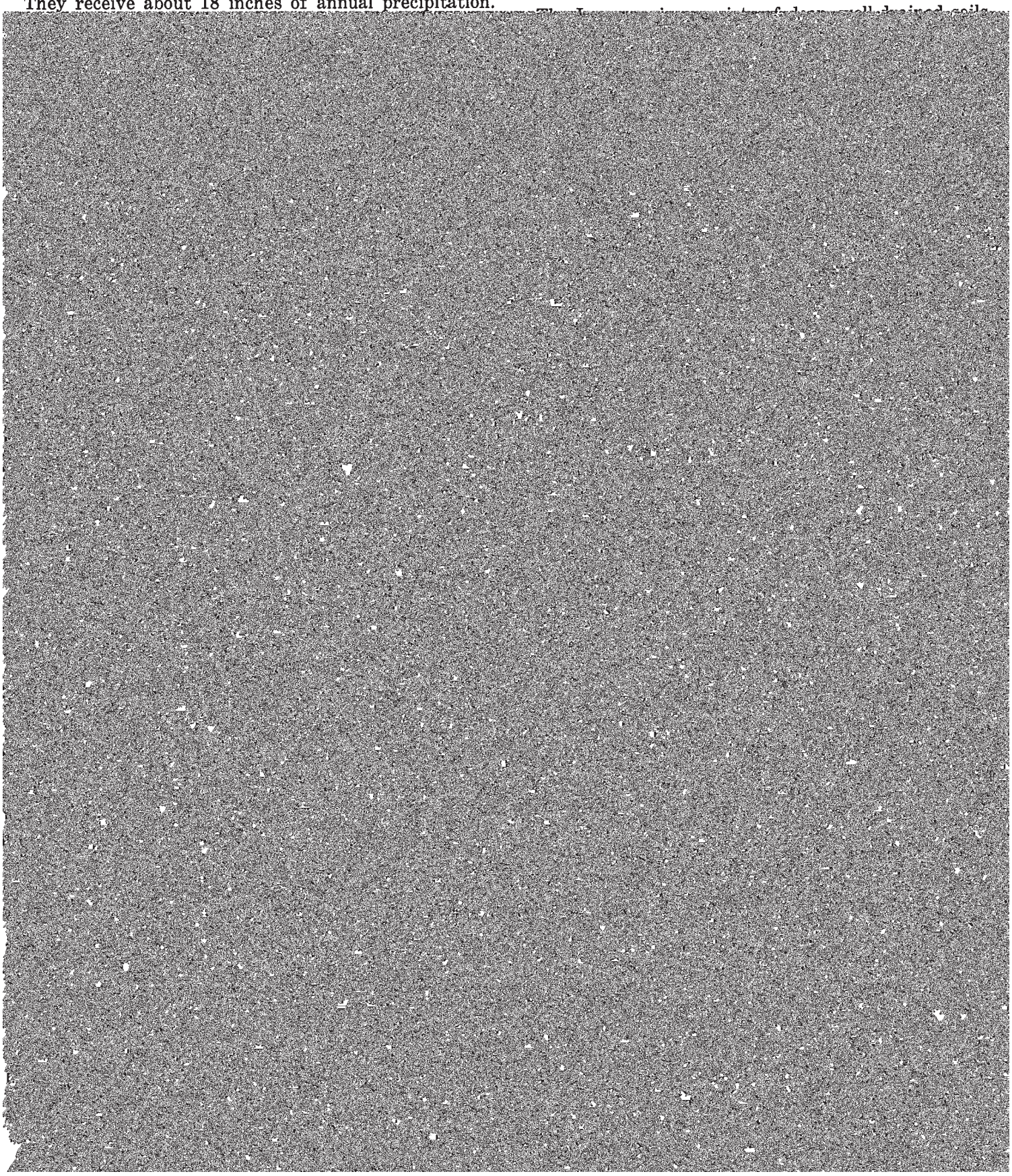
Representative profile of Kezar gravelly sandy loam, 5 to 35 percent slopes; sec. 22, T. 49 N., R. 1 W., Gunnison County:

A1—0 to 6 inches, brown (7.5YR 4/3) gravelly sandy loam, dark brown (7.5YR 3/3) moist; weak, medium and coarse, granular structure parting to moderate, fine, granular; soft, very friable; 25 percent fine, angular, granitic gravel; pH 7.0; clear, smooth boundary.

B1t—6 to 10 inches, brown (7.5YR 5/3) gravelly heavy coarse sandy loam, dark brown (7.5YR 3/3) moist; weak, fine, subangular blocky structure parting to moderate, fine, granular; slightly hard, friable; few, thin, patchy clay films on ped faces; 25 per-

Kubler soils are at elevations of 8,000 to 9,000 feet. They receive about 18 inches of annual precipitation.

Leaps Series



thick. The subsoil is brown and yellowish-brown gravelly sandy loam and sandy clay loam about 20 inches thick. Gneiss is at a depth of 28 inches.

Lucky soils are at elevations of 7,500 to 9,000 feet. The average annual soil temperature is 42°F. The annual precipitation is about 18 inches. The native vegetation is commonly big sagebrush, Arizona fescue, wheatgrass, native bluegrass, and mountain muhly.

Permeability is moderate. Roots can penetrate to a depth of only about 2½ feet, and available water capacity is low.

These soils are used mainly as range. They also provide habitat for wildlife.

Representative profile of Lucky gravelly sandy loam in an area of Lucky-Cheadle gravelly sandy loams, 5 to 45 percent slopes; NE1/4 sec. 10, T. 48 N., R. 1 E., Gunnison County:

A1—0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; moderate, fine, granular structure; soft, very friable; about 15 percent angular gravel; pH 6.6; clear, smooth boundary.

B1—8 to 12 inches, brown (10YR 5/3) gravelly heavy sandy loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable; about 10 percent angular gravel; pH 6.8; clear, smooth boundary.

B2t—12 to 22 inches, brown (7.5YR 5/4), gravelly sandy

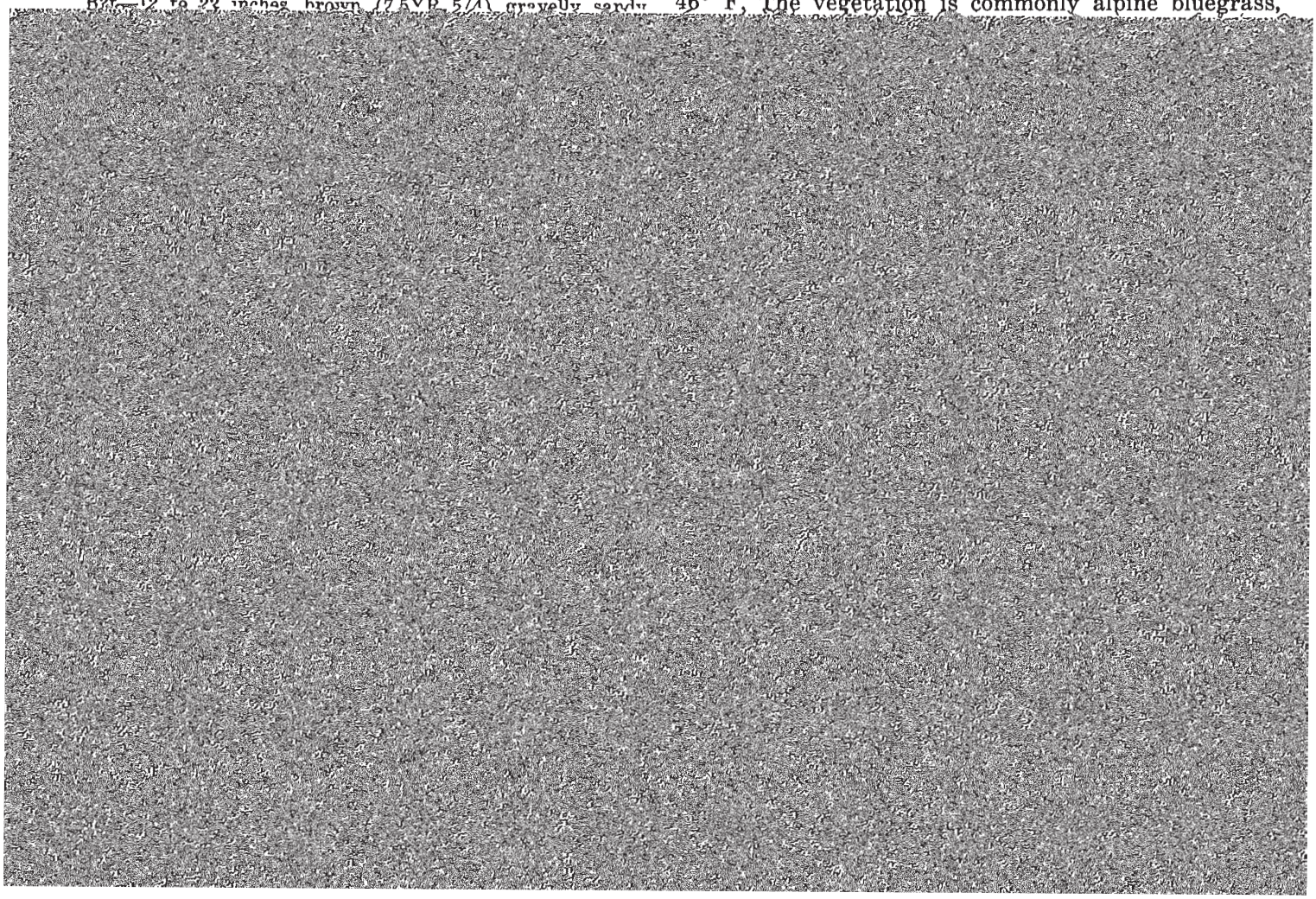
stock and wildlife. Runoff is medium. The erosion hazard is slight if plant cover is adequate. It is moderate during snowmelt. Capability unit VIIe-3 nonirrigated; Lucky soil in Mountain Loam range site, Cheadle soil in Dry Mountain Loam range site.

Meredith Series

The Meredith series consists of deep, well-drained soils on high mountainsides and alpine rims above timberline. Slopes are 8 to 50 percent. These soils formed in stony material derived from latite basalt. The parent material is very hard and resistant to weathering and is commonly fractured to a depth of several feet.

Typically, these soils have a surface mat of partly decomposed plant material. In a representative profile the surface layer is dark-brown very stony loam about 5 inches thick. The subsoil is brown very stony silt loam about 15 inches thick. The substratum to a depth of 60 inches is brown very stony silt loam that has many open voids between stones.

Meredith soils are at elevations of 11,000 to 12,600 feet. They receive approximately 30 inches of precipitation annually. The average annual soil temperature is 30° F. The average soil temperature in summer is 46° F. The vegetation is commonly alpine bluegrass,



outcrop and Rockslides on excessively steep terrain and rock streams in less steep areas. Included areas make up less than 15 percent of the total acreage.

This soil is used for range and wildlife and provides summer grazing for sheep, deer, and elk. Runoff is medium to rapid, depending on the slope. The erosion hazard is high. Capability unit VIIs-3 nonirrigated; Alpine Slopes range site.

Mergel Series

percent. These soils formed in gravelly and cobbly material weathered from rhyolite and breccia.

In a representative profile the surface layer is very dark gray loam about 10 inches thick. The subsurface layer is light brownish-gray loam about 3 inches thick. The next layer is mixed, light brownish-gray and brown gravelly clay loam about 14 inches thick. The subsoil is brown and pale-brown light gravelly clay about 25 inches thick. The substratum to a depth of 60 inches is pale-brown gravelly clay loam.

Mord soils are at elevations of 9,000 to 10,000 feet.

Included with this soil in mapping are small areas of Leaps, Dollard, and Bogan soils on steep slopes or in places where the soil mantle is shallow over bedrock; areas of Duffson and Hopkins soils at lower elevations; and areas of Mord loam where slopes are more than 30 percent. Small rounded knobs and ridges that have a very high content of angular stone fragments are common. Also included are small areas where slopes are less than 5 percent or more than 30 percent. Included soils make up less than 12 percent of the total acreage.

Almost all the acreage is range. Small areas are irrigated for hay and pasture. Runoff is medium to rapid, and the erosion hazard is slight to moderate. Capability unit VIe-1 irrigated, VIe-4 nonirrigated; Subalpine Loam range site.

Morop Series

The Morop series consists of deep, well-drained soils on uplands. Slopes are 5 to 40 percent. These soils formed in old alluvial fan sediment and glacial till deposits that were derived from basaltic material.

In a representative profile the surface layer is dark grayish-brown stony loam about 6 inches thick. The subsoil, about 19 inches thick, is dark grayish-brown, brown, and pale-brown stony clay loam and clay. The substratum to a depth of 60 inches is very pale brown stony loam.

Morop soils are at elevations of 8,000 to 9,000 feet. The average annual soil temperature is 42° F. The annual precipitation is about 16 inches. The native vegetation is commonly big sagebrush, Arizona fescue, wheatgrass, and native bluegrass.

Permeability is slow. Roots can penetrate to a depth of 60 inches or more, and available water capacity is high.

These soils are used principally as range.

Representative profile of Morop stony loam, 5 to 40 percent slopes; NW1/4 sec. 24, T. 51 N., R. 1 W., Gunnison County:

A1—0 to 6 inches, dark grayish-brown (10YR 4/3) stony loam, very dark brown (10YR 2/2) moist; moderate, medium, granular structure; soft, very friable; about 15 percent angular stones, cobblestones, and gravel; pH 7.0; clear, smooth boundary.

B1t—6 to 10 inches, dark grayish-brown (10YR 4/2) stony clay loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure; hard, friable; thin continuous clay films on ped faces; many, dark-colored, ferromagnesian-rich minerals; about 15 percent angular stones, cobblestones, and gravel; pH 7.0; clear, smooth boundary.

B2t—10 to 20 inches, brown (10YR 5/3) stony clay, dark brown (10YR 4/3) moist; moderate, medium, angular blocky structure parting to moderate, fine, angular blocky; very hard, firm; thin continuous clay films; many, dark-colored, ferromagnesian-rich minerals; about 10 percent angular stones, cobblestones, and gravel; pH 7.4; clear, smooth boundary.

B3tca—20 to 25 inches, pale-brown (10YR 6/3) stony clay loam, brown (10YR 5/3) moist; moderate, medium, subangular blocky structure; very hard, friable; few, thin, patchy clay films on ped faces; many, dark-colored, ferromagnesian-rich minerals; about 20 percent angular stones, cobblestones, and gravel; strongly calcareous; thin white (10YR 8/2) lime crusts on bottom of coarse fragments and common fine lime segregations; pH 8.0; gradual, wavy boundary.

Cca—25 to 60 inches, very pale brown (10YR 7/3) stony loam, brown (10YR 5/3) moist; massive; hard, friable; about 30 percent angular stones, cobblestones, and gravel; strongly calcareous; thin white (10YR 8/2) lime crusts on bottom of coarse fragments and many fine and medium lime segregations; pH 8.4; gradual, smooth boundary.

The A horizon is typically stony loam, but in places is loam and light clay loam. It ranges from very dark grayish brown or grayish brown to brown or dark brown. The content of coarse fragments, dominantly stones, in the A and B horizons ranges from 5 to 35 percent.

Morop stony loam, 5 to 40 percent slopes (MrE).—This soil is mainly in the Ohio Creek area on south slopes of Flattop Mountain. In localized areas the surface layer is up to 35 percent stones.

Included with this soil in mapping are small areas of Cochetopa and Dollard soils and small areas where slopes are less than 5 percent or more than 40 percent.

Nearly all the acreage is in native vegetation and is used for grazing. Small areas are irrigated for hay and pasture. Runoff is slow or medium, and the erosion hazard is moderate. Capability unit VIe-1 irrigated, VIIs-1 nonirrigated; Mountain Loam range site.

Nutras Series

The Nutras series consists of deep, well-drained soils on ridgetops, mesas, and basalt flows. Slopes are 10 to 50 percent. These soils formed in stony material derived from latite basalt, which is resistant to weathering.

Typically, these soils have a 4-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the mineral surface layer is white stony loam about 9 inches thick. The subsurface layer is about 6 inches of mixed pinkish-gray and reddish-brown stony clay loam. The subsoil is reddish-brown extremely stony clay about 25 inches thick. The substratum to a depth of 60 inches is reddish-brown extremely stony clay.

Nutras soils are at elevations of 10,000 to 11,500 feet. The annual precipitation is more than 20 inches. The average annual soil temperature is 38° F. The native vegetation is commonly Engelmann spruce, subalpine fir, and scattered aspen. The understory is Fendler bluegrass, spike trisetum, russet buffaloberry, mountain birch, and alder.

Permeability is slow, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used chiefly for woodland, wildlife, and watershed.

Representative profile of Nutras stony loam, 10 to 50 percent slopes, in a wooded area east of Powderhorn Creek; N1/2 sec. 33, T. 45 N., R. 2 W., Hinsdale County:

O1—4 inches to 0, undecomposed organic material grading to partially decomposed material, chiefly needles, bark, and twigs.

A2—0 to 9 inches, white (10YR 8/2) stony loam, very pale brown (10YR 7/3) moist; moderate, thin, platy structure parting to moderate, very fine, granular; soft, very friable; about 30 percent stones, cobblestones, and gravel; pH 5.4; gradual, smooth boundary.

A&B—9 to 15 inches, mixed colors of pinkish-gray (5YR 7/2) and reddish-brown (5YR 5/4) stony clay loam, reddish gray (5YR 5/2) and reddish brown (5YR 5/4) moist; moderate, medium and fine, subangular

blocky structure; slightly hard, friable; clayey B2t material imbedded in light-colored matrix similar to A2 material; thin patchy clay films on peds in clayey material; dark-colored ferromagnesian grains; about 30 percent stones, cobblestones, and gravel; pH 5.4; gradual, wavy boundary.

B2t—15 to 32 inches, reddish-brown (5YR 5/4) extremely stony clay, reddish brown (5YR 4/4) moist; strong, medium and fine, subangular blocky structure; ex-

Permeability is moderately slow, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used for grazing, recreation, and wildlife.

The Parlin soils in the Gunnison Area are mapped only with Hopkins and Mergel soils.

Representative profile of Parlin channery loam, 5 to

easterly exposures where the effective moisture is greater. It has a profile similar to the one described as representative of the Parlin series, but the surface layer and subsoil are gravelly. The Mergel soil is on windswept, southerly exposures. It has the profile described as representative of the Mergel series.

Included with these soils in mapping are areas of Dollard and Corpening soils, areas of Rock outcrop commonly on the steeper slopes, and small areas of Evanston and Dewville soils on small fans. Included soils make up less than 15 percent of the total acreage.

Nearly all the acreage is in native vegetation and is used as range. A few very small areas are irrigated. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VII-2 [illegible]

percent stones, cobblestones, and gravel; pH 6.4; gradual, smooth boundary.

C—42 to 60 inches, brown (7.5YR 5/4) extremely stony clay loam, dark brown (7.5YR 4/4) moist; massive; hard, friable; 70 percent angular stones, cobblestones, and gravel; pH 6.6.

The A horizon is typically loam, but in places is stony loam. It ranges from 4 to 14 inches in thickness and from very dark grayish brown to brown in color. The B horizon ranges from brown to reddish brown. The content of coarse fragments, dominantly stones, in the B horizon ranges from 35 to 70 percent.

Posant Series

The Posant series consists of shallow, well-drained [illegible]

up 30 percent of the mapped area. It commonly forms escarpments or columns on steeper terrain.

Included with this soil in mapping are areas of Wood-

medium, angular blocky structure; extremely hard, firm; thick continuous clay films on ped faces; 20 percent granitic gravel; pH 6.0; gradual, wavy

fragments, mostly rhyolite and tuff; pH 7.2; clear, smooth boundary.

B2—12 to 22 inches, light-brown (7.5YR 6/3) channery loam, dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure; slightly hard, very friable; 20 percent stone fragments; pH 7.2; clear, wavy boundary.

C1ca—22 to 36 inches, very pale brown (10YR 7/3) channery loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; 25 percent stone fragments; calcareous; white (10YR 8/2) calcium carbonate concretions and coatings on rock fragments; pH 8.0; gradual, wavy boundary.

C2ca—36 to 60 inches, light yellowish-brown (2.5Y 6/3) channery loam, light olive brown (2.5Y 5/3) moist; massive; hard, very friable; 20 percent stone fragments; calcareous; some visible calcium carbonate concretions and coatings on bottom of rock fragments; pH 8.0.

The A horizon is channery loam and channery fine sandy loam. It ranges from 6 to 15 inches in thickness and from grayish brown or very dark grayish brown to brown in color. The B2 horizon ranges from light brown or brown to grayish brown or light brownish gray. The soil profile ranges from neutral to moderately alkaline. The content of channery material ranges from 15 to 35 percent.

Redcloud channery loam, 3 to 30 percent slopes (RcE).—This soil is principally in the Cochetopa Park area.

Included with this soil in mapping are areas of Evanston, Parlin, and Hopkins soils and areas of eroded Redcloud soil commonly at the higher elevations. Also included are small acreages of Alluvial land, wet, in small drainageways and a few areas of Rock outcrop and Stony rock land on the steeper slopes. Included soils make up less than 15 percent of the total acreage.

Nearly all the acreage is in native vegetation and is used for grazing and wildlife. Runoff is medium, and the erosion hazard is moderate. Capability unit VIe-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Rock Outcrop

Rock outcrop (Ro) consists of bare exposures of bedrock along canyon walls, on escarpments surrounding mesa tops, and on very steep upland slopes. It is more than 90 percent exposed bedrock, principally down in snowslides. Many of the higher areas are unstable and are likely to slide at any time. Many areas of Rockslides are along the edges of the Cannibal Plateau.

Rockslides can be many feet thick or only a thin mantle covering the original soil. Trees and shrubs grow between the rocks where soil material is near the surface. Older areas that have become stabilized support sparse stands of timber and grass, even though the surface is still very stony.

Rockslides is valuable in maintaining water yields because snow accumulates between the rocks in winter and is slower to melt during spring thaw. It absorbs runoff from heavy rain and rapidly melting snow and allows a more even distribution of water to springs and creeks. It also protects the more erodible soils below. Capability unit VIIIs-2.

Ruby Series

The Ruby series consists of deep, well-drained soils on upland ridges and benches. Slopes are 5 to 40 percent. These soils formed in locally transported gravelly material that was derived from rhyolite and rhyolitic tuff.

In a representative profile the surface layer is brown gravelly sandy loam about 8 inches thick. The subsoil is brown gravelly clay loam about 5 inches thick. Overlapping rhyolite flagstone that contains many voids is at a depth of 13 inches.

Ruby soils are at elevations of 9,000 to 10,000 feet. They receive about 20 inches of annual precipitation. The average annual soil temperature is about 38° F. The native vegetation is commonly big sagebrush, native bluegrass, Columbia needlegrass, Letterman needlegrass, and thin stands of Thurber fescue.

Permeability is moderate. Roots can penetrate to a depth of only about 13 inches, and available water capacity is low.

These soils are important for grazing, recreation, and wildlife.

Representative profile of Ruby gravelly sandy loam,

the profile described as representative of the series. At elevations near 10,000 feet, the surface layer is dark brown.

Included with this soil in mapping are areas of Woosley, Vulcan, and Cebolia soils and small areas of Ruby soils where slopes are 30 to 45 percent. Also included are small areas of Rock outcrop and Stony rock land on the steeper slopes. Included soils make up 15 percent of the total acreage.

Most of the acreage is in native vegetation and is used for grazing and wildlife. Permeability is moderate. Runoff is medium or high, and the erosion hazard is moderate or high. Capability unit VIIe-3 nonirrigated; Shallow Subalpine range site.

Ruby extremely rocky sandy loam, 5 to 40 percent slopes (RyE).—This mapping unit is in the south-central part of the survey area on upland benches and side

Representative profile of Sapinero stony loam, mapped in an area of Shule and Sapinero loams, 10 to 50 percent slopes; N1/2 sec. 10, T. 47 N., R. 5 W., Gunnison County:

O1—3 inches to 0, surface litter of undecomposed and partially decomposed leaves and needles of aspen, spruce, and fir trees.

A1—0 to 4 inches, grayish-brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; soft, very friable; about 10 percent stones and gravel; pH 7.0; clear, smooth boundary.

A2—4 to 19 inches, light-gray (10YR 7/2) very stony loam, grayish brown (10YR 5/2) moist; weak, fine, granular structure; soft, very friable; 20 percent stones, cobblestones, and gravel; pH 6.4; clear, wavy boundary.

A&B—19 to 34 inches, mixed light-gray (10YR 7/2) and light-brown (7.5YR 6/3) extremely stony clay loam, brown (10YR 5/3) and dark brown (7.5YR 4/3)

slopes; SE1/4 sec. 36, T. 47 N., R. 5 W., Gunnison County:

O1—4 inches to 1 inch, organic material consisting of bark, twigs, leaves, and needles.

O2—1 inch to 0, partly decomposed organic material.

A2—0 to 8 inches, pinkish-gray (7.5YR 7/2) loam, brown (7.5YR 5/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; weak platy structure in places; soft, very friable; 5 percent gravel and stones; pH 7.0; clear, smooth boundary.

A&B—8 to 16 inches, mixed-colored, including pinkish-gray (7.5YR 7/2) and brown (7.5YR 5/3), heavy loam, brown (7.5YR 5/2) and dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable; seams and nodules of B2t material imbedded in A2 matrix; 10 percent stones

precipitation. The average annual soil temperature is 42° F. The average soil temperature in summer is about 62°. The native vegetation is commonly fringed sage, winterfat, phlox, western wheatgrass, squirreltail, dryland sedge, and slimstem muhly.

Permeability is moderately rapid. Roots can penetrate to a depth of only about 20 inches, and available water capacity is low.

Most of the acreage is in native vegetation and is used as range and wildlife habitat.

The Spring Creek soils in this survey area are mapped only with Duffson soils.

Representative profile of Spring Creek stony loam in native vegetation; NW1/4 sec. 3, T. 49 N., R. 1 W.,

Sunshine Series

The Sunshine series consists of deep, well-drained soils on mesas and valley-fill slopes. Slopes are 5 to 35 percent. These soils formed in alluvium that was derived from rhyolite and rhyolitic tuff.

In a representative profile the surface layer is very dark gray loam about 11 inches thick. The subsurface layer is about 4 inches of pinkish-gray loam. Next is a 5-inch layer of pinkish-gray and brown gravelly loam. The subsoil is brown extremely stony clay about 16 inches thick. The substratum to a depth of 60 inches is loose, overlapping, rhyolitic flagstone that has 1- to 2-inch voids between the rocks.

Sunshine soils are at elevations of 9,000 to 10,000 feet. They receive about 20 inches of annual precipitation. The annual soil temperature is about 38° F. The average soil temperature in summer is less than 52°. The native vegetation is commonly big sagebrush, silver sagebrush, and scattered clumps of aspen. Grasses are chiefly Thurber fescue, nodding brome, and mountain bluegrass.

Permeability is slow. Roots can penetrate to a depth of only about 36 inches, and available water capacity is low.

These soils are important for grazing, recreation, and wildlife.

Representative profile of Sunshine loam, 5 to 35 percent slopes; NW1/4 sec. 17, T. 45 N., R. 2 E., Saguache County:

A1—0 to 11 inches, very dark gray (7.5YR 3/1) loam, black (10YR 2/1) moist; moderate, medium, granular structure parting to moderate, fine, granular; soft, very friable; 10 percent angular rhyolitic gravel; pH 6.8; clear, smooth boundary.

A2—11 to 15 inches, pinkish-gray (7.5YR 7/2) gravelly loam, brown (7.5YR 5/2) moist; moderate, fine, granular structure; soft, very friable; about 15 percent angular gravel and cobblestones; pH 6.8; clear, wavy boundary.

A&B—15 to 20 inches, mixed colors pinkish-gray (7.5YR 7/2) and brown (7.5YR 5/2) gravelly loam, brown (7.5YR 5/2) and dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; slightly hard, friable; about 40 percent streaks and seams

and Ruby soils. Included soils make up less than 10 percent of the total acreage.

Nearly all the acreage is in native vegetation and is used for grazing. This soil also provides habitat for deer and elk. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIe-4 nonirrigated; Subalpine Loam range site.

Tolvar Series

The Tolvar series consists of deep, well-drained soils on mountainsides and adjacent alluvial fans. Slopes are 10 to 50 percent. These soils formed in alluvium and colluvium weathered from granite.

Typically, these soils have a 4-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the surface layer is dark grayish-brown gravelly coarse sandy loam about 2 inches thick. The subsurface layer is light-gray gravelly coarse sandy loam about 12 inches thick. The next layer, about 7 inches thick, is a mixture of reddish-brown and light-gray gravelly sandy clay loam. The subsoil is reddish-brown and brown very gravelly sandy clay loam and coarse sandy loam about 25 inches thick. The substratum to a depth of 60 inches is light yellowish-brown very gravelly coarse sandy loam.

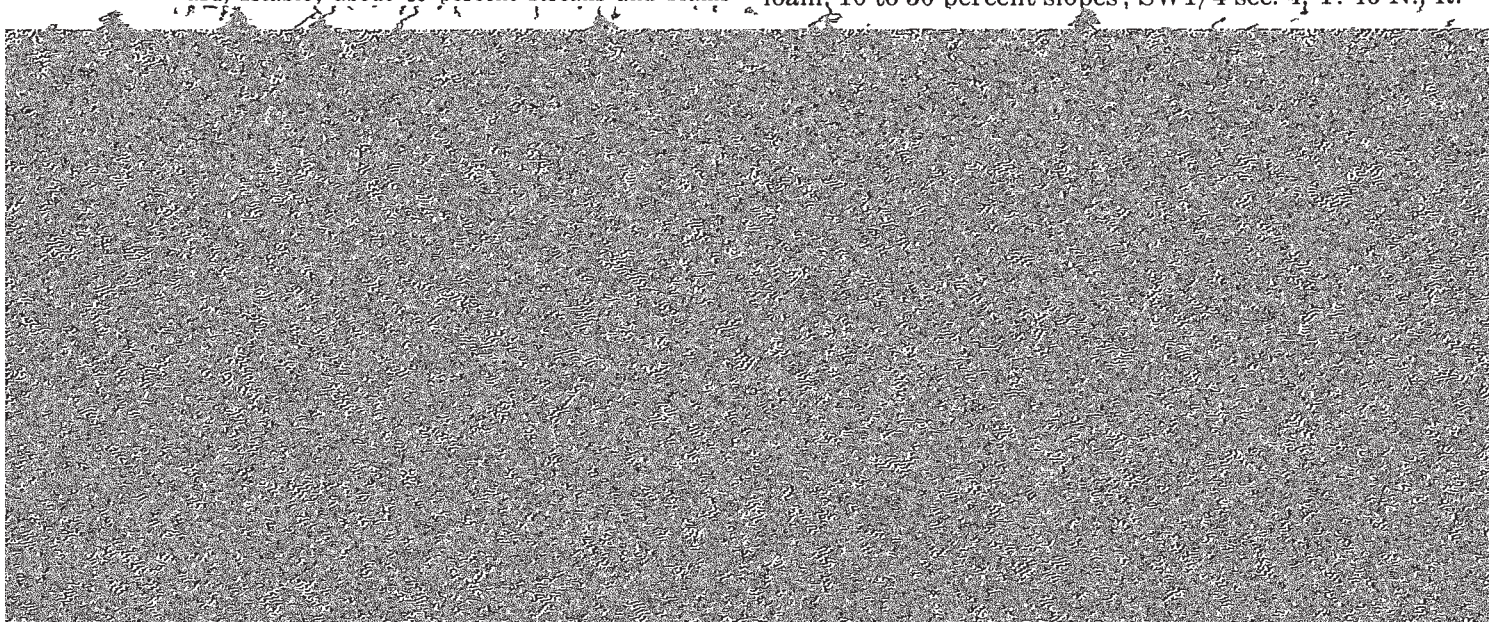
Tolvar soils are at elevations of 8,500 to 10,000 feet. They receive more than 20 inches of annual precipitation. The average annual soil temperature is less than 38° F. The overstory vegetation is commonly Engelmann spruce, subalpine fir, and aspen. The understory is chiefly mountainash, common juniper, boxleaf myrtle, elk sedge, and bearberry.

Permeability is moderate, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used for timber production, wildlife, and watershed.

The Tolvar soils in this survey area are mapped only with Uinta soils.

Representative profile of Tolvar gravelly coarse sandy loam, 10 to 50 percent slopes; SW1/4 sec. 4, T. 46 N., R.



sandy clay loam, reddish brown (5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, very friable; thin continuous clay films on ped faces; 50 percent fine and very fine, angular, granitic gravel; pH 6.4; gradual, wavy boundary.

B3t—40 to 46 inches, brown (7.5YR 5/4) very gravelly coarse sandy loam, brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; hard, very friable; few, thin, patchy clay films on ped faces; 50 percent fine, angular, granitic gravel and cobblestones; pH 6.4; gradual, wavy boundary.

C—46 to 60 inches, light yellowish-brown (10YR 6/4) very gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, very friable; 50 percent angular granitic gravel and cobblestones; pH 6.4.

The A1 horizon is 0 to 4 inches thick. The A2 horizon ranges from light brownish gray or light gray to pinkish gray or pink. The B2t horizon is reddish-brown or light reddish-brown sandy clay loam that is 35 to 50 percent very fine and fine, angular, granitic gravel. The soil is slightly acid or medium acid. Bedrock is commonly below a depth of 40 inches.

Tongue River Series

The Tongue River series consists of moderately deep, well-drained soils on mountainsides. Slopes are 10 to 50 percent. The soils formed in colluvium that was derived from sandstone and interbedded shale.

Typically these soils have a 5-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the surface layer is grayish-brown loam about 3 inches thick. The subsurface layer is about 10 inches of light-gray loam. Next is a 7-inch layer of brown and very pale brown sandy clay loam. The subsoil is brown and light olive-brown silty clay loam about 18 inches thick. Olive and buff sandstone interbedded with thin layers of shale is at a depth of 38 inches.

Tongue River soils are at elevations of 9,000 to 10,200 feet. They receive about 24 inches of annual precipitation. The average annual soil temperature is 36° F. The native vegetation is commonly Engelmann spruce, subalpine fir, lodgepole pine, and aspen. The understory is dominantly spike trisetum, elk sedge, boxleaf myrtle, alder, and common juniper.

[illegible]

and bands of B2t material interbedded in a matrix of A2 material; few, thin, patchy clay films on ped faces; pH 6.4; gradual, wavy boundary.

B2t—20 to 32 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; strong, medium, subangular blocky structure; hard, friable; thin nearly continuous clay films on ped faces; pH 6.4; clear, smooth boundary.

B3t—32 to 38 inches, light olive-brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak, medium, subangular blocky structure; hard, very friable; few, thin, patchy clay films on ped faces; 20 percent weathered sandstone and shale gravel fragments throughout horizon; pH 6.4; gradual, wavy boundary.

R—38 to 60 inches, olive and buff sandstone interbedded with thin strata of shale.

The A2 horizon is typically loam or silt loam, but in places is stony silt loam. It is light gray or very pale brown and ranges from 5 to 15 inches in thickness. The B2t horizon ranges from brown or pale brown to light brownish gray or grayish brown. The soil is slightly acid or neutral. Sandstone interbedded with shale is at a depth of 20 to 40 inches.

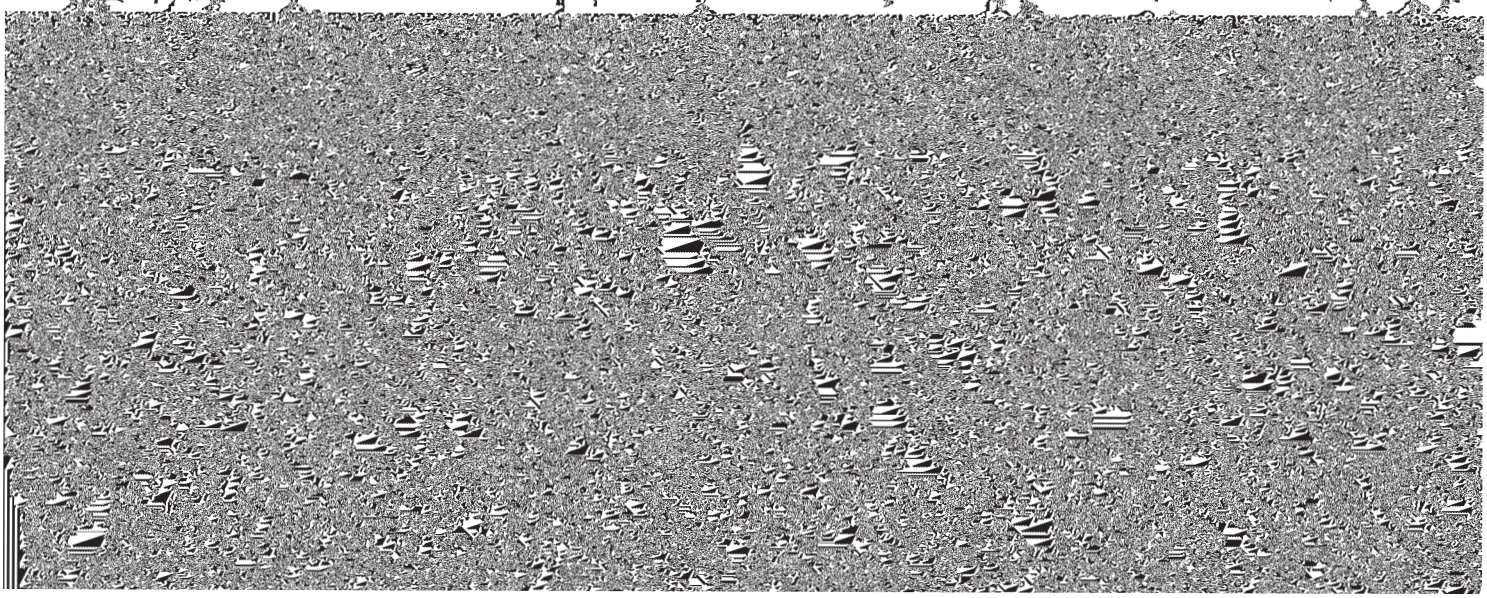
Tongue River loam, 10 to 50 percent slopes (TrF).—This soil is mainly in the Crested Butte and Carbon Peak parts of the survey area. Included with it in mapping are small areas of Rock outcrop and Stony rock land, areas of Bead and Bogan soils, and small areas of Tongue River soils where slopes are 50 to 70 percent. Included soils make up 10 percent of the total acreage.

Almost all the acreage is forested, mainly with Engelmann spruce, subalpine fir, and aspen. Northern exposures are mainly in lodgepole pine. Runoff is medium or high, and the erosion hazard is high. Capability unit VIIe-2 nonirrigated; woodland group 4.

Uinta Series

The Uinta series consists of deep, well-drained soils on mountainsides. Slopes are 10 to 50 percent. These soils formed in locally transported alluvium and colluvium that were derived mainly from gneiss or schist.

Typically, these soils have a 4-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the surface layer is light brownish-gray stony loam about 4 inches thick. The



O2—1 inch to 0, partly decomposed organic material.

A1—0 to 4 inches, light brownish-gray (10YR 6/2) stony loam, dark grayish brown (10YR 4/2) moist; strong, fine, granular structure; soft, very friable; 15 percent stone and gravel; pH 6.2; gradual, smooth boundary.

A2—4 to 18 inches, light-gray (10YR 7/2) stony loam, grayish brown (10YR 5/2) moist; weak to moderate, fine, subangular blocky structure; soft, very friable; 15 percent stone and gravel; pH 6.0; gradual, wavy boundary.

A&B—18 to 25 inches, mixed pink (7.5YR 7/2) to reddish-brown (5YR 5/4) stony clay loam, brown (7.5YR 5/3) and reddish brown (5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable; clayey nodules similar to B2t material embedded in light-colored matrix similar to A2 material; 15 percent gravel and stones; pH 5.8; diffuse, wavy boundary.

B2t—25 to 50 inches, reddish-brown (5YR 5/4) stony clay loam, reddish brown (5YR 4/4) moist; moderate, medium, subangular blocky structure; very hard, friable; thin nearly continuous clay films on ped faces; 25 percent stone and gravel; pH 5.0.

C—50 to 60 inches, reddish-brown (5YR 5/4) very stony clay loam, reddish brown (5YR 4/4) moist; massive; hard, friable; 50 percent stone and gravel; pH 5.0.

The A2 horizon is loam or stony loam and ranges from light gray or pale brown to pinkish gray. It is as much as 30 percent gravel and cobblestones. The B2t horizon ranges from brown to reddish brown. It is 15 to 35 percent angular coarse fragments. Gneiss or schist is commonly at a depth of 50 to 60 inches. Reaction ranges from slightly acid to very strongly acid.

Uinta and Tolvar soils, 10 to 50 percent slopes (UtF).—This mapping unit is mainly in the southern and eastern

Typically these soils have a 4-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the mineral surface layer is light-gray gravelly sandy loam about 17 inches thick. The next layer, about 9 inches thick, is reddish-brown and light-gray very stony and gravelly clay loam. The subsoil is about 10 inches of reddish-brown very stony and gravelly clay. Overlapping flagstone that has 1- to 2-inch voids is at a depth of 36 inches.

Vulcan soils are at elevations of 8,500 to 10,000 feet. The average annual precipitation is about 20 inches. The average annual soil temperature is 46° F. The native vegetation is commonly lodgepole pine, Engelmann spruce, Douglas-fir, and aspen. The understory is chiefly Oregongrape, kinnikinnick, elk sedge, and common juniper.

Permeability is slow. Roots can penetrate to a depth of only about 30 inches, and available water capacity is low.

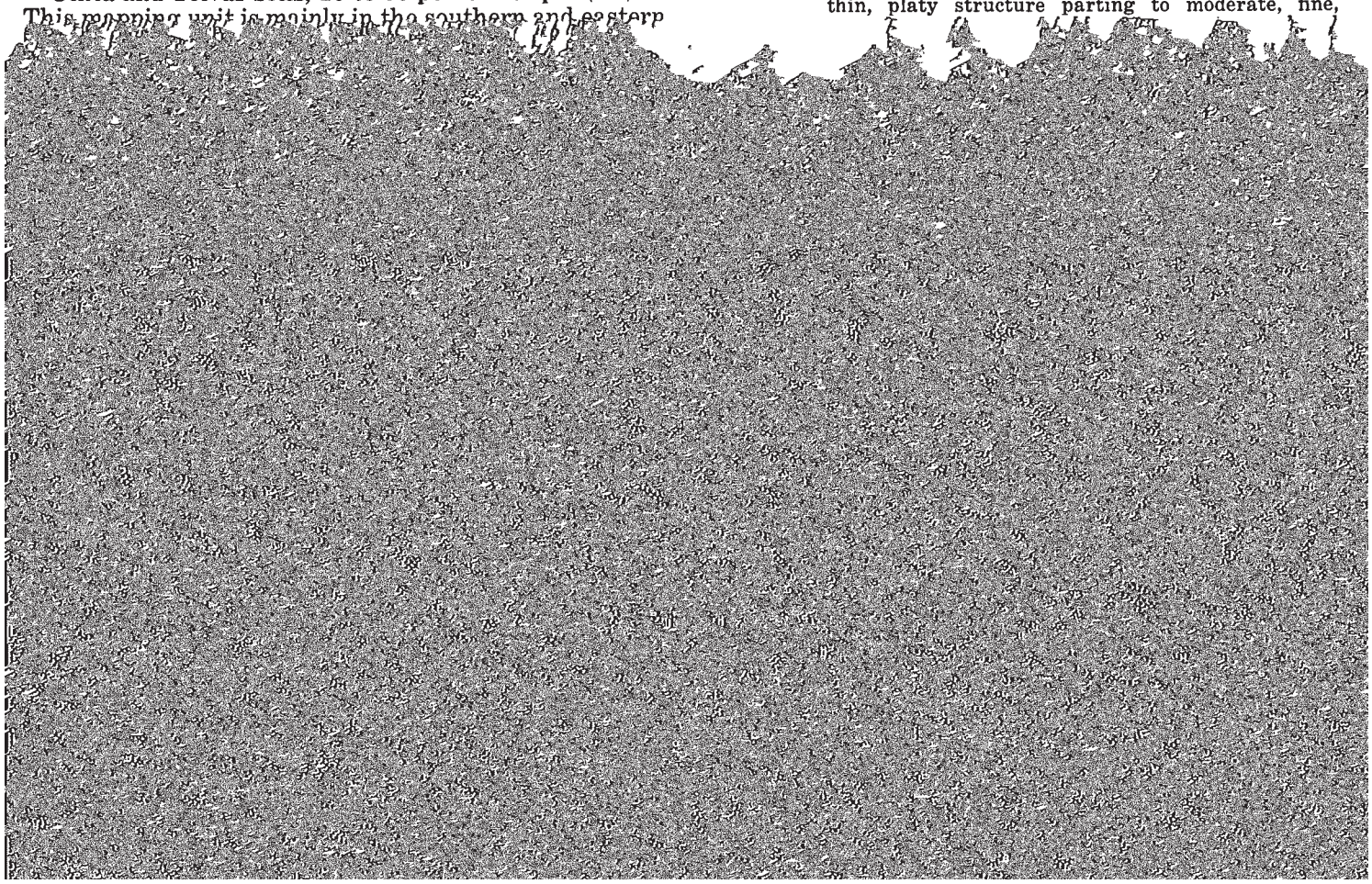
These soils are used for timber production, recreation, and wildlife.

Representative profile of Vulcan gravelly sandy loam, 10 to 55 percent slopes; SW1/4 sec. 29, T. 47 N., R. 2 E., Saguache County:

O1—4 inches to 1 inch, undecomposed organic material, chiefly needles, bark, twigs, and leaves.

O2—1 inch to 0, undecomposed organic material like that of the horizon above.

A2—0 to 17 inches, light-gray (10YR 7/2) gravelly sandy loam, light brownish gray (10YR 6/2) moist; weak, thin, platy structure parting to moderate, fine,



ern part. Included soils make up 15 percent or less of the total acreage.

The acreage is almost entirely forested. Tree species vary, depending on exposure and altitude, and include Douglas-fir, Engelmann spruce, aspen, and common juniper. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIIe-2 nonirrigated; woodland group 3.

Wetterhorn Series

The Wetterhorn series consists of moderately deep, well-drained soils on mountainsides and ridgetops. Slopes are 10 to 55 percent. These soils formed in local alluvium and colluvium that were derived from quartz latite or breccia.

Typically, these soils have a 3-inch mat of undecomposed and partially decomposed needles, bark, and twigs. In a representative profile the mineral surface layer is pinkish-gray stony loam about 12 inches thick. The next layer is mixed pinkish-gray and brown stony loam. The subsoil is brown stony clay loam about 16 inches thick. Partly weathered quartz latite is at a depth of 36 inches.

Wetterhorn soils are at elevations of 9,500 to 11,000 feet. They receive about 25 inches of annual precipitation. The average annual soil temperature is about 38° F. The vegetation is [illegible]

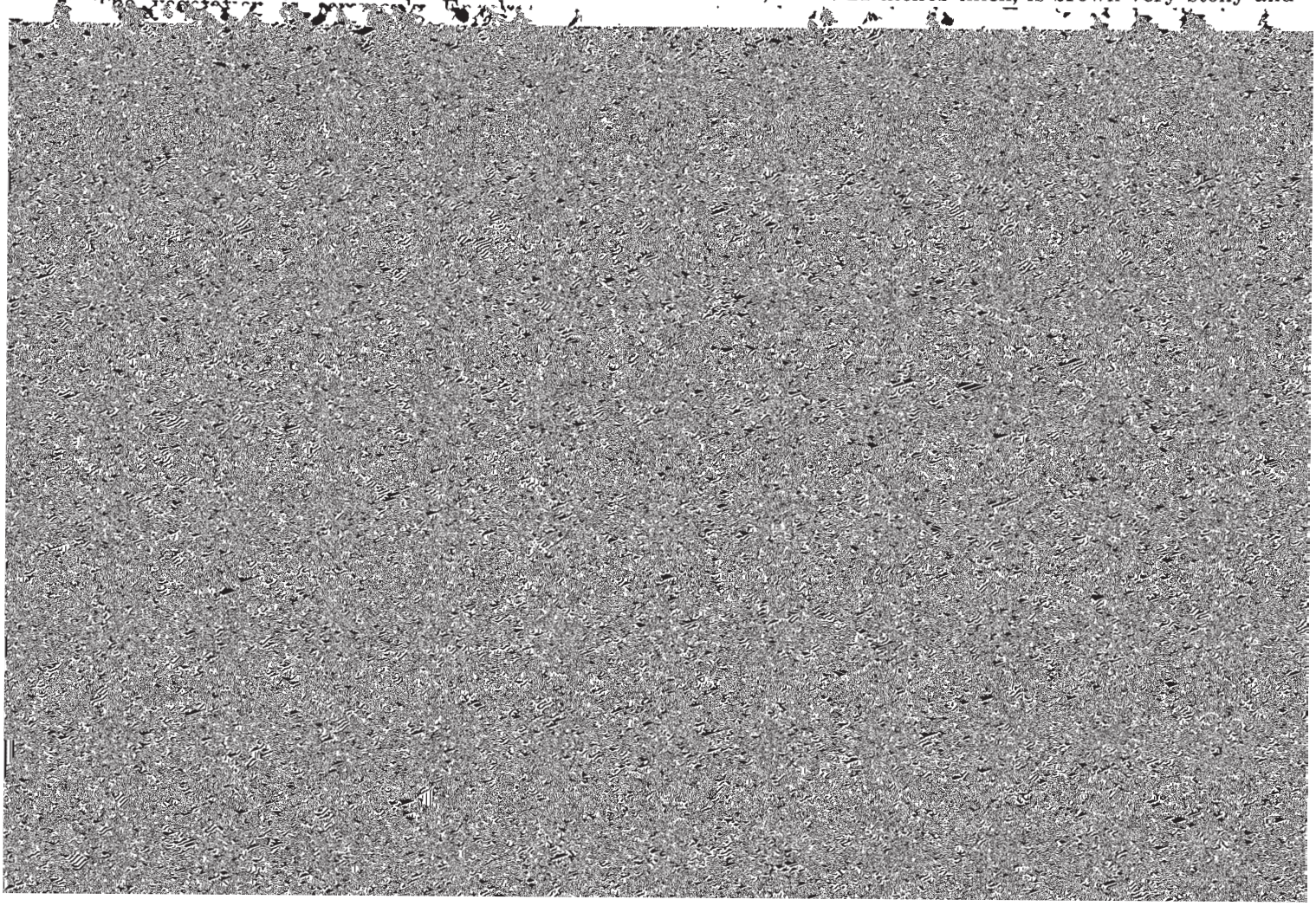
survey area. Included with it in mapping are areas of Nutras and Shule soils; small areas of Vulcan, Uinta, and Tolvar soils at lower elevations; areas of Rock outcrop and Rockslides commonly at higher elevations; and small areas where slopes are less than 10 or more than 55 percent. Included soils make up less than 15 percent of the total acreage.

Almost all the acreage is forested and is used for timber production. Large areas are in second-growth timber. Areas destroyed by fire or heavily logged commonly revert to aspen within a few years. Deer and elk find food and concealment during the summer. Some roads have been constructed, but much of the area is still virtually inaccessible. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIIe-2 nonirrigated; woodland group 3.

Woodhall Series

The Woodhall series consists of moderately deep, well-drained soils on ridgetops, mountain spurs, and mountainsides. Slopes are 5 to 50 percent. These soils formed in locally transported stony and gravelly material weathered from rhyolitic tuff.

In a representative profile the surface layer is dark grayish-brown gravelly loam about 9 inches thick. The subsoil, about 21 inches thick, is brown very stony and



hall gravelly loam and 30 percent Rock outcrop and Stony rock land. It is in the southern part of the survey area. The largest areas are near Powderhorn and along the Lake Fork of the Gunnison River.

Included with this soil in mapping are small areas of Vulcan and Youman soils and small areas of Posant soils on the steeper slopes. Included soils make up less than 15 percent of the total acreage.

This soil is used for grazing and timber production. Livestock graze the area in summer, and deer and elk find food and concealment. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIIs-2 nonirrigated; woodland group 1.

Woosley Series

The Woosley series consists of moderately deep, well-drained soils on upland hillsides, ridges, and mountainsides. Slopes are 10 to 60 percent. These soils formed in calcareous material weathered from chlorite-schist or metagabbro.

In a representative profile the surface layer is grayish-brown stony loam about 5 inches thick. The subsoil, about 25 inches thick, is brown clay loam that is calcareous in the lower part. Weathered chlorite-schist is at a depth of about 30 inches.

Woosley soils are at elevations of 9,000 to 10,000 feet. The average annual precipitation is about 17 inches. The average annual soil temperature is 40° F., and the average soil temperature in summer is 54°. The native vegetation is commonly open stands of ponderosa pine and Douglas-fir. The understory is dominantly big sagebrush, Arizona fescue, needlegrass, and native bluegrass.

Permeability is slow. Roots can penetrate to a depth of only about 30 inches, and available water capacity is low.

These soils are used for timber production, grazing, recreation, and wildlife.

Representative profile of Woosley stony loam, 10 to 60 percent slopes, 2.8 miles southwest of the Cebolla Creek road; sec. 2, T. 45 N., R. 2 W., Gunnison County:

A1—0 to 5 inches, grayish-brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) moist; strong, very fine, granular structure; soft, very friable; 20 percent angular stones and gravel; pH 6.8; clear, smooth boundary.

B1t—5 to 10 inches, brown (10YR 5/3) stony light clay loam, dark brown (10YR 3/3) moist; moderate, meduim, subangular blocky structure parting to strong, medium, granular; slightly hard, very friable; thin patchy clay films on vertical surface of peds; 10 percent angular stones and gravel; pH 6.8; clear, smooth boundary.

B2t—10 to 19 inches, brown (7.5YR 5/3) clay loam, dark

The A horizon is typically stony loam, but ranges from loam to very stony loam. It is 5 to 10 inches thick and ranges from brown to dark grayish brown or grayish brown. The content of angular gravel and stones in the B2t horizon ranges fom 5 to 35 percent by volume. This horizon is brown or light brown. Depth to weathered bedrock ranges from 20 to 40 inches. Woosley soils are typically calcareous in the lower part of the subsoil. Some areas are lime free.

Woosley very rocky loam, 10 to 60 percent slopes (WvF).—This mapping unit is about 55 percent Woosley stony loam and 30 percent Rock outcrop and Stony rock land. It is mainly in the Powderhorn part of the survey area on south-facing slopes.

Included with this soil in mapping are small areas of Carbol soils and areas of Uinta and Tolvar soils on northern exposures. Included soils make up less than 15 percent of the total acreage.

This unit is almost entirely in native vegetation. It is used chiefly for timber production. It is also grazed by livestock. Deer and elk often feed on the sunny slopes in winter. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIIe-2 nonirrigated; woodland group 1.

Youga Series

The Youga series consists of deep, well-drained soils on upland hillsides and mountainsides. Slopes are 3 to 30 percent. These soils formed in gravelly and cobbly glacial till and alluvial fan sediment.

In a representative profile the surface layer is very dark grayish-brown loam about 6 inches thick. The subsoil is dark-brown and brown gravelly clay loam about 23 inches thick. The substratum to a depth of 60 inches is pale-brown gravelly clay loam.

Youga soils are at elevations of 8,500 to 9,500 feet. They receive 20 inches of annual precipitation. The average annual soil temperature is 39° F. The vegetation is commonly Thurber fescue, bearded wheatgrass, nodding brome, big sagebrush, and scattered clumps of aspen.

Permeability is slow. Roots can penetrate to a depth of 60 inches or more, and available water capacity is high.

These soils are used for grazing and wildlife.

Representative profile of Youga loam, 3 to 30 percent slopes; NE1/4 sec. 7, T. 50 N., R. 2 E., Gunnison County:

A1—0 to 6 inches, very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) moist; weak, medium, subangular blocky structure parting to weak, fine, granular; soft, very friable; 5 to 10 percent cobblestones and stones; pH 6.7; clear, smooth boundary.

B1t—6 to 10 inches, dark-brown (7.5YR 4/3) gravelly light

thin patchy clay films on ped faces; 20 percent gravel and cobblestones; pH 7.1; gradual, smooth boundary.

C—29 to 60 inches, pale-brown (10YR 6/3) gravelly light clay loam, dark brown (10YR 4/3) moist; massive; hard, friable; 30 percent gravel and cobblestones; pH 6.8.

The A horizon is typically loam, but in places is gravelly and cobbly. The B2t horizon is clay loam that is 10 to 30 percent gravel and cobblestones.

Youga loam, 3 to 30 percent slopes (YgE).—This soil is mainly in the northern part of the survey area, ordinarily on northern exposures.

Included with this soil in mapping are small areas of Parlin and Mergel soils at lower elevations and small areas of eroded Youga soils. Included soils make up 10 percent of the total acreage.

This soil is used extensively for grazing and for wildlife. Runoff is medium, and the erosion hazard is moderate. Capability unit VIe-4 nonirrigated; Subalpine Loam range site.

Youman Series

The Youman series consists of deep, well-drained soils on alluvial fans and valley-fill slopes. Slopes are 5 to 35 percent. These soils formed in alluvial sediment that was derived from rhyolite and rhyolitic tuff.

In a representative profile the surface layer is very dark gray loam about 12 inches thick. The subsoil is brown and reddish-brown heavy clay loam about 28 inches thick. The substratum to a depth of 60 inches is light-brown heavy clay loam.

Youman soils are at elevations of 9,000 to 10,500 feet. They receive approximately 20 inches of annual precipitation. The average annual soil temperature is 38° F. The vegetation is commonly Thurber fescue, big bluegrass, Idaho fescue, big sagebrush, and scattered

B3t—35 to 40 inches, light reddish-brown (5YR 6/4) heavy clay loam, reddish brown (5YR 5/4) moist; moderate, coarse, subangular blocky structure; extremely hard, firm; thin patchy clay films on ped faces; pH 7.0; gradual, smooth boundary.

C—40 to 60 inches, light-brown (7.5YR 6/4) heavy clay loam, brown (7.5YR 5/4) moist; weak, coarse, angular blocky structure; extremely hard, very firm; pH 7.0.

The A horizon is typically loam, but in places is stony. It ranges from 6 to 15 inches in thickness and from very dark gray to black in color. The B2t horizon is typically heavy clay loam, but ranges to clay in places. The content of angular coarse fragments is as high as 30 percent in the lower part of the subsoil and in the substratum.

Youman-Leaps loams, 5 to 35 percent slopes (YlE).—This mapping unit is about 60 percent Youman soil and 30 percent Leaps soil. It is on uplands, mainly in the extreme west-central part of the survey area. The Leaps soil is along narrow, winding valleys and on toe slopes. It has a profile similar to the one described as representative of the Leaps series, but the surface layer is loam. The Youman soil is on somewhat rounded knobs and roughly parallel ridges.

Included with these soils in mapping are 2- to 5-acre tracts of Kubler and Dollard soils on dry southerly exposures. Small kames and kettles, typical of glaciated terrain, are scattered throughout this mapping unit. Included soils make up about 10 percent of the total acreage.

This unit is in native range and is used for livestock grazing and wildlife. Runoff is medium to rapid, depending on the slope. The erosion hazard is high on the Leaps soil and moderate on the Youman soil. Capability unit VIe-4 nonirrigated; Youman soil in Subalpine Loam range site, Leaps soil in Deep Clay Loam range site.

Youman-Passar loams, 5 to 30 percent slopes (YpE).—This mapping unit is about 55 percent Youman soil and

management by capability units. It also shows estimated yields of meadow hay on the soils under irrigation.

This part of the survey also contains information on range management and on the suitability of the soils

water management increases production. Moderate applications of nitrogen and phosphate fertilizers give good results. The soils have a potential nitrogen supply from the action of soil bacteria, but because the soil temperature is cool, bacterial action is very slow and

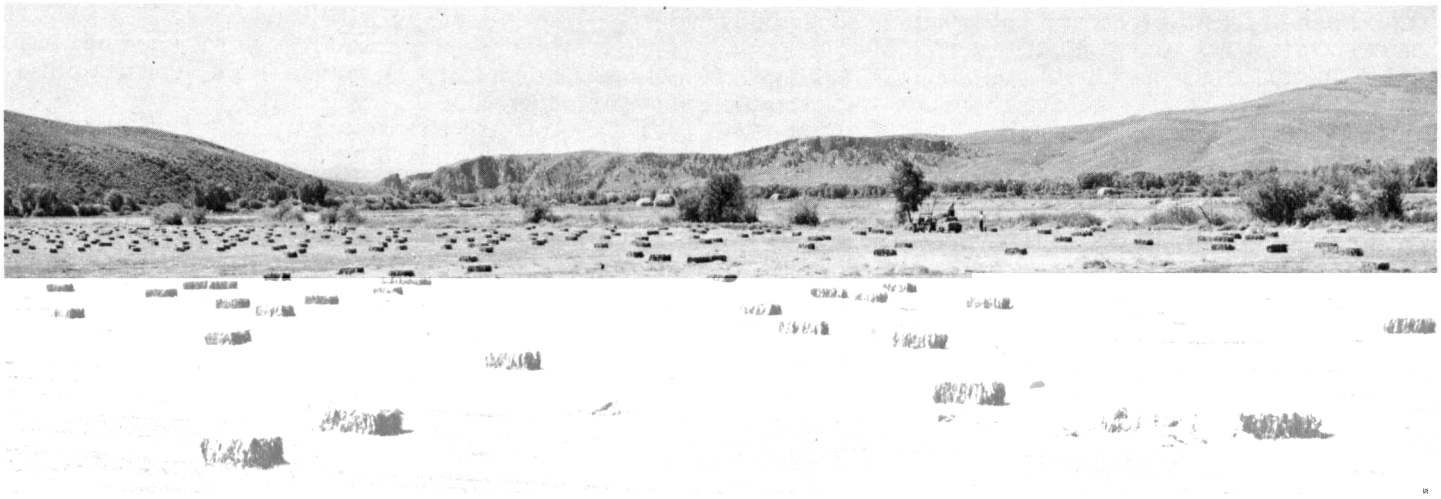


Figure 7.—**Bales of native hay on Irim loam, 0 to 1 percent slopes.**

the unit. These levels are described in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are desig-

restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations

productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-1.

the surface. The water table fluctuates between the surface and a depth of 3 feet.

These soils are subject to occasional flooding. Available water capacity is low to high. Permeability is slow to moderate.

and renovated. Hay and pasture plants respond well to fertilization and water management. Timothy, brome, intermediate wheatgrass, and alsike, red, and Ladino clovers are the species seeded and interseeded.

CAPABILITY UNIT VIe-1, IRRIGATED

This unit consists of deep and moderately deep, well-drained, moderately sloping to steep soils on alluvial fans, mountainsides, and hillsides. These soils have a medium textured and moderately fine textured surface layer. Lime layers are common below the subsoil. Bedrock is at a depth of 20 to 40 inches in the moderately deep soils. Scattered stones or cobblestones occur in some of the soils and are commonly concentrated in localized areas.

These soils are subject to water erosion, low temperature, and low precipitation. Available water capacity is low to high. Permeability is slow to moderate.

These soils are suited to native hay, and to irrigated pasture where water is available. Suitable pasture and hay plants are smooth brome, timothy, orchardgrass, intermediate wheatgrass, and red, alsike, and Ladino clovers. In establishing a new stand of grass, extra care must be taken in plowing to prevent excessive erosion. If the soils are not to be seeded to hay or pasture for a year or more, a small grain crop should be seeded to provide a protective cover. Irrigation ditches should be constructed on the contour. Supply ditches should have drop structures to minimize ditch erosion. Short irrigation runs and small flow in the runs keep erosion at a minimum.

Good pasture management is important when these soils are used for grazing. Maintaining good grasses and legumes, carefully managing irrigation water, and maintaining fertility increase production and limit the amount of erosion and deterioration.

CAPABILITY UNIT VIw-1, IRRIGATED

Only Alluvial land, wet, is in this capability unit. It is deep, dark colored, very poorly drained, stratified, and moderately coarse textured to moderately fine textured and contains numerous stones and cobblestones. It is in narrow winding valleys and on flood plains and receives water from springs and stream flow. The water table is at or near the surface during most of the year. Slopes are 0 to 5 percent.

Alluvial land, wet, is used for grazing and wildlife, but in some areas it is too wet for livestock. It cannot be plowed and seeded, because the water table is high. Removing excess water from shallow depressions and basins through furrows helps control the water table and promotes the growth of better grasses and clover. Erosion is not a hazard.

CAPABILITY UNIT VIs-1, IRRIGATED

This unit consists of deep, gently sloping to moderately sloping, cobbly and gravelly soils on terraces and alluvial fans. The surface layer of these soils is gravelly and cobbly sandy loam or cobbly loam. Very cobbly or very gravelly material is below a depth of 19 inches.

Available water capacity is low. Permeability is moderate to rapid. The erosion hazard is none to slight.

About half the acreage is irrigated and is suited to pasture or hay. Maintaining a good plant cover is difficult during periods of drought. Cultivating is difficult because the surface layer is cobbly or gravelly. Renovation is needed in places to establish desirable vegetation. The principal management concern is maintaining adequate moisture and an adequate supply of plant nutrients. Light, frequent irrigation and short runs are needed to prevent loss of water through deep percolation.

CAPABILITY UNIT VIe-2, NONIRRIGATED

This unit consists of deep, well-drained, gently sloping to moderately sloping soils that are mainly on alluvial fans and valley-fill slopes. The surface layer of these soils is medium textured to moderately coarse textured. In some areas it is gravelly, cobbly, or channery.

These soils are subject to water erosion unless protected. Available water capacity is low. Permeability is moderate to slow.

Most of the acreage is in native vegetation and is used for grazing. In some areas range seeding or interseeding is desirable. Equipment can be used in all areas. Grazing management should be carefully considered to maintain the most desirable grass species.

CAPABILITY UNIT VIe-4, NONIRRIGATED

This unit is in that part of the survey area where the annual precipitation is about 20 inches. It consists of moderately deep to deep, well-drained, gently sloping to moderately steep soils on uplands. These soils have a surface layer of loam or silt loam. Some are moderately deep over bedrock.

These soils are subject to erosion. Available water capacity is low to high, depending on depth to bedrock. Permeability is moderate to slow.

Most of the acreage is in native vegetation. Potential forage production is high under good grazing management. Seeding to replenish depleted areas is desirable. Mechanical equipment can be used in most areas. Controlling big sagebrush, silver sagebrush, and other undesirable vegetation, by the use of herbicides, for example, increases the vigor and amount of the understory grasses.

CAPABILITY UNIT VIe-5, NONIRRIGATED

This unit consists of moderately sloping to steep, well-drained soils on uplands. These soils are shallow and moderately deep over bedrock. The surface layer is medium textured and moderately coarse textured. Small angular pebbles and larger channery fragments are in the surface layer and throughout most of the soil.

Water erosion is a hazard. Available water capacity is low. In most places permeability is moderate.

Most of the acreage is used for grazing. Seeding to reestablish depleted forage species is desirable. Mechanical equipment can be used in preparing seedbeds and in seeding. Herbicides are used to control big sagebrush and other undesirable plants, in order to increase grass production.

Good grazing management is needed to maintain desirable vegetation and reduce erosion. Grazing should

be deferred in spring until the plant cover is adequate. Rotation grazing is needed during the growing period.

CAPABILITY UNIT VIw-3, NONIRRIGATED

Only Alluvial land is in this unit. It is deep, well drained, and nearly level to strongly sloping and is in narrow, winding valleys and on small fans and valley-fill toe slopes. The upper part is typically medium textured. The lower part is highly stratified. Flooding and gully erosion along drainageways are the main limitations.

Most of the acreage is in native vegetation and is used for grazing. Potential production is high because Alluvial land receives additional moisture as runoff from higher soils. Good grazing management is essential for maximum production and erosion control.

CAPABILITY UNIT VIIe-1, NONIRRIGATED

This unit consists of moderately sloping to steep, well-drained soils that are moderately deep to deep over bedrock. These soils are on uplands. The surface layer is silty clay loam. Permeability is slow, and available water capacity is high.

These soils are well suited to range. They should not be seeded because runoff is rapid and erosion is a hazard. If well managed, they produce moderate to high yields of forage. Deferred grazing, rotation grazing, and proper range use are needed to prevent depletion of the plant cover.

CAPABILITY UNIT VIIe-2, NONIRRIGATED

This unit consists of moderately deep to deep, strongly sloping to very steep, well-drained soils on hills and uplands. The surface layer of these soils is medium textured to moderately coarse textured and in places is gravelly or stony. The content of stones and gravel in the soil is high. Rock outcrop is common in some areas.

These soils receive more than 20 inches of annual precipitation, much of which is snow. Available water capacity is low to high. Permeability is slow to moderate.

The vegetation is dominantly Engelmann spruce, subalpine fir, Douglas-fir, and lodgepole pine. Aspen is dominant in most areas where the commercial trees have been destroyed by fire, logging, or some other means. Aspen will gradually be replaced by conifers if a seed source is available.

Stones, rocks, and steep slopes are moderate to severe limitations to the use of equipment. Good timber management is needed to protect these soils from erosion and to maintain productive stands. The erosion hazard is moderate or high, depending on slope, in those areas disturbed by fire, poor logging methods, and improper road construction. Some good trees should remain after cutting or harvesting as a seed source and for future harvest.

In places the understory vegetation is used for grazing.

CAPABILITY UNIT VIIs-3, NONIRRIGATED

This unit consists of well-drained and excessively drained, moderately sloping to very steep soils that are shallow to deep over bedrock. These soils are on uplands. The surface layer is medium textured and moderately coarse textured and is gravelly, channery, or stony. Rock outcrop is common in some areas.

Available water capacity is low to high, and permeability is moderately slow or moderate. In most places water erosion is a moderate to high hazard. Wind erosion can be a slight hazard on southern and western exposures.

Nearly all the acreage is in native vegetation and is used for grazing. Improving and maintaining the present vegetation are important. In most places the soils are too rocky, too steep, and too erodible for seeding. If necessary, mechanical equipment can be used in the less sloping, less stony areas.

Good grazing management is needed to maintain the most desirable vegetation and to prevent loss of soil through erosion. Grazing can be deferred early in spring until after plants have made sufficient growth.

CAPABILITY UNIT VIIw-4, NONIRRIGATED

Only Alluvial land, occasionally flooded, is in this unit. It is nearly level or gently sloping and varies widely in color, texture, depth, and drainage. It is on the flood plain and is subject to flooding and channel change. Very cobbly areas are interspersed with deeper soil material.

Alluvial land, occasionally flooded, is not suitable for cultivation. It can be used for limited grazing, wildlife, and recreation. Erosion can be a hazard, but the most serious limitations are overflow and detrimental deposition of silt, sand, and gravel. Drainage is not practical.

CAPABILITY UNIT VIIs-1, NONIRRIGATED

This unit consists of shallow to deep, well-drained, moderately sloping to very steep soils on uplands. The surface layer of these soils is loam and fine sandy loam and in most places is stony or cobbly.

Permeability is rapid to slow. In most places available water capacity is low, but in some it is high.

Nearly all the acreage is in native vegetation and is used for grazing.

These soils are so steep and have so many stones and cobblestones in the surface layer that seeding them is not feasible. Grazing should be deferred early in spring until the grass cover is adequate. Rotation grazing insures growth of the more desirable plants and improves forage production.

CAPABILITY UNIT VIIs-2, NONIRRIGATED

This unit consists of well-drained, strongly sloping to very steep soils on mountainsides and hillsides, generally on southerly and westerly exposures. These soils have a moderately coarse textured and medium-textured surface layer that is gravelly, channery, or stony. They are shallow to moderately deep over bedrock. Rock outcrop is common.

Permeability is moderate and moderately rapid, and available water capacity is low. The erosion hazard is moderate or high. The root zone is shallow, and an adequate vegetative cover is difficult to maintain. Snowmelt early in spring often results in deficient moisture for plants during the growing season.

Most of the acreage is in native vegetation and is used for timber and limited grazing. The dominant

TABLE 2.—*Predicted average yields per acre under improved management on principal irrigated soils*

and characteristic plant community. The range site retains its ability to produce this potential plant community unless it is materially altered or the environment changes. Its inherent productivity, like that of other agricultural land, depends on the combined effects of

mentioned in the description of each site. The Guide to Mapping Units at the back of this publication shows the range site classification for most soils in the survey area. Not all are assigned to a range site.

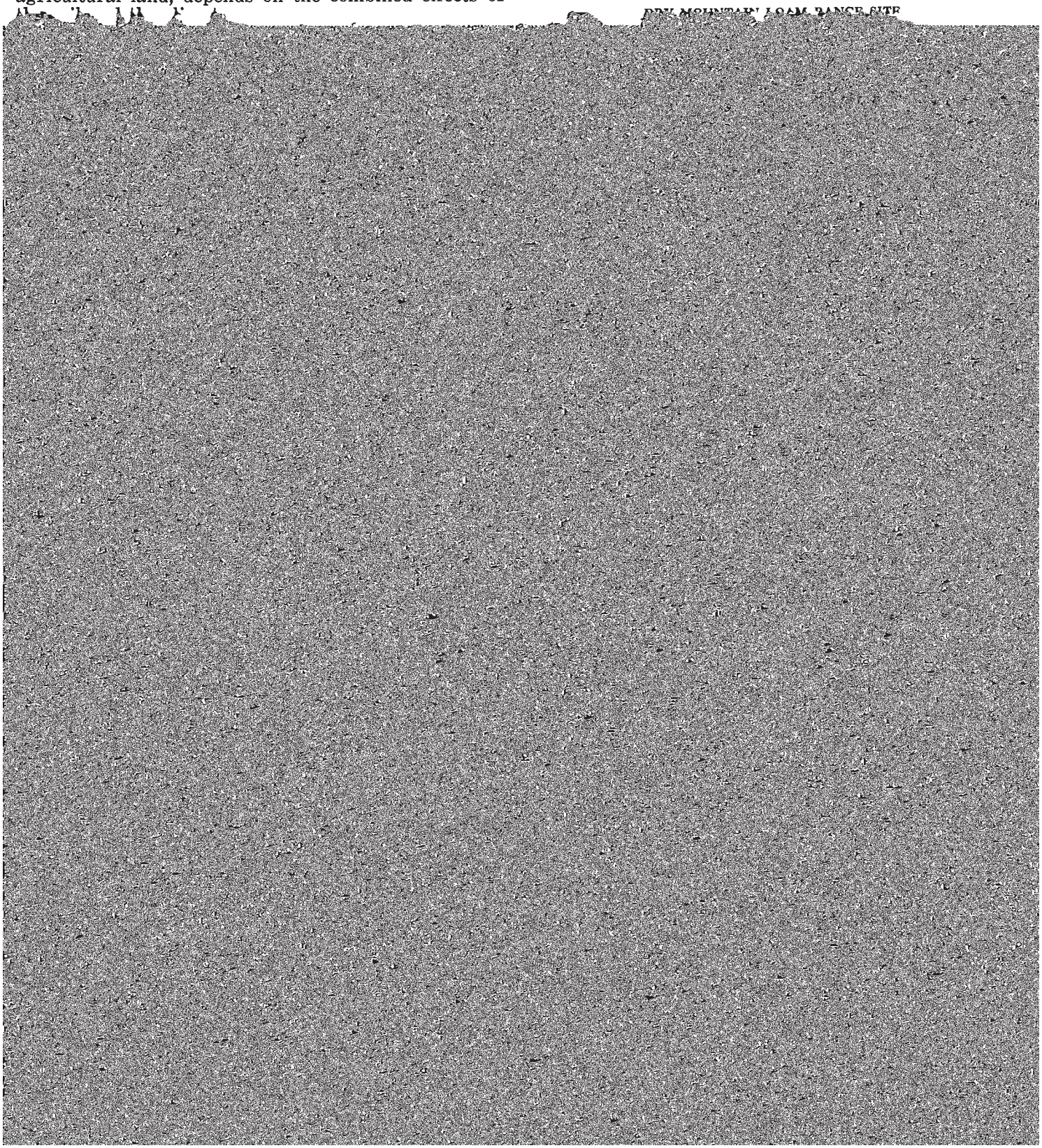


Figure 8.—**Dry Mountain Loam range site in poor condition. Unless range condition is good or excellent, big sagebrush is dominant.**

MOUNTAIN LOAM RANGE SITE

This is the most extensive range site at elevations of about 8,300 to 9,300 feet. It is also on many steep, north and northeast exposures at lower elevations (fig. 9). Slopes are mostly less than 10 percent, but in many places range up to 30 or 40 percent. The average annual precipitation is 15 to 20 inches. There is usually a good snow cover in winter.

The soils in this site are moderately deep or deep. They are medium textured and in places are gravelly, channery, or stony. Available water capacity is low to high, and permeability is slow to moderate.

An open overstory of big sagebrush and an almost unbroken cover of grasses and forbs characterize this range site. Western, slender, and bearded wheatgrass plus nodding and mountain brome, Arizona fescue, junegrass, and other grasses are dominant in the potential plant community. Forbs are western yarrow, Indian paintbrush, sulfur buckwheat, Fremont geranium, silvery lupine, and several less abundant species. Snowberry, Douglas rabbitbrush, fringed sage, and smaller amounts of serviceberry and antelope bitterbrush occur in the plant community.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses:	
Arizona fescue	15
Western wheatgrass	10
Nodding brome	5
Mountain brome	5
Bearded wheatgrass	5
Slender wheatgrass	5
Junegrass	5
Mountain muhly	5
Muttongrass	5
Squirreltail	5
Elk sedge	3
Others	5
Forbs:	
American vetch	2
Indian paintbrush	2
Silvery lupine	1
Showy cinquefoil	1
Sulfur buckwheat	1
Western yarrow	1
Others	2
Shrubs:	
Big sagebrush	10
Snowberry	3
Douglas rabbitbrush	2
Others	2

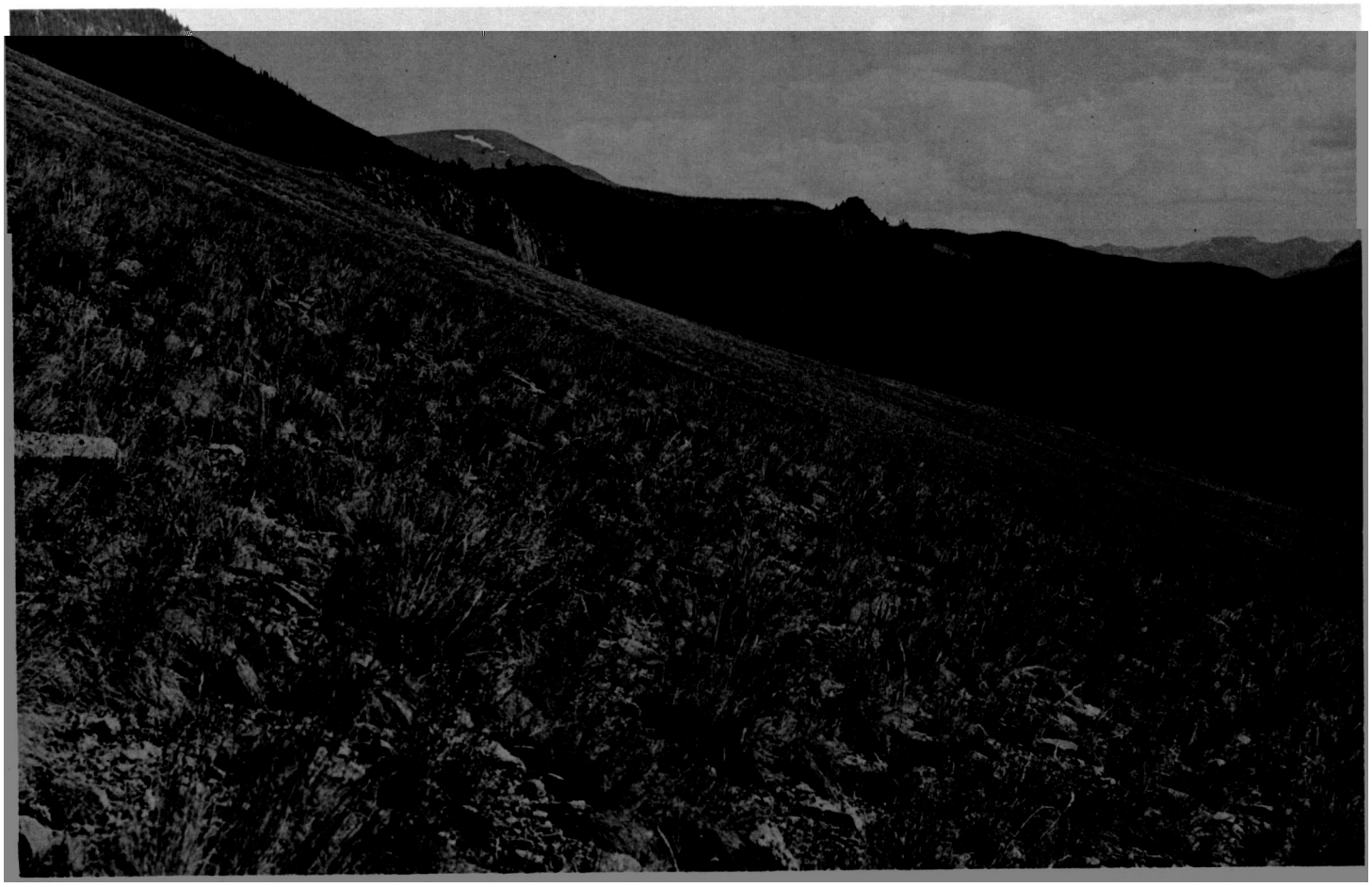


Figure 9.—**Mountain Loam range site in excellent condition.**

The total annual yield of air-dry forage fluctuates between 1,800 pounds per acre in favorable years and 1,200 pounds per acre in less favorable years.

Continued heavy grazing during the growing season for several successive years results in a change in the potential plant community. Most of the main forage grasses decrease and are replaced by big sagebrush, fringed sage, western yarrow, sulfur buckwheat, Douglas rabbitbrush, and other increasers. The final stage of poor range condition is characterized by a high percentage of bare ground and annual weeds.

At least 80 percent of the vegetation on this site provides forage for cattle.

MOUNTAIN OUTWASH RANGE SITE

This site is extensive in Cochetopa Park. It is on slope wash fans, valley-fill slopes, and terraces. It also occurs as small acreages on some of the older terraces along the Lake Fork of the Gunnison River. Slopes range up to 30 percent, but are mostly less than 8 percent. The climate is characterized by extremely cold temperatures and little or no snow cover in winter. Daytime temperatures in summer are as high as the eighties, but at night near freezing temperatures are not unusual.

The soils in this site formed in outwash material. They are medium textured or moderately coarse textured and in places are gravelly, channery, or cobbly. Available water capacity is low to high, and permeability is slow to rapid.

The potential plant community consists of grasses and forbs and a few scattered shrubs (fig. 10). Arizona fescue is the dominant grass. Mountain muhly, muttongrass, and Indian ricegrass are next in abundance. Forbs are showy cinquefoil, Indian paintbrush, rose pussytoes, and Fremont geranium. Common shrubs and half shrubs are wax currant, fringed sage, winterfat, and Douglas rabbitbrush.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses:	
Arizona fescue	20
Mountain muhly	10
Indian ricegrass	10
Muttongrass	10
Western wheatgrass	5
Junegrass	5
Squirreltail	5
Blue grama	2
Slimstem muhly	2
Letterman needlegrass	2

Figure 10.—**Abundance of increaser grasses on Mountain Outwash range site. Typical profile of Redcloud channery loam is in the foreground.**

	Percent
Forbs:	
Showy cinquefoil	2
Indian paintbrush	2
Fremont geranium	2
Rose pussytoes	1
Others	4
Shrubs:	
Fringed sagebrush	8
Douglas rabbitbrush	3
Big sagebrush	3
Wax currant	2
Winterfat	2

The total annual yield of air-dry forage fluctuates between 1,000 pounds per acre in favorable years and 600 pounds per acre in less favorable years.

If this site is subjected to prolonged heavy grazing or other major disturbance, a sharp reduction takes place in a number of the more palatable forage species and a corresponding increase in the species less palatable or better adapted to withstand close grazing. As the site deteriorates further, it loses most of its original plant cover and has a sparse cover of shrubs and short-growing grasses. Pingue and annual weeds invade.

About 65 percent of the vegetation on this site provides forage for cattle.

MOUNTAIN MEADOW RANGE SITE

This site occurs throughout the survey area, below timberline, in naturally irrigated and subirrigated areas in valleys and swales. Slopes are less than 5 percent. The soils are stratified and very poorly drained. They have a high organic-matter content. Numerous stones are on the surface.

The potential plant community is a lush growth of grasses, sedges, and rushes mixed with forbs and a few woody plants. Tufted hairgrass is the most abundant grass. It is closely associated with slender wheatgrass, Nebraska sedge, Baltic rush, reedgrass, foxtail barley, and other grasses. Forbs are American bistort, fireweed, showy cinquefoil, and others. Woody plants are willows, shrubby cinquefoil, and silver sagebrush.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses and grasslike plants:	
Tufted hairgrass	45
Slender wheatgrass	10
Nebraska sedge	10
Baltic rush	5
Ovalhead sedge	2
Reedgrass	2
Foxtail barley	2
Others	2
Forbs:	
American bistort	5
Wild celery	2
Cow parsnip	2
Showy cinquefoil	2

	Percent
Forbs—Continued	
Rocky Mountain iris	1
Elephanthead lousewort	1
Others	5
Shrubs:	
Willow	2
Shrubby cinquefoil	2

The total annual yield of air-dry forage from this moist site varies less than that of upland sites because available moisture is generally adequate. Yields range from 4,000 pounds per acre in favorable years to 3,000 pounds per acre in less favorable years.

If this site is subjected to repeated heavy grazing, many of the palatable grasses disappear and are replaced by iris, cinquefoil, dandelion, annual weeds, and other plants.

About 90 percent of the vegetation on this site provides forage for livestock.

MOUNTAIN SWALE RANGE SITE

This site is below timberline in valleys and swales. It is in a physiographic position similar to that of the Mountain Meadow range site, but in contrast, it is not subirrigated. It is along drainageways and is sub-

result in an increase in big sagebrush, rabbitbrush, Kentucky bluegrass, and annual forbs. These plants replace many of the species listed in the potential plant community.

About 80 percent of the vegetation on this site provides forage for cattle.

DEEP CLAY LOAM RANGE SITE

This site is generally at higher elevations where annual precipitation is more than 15 inches. Slopes are 5 to 30 percent. The soils are moderately deep to deep. The surface layer is silty clay loam. Permeability is slow, and available water capacity is high.

Western wheatgrass, muttongrass, Arizona fescue, nodding brome, and junegrass are the principal grasses. Mulesear wyethia, arrowleaf balsamroot, silvery lupine, Fremont geranium, and American vetch are showy forbs in the potential plant community. Scattered big sagebrush, mountain snowberry, and Parry rabbitbrush are also part of the plant cover.

Following are percentages, by weight, of the total annual yield for the potential plant community:

Percent

Figure 11.—**Subalpine Loam range site, on Mord soil, showing good stand of Thurber fescue.**

moderate to very slow, and available water capacity is mostly high.

A luxuriant growth of grasses and forbs and a sprinkling of shrubs characterize the potential plant

	Percent
Shrubs:	
Silver sagebrush	4
Mountain snowberry	3
Shrubby cinquefoil	2
Nettle-leaf	1

They are moderately coarse textured and in places are stony or gravelly. Available water capacity is low, and permeability is moderately slow.

An interrupted stand of grasses, forbs, and shrubs characterizes the potential plant community on this site. Muttongrass, Letterman needlegrass, mountain muhly, Arizona fescue, and Thurber fescue are the principal

	Percent
Grasses and grasslike plants:	
Kobresia	20
Sedges	10
Alpine bluegrass	5
Tufted hairgrass	5
Scribner wheatgrass	3
Baker wheatgrass	2
Spike trisetum	2
[illegible]	[illegible]

Figure 12.—**Alpine Slopes range site near timberline.**

The trees protect the soils against erosion and produce valuable wildlife food and cover, which is important to the economy of the Gunnison Area, and the understory provides grazing for sheep and cattle. The woodland is also important as a recreation site and valuable as watershed for the survey area. The Gunnison Area has long been noted for its hunting, fishing, and recreation. Well-kept and well-managed forests can maintain and enhance these values.

Woodland management

Management of woodland can be planned more effectively if soils are grouped according to those characteristics that affect growth of trees and management of the stands. The soils of the Gunnison Area have been assigned to four woodland groups. Each group consists of soils that are about the same in suitability for trees, potential productivity, and management requirements.

Some soils are more productive of trees than others. The height to which a species of tree will grow in a specified number of years, or the site index, indicates the productivity of a soil. The higher the site index, the higher the potential productivity of the soil.

The four woodland groups in the Gunnison Area are listed in table 3. The table shows the site index range for each group, lists the trees that are potentially good timber, shows the degree of soil-related hazards and limitations that must be considered in management, and evaluates the understory utilized as forage. The soil-related hazards and limitations are defined in the paragraphs that follow.

Plant competition refers to the rate of invasion by unwanted trees and shrubs, such as oak brush. Competition is *slight* if it does not prevent adequate natural regeneration and early growth, or interfere with the normal development of planted seedlings. Competition is *moderate* if it delays the establishment and slows the growth of seedlings, either naturally occurring or planted, but does not prevent the eventual development of a fully stocked, normal stand. Competition is *severe* if it prevents adequate restocking, either natural or artificial, without intensive preparation of the site and without special maintenance practices, including weeding.

Seedling mortality refers to the expected loss of seedlings as a result of unfavorable soil characteristics or topographic features. Even if healthy seedlings of suitable species are correctly planted or occur naturally in adequate numbers, some will not survive if conditions are unfavorable. The degrees of seedling mortality

TABLE 3.—*Woodland groups, wood crops and forage,*

Woodland groups	Tree species	Productivity		Plant competition	Seedling mortality
		Site index	Estimated time to grow sawlogs		
		Feet	*Years*		*Percent*
1	Ponderosa pine	40–50	160	Moderate	25–75
	Douglas-fir	40–50	160		
[illegible]	[illegible]	[illegible]	[illegible]	Slight	25–50

and factors in management

Windthrow hazard	Erosion hazard	Equipment limitation	Understory utilized as forage	Remarks
Slight	Moderate to severe	Moderate to severe	Fair to good grazing	Little or no aspen.
Slight	Moderate	Moderate to severe	Fair to poor grazing	Aspen usually poor quality.
Slight	Moderate	Moderate to severe	Fair to poor grazing except in stands of aspen.	Aspen usually not of commercial quality.
Slight	Slight	Moderate to severe	Poor grazing except in stands of aspen.	Potential for commercial quality aspen.

percent. Permeability is slow, and available water capacity is high to low. Aspen and lodgepole pine are the major trees in areas where fire or other serious disturbances have occurred.

The site index range is 55 to 65 for Engelmann spruce, 45 to 65 for lodgepole pine, and 50 to 60 for subalpine fir.

WOODLAND GROUP 4

This group consists of soils on which lodgepole pine, Engelmann spruce, and subalpine fir are dominant. These soils are in the areas of higher precipitation, on mesa tops, such as Blue Mesa. They are the most typical forest soils in the survey area. They have a higher site index and greater production potential than soils in the other woodland groups. They are moderately deep to deep. The surface layer is loam or stony loam. Slopes are 10 to 50 percent. Permeability is slow, and available water capacity is moderate or low. Most burned or distributed areas commonly revert to aspen. Some revert to lodgepole pine.

The site index range is 65 to 90 for Engelmann spruce, 65 to 76 for lodgepole pine, and 60 to 80 for subalpine fir.

Recreation[5]

Many factors determine whether or not recreational development is feasible at a given location. Some of the more important factors are the economic, legal, and social considerations and the location, climate, scenery, soil, and water.

Table 4 rates the soils in the Gunnison Area, by soil associations, according to limitations that affect their suitability for selected recreational uses. Limitations are expressed as *slight*, *moderate*, or *severe*. A *slight* limitation means that soil properties are generally favorable and limitations are so minor that they can be easily overcome. *Moderate* means that the limitation can be overcome or modified by planning, design, or special maintenance. *Severe* means that costly soil reclamation, special design, intensive maintenance, or a combination of these, is required. Some of the soil properties considered in the ratings are slope, wetness, soil texture, soil depth, hazard of flooding, and stoniness.

Onsite investigation is needed as part of the initial planning for any proposed recreational development. Specific sites within an association, for example, can have only a slight limitation for a specific use, even though table 4 shows a severe limitation for the association.

Engineering Uses of the Soils[6]

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation material upon which structures are built. Some soil properties are of special interest because they affect construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important in engineering are permeability, shear strength, density, shrink-swell potential, water-holding capacity, grain-size distribution, plasticity, and reaction.

Information concerning these and related soil properties is given in tables 5 and 6. The estimates and interpretations of soil properties in these tables can be used in—

1. Planning and designing agricultural drainage systems, farm ponds, irrigation systems, terraces, and other structures used for controlling water and conserving soil.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating portable sources of sand, gravel, or rock suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational sites.

[5] ELDIE W. MUSTARD, State biologist, Soil Conservation Service, helped prepare this section.

[6] LLOYD G. LAUDENSCHLAGER, area engineer, and RONALD I. BLEWITT, assistant State conservation engineer, Soil Conservation Service, helped prepare this section.

TABLE 4.—*Limitations of soils, by soil*

Soil association	Recreation			
	Vacation ranches	Picnic and sports areas	Fishing areas	
			Natural	Developed
1. Evanston-Gas Creek-Irim	Moderate	Moderate	None to slight	None to slight
2. Parlin-Lucky-Hopkins	Moderate	Moderate	Severe	Moderate
3. Vulcan-Wetterhorn-Ruby	Severe	Moderate	Moderate	Moderate
4. Posant-Woodhall-Stony rock land	Severe	Severe	Severe	Severe
5. Shule-Youman-Passar	Moderate	Moderate	Moderate	Moderate
6. [illegible]	Severe	Severe	Moderate	Moderate

associations, for specialized recreation

Recreation—Continued					
Camping and hiking	Hunting			Shooting preserves	Rural cottages and homesites
	Big game	Upland game	Waterfowl		
Severe	Moderate	Moderate	None to slight	Moderate	Moderate.
Moderate	None to slight	None to slight	Moderate	Moderate	Moderate.
Moderate	None to slight	Moderate	Moderate	Moderate	Severe.
Severe	Moderate	Moderate	Severe	Severe	Severe.
Moderate	None to slight	None to slight	Moderate	Moderate	Moderate.
Severe	Moderate	Moderate	Severe	Severe	Severe.

Engineering interpretations

that affect mining of the materials, nor do they indicate

TABLE 5.—*Estimates of soil*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The the instructions for referring to other series that appear in the first column of

Soil series and map symbols	Depth to bedrock	Depth from surface (typical profile)	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Alluvial land: Ad, Ao, Aw. No valid estimates can be made. Material too variable.					
Bead: BaF	>5	0–5	Fine sandy loam	SM	A–4
		5–18	Sandy clay loam	SC	A–6
		18–60	Stony clay and very stony clay	CH	A–7
Big Blue: BbA, BbB	>5	0–10	Loam	ML	A–4
		10–52	Clay and heavy clay loam	CH	A–7
		52–60	Stratified sand, gravel and cobblestones.	GW or GP	A–1
Bogan: BoE	2.0–3.0	0–16	Silt loam	ML	A–4
		16–24	Light silty clay loam	CL	A–7
		24	Interbedded shale and sandstone.		
Bosler: BsB	>5	0–22	Sandy loam	SM	A–2 or A–4
		22–32	Gravelly sandy clay loam	SC or GC	A–2
		32	Very cobbly loamy sand	SM	A–2
Carbol: CaF	1.0–1.5	0–8	Gravelly sandy loam	SM	A–2
		8–16	Gravelly sandy clay loam	SC	A–2
		16	Granite.		
Cathedral Mapped only with Kezar soils.	1.0–1.5	0–15	Very gravelly sandy loam	GP–GM	A–1
		15	Granite.		
Cebolia: CeE	>5	0–15	Loam	ML–CL	A–4
		15–60	Clay	CH	A–7
Cheadle Mapped only with Lucky soils.	1.0–1.5	0–17	Gravelly sandy loam and stony loam.	GM or SM	A–2 or A–4
		17	Fractured gneiss.		
Cochetopa: CoE	>5	0–12	Loam	ML	A–4
		12–45	Gravelly clay	CH	A–7
		45–60	Stony clay loam	CL	A–7 or A–6
Corpening: CrE	1.0–2.0	0–14	Fine sandy loam	SM	A–4
		14	Calcareous standstone.		
Curecanti: CuB	>5	0–7	Gravelly loam	SM	A–4
		7–19	Very cobbly sandy clay loam	GC	A–2
		19–60	Very cobbly sandy loam	GP–GM	A–1
Dewville: DeB, DeC	>5	0–10	Loam, gravelly sandy loam, and sandy loam.	ML or SM	A–4
		10–22	Sandy clay loam	SC	A–6
		22–60	Sandy loam	SM	A–2
Dollard: DoE	1.5–2.5	0–6	Silty clay loam	CL	A–7
		6–25	Silty clay	CH	A–7
		25	Shale.		
*Duffson: DrE, DsE For Corpening part of DrE, see Corpening series. For Spring Creek part of DsE, see Spring Creek series.	2.0–3.0	0–8	Loam	ML	A–4
		8–16	Clay loam	CL	A–6
		16–30	Loam	ML	A–4
		30	Sandstone.		
Evanston: EvB, EvD	>5	0–9	Loam	ML	A–4
		9–18	Clay loam	CL	A–6
		18–60	Loam	ML	A–4
Fola: FoB	>5	0–6	Cobbly sandy loam	SM	A–2
		6–60	Very cobbly sandy loam	SM	A–2 or A–1
Gas Creek: GaA, GaB	>5	0–7	Sandy loam	SM	A–2
		7–15	Very cobbly sandy loam	SM	A–1
		15–60	Very cobbly sand	SP–SM	A–1

properties significant in engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully this table. The symbol > means more than; the symbol < means less than]

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
	No. 4	No. 10	No. 40	No. 200				
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
0–45	90–100	85–95	60–70	35–50	2.0–6.0	0.08–0.11	5.6–6.5	Low.
0–40	85–95	80–90	70–80	35–50	0.6–2.0	0.10–0.15	5.1–6.0	Moderate.
15–40	65–80	65–75	60–70	50–65	0.06–0.2	0.13–0.15	5.1–6.0	Moderate.
0	95–100	90–100	80–90	60–75	0.6–2.0	0.10–0.15	7.4–8.4	Low.
0	95–100	90–100	85–95	75–90	0.06–0.2	0.13–0.18	7.4–8.4	High.
0–45	20–50	10–40	5–15	0–5	>20.0	0.03–0.05	7.4–8.4	Low.
0	90–100	90–100	85–95	65–80	0.6–2.0	0.11–0.16	6.1–7.3	Low.
0	90–100	85–95	85–90	75–85	0.6–2.0	0.12–0.18	6.6–7.3	Moderate.
0	85–95	80–90	50–65	30–40	2.0–6.0	0.08–0.11	6.6–7.8	Low.
15–60	55–65	50–60	45–50	20–30	0.6–2.0	0.08–0.11	6.6–7.8	Low.
55–70	65–75	60–70	30–40	10–20	6.0–20.0	0.02–0.04	7.9–9.0	Low.
0	75–85	50–75	45–50	20–30	2.0–6.0	0.05–0.07	6.6–7.3	Low.
0	70–90	50–75	50–60	25–35	2.0–6.0	0.08–0.11	6.6–7.3	Low.
0	25–40	20–35	10–20	5–10	6.0–2.0	0.03–0.06	6.6–7.3	Low.
0–20	90–100	85–95	75–85	55–65	0.6–2.0	0.11–0.16	6.6–7.3	Low.
0–20	85–95	80–90	75–85	65–80	0.06–0.2	0.13–0.21	7.4–8.4	High.
10–45	60–75	55–70	45–65	30–50	0.6–2.0	0.05–0.07	7.0–8.5	Low.
0–20	85–95	80–90	70–85	55–65	0.6–2.0	0.10–0.15	6.6–7.3	Low.
0–20	70–90	70–90	65–85	50–75	0.06–0.2	0.13–0.21	6.6–7.3	High.
0–30	75–85	70–90	65–80	50–70	0.06–0.2	0.11–0.16	7.4–7.8	Moderate.
0–10	80–100	75–95	65–75	36–50	2.0–6.0	0.08–0.11	7.9–8.4	Low.
10–40	75–85	70–80	60–70	40–50	2.0–6.0	0.08–0.11	6.6–7.3	Low.
0–55	40–55	35–50	30–40	15–25	0.6–2.0	0.05–0.07	6.6–7.3	Low.
30–45	25–40	25–35	15–25	5–10	6.0–20.0	<0.03	6.6–7.3	Low.
0	80–100	75–95	75–85	25–65	0.6–2.0	0.10–0.15	6.6–7.3	Low.
0	80–95	75–90	65–75	35–45	0.6–2.0	0.10–0.15	6.6–7.3	Moderate.
0	80–95	75–90	50–60	25–35	2.0–6.0	0.08–0.11	7.4–8.4	Low.
0	95–100	95–100	90–95	80–90	0.06–0.2	0.12–0.18	7.4–8.4	Moderate.
0	95–100	95–100	90–95	85–90	0.06–0.2	0.13–0.21	7.9–9.0	High.
5–15	85–95	75–90	70–80	50–65	0.6–2.0	0.10–0.15	6.6–7.3	Low.
5–15	85–95	75–90	75–85	60–70	0.2–0.6	0.12–0.18	6.6–7.3	Moderate.
10–20	85–95	80–90	70–80	50–65	0.6–2.0	0.10–0.15	7.9–8.4	Low.
0–5	90–100	90–95	75–85	55–70	0.6–2.0	0.10–0.15	6.1–7.3	Low.

TABLE 5.—*Estimates of soil properties*

Soil series and map symbols	Depth to bedrock	Depth from surface (typical profile)	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Gateview: GeB, GeE	>5	0–10	Cobbly loam	SM	A–4
		10–60	Very gravelly sandy loam	GM or SM	A–1
Gold Creek: GrB	>5	0–9	Silty clay loam	CH	A–7
		9–41	Silty clay	CH	A–7
		41–60	Very gravelly and cobbly sand	GP	A–1
Hopkins Mapped only with Parlin soils.	>5	0–16	Channery loam	ML	A–4
		16–60	Rhyolitic flagstone	GP	A–1
Irim: IrA, IrB	>5	0–11	Loam	ML	A–4
		11–60	Very gravelly loam	GM	A–1
Jerry: JeE	>5	0–11	Loam	ML	A–4
		11–45	Gravelly heavy clay loam	CH	A–7
		45–60	Stony loam	ML	A–4

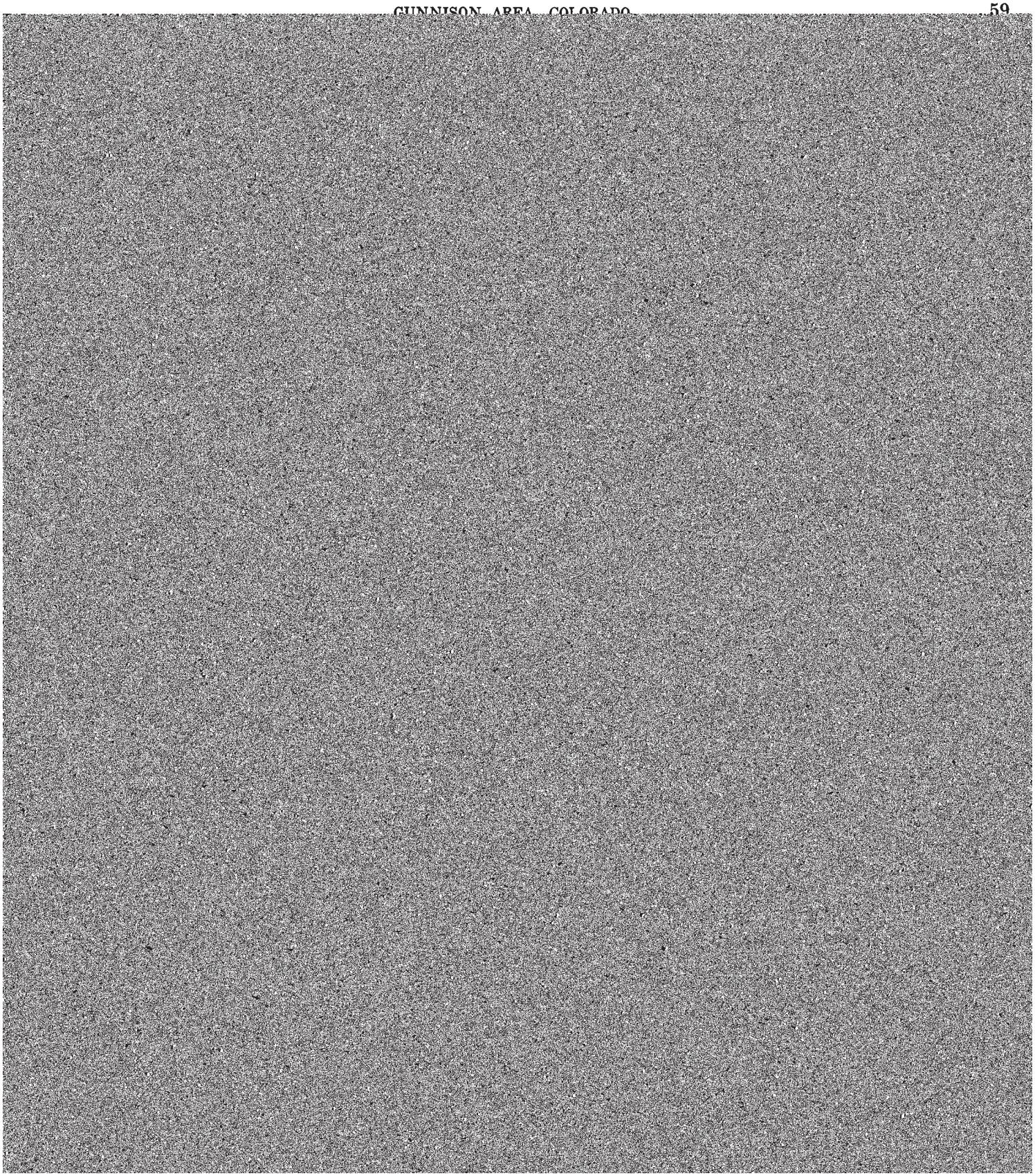


TABLE 5.—*Estimates of soil properties*

Soil series and map symbols	Depth to bedrock	Depth from surface (typical profile)	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Ruby: RuE, RyE	>5	0–6	Gravelly sandy loam	SM or GM	A–2 or A–1
		6–13	Gravelly clay loam	GC	A–6
		13–60	Rhyolitic flagstone	GP	A–1
Sapinero Mapped only with Shule soils.	>5	0–19	Stony and very stony loam	ML	A–4
		19–44	Extremely stony clay loam	GC or CL	A–6 or A–2
		44	Rhyolitic flagstone	GP	A–1
*Shule: SsF For Sapinero part of SsF, see Sapinero series.	1.5–3.5	0–16	Loam	ML	A–4
		16–34	Clay loam	CL	A–6
		34	Rhyolite.		
Spring Creek Mapped only with Duffson soils.	1.0–2.0	0–9	Stony loam	ML	A–4
		9–19	Gravelly and very gravelly loam	GM	A–1
		19	Rhyolitic tuff.		
Stony rock land: St. No valid estimates can be made. Material too variable.					
Sunshine: SuE	>5	0–20	Loam and gravelly loam	ML	A–4
		20–36	Extremely stony clay	CH or GC	A–7
		36	Rhyolitic flagstone	GP	A–1
Tolvar Mapped only with Uinta soils.	3.5–>5.0	0–14	Gravelly coarse sandy loam	SM or GM	A–1
		14–40	Gravelly sandy clay loam	GC	A–2
		40–60	Very gravelly coarse sandy loam	GM	A–1
Tongue River: TrF	1.5–3.5	0–13	Loam	ML	A–4
		13–20	Sandy clay loam	SC	A–6
		20–38	Silty clay loam	CL	A–6
		38	Sandstone and interbedded shale.		
*Uinta: UtF For Tolvar part of UtF, see Tolvar series.	4.0–>5.0	0–18	Stony loam	ML	A–4
		18–60	Stony and very stony clay loam	CL	A–6
Vulcan: VuE	>5	0–17	Gravelly sandy loam	SM or GM	A–1
		17–36	Very stony and gravelly clay loam and clay.	GC	A–2
		36–60	Rhyolitic flagstone	GP	A–1
Wetterhorn: WeF	1.5–3.5	0–20	Stony loam	ML or SM	A–4
		20–36	Stony clay loam	CL	A–7
		36	Quartz latite.		
Woodhall: WoF	>5	0–9	Gravelly loam	SM	A–4
		9–30	Very stony and extremely stony clay loam.	GC or SC	A–6 or A–2
		30	Fractured rhyolite.		
Woosley: WvF	1.5–3.5	0–5	Stony loam	SM	A–4
		5–30	Clay loam	CL	A–6
		30	Chlorite-schist.		
Youga: YgE	>5	0–10	Loam	ML or SM	A–4
		10–60	Gravelly clay loam	CL	A–6
*Youman: YlE, YpE For Leaps part of YlE, see Leaps series. For Passar	>5	0–12	Loam	ML	A–4
		12–60	Heavy clay loam	CH	A–7

significant in engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
	No. 4	No. 10	No. 40	No. 200				
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
0–45	55–80	50–75	40–60	20–35	2.0–6.0	0.08–0.11	6.1–7.0	Low.
0–5	55–80	50–75	45–65	35–50	0.2–0.6	0.11–0.16	6.1–7.0	Moderate.
60–100	0–10	0–5	0	0	>20.0	0–0.02	6.5–7.0	Low.
10–30	65–85	60–80	60–65	50–55	0.6–2.0	0.10–0.14	6.6–7.3	Low.
40–70	25–65	30–60	25–55	20–50	0.2–0.6	0.08–0.11	6.1–6.5	Moderate.
60–100	0–10	0–5	0	0	>20.0	0–0.02	6.5–7.0	Low.
0–25	70–95	65–90	70–80	55–65	0.6–2.0	0.10–0.15	6.1–7.3	Low.
0–25	70–95	65–90	75–85	60–70	0.06–0.2	0.12–0.18	6.1–7.0	Moderate.
5–20	85–90	75–85	70–75	50–60	0.6–2.0	0.10–0.15	6.6–7.3	Low.
10–30	40–55	35–50	25–40	20–30	2.0–6.0	0.08–0.11	7.9–8.4	Low.
0–20	70–90	65–85	70–75	55–65	0.6–2.0	0.10–0.15	6.6–7.3	Low.
30–75	55–75	50–70	45–65	40–60	0.06–0.20	0.05–0.07	6.6–7.3	Moderate.
60–100	0–10	0–5	0	0	>20+	0–0.02	6.6–7.3	Low.
0–5	55–75	40–60	25–35	15–20	2.0–6.0	0.05–0.07	5.6–6.5	Low.
0–5	55–65	35–50	30–40	20–30	0.6–2.0	0.08–0.11	5.6–6.5	Low.
0–20	55–60	35–45	25–35	15–20	0.6–2.0	0.08–0.11	5.6–6.5	Low.
0–10	90–100	85–95	75–85	50–60	0.6–2.0	0.10–0.15	6.1–7.0	Low.
0	90–100	85–95	70–80	35–50	0.6–2.0	0.10–0.15	6.1–7.0	Moderate.
0–5	90–100	85–95	80–90	70–85	0.06–0.2	0.12–0.18	6.1–7.0	Moderate.
0–25	80–90	75–85	70–75	50–60	0.6–2.0	0.10–0.15	6.1–6.5	Low.
10–40	80–90	75–85	70–80	55–65	0.06–0.2	0.11–0.16	5.0–6.0	Moderate.
0–15	55–70	50–65	30–40	15–25	6.0–20.0	0.05–0.07	6.1–6.5	Low.
20–60	30–45	25–40	20–35	15–30	0.06–0.2	0.07–0.09	5.6–6.5	Moderate.
60–100	0–10	0–5	0	0	>20.0	0–0.02	6.1–6.5	Low.
0–20	75–85	70–80	65–70	45–55	0.6–2.0	0.10–0.15	5.6–6.6	Low.
0–25	70–85	65–75	60–65	50–55	0.06–0.2	0.12–0.18	5.6–6.6	Moderate.
0–20	70–80	65–75	50–65	35–50	0.6–2.0	0.10–0.15	6.1–7.3	Low.
50–75	45–70	40–65	35–60	30–45	0.06–0.2	0.05–0.07	6.1–7.3	Moderate.
0–30	80–90	70–80	65–75	40–50	0.6–2.0	0.08–0.11	6.6–7.3	Low.
0–25	70–95	65–90	75–85	50–70	0.06–0.2	0.12–0.18	6.6–8.4	Moderate.
0–20	75–95	70–90	60–80	40–60	0.6–2.0	0.10–0.15	6.6–7.3	Low.

TABLE 6.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The the instructions for referring to other series

Soil series and map symbol	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Ponds and reservoirs	Embankments, dikes, and levees
Alluvial land: Ad, Ao, Aw	Information inadequate. Onsite determination needed.	Information inadequate. Onsite determination needed.	Information inadequate. Onsite determination. needed.	Information inadequate. Onsite determination needed.	Information inadequate. Onsite determination needed.
Bead: BaF	Poor: stony; slopes are 10 to 50 percent.	Unsuitable: excessive fines.	Poor: A–7 below a depth of 18 inches; slope is 10 to 50 percent.	Slope is 10 to 50 percent.	More than 35 percent coarse fragments, mostly stones; fair compaction characteristics.
Big Blue: BbA, BbB	Poor: poorly drained.	Unsuitable: fine-grained material.	Poor: A–7; high shrink-swell potential.	Site limited to dug ponds; seasonal high water table at the surface or within a depth of 36 inches.	Poor compaction characteristics; high shrink-swell potential.
Bogan: BoE	Fair: slope is 5 to 30 percent; bedrock at a depth of 20 to 40 inches.	Unsuitable: fine-grained material.	Poor: low shear strength; shale at a depth of 20 to 40 inches.	Slope is 5 to 30 percent; shale at a depth of 20 to 40 inches.	Poor compaction characteristics; high piping potential.
Bosler: BsB	Good	Poor: excessive fines and cobblestones.	Good: A–2; many cobblestones below a depth of 32 inches.	Rapid permeability below a depth of 32 inches.	Low compressibility; medium compacted permeability.
Carbol: CaF	Poor: bedrock at a depth of 10 to 20 inches.	Unsuitable: excessive fines.	Poor: bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; slope is 15 to 60 percent.	Bedrock at a depth of 10 to 20 inches.
Cathedral	Poor: bedrock at a depth of 10 to	Unsuitable: bedrock at a depth	Poor: bedrock at a depth of 10 to	Bedrock at a depth of 10 to	Bedrock at a depth of 10 to 20

interpretations

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully that appear in the first column of this table]

Soil features affecting—Continued		Degree and kind of limitation for—			
Drainage of cropland	Irrigation	Local roads and streets	Dwellings without basements	Septic tank filter fields	Sewage lagoons
Information inadequate. Onsite determination needed.	Information inadequate. Onsite determination needed.	Severe: flood hazard; seasonal high water table in unit Aw.	Severe: flood hazard; seasonal high water table in unit Aw.	Severe: flood hazard; seasonal high water table in unit Aw.	Severe: flood hazard.
No drainage needed	Not applicable	Severe: slope is 10 to 50 percent; more than 35 percent stone fragments.	Severe: slope is 10 to 50 percent; moderate shrink-swell potential.	Severe: slope is 10 to 50 percent; slow permeability.	Severe: slope is 10 to 50 percent; more than 35 percent stone fragments.
Low wet areas; slow permeability.	Slow permeability; high available water capacity.	Severe: seasonal high water table at the surface or within a depth of 36 inches; high shrink-swell potential.	Severe: seasonal high water table at a depth of 0 to 36 inches; high shrink-swell potential.	Severe: slow permeability; seasonal high water table at a depth of 36 inches.	Severe: seasonal high water table at the surface or within a depth of 36 inches.
Well drained; bedrock at a depth of 20 to 40 inches; slopes are 5 to 30 percent.	Moderately deep; moderate permeability; low available water capacity.	Severe: slope is 5 to 30 percent; shale at a depth of 20 to 40 inches; low shear strength.	Severe: slope is 5 to 30 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 5 to 30 percent; shale at a depth of 20 to 40 inches.	Severe: slope is 5 to 30 percent; shale at a depth of 20 to 40 inches.
Well drained; slope is 5 to 30 percent.	Moderate permeability; low available water capacity.	Slight	Slight	Slight: may pollute nearby domestic water supply.	Severe: rapid permeability.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 15 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 15 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 15 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 15 to 60 percent.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 35 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 35 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 35 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 35 percent.
No drainage needed	Not applicable	Severe: slope is 5 to 30 percent; plastic clay below a depth of 15 inches; high shrink-swell potential.	Severe: slope is 5 to 30 percent; high shrink-swell potential.	Severe: slow permeability; slope is 5 to 30 percent.	Severe: slope is 5 to 30 percent.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 45 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 45 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 45 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope 5 to 45 percent.
Well drained; slow permeability.	Slow permeability; high available water capacity; slope is 5 to 30 percent.	Severe: slope is 5 to 30 percent; high shrink-swell potential; plastic clay.	Severe: slope is 5 to 30 percent; high shrink-swell potential.	Severe: slope is 5 to 30 percent; slow permeability.	Severe: slope is 5 to 30 percent.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Ponds and reservoirs	Embankments, dikes, and levees
Curecanti: CuB	Poor: gravelly and cobbly.	Fair: excessive fines and cobblestones.	Good: A–1; many cobblestones.	Rapid permeability below a depth of 19 inches.	Good stability; high compacted permeability.
Dewville: DeB, DeC	Good	Poor: SM material below a depth of 22 inches.	Fair: moderate shrink-swell potential; erodible if not confined.	Slope is 1 to 15 percent; moderately rapid permeability below a depth of 22 inches.	Moderately erodible.
Dollard: DoE	Poor: high clay content.	Unsuitable: fine-grained material.	Poor: A–7; shale at a depth of 20 to 40 inches; low shear strength.	Slope is 5 to 30 percent; slow permeability.	High shrink-swell potential; poor compaction characteristics.
*Duffson: DrE, DsE For Corpening part of DrE, see Corpening series. For Spring Creek part of DsE, see Spring Creek series.	Fair: coarse fragments.	Unsuitable: fine-grained material; bedrock at a depth of 20 to 40 inches.	Fair: A–4; fair shear strength; sandstone at a depth of 20 to 40 inches.	Slope is 5 to 40 percent.	Bedrock at a depth of 20 to 40 inches; high piping potential; fair compaction characteristics.
Evanston: EvB, EvD	Fair: clay loam at a depth of 9 inches.	Unsuitable: fine-grained material.	Fair: A–4; fair shear strength.	Slope is 1 to 20 percent.	Fair stability; high piping potential; poor compaction characteristics.
Fola: FoB	Poor: high cobblestone content.	Poor: excessive fines and cobblestones.	Good: A–2 or A–1; many cobblestones.	Rapid permeability.	Low compressibility; medium compacted permeability.
Gas Creek: GaA, GaB	Poor: mostly poorly drained; high cobblestone content.	Fair: excessive fines and cobblestones; seasonal high water table less than 3 feet from surface.	Poor: A–1; seasonal high water table at less than 3 feet from surface.	Seasonal high water table at less than 3 feet from surface; rapid permeability.	Seasonal high water table at less than 3 feet from surface.
Gateview: GeB, GeE	Poor: high cobblestone content.	Poor: high cobblestone content.	Good: A–1; many cobblestones.	Rapid permeability; slope is 2 to 30 percent.	Low compressibility; medium compacted permeability.
Gold Creek: GrB	Poor: strongly to very strongly alkaline; high sodium content.	Fair for gravel; 40 inches of overburden; seasonal high water table at the surface or within a depth of 36 inches.	Poor: A–7; low shear strength; high shrink-swell potential; seasonal high water table at the surface or within a depth of 36 inches.	Seasonal high water table at the surface or within a depth of 36 inches; gravel below a depth of 41 inches.	Poor compaction characteristics; high shrink-well potential.
Hopkins Mapped only with Parlin soils.	Poor: high cobblestone content.	Unsuitable: fine-grained material; flagstone at a depth of 10 to 20 inches.	Poor: flagstone at a depth of 10 to 20 inches; slope is 5 to 45 percent.	Less than 20 inches deep to flagstone; very rapid permeability.	Flagstone at a depth of 10 to 20 inches.
Irim: IrA, IrB	Poor: poorly drained.	Poor for gravel; seasonal high water table at the surface or within a depth of 36 inches.	Poor: seasonal high water table at the surface or within a depth of 36 inches.	Moderate permeability.	Good stability; low compacted permeability.

interpretations—Continued

Soil features affecting—Continued		Degree and kind of limitation for—			
Drainage of cropland	Irrigation	Local roads and streets	Dwellings without basements	Septic tank filter fields	Sewage lagoons
Well drained; slope is 1 to 8 percent.	Moderate permeability; low available water capacity.	Slight	Slight	Slight: may pollute nearby domestic water supply.	Severe: rapid permeability below a depth of 19 inches; very cobbly.
Well drained; moderate permeability.	Moderate permeability; moderate available water capacity.	Moderate: moderate shrink-swell potential.	Moderate: slope is 1 to 15 percent; moderate shrink-swell potential.	Moderate: slope is 1 to 15 percent; moderate permeability.	Moderate: slope is 1 to 15 percent; moderate permeability.
Slow permeability; slope is 5 to 30 percent.	Slow permeability; high available water capacity; slope is 5 to 30	Severe: low shear strength; high shrink-swell potential.	Severe: slope is 5 to 30 percent; high shrink-swell potential.	Severe: shale at a depth of 20 to 40 inches; slope is 5 to 30 per-	Severe: shale at a depth of 20 to 40 inches; slope is 5 to 30 percent.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Ponds and	Embankments,

interpretations—Continued

Soil features affecting—Continued		Degree and kind of limitation for—			
Drainage of cropland	Irrigation	Local roads and streets	Dwellings without basements	Septic tank filter fields	Sewage lagoons
Well drained; slow permeability.	Slow permeability; moderate available water capacity; slope is 5 to 30 percent.	Severe: slope is 5 to 30 percent; low shear strength.	Moderate shrink-swell potential from a depth of 11 to 45 inches; slope is 5 to 30 percent.	Severe: Slope is 5 to 30 percent; slow permeability.	Severe: slope is 5 to 30 percent.
No drainage needed	Not applicable	Severe: bedrock at a depth of 20 to 40 inches; slope is 5 to 35 percent.	Severe: slope is 5 to 35 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 5 to 35 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slope is 5 to 35 percent.
Well drained; slow permeability.	Slow permeability; moderate available water capacity; slope is 5 to 35 percent.	Severe: slope is 5 to 35 percent; low shear strength; high shrink-swell potential.	Severe: high shrink-swell potential; slope is 5 to 35 percent.	Severe: slow permeability; slope is 5 to 35 percent.	Severe: slope is 5 to 35 percent.
No drainage needed	Not applicable	Severe: low shear strength; slope is	Severe: slope is 5 to 30 percent;	Severe: slope is 5 to 30 percent;	Severe: slope is 5 to 30 percent.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Ponds and reservoirs	Embankments, dikes, and levees
Passar Mapped only with Youman soils.	Poor: clay loam to a depth of 15 inches; extremely stony clay below.	Unsuitable: fine-grained material.	Poor: A–7; low shear strength; moderate shrink-swell potential.	Slope is 5 to 30 percent; 25 to 60 percent stones below a depth of 15 inches.	Clayey material; 25 to 60 percent stones below a depth of 15 inches.
Posant: PoF	Poor: very gravelly.	Unsuitable: bedrock at a depth of 10 to 20 inches; excessive fines.	Poor: bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; slopes are 10 to 60 percent.	Bedrock at a depth of 10 to 20 inches.
Powderhorn: PwE	Fair: gravelly loam at a depth of 12 inches.	Unsuitable: fine-grained material.	Poor: A–7; high shrink-swell potential; low shear strength.	Slope is 5 to 30 percent.	Clayey material; poor stability and compaction characteristics; high shrink-swell potential.
Redcloud: RcE	Poor: high content of stone fragments.	Unsuitable: fine-grained material.	Fair: A–4; excessive fines.	Slope is 5 to 30 percent.	Low compressibility; fair stability; medium piping potential.
Rock outcrop: Ro	Not applicable	Unsuitable: bedrock at surface.	Not applicable	Not applicable	Not applicable
Rockslides: Rs	Poor: high stone and boulder content.	Unsuitable	Not applicable	Not applicable	Not applicable
Ruby: RuE, RyE	Poor: gravelly	Unsuitable: flagstone at a depth of 10 to 20 inches.	Poor: flagstone at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Flagstone at a depth of 10 to 20 inches; very rapid permeability.	Flagstone at a depth of 10 to 20 inches.
Sapinero Mapped only with Shule soils.	Poor: stony	Unsuitable: fine-grained material; stony.	Poor: stony material; fair stability; moderate shrink-swell potential; slope is 10 to 50 percent.	Slope is 10 to 50 percent; 25 to 55 percent stones.	Fair stability; dominantly stony.
*Shule: SsF For Sapinero part of SsF, see Sapinero series.	Good to a depth of 16 inches.	Unsuitable: fine-grained material.	Fair: bedrock at a depth of 20 to 40 inches; moderate shrink-swell potential; fair stability; slope is 10 to 50 percent.	Slope is 10 to 50 percent; bedrock at a depth of 20 to 40 inches.	Fair stability; bedrock at a depth of 20 to 40 inches.
Spring Creek Mapped only with Duffson soils.	Poor: stony; bedrock at a depth of 10 to 20 inches.	Unsuitable: fine-grained material; bedrock at a depth of 10 to 20 inches.	Poor: bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Bedrock at a depth of 10 to 20 inches; fair stability.
Stony rock land: St	Poor: stony	Unsuitable: stony; bedrock at less than 20 inches.	Not applicable	Not applicable	Not applicable
Sunshine: SuE	Poor: 10 to 20 percent stones,	Unsuitable: fine-grained ma-	Poor: moderate shrink-swell po-	Slope is 5 to 35 percent.	Extremely stony clayey material

interpretations—Continued

Soil features affecting—Continued		Degree and kind of limitation for—			
Drainage of cropland	Irrigation	Local roads and streets	Dwellings without basements	Septic tank filter fields	Sewage lagoons
No drainage needed	Not applicable	Severe: slope is 5 to 30 percent; 25 to 60 percent stones below a depth of 15 inches; moderate shrink-swell potential.	Severe: slope is 5 to 30 percent; moderate shrink-swell potential.	Severe: slope is 5 to 30 percent; slow permeability.	Severe: slope is 5 to 30 percent; 25 to 60 percent stones below a depth of 15 inches.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 10 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 10 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 10 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 10 to 60 percent.
No drainage needed	Not applicable	Severe: high shrink-swell potential; slope is 5 to 30 percent; low shear strength.	Severe: slope is 5 to 30 percent; high shrink-swell potential.	Severe: slope is 5 to 30 percent; slow permeability.	Severe: slope is 5 to 30 percent.
Well drained; moderate permeability.	Moderate permeability; moderate available water capacity; slope is 5 to 30 percent.	Moderate to severe: GM with fines; slope is 5 to 30 percent.	Moderate to severe: slope is 5 to 30 percent.	Severe: slope is 5 to 30 percent; moderate permeability.	Severe: slope is 5 to 30 percent; moderate permeability.
Not applicable	Not applicable	Severe: bedrock at surface.	Not applicable	Not applicable	Not applicable.
Not applicable	Not applicable	Severe: slide area	Not applicable	Not applicable	Not applicable.
No drainage needed	Not applicable	Severe: flagstone at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: open-voided flagstone at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: open-voided flagstone at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: open-voided flagstone at a depth of 10 to 20 inches; slope is 5 to 40 percent.
No drainage needed	Not applicable	Severe: slope is 10 to 50 percent; 25 to 55 percent stones.	Severe: slope is 10 to 50 percent; moderate shrink-swell potential.	Severe: slope is 10 to 50 percent; moderately slow permeability.	Severe: slope is 10 to 50 percent; very stony.
No drainage needed	Not applicable	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.
Not applicable	Not applicable	Severe: slope is 10 to 80 percent; shallow to bedrock in complex development.	Not applicable	Not applicable	Not applicable.
No drainage needed	Not applicable	Severe: stony clay; flagstone at a depth of 20 to 40 inches; slope is 5 to 35 percent.	Severe: open-voided flagstone at a depth of 20 to 40 inches; moderate shrink-swell potential; slope is 5 to 35 percent.	Severe: open-voided flagstone at a depth of 20 to 40 inches; slow permeability; slope is 5 to 35 percent.	Severe: open-voided flagstone at a depth of 20 to 40 inches; slope is 5 to 35 percent.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Ponds and reservoirs	Embankments, dikes, and levees
Tolvar ..... Mapped only with Uinta soils.	Poor: 15 to 50 percent gravel.	Poor: GM material below a depth of 40 inches; slope is 10 to 50 percent.	Poor: A–2 over A–1 material; slope is 10 to 50 percent.	Slope is 10 to 50 percent.	Good to moderate stability.
Tongue River: TrF	Fair: sandy clay loam at a depth of 13 inches.	Unsuitable: fine-grained material; sandstone at a depth of 20 to 40 inches.	Poor: moderate shrink-swell potential; sandstone at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Slope is 10 to 50 percent.	Fair stability; bedrock at a depth of 20 to 40 inches.
*Uinta: UtF ..... For Tolvar part of UtF, see Tolvar series.	Poor: stony.....	Unsuitable: fine-grained material.	Poor: A–4 and A–6; slope is 10 to 50 percent; moderate shrink-swell potential; low shear strength.	Slope is 10 to 50 percent.	Stony and very stony clayey material below a depth of 18 inches; fair stability.
Vulcan: VuE	Poor: gravelly and stony.	Unsuitable: excessive fines; flagstone at a depth of 20 to 40 inches.	Poor: A–2; open-voided flagstone at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Slope is 10 to 55 percent.	Open-voided flagstone at a depth of 20 to 40 inches; very stony clay loam and clay at a depth of 17 inches.
Wetterhorn: WeF	Poor: stony.....	Unsuitable: fine-grained material; bedrock at a depth of 20 to 40 inches.	Poor: moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches.	Slope is 10 to 55 percent.	Fair stability; moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches.
Woodhall: WoF	Poor: gravelly.....	Unsuitable: fine-grained material; bedrock at a depth of 20 to 40 inches.	Poor: A–6; 35 to 60 percent stones; moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches; slope is 5 to 50 percent.	Slope is 5 to 50 percent.	Moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches.
Woosley: WvF	Poor: stony.....	Unsuitable: fine-grained material; bedrock at a depth of 20 to 40 inches.	Poor: moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches; slope is 10 to 60 percent.	Slope is 10 to 60 percent.	Clayey; moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches; poor compaction characteristics.
Youga: YgE	Poor: gravelly.....	Unsuitable: fine-grained material.	Moderate to severe: A–6; moderate shrink-swell potential; low shear strength.	Slope is 3 to 30 percent.	Clayey; moderate shrink-swell potential; poor compaction characteristics.
*Youman: YlE, YpE ..... For Leaps part of YlE, see Leaps series. For Passar part of YpE, see Passar series.	Fair: clay loam at a depth of 12 inches.	Unsuitable: fine-grained material.	Poor: A–7; high shrink-swell potential; low shear strength.	Slope is 5 to 35 percent.	Clayey material; high shrink-swell potential; poor compaction characteristics.

interpretations—Continued

Soil features affecting—Continued		Degree and kind of limitation for—			
Drainage of cropland	Irrigation	Local roads and streets	Dwellings without basements	Septic tank filter fields	Sewage lagoons
No drainage needed	Not applicable	Severe: slope is 10 to 50 percent.	Severe: slope is 10 to 50 percent.	Severe: slope is 10 to 50 percent; moderate permeability.	Severe: slope is 10 to 50 percent; moderate permeability.
No drainage needed	Not applicable	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.
No drainage needed	Not applicable	Severe: slope is 10 to 50 percent; low shear strength.	Severe: slope is 10 to 50 percent; moderate shrink-swell potential.	Severe: slope is 10 to 50 percent; slow permeability.	Severe: slope is 10 to 50 percent.
No drainage needed	Not applicable	Severe: open-voided flagstone at a depth of 20 to 40 inches; slope is 10 to 55 percent.	Severe: slope is 10 to 55 percent; open-voided flagstone at a depth of 20 to 40 inches.	Severe: slope is 10 to 55 percent; open-voided flagstone ot a depth of 20 to 40 inches.	Severe: slope is 10 to 55 percent; open-voided flagstone at a depth of 20 to 40 inches.
No drainage needed	Not applicable	Severe: slope is 10 to 55 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 10 to 55 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 55 percent; slow permeability.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 55 percent.
No drainage needed	Not applicable	Severe: slope is 5 to 50 percent; 35 to 60 percent stones; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slope is 5 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 5 to 50 percent; moderately slow permeability.	Severe: bedrock at a depth of 20 to 40 inches; slope is 5 to 50 percent.
No drainage needed	Not applicable	Severe: slope is 10 to 60 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 10 to 60 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 10 to 60 percent; bedrock at a depth of 20 to 40 inches; moderately slow permeability.	Severe: slope is 10 to 60 percent; bedrock at a depth of 20 to 40 inches.
No drainage needed	Not applicable	Moderate to severe: slope is 3 to 30 percent; moderate shrink-swell potential.	Moderate to severe: slope is 3 to 30 percent; moderate shrink-swell potential.	Severe: slope is 3 to 30 percent; slow permeability.	Severe: slope is 3 to 30 percent.
No drainage needed	Not applicable	Severe: high shrink-swell potential; low shear strength.	Severe: slope is 5 to 35 percent; high shrink-swell potential.	Severe: slope is 5 to 35 percent; slow permeability.	Severe: slope is 5 to 35 percent.

AASHO and Unified classifications of the soil material and the shrink-swell potential indicate traffic supporting capacity. Wetness and flooding affect the stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect the ease of excavation and the amount of cut and fill needed for an even

landscape differs from place to place, depending upon the nature and intensity of the factors that control its development.

Five major factors are recognized as being influential in the development of the soil in its virgin state at any specific location. Briefly stated, these five are climate, living organisms, time, relief, and parent material. All

ingly warmer as elevation decreases. Yearly precipitation is greatest at the higher elevations. The rapidly changing character of soil climate makes generalizations relative to the entire survey area meaningless. By understanding the relationship of temperature and precipitation to elevation, a general evaluation of the climate at any given point can be made.

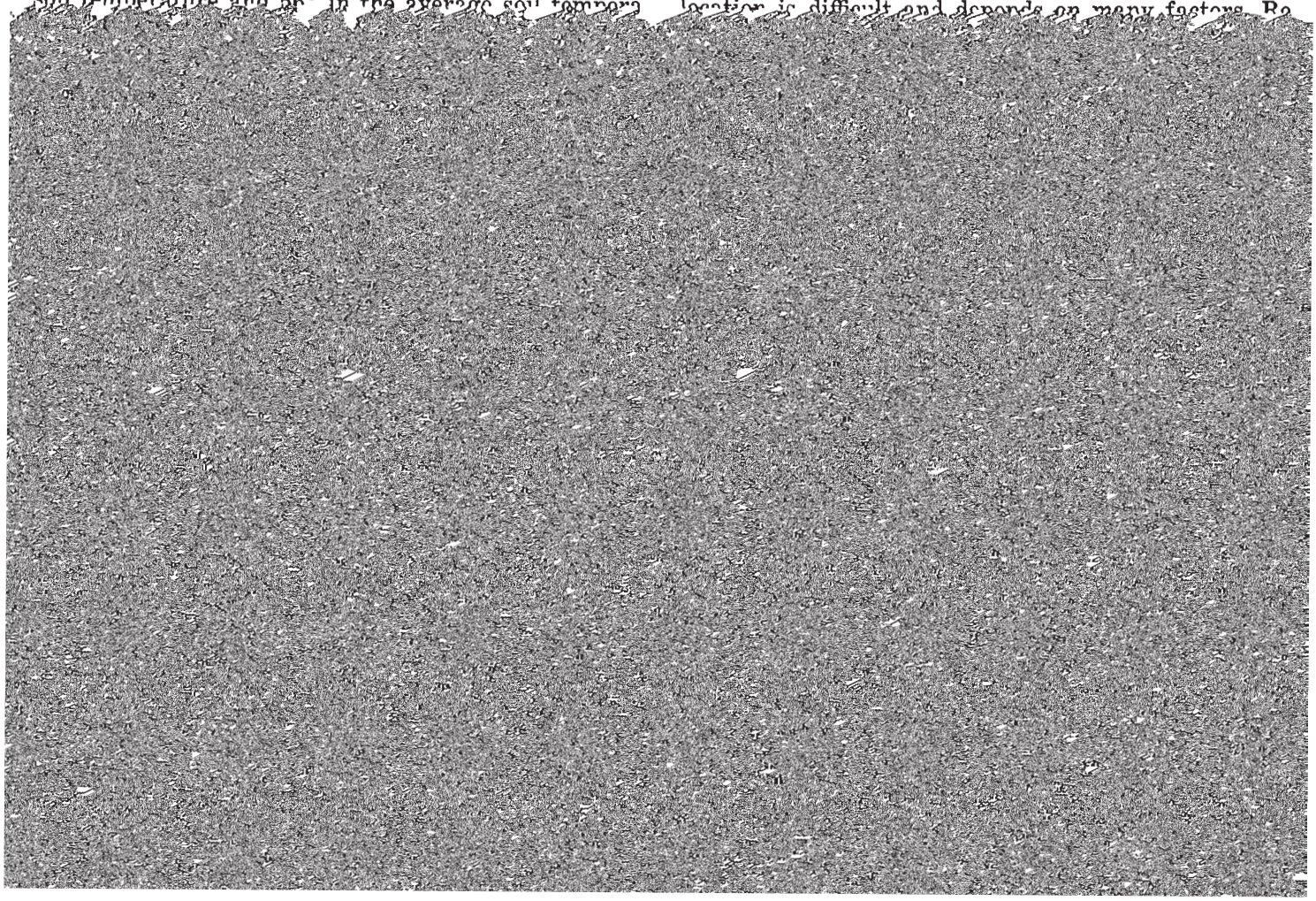
Average annual air temperature at the Gunnison Weather Station, elevation 7,694 feet, is 37° F., and the average air temperature in summer is about 59°. Precise weather data for the higher elevations in the Gunnison Area are not available. By projecting data from other Colorado stations at high elevations, it can be anticipated that at 11,600 feet the average annual air temperature would be approximately 27°, and the average air temperature in summer about 45°.

In evaluating soil climate, soil temperature measurements are more useful than air temperature measurements. Thirteen sites in the survey area and adjacent areas were measured to determine soil temperature at a depth of 20 inches. The site at the lowest elevation, 6,000 feet, had an average annual soil temperature of 51°, and an average soil temperature in summer of 67°. The site at the highest elevation, 11,000 feet, had an average annual soil temperature of 37° and an average soil temperature in summer of 39°. This represents a decrease of about 28° in the average annual soil temperature and 56° in the average soil tempera-

cipitation occur in June and August. Precipitation increases with increasing elevation, but precise data are not available in the survey area. The generalized average annual precipitation map for Colorado indicates that precipitation is about 25 inches per year at elevations above 10,000 feet and about 16 inches at 7,500 feet. Precipitation is not so uniform nor so predictable as temperature because it is subject to irregularities in wind current, and no standard increase relative to elevation can be applied with reasonable accuracy at each location.

The effectiveness of precipitation in providing a supply of soil moisture depends on many factors other than total amount. Slopes are steep, humidity is moderately low, and rainfall intensities are relatively great over much of the lower elevations. All of these factors contribute to loss of soil moisture. On the other hand, at lower elevations the soil is frozen for shorter periods, less water runs off in winter and spring, and the period of greatest activity of soil-forming processes is longer. Higher elevations receive more total precipitation, but much of it is snow, runoff is great in spring, slopes are very steep, and the ground is cold for long periods.

In summary, the climate in the Gunnison Area, relative to soil genesis, can be characterized by its extremes and variability. Characterization at any one location is difficult and depends on many factors. Re-



Most soils in the Gunnison Area have this general character.

In the steeper areas or in the driest areas at low elevations, some grassland soils have not developed a thick, dark-colored surface layer. The genetic processes in these localities are probably nearly identical to those in areas where the soils have a darker surface layer. These processes, however, are proceeding at a much slower rate, and the decomposition of organic matter is nearly equal to the yearly accumulation. These light-colored soils support grass vegetation, but the grass cover is much thinner, largely because the amount of soil moisture differs locally.

Minor soil differences resulting from different amounts of vegetation are common within a landscape. Those parts of the landscape that are gently sloping or that have received additional moisture as runoff from higher lying soils generally develop the thicker, dark-colored horizons. These horizons are thinner in the steeper areas, and in areas where runoff is rapid.

As elevation increases in the Gunnison Area, the natural vegetation changes from dominantly grass to dominantly forest. This transition does not occur abruptly. In a fairly wide transitional area, timber stands are only moderately dense, and grasses, shrubs, and bushes constitute a significant part of the ground cover. In these transitional areas soils that have properties of both grassland and forest soils occur in many land-

organisms in soils of the Gunnison Area. Those microorganisms best adapted to neutral or alkaline soils, alternate wet and dry periods, and moderately large seasonal ranges in soil temperature are dominant at lower elevations. Strains active in more acid environments, prolonged wet periods, and cool soil temperatures with fairly narrow seasonal fluctuation are more active at higher elevations.

Time

If the kind and magnitude of all other forces active in soil formation are equal, the parts of any given landscape that have been subjected to this activity for the longest period will have the strongest degree of soil development. It is difficult, however, to determine the chronological age of a soil, for obviously no such uniformity exists among the soil-forming forces. The degree of horizon development in a soil profile may have resulted from differences in the intensity of factors other than time. Consequently, the degree of development alone is not a reliable criterion.

Unless specific dating can be accomplished by archeological means or by evaluating the decay of radioactive substances, the soil scientist must rely upon geomorphic studies of landscape evolution to arrive at relative dates for particular landscapes. Unfortunately, good geomorphic studies require skilled geomorphologists. In his daily work, however, the soil scientist can

are older than the present flood plains. They occur in most of the broader valleys in the survey area and are a mixed system of pediment surfaces associated with past erosion cycles. Their age in any one landscape can vary appreciably, and no attempt has been made to distinguish between ages.

Characteristics of the soils developing in these materials vary widely, but all show some degree of genetic horizon development other than the development of an A horizon. The B2 horizon ranges from weak evidence of alteration to a continuous illuvial horizon of silicate clay accumulation. Carbonate translocation is evident in areas where the parent material originally contained free carbonates.

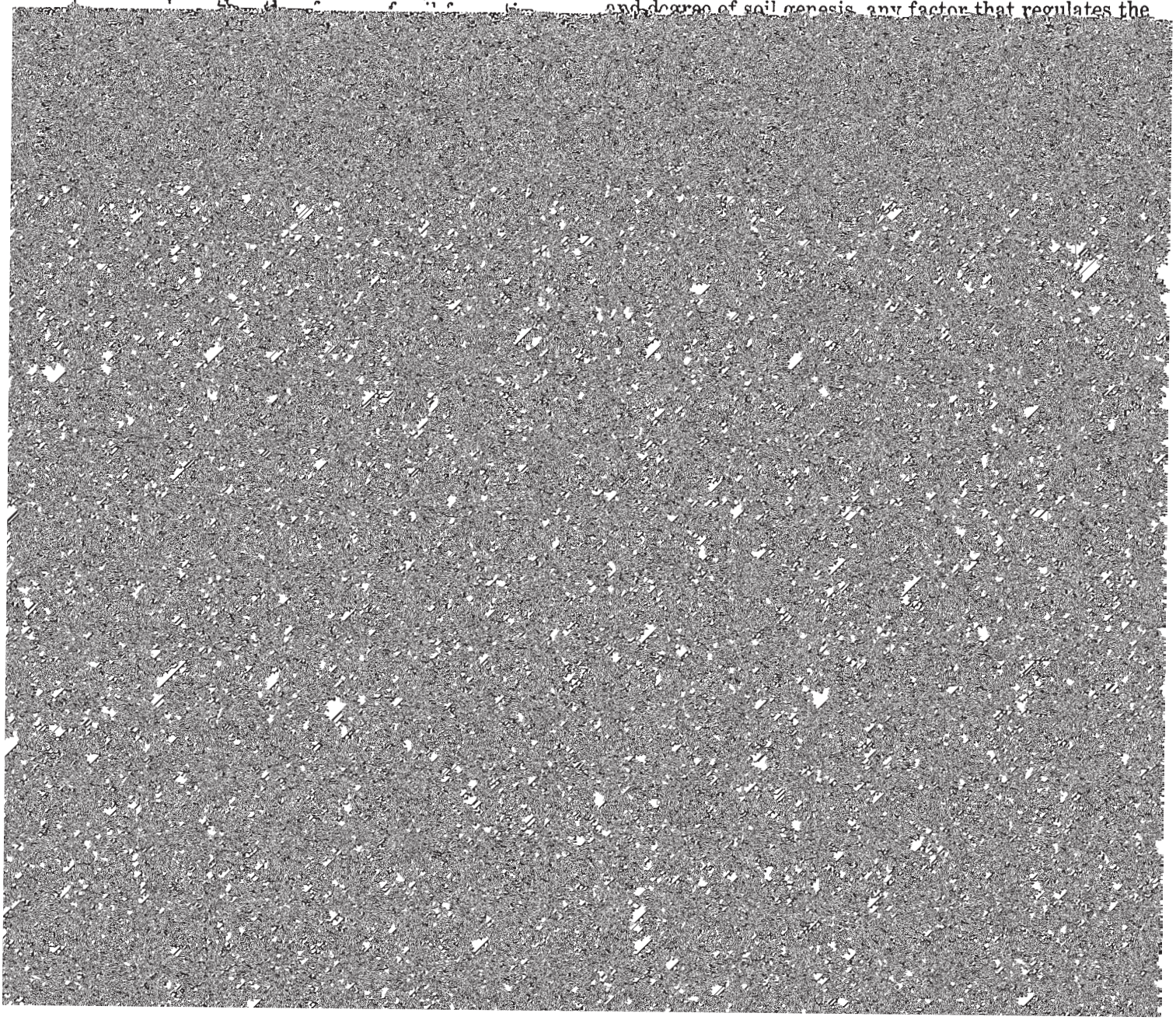
The lack of specific dating for these land surfaces makes it impossible to specifically relate any one landform with any degree of solum development. In local-

hand, genetically young soils occurring on these deposits do not necessarily imply youthful parent material, since geologic erosion may have kept pace with genetic development.

Relief

Some of the effects of relief on soil development have been discussed in preceding paragraphs. The slope, shape, or contour of any part of a landscape has a pronounced effect on soil development, mainly through the physical control such factors exert on water movement, both in and over the soil. Landform and contour also affect soil temperature, wind movement, and geologic or accelerated erosion.

The effect of slope and contour on distribution of surface water is easily understood. Since the amount of water entering the soil is important to both the kind and degree of soil genesis, any factor that regulates the



genesis since it represents the original state from which the kind and degree of change must be evaluated.

A complete evaluation of the character of parent material relative to the changes introduced by soil

Some deposits contain free carbonates and others do not, but rarely are they more than slightly acid in reaction.

Residual or locally transported material from sedi-

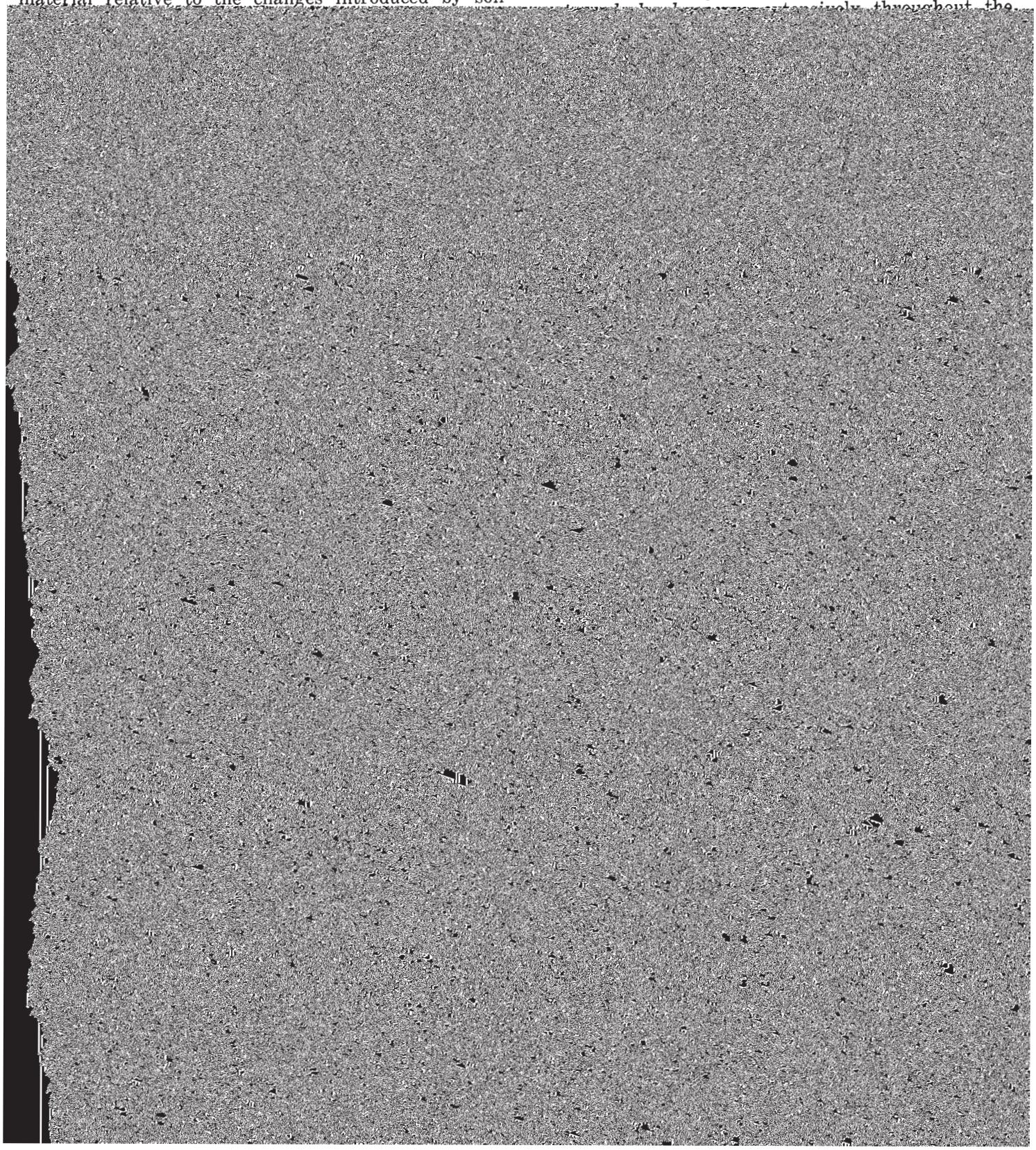


TABLE 7.—*Soil series classified according to the current system of classification*

Series	Family	Subgroup	Order

do not have distinct genetic horizons. They have only slight darkening of the surface horizon or an inconsistent accumulation of soluble salts. There may be considerable physical or chemical difference among these soils, but these differences are characteristics of the parent material and are not the result of soil development. The common characteristic of Entisols is a lack of distinguishing genetic horizonation.

The only major subdivision of Entisols represented in the Gunnison Area is the Orthents. These are well-drained soils that are finer than loamy fine sand, lack fragments of diagnostic horizons in the upper part, and have an organic-matter distribution pattern that reaches a maximum in the surface horizon and decreases with increasing depth.

The only subdivision of the Orthents represented in the Gunnison Area is the Torriorthents, which are in dry areas where soil moisture supplies are limited.

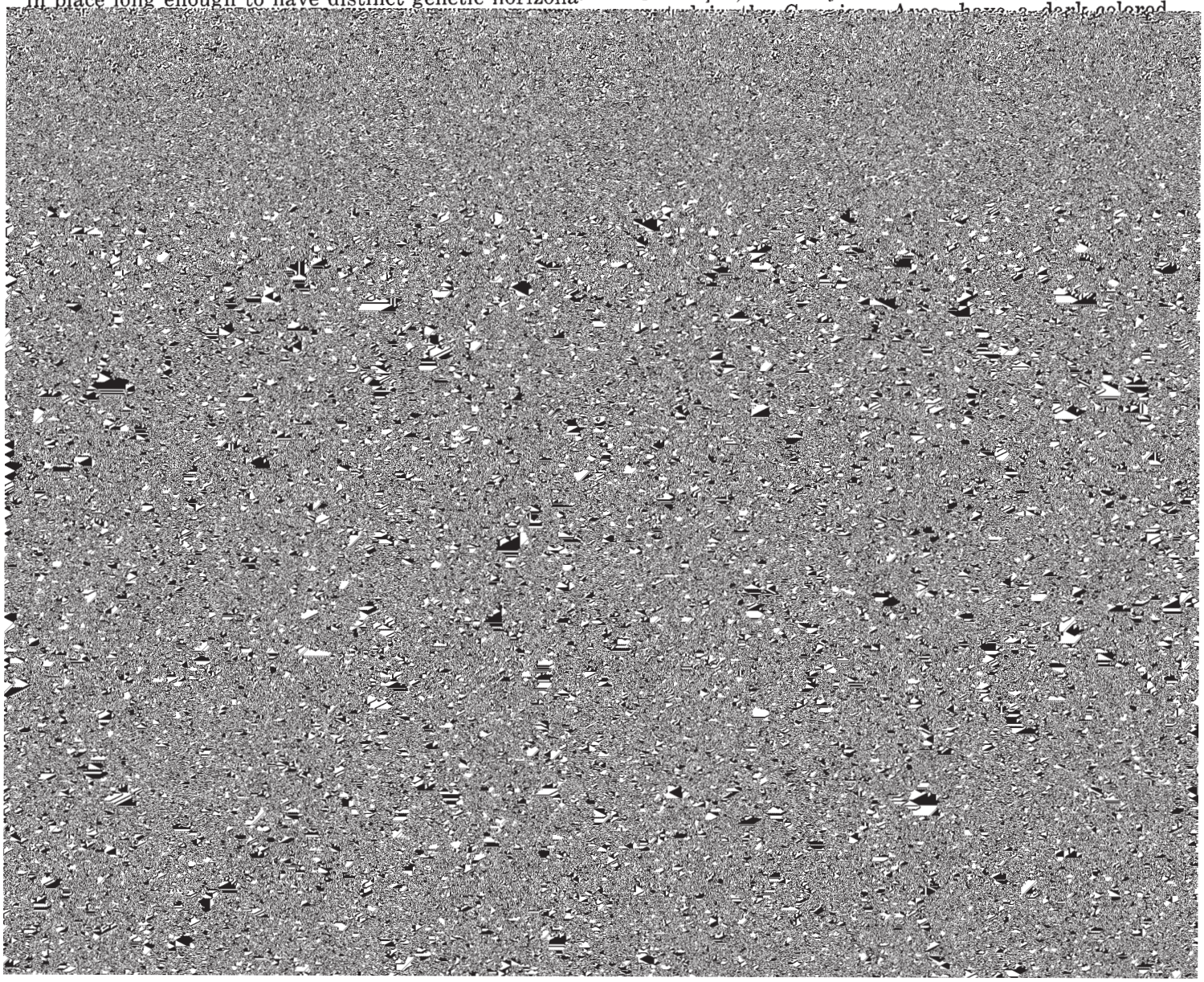
Aridisols are light-colored, dry soils that have been in place long enough to have distinct genetic horizona-

clay accumulation and have no duripan or strong concentration of secondary carbonate. In the Gunnison Area they have an average annual soil temperature of less than 47°. Their average soil temperature in summer is more than 58°.

Borolls are subdivided into Haploborolls, Argiborolls, and Cryoborolls. Haploborolls do not have a horizon of silicate clay accumulation and have an average soil temperature in summer of more than 59°. Argiborolls have a B2t horizon of silicate clay accumulation and an average soil temperature in summer of 59° or more. Cryoborolls have an average soil temperature in summer of less than 59°.

Inceptisols are weakly developed soils that have more horizonation than Entisols, but do not have a horizon of silicate clay accumulation. They have a dark-colored surface horizon similar to that of the Mollisols, but differ from the Mollisols in having less than 50 percent base saturation in the surface horizon.

Umbrepts, the only subdivision of Inceptisols rep-



of the moisture control section for more than one-fourth, but less than one-half, of the time. In the Gunnison Area they are light-colored, calcareous soils that have no genetic horizonation other than a slight darkening of the surface horizon, weak grades of structure, or inconsistent accumulation of soluble salts at any depth. They are mildly alkaline to strongly alkaline, fine textured, and calcareous throughout. The average annual soil temperature at a depth of 20 inches is less than 47°. The average soil temperature in summer is 59° or more.

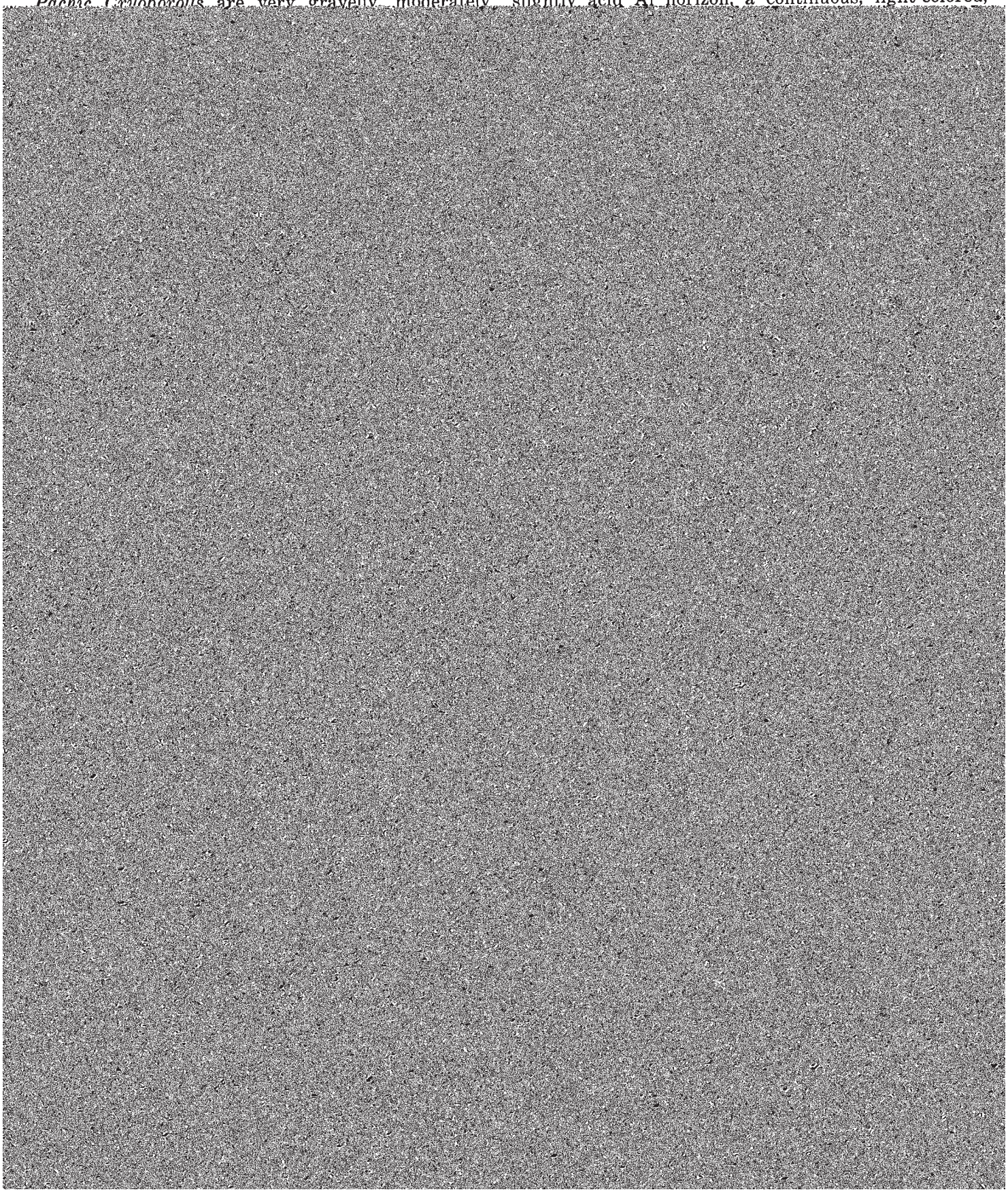
Borollic Camborthids are light-colored, moderately coarse textured, mildly alkaline soils that have a B2 horizon showing evidence of alteration but having no silicate clay accumulation. In the Gunnison Area these soils are noncalcareous throughout. The lack of carbonate is not the result of genesis but is characteristic of the parent sediment. These soils are associated with large amounts of gravel and cobblestones and are more than 35 percent coarse fragments throughout the solum and C horizon. The average annual soil temperature at a depth of 20 inches is less than 47°. The average [illegible] and a thin C horizon. The content of organic carbon decreases uniformly with increasing depth.

Torriorthentic Haploborolls are dark-colored, mildly alkaline to moderately alkaline, well-drained soils that are calcareous at or near the surface or lack definite horizons of alteration below the dark-colored A horizon. They are characterized by a moderately dark colored A horizon and a light-colored, calcareous C horizon. The content of organic carbon decreases uniformly with increasing depth.

Aridic Argiborolls are medium textured to moderately fine textured, well-drained grassland soils. They are characterized by a moderately dark colored, neutral to slightly acid A horizon over a continuous B2t horizon of silicate clay accumulation. The content of organic carbon decreases uniformly with increasing depth. In areas where the parent material contains free carbonates, continuous horizons of secondary carbonates occur below the solum.

Aridic Lithic Argiborolls are fine-textured, very gravelly, well-drained grassland soils. They are char-

Pachic Cryoborolls are very gravelly, moderately slightly acid Al horizon, a continuous, light-colored,



industry. The old railroad grades are still noticeable, but all railroads have disappeared. Many unimproved roads are traveled by jeep. Commercial airline flights are available daily.

Native woodland products were used for railroad ties and mining props. The indiscriminate cutting of trees has adversely affected the production of lumber and forestry products. Recently, scientific methods of harvesting timber have become more widely used. Logs are transported principally by truck to sawmills and

ucts. Ranches have increased in number and size and now include nearly all the usable agricultural land. Cow-calf ranching has been the result of these changes. The present trend, generally by nonresident landowners, is toward consolidating ranches into larger, more efficient enterprises.

Meadow grass and clover and hayfields are irrigated (fig. 13). Livestock graze the meadow in spring and after they are removed from the range in fall. Cattle are marketed after grazing the meadow grasses in

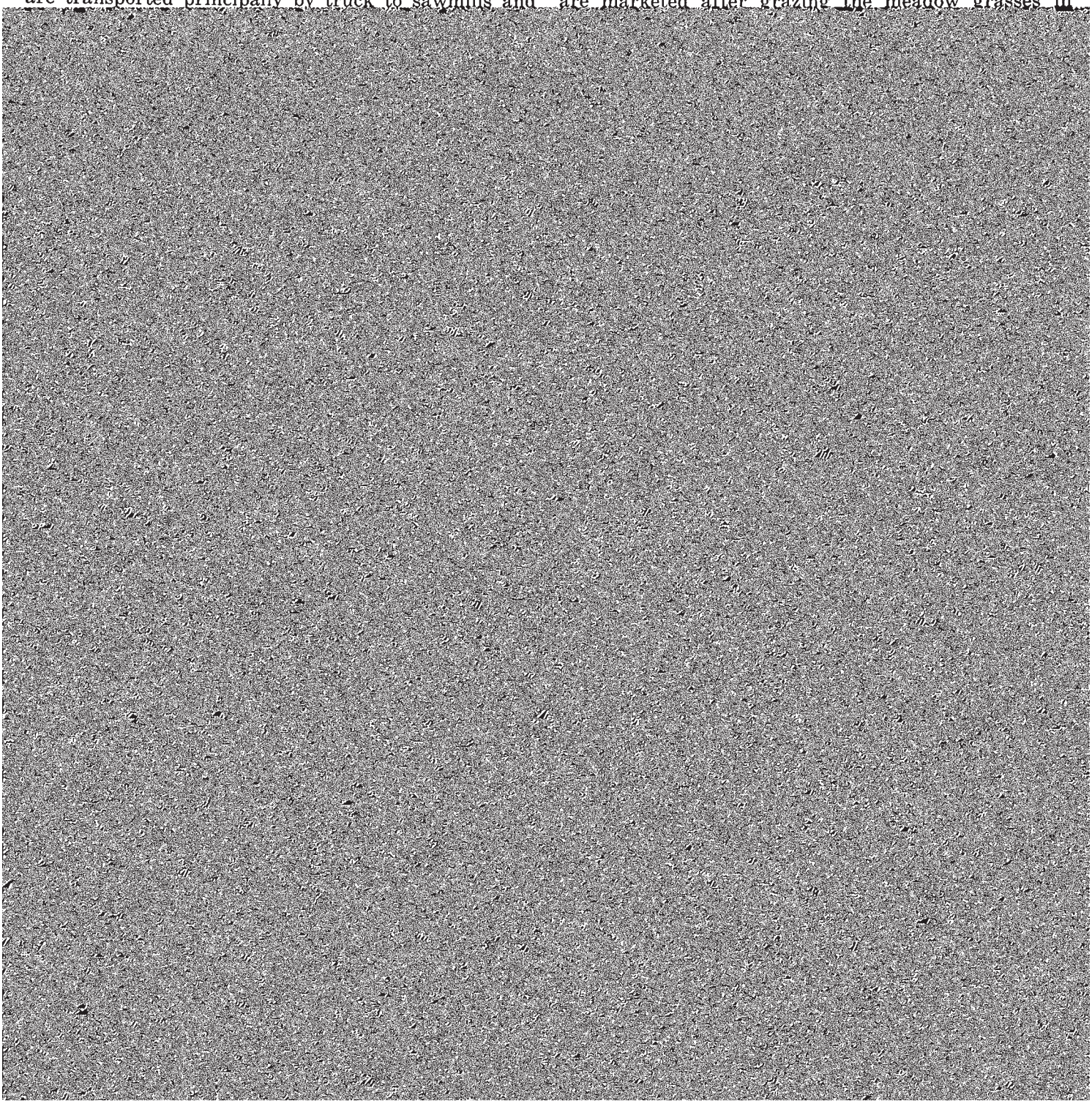


Figure 13.—Top: **Irrigated pasture and mountain meadow on Gateview and Fola soils.** ***Bottom:*** **Irrigated hay carries livestock through winter.**

TABLE 8.—*Temperature and precipitation*

[All data from Gunnison, elevation 7,675 feet]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	Two years in 10 will have—		Average number of days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F	°F	°F	°F	Inches	Inches	Inches		Inches
January	28	−5	42	−25	0.97	0.3	1.7	30	6
February	32	−1	46	−23	.98	.5	1.6	27	11
March	42	11	56	−6	.81	.3	1.1	16	8
April	57	23	71	13	.80	.5	1.3	(1)	3
May	67	29	78	21	.76	.4	1.2	(1)	1
June	78	36	86	28	.78	.3	1.4	0	—
July	83	42	89	35	1.47	.9	2.2	0	—
August	81	41	87	32	1.46	.7	2.3	0	—
September	75	31	83	23	.89	.4	1.3	0	—
October	64	22	75	11	.72	.2	1.1	0	—
November	47	10	61	−4	.60	.2	1.0	4	2
December	34	−1	47	−17	.76	.2	1.0	14	4
Year	57	20	[2] 90	[3] −31	11.00	8.2	12.4	91	7

[1] Less than one-half day. [2] Average annual highest temperature. [3] Average annual lowest temperature.

drifts are the last to melt; and thus retard runoff, which allows more even distribution of streamflow in spring and summer. At elevations above timberline some large snowdrifts remain throughout most of the summer. Warming trends in May and June are the periods of greatest runoff. During this time streams are at a peak and overflow on flood plains and lowlands along major drainageways.

Climatic summaries are shown in tables 8 and 9.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Basalt. A fine-grained, dark-colored igneous rock.

Base course (engineering). In road construction, selected material of planned thickness used as a foundation for pavement.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blanket (engineering). A thin layer of clayey soil or other slowly permeable material placed on the upstream floor of

clay loam, silty clay loam. *Fine-textured*: Sandy clay, silty clay, and clay.

Forage. Plant material that can be used as feed by domestic animals; it may be grazed or cut for hay.

Forb. Any herbaceous plant, neither a grass nor a sedge, that is grazed on western range.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Gneiss. A coarse-grained, laminated or foliated metamorphic rock.

Granite. A light-colored, coarse-grained igneous rock.

Habitat. The natural abode of a plant or animal; it refers to the kind of environment in which a plant or animal normally lives as opposed to its range, or geological distribution.

Heavy soil. An old term formerly used for clayey or fine-textured soils.

Herb. A plant that dies annually or after flowering; grasses and forbs, as distinguished from shrubs and trees.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below

tinct, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Overgrazing. Grazing so heavy as to impair future forage production and to deteriorate plants, soil, or both. Contrasts with undergrazing.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Percolation. The downward movement of water through the soil.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, mod-*

for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Shale. A sedimentary rock formed by the hardening of clay deposits.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. Woodland groups are described on pages 52 and 53. Additional information is given in tables as follows:

Acreage and extent, table 1, page 9.
Predicted yields, table 2, page 43.

Engineering, table 5, page 56 and table 6, page 62.

Map symbol	Mapping unit	Page	Capability unit: Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Woodland Number
Ad	Alluvial land----------	8	-----	--	VIw-3	42	Mountain Swale	48	--
Ao	Alluvial land, occasionally flooded----------	8	-----	--	VIIw-4	42	----------	--	--
Aw	Alluvial land, wet----------	8	VIw-1	41	-----	--	Mountain Meadow	47	--
BaF	Bead fine sandy loam, 10 to 50 percent slopes------	10	-----	--	VIIe-2	42	----------	--	3
BbA	Big Blue loam, 0 to 1 percent slopes----------	10	Vw-1	40	-----	--	----------	--	--
BbB	Big Blue loam, 1 to 5 percent slopes----------	10	Vw-2	40	-----	--	----------	--	--
BoE	Bogan silt loam, 5 to 30 percent slopes----------	11	VIe-1	41	VIe-4	41	Subalpine Loam	48	--
BsB	Bosler sandy loam, 1 to 8 percent slopes----------	11	Vc-1	40	VIe-2	41	Mountain Outwash	46	--
CaF	Carbol very rocky sandy loam, 15 to 60 percent slopes----------	12	-----	--	VIIs-2	42	----------	--	1
CeE	Cebolia loam, 5 to 30 percent slopes----------	13	-----	--	VIe-4	41	Subalpine Loam	48	--
CoE	Cochetopa loam, 5 to 30 percent slopes----------	13	VIe-1	41	VIe-4	41	Subalpine Loam	48	--
CrE	Corpening fine sandy loam,	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Woodland Number
GaB	Gas Creek sandy loam, 1 to 5 percent slopes----------	18	VIs-1	41	-----	--	----------	--	--
GeB	Gateview cobbly loam, 2 to 8 percent slopes----------	19	VIs-1	41	VIe-2	41	Subalpine Loam	48	--
GeE	Gateview cobbly loam, 8 to 30 percent slopes---------	19	VIe-1	41	VIIs-1	42	Subalpine Loam	48	--
GrB	Gold Creek silty clay loam, 0 to 5 percent slopes-----	19	Vw-3	40	-----	--	----------	--	--
IrA	Irim loam, 0 to 1 percent slopes----------	20	Vw-1	40	-----	--	----------	--	--
IrB	Irim loam, 1 to 5 percent slopes----------	20	Vw-2	40	-----	--	---------	--	--
JeE	Jerry loam, 5 to 30 percent slopes----------	21	VIe-1	41	VIe-4	41	Subalpine Loam	48	--
KcE	Kezar-Cathedral gravelly sandy loams, 5 to 35 percent slopes----------	21	-----	--	VIe-5	41	----------	--	--
	Kezar soil----------	--	-----	--	-----	--	Mountain Loam	45	--
	Cathedral soil----------	--	-----	--	-----	--	Dry Mountain Loam	44	--
KuE	Kubler loam, 5 to 35 percent slopes----------	22	VIe-1	41	VIe-4	41	Subalpine Loam	48	--
LeE	Leaps silty clay loam, 5 to 30 percent slopes------	22	-----	--	VIIe-1	42	Deep Clay Loam	48	--
LhF	Lucky-Cheadle gravelly sandy loams, 5 to 45 percent slopes----------	23	-----	--	VIIe-3	42	----------	--	--
	Lucky soil----------	--	-----	--	-----	--	Mountain Loam	45	--
	Cheadle soil----------	--	-----	--	-----	--	Dry Mountain Loam	44	--
MeF	Meredith very stony loam, 8 to 50 percent slopes----	23	-----	--	VIIs-3	43	Alpine Slopes	50	--
MoE	Mord loam, 5 to 30 percent slopes----------	24	VIe-1	41	VIe-4	41	Subalpine Loam	48	--
MrE	Morop stony loam, 5 to 40 percent slopes----------	25	VIe-1	41	VIIs-1	42	Mountain Loam	45	--
NuF	Nutras stony loam, 10 to 50 percent slopes----------	26	-----	--	VIIe-2	42	----------	--	4
PhF	Parlin-Hopkins channery loams, 5 to 45 percent slopes----------	26	-----	--	VIIe-3	42	----------	--	--
	Parlin soil----------	--	-----	--	-----	--	Mountain Loam	45	--
	Hopkins soil----------	--	-----	--	-----	--	Dry Mountain Loam	44	--
PmF	Parlin-Mergel gravelly loams, 5 to 45 percent slopes----------	26	-----	--	VIIe-3	42	----------	--	--
	Parlin soil----------	--	-----	--	-----	--	Mountain Loam	45	--
	Mergel soil----------	--	-----	--	-----	--	Dry Mountain Loam	44	--
PoF	Posant very rocky loam, 10 to 60 percent slopes------	27	-----	--	VIIs-2	42	----------	--	1
PwE	Powderhorn loam, 5 to 30 percent slopes----------	28	-----	--	VIe-4	41	Subalpine Loam	48	--
RcE	Redcloud channery loam, 3 to 30 percent slopes------	29	VIe-1	41	VIe-2	41	Mountain Outwash	46	--
Ro	Rock outcrop----------	29	-----	--	VIIIs-1	43	----------	--	--
Rs	Rockslides----------	29	-----	--	VIIIs-2	43	----------	--	--
RuE	Ruby gravelly sandy loam, 5 to 30 percent slopes----	29	-----	--	VIIe-3	42	Shallow Subalpine	49	--

GUIDE TO MAPPING UNITS--Continued

Map	Capability unit		Range site	Woodland
	Irrigated	Nonirrigated		

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