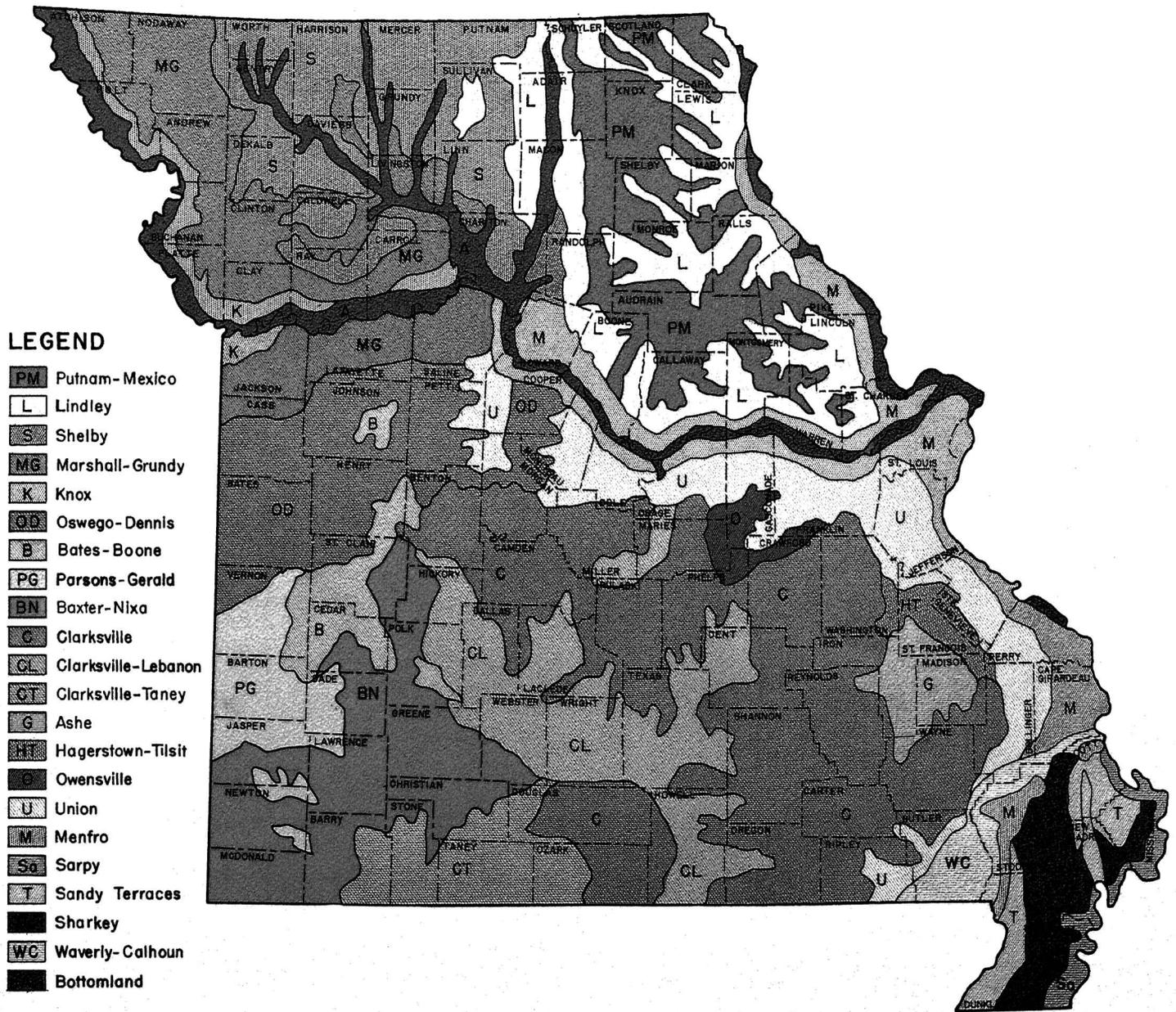


MAJOR SOIL AREAS



OF MISSOURI, 1962

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This bulletin, and the soil map it contains, gives general information on the soil resources of Missouri. It describes the physical characteristics of the soils in different parts of the state, and defines the significant features that effect use of the land and improvement of the soil. Many, both within and outside the State, are interested in such general information. This includes, farmers, land buyers, appraisers, loan agencies, teachers, engineers, geographers and many others.

The soils of Missouri are many and varied. More than 150 types have been recognized. It is not possible to show individual soil types on a small scale map, but they can be grouped on the basis of similarity and relationship into larger map units. These are indicated on the soil map. Use of the map is basic to an understanding of the soils of Missouri.

Of interest is the geographic position of Missouri and its relation to the great soil regions of the Mississippi Valley. The soils of northern Missouri are a part of the vast Corn Belt of Iowa, Illinois, and other states to the north. The prairie section of western Missouri is the eastern edge of the Plains region of Kansas and Oklahoma. The Ozark region extends into Arkansas. The lowland of southeastern Missouri is the upper end of the vast Mississippi delta that extends to the Gulf of Mexico. Within each of these large soil and physiographic areas occur variations that give the entire state an unusual complexity of soil conditions that is reflected in the diversity of crops and types of farming, and also in the prosperity of the farmers.

Soils of Many Kinds

The main factors which cause the diverse Missouri soils are: parent or geological material

from which the soils were derived, climate, topography, drainage, natural vegetation, and the length of time the soils have weathered. Limestone, sandstone, shale, loess, and glacial clay, are geologic materials that produce many types of soils, particularly as they differ in clay content. The climate is responsible for the depth of weathering and the acid nature of most soils. Topography determines the general depth of the surface soil and causes different soil-forming materials to be exposed at the surface. Differences in drainage result in many different soils, particularly on level land. The type of natural vegetation, that is, trees or grass, greatly influences the kind of soil formed. Soils that were formed under a forest cover are generally lighter in color than soils formed under a grass cover. The time factor is also of tremendous significance in determining the character and quality of soils. Most of the soils in the southern half of Missouri are geologically much older than the soils formed from loess and glacial till in the northern half of the state. The former are weathered and leached to a much greater degree and depth, and are of lower fertility. The soil at any one place is not determined by any one of the factors mentioned; rather, it is the product of all these factors operating in varying degrees of intensity.

Soil-Forming Materials

To understand the soil resources of the State, it is essential to give consideration to the soil-forming materials. Of these, loess, glacial till, limestone, shales, and alluvial deposits are the most important. Sandstone and granite are of minor importance in Missouri. The texture or clay content and the mineralogic composition of soils are largely determined by these geologic materials.

During the glacial period, the northern half of Missouri and a large part of the surrounding states—Illinois, Iowa, Nebraska, and Kansas—were completely covered by a mantle of wind-blown dust, or “loess”. It occurs in great thickness along the Missouri and Mississippi Rivers, particularly in the northwest, where it attains a depth of 50 to 75 or more feet. It is recognized by its distinctive brown color and uniformity of texture. Receding from the river hills the loess ranges from four to ten feet in depth, and is the material from which most of the prairie soils have been formed. It should be noted that loess is the most extensive single soil-forming material in the State.

Loess occurs in other parts of the world—notably China, the Ukraine of Russia, Argentina, and elsewhere. In each of these locations it gives rise to the most productive agricultural soils, noted for their lasting qualities under continued use. The high agricultural rank of Missouri, and of the Corn Belt, must be attributed largely to the extensive loess-derived soils.

Glacial till, consisting of clay with a small admixture of sand and gravel, is the important soil-forming material in the northern part of the state where the surface is not mantled by loess. The so-called glacial soils are most extensive in the region drained by the Grand and Chariton Rivers. The texture of the surface soils is usually a loam and that of the subsoil a clay loam.

Shales are the important soil-forming materials in the prairie region of southwestern Missouri. The many different soils are due in part to the variations in the shale materials that range from fine sand to clay, and from acid to calcareous in reaction. The dark soils in Bates County, and the counties to the north and east, are associated with clay shales that frequently contain thin inter-bedded layers of limestone. In the southern part of this prairie region sandy shales and even sandstones predominate. The associated soils are lighter in color, contain less clay and are of lower productivity.

Practically all of the soils in the entire Ozark region of southern Missouri contain chert rock. The latter may occur as fragments in the subsoil, or more generally it comprises 50 or more percent of the soil mass. The chert is evidence that the soils are derived from the impure limestone which characterizes the Ozark region.

The content of phosphorus is low. The calcium and magnesium have been largely removed by leaching. In general, the soils derived from cherty limestone material alone are of relatively low fertility. This may not be in accord with popular opinion, and does not apply to soils from pure limestone in other sections of the country. It should be noted that the “red limestone soils” in Madison and St. Francois Counties and elsewhere are very productive, but these are derived from chert-free and comparatively pure limestone material.

It is apparent that the geologic origin of the soil material has had a tremendous influence in determining not only the physical properties but also the general fertility level of the soils in Missouri. The larger physiographic and soil regions, such as the Ozark area, the western prairie, and the northern glacial plain, are closely correlated with the different geologic conditions.

Forest and Prairie Land

Missouri is on the border of the continental forest and grassland regions. The forested land originally included all of the Ozark and Lowland regions, and much of the hilly land along the streams in the northern part of the State. Prairie vegetation dominated in western Missouri and in most of northern Missouri.

The effect of the vegetation cover on soil-forming processes is well established. These processes are more active under forest than under grass. It is generally assumed that prairie soils are darker in color, contain more organic matter, and are more productive than areas that were forested. Although this assumption is generally correct, there are many exceptions, so that it is not a rule. Some of the most productive soils, including most of the bottomlands, were originally forested. Such inferiority as applies to much of the forest land should be attributed to other factors—such as the soil-forming material, the age and degree of weathering—rather than to the vegetation cover.

It is a prevailing opinion also that prairie land has a level or gently rolling topography and that forest land is hilly. This, too, is an opinion to which there are many exceptions. The hilly land in northwestern Missouri was

formerly grass-covered. The correlation between topography and vegetation is most definite in northeastern Missouri, for here the level prairie is in sharp contrast to the forested slopes.

Practically all the prairie land is now in agricultural use. Of the original twenty-five million acres of forest land, approximately fourteen million acres remain in timber.

Soil Formation and the Soil Profile

In the process of soil formation during geologic time, soils acquire definite (morphological) characteristics that are expressed in the vertical cross section usually called the *soil profile*. The profile is the succession of layers or horizons, differing in color, texture, and structure, from the surface downward to the limit of most active weathering, normally about three feet. It is in the profile features that the soils of Missouri have the greatest variation. Soils formed most recently may have a profile which shows little stratification but which is rather uniform throughout in color and texture. Most of the bottomland soils are of this type. Other soils may have five or more distinct horizons. It is the character of the profile which offers the main criterion for classifying soils into different types and groups.

Great significance is assigned to the profile features because they provide an index to the age or maturity of the soil—the degree of leaching or weathering it has undergone—and therefore are an indication of the inherent fertility. Soils with the most distinct profiles occur on level uplands, and are most pronounced in the level ridgetops and the plateau areas of the Ozark region and in the prairie sections of northeastern and southwestern Missouri.

Physical Features of Soils

The physical features that give diversity to soils include color, depth of top soil, texture, subsoil, subsoil pans, tilth (structure), and underlying material. Each of these is of great significance in identifying soils and also in interpreting their fertility levels.

In color, the soils vary from black, or dark brown in the northwestern part of the State, to light brown and gray in the southern part. In general, the color becomes lighter from north to south. This is due, in part, to a climatic change, but more largely to a difference in original vegetation. The region of most uniformly dark soils includes all of the northwestern quarter of the State and the west central section north and west of a line extending from Boonville through Clinton, Sedalia, and Butler. Dark gray is the dominant color of the soils in the northeastern part of the state. The Ozark border region, both on the east and west, is characterized by brown and reddish brown soils. In the Ozark region proper, the soils are uniformly gray to light brown in color. The widest range in color—from black to brown to almost white—prevails in the Southeastern Lowland region.

Variations in depth of the surface, or top soil, range from eighteen or more inches for some of the dark prairie soils in northwestern Missouri, to six or eight inches for most of the soils in the Ozark region. Throughout the northeastern, central and southwestern sections, approximately ten inches is the normal depth. It should be noted that for all of the State the depth of the topsoil is greater than the depth to which normal cultivation extends. On slopes, where erosion or soil washing is active, the original surface soil has frequently been modified or reduced in depth. By the same process, the depth of the soils in the valleys has been increased. However, statements that 15 to 50 percent of Missouri's top soil over large areas has been lost by erosion have not been verified by soil survey field studies and should be discounted. A variable depth of one to three feet of top soil characterizes most alluvial or bottomland soils.

In one characteristic—that of surface soil texture—there is remarkable uniformity. A medium texture, silt loam or loam, characterizes more than 90 percent of the upland soils of the State. It should be noted that most of the soils of the Ozark region contain varying amounts of chert stone, sometimes called flint rock. But if only the fine soil material is considered, then the silt texture is apparent. Almost 25% of all soils are stony silt loams. Moderately sandy soils occur in the southwestern part of the State, and

in local areas in the Ozark region. Wide ranges in texture, from plastic clay to loose sand, occur in the bottomlands, particularly in the lowland region. The dominant factor of medium textures is of tremendous significance, because it is soils of this class that have the most favorable moisture-holding capacity, that can have the best tilth, that are most easily tilled, and that have the widest crop adaptation.

The texture and other physical features of subsoils are, in general, more variable than those of the surface soils. The majority of upland soils in Missouri have a heavy or clay-like subsoil. It is a condition that may be of great significance where erosion is active and may limit the range in crop adaptation. It is a condition that is favorable to the retention of water in ponds. Clay subsoils are characteristic of most of the soils derived from glacial till and from shales in the northern and western parts of the state. Moderately heavy subsoils, dominantly silty clay loams, are peculiar to the soils of the Ozark region.

Of particular interest are soils with "pans". The level prairies of northeastern and southwestern Missouri have distinct, dense clay subsoils, frequently called "claypans". These occur at a depth of sixteen to eighteen inches, they are gray-brown in color, and have a thickness of about twelve inches. The "pan" is a product of normal soil-forming processes in level areas over a long period of time. It rarely occurs where the slope of the land is more than six percent. It retards the free downward movement of water, and also is unfavorable to root penetration. The slow internal drainage sometimes delays cultivation of the land in wet seasons. There are different types of claypan soils, but most are intensively farmed.

In the Ozark region some of the level ridge-top land has a "hardpan" substratum. The hardpan consists of cemented soil material that is gray in color and extremely hard and brittle when dry. It occurs in the lower subsoil at a depth of 30 to 36 inches. A hardpan structure is associated with low soil fertility and poor crop growth.

Major Soil Areas

For convenience of discussion, the soils of Missouri can be divided into four physiographic

regions, and each of these divided into several major soil areas. These are indicated on the soil map. It should be noted that in such a grouping, each soil area includes variations. However, each area is characterized by a general uniformity in soil color, type of profile, similarity of topography and character of landscape. Each area is named for the dominant soil type or types although as already indicated, other types of minor extent are included in each group.

Grouping of Missouri Soils

North Missouri—glacial and loess region

Putnam-Mexico—level prairie

Lindley—rolling forest

Shelby—rolling prairie

Marshall-Grundy—dark prairie

Knox—river hills

Southwest Missouri—plains region

Oswego-Dennis—dark prairie

Bates-Boone—sandstone-shale prairie border

Parsons-Gerald—level prairie

Ozark Region

Baxter-Nixa—southwestern Ozark border

Clarksville stony—Ozark center

Clarksville-Lebanon—Ozark plateau

Clarksville-Taney—limestone glades

Owensville—Gasconade Meramec divide

Ashe—granite hills

Hagerstown-Tilsit—Farmington basin

Menfro—river hills

Union—northeastern Ozark border

Southeast Lowland Region

Sarpy—Mississippi River Bottom

Sharkey—clay bottom

Sandy terraces—sandy bench land

Waverly-Calhoun—grayland

River bottom—alluvial soils

North Missouri—Glacial and Loess Region

The glacial and loess region is not a distinct soil or physiographic region limited to Missouri, but is part of a larger landscape that extends north into Iowa. It includes a rather wide range of soils, but practically all are derived from glacial till and from loess. This is of great significance because these materials are responsible for

the generally high level of soil fertility.

Following the last ice age all of northern Missouri was left covered by a glacial deposit, already referred to as glacial till. It is composed of clay with a small admixture of sand and pebbles. The till varies in thickness from 5 to more than 100 feet. In general, it is thickest over the north central part of the state, and thinnest at the outer and southern border of the region. Following the glacial period, this glacial till was covered by wind-laid loess. This deposit, ranging from 4 to more than 60 feet in thickness, is of greatest depth along the Missouri and Mississippi Rivers, and gradually thins out away from the streams. In subsequent time, much of the loess has been removed by erosion over large areas, and the underlying till exposed to the surface, where it is now the soil-forming material. An understanding of the relation of the loess to the till aids greatly in an understanding of the character and distribution of the soils in this large and important soil region.

Putnam-Mexico—Level Prairie

One of the most distinct soil areas of Missouri is the level prairie in the northeastern part of the state. East of the Wabash Railroad, from Moberly to Kirksville, and extending as a serrated plain almost to the Mississippi River, is a broad level upland, characterized by a remarkably uniform soil derived from loess. It grades in color from dull gray in the south to a very dark gray in the north. The silt loam surface soil varies from ten to twelve inches in depth and usually grades into a lighter colored silty material four to six inches in thickness. The subsoil is a dense plastic clay, gray-brown in color and classified as a claypan. On some of the broad level areas, drainage may be slow, but most of the land including all the Mexico soil, has sufficient slope to provide surface runoff. Included in the Putnam-Mexico soil area are narrow bands of Lindley soil along the small streams. Because of small extent these could not be indicated on the general soil map.

The Putnam soil, because of its favorable topography and texture, is easily tilled, and practically all of it is in cultivation for corn, oats, wheat, soybeans, and grasses. A general type of farming prevails, with much emphasis on live-

stock production. Bluegrass thrives and it is an important factor in the use of the land. Limestone and fertilizer are extensively used. It is a highly improved agricultural area.

Lindley—Rolling Forest Land

Throughout the northeastern quarter of Missouri the streams are bordered by rolling and formerly forested land where the loess deposit has been removed by erosion and the glacial till is the soil-forming material. The soils are characteristically light in color and shallow in depth. The surface soil is dominantly a gray-brown loam or silt loam and the subsoil a yellow-brown sandy clay loam. Because of the sloping surface, and also because of the soil material, all land is more or less eroded and gullies are frequent. Probably fifty per cent of the Lindley soil area is too steep for cultivation, but all of it is suitable for pasture. It is estimated that about fifteen percent remains forested.

It is difficult to improve some of the soil by fertilization because of slope and erosion. However, all of it is very responsive to fertilization. It is most deficient in nitrogen. The Lindley soil area is limited in agricultural use, and most of it will remain in pasture.

Shelby—Rolling Prairie

The north central part of Missouri, including most of the Grand River drainage area, is characterized by dark shallow soils, derived from glacial till. The surface soil varies from dark brown to gray-brown in color, and from eight to twelve inches in depth. The subsoil is dominantly a yellow-brown, plastic, sandy clay loam. In general, the soils in the western part of the area are darker in color than in the eastern part. The original prairie vegetation was interspersed by numerous forested areas.

The entire area of Shelby soils is dissected by numerous streams. The topography varies from rolling to moderately hilly, but most of the land is suitable for cultivation. Erosion is severe. On the steeper slopes, there may be spots where most of the dark surface soil has been removed and the yellow subsoil exposed. The soil is inherently fertile, but limited in use because

of erosion. Corn and oats are the major crops. Much of the land is in permanent grass and includes some of the most productive pastures in the State. Erosion control is one of the major problems.

Marshall-Grundy— Dark Prairie

This is one of the largest and most productive soil areas in the State. It forms the "Corn Belt" of northwestern and west-central Missouri. The soils are derived from loess, and therefore, have a silt loam texture. The surface soils are dark brown to black in color, ten to fifteen or more inches in depth, and of mellow granular structure. The subsoils of the Marshall and associated types are dull brown silty clay loams, open, and of great depth. On the level to gently rolling prairie land in Caldwell, Livingston and surrounding counties where the Grundy soils predominate, the surface soils are somewhat shallower in depth, and the subsoils contain more clay—usually a silty clay in texture.

The topography of the Marshall-Grundy soil area is rolling, but rarely level. All of the land is suitable for cultivation, and more than 60 percent of it is used for tilled crops. A diversified type of farming prevails, based on grain and livestock production. In the northwestern part of the state, corn, oats, alfalfa, and grass are the important crops. Cattle and hogs in large number are fattened for market. In some sections 25 percent of all land is in corn. Bluegrass seed is produced in large quantities. Few upland soils have a greater potential value for production, or are suited to a greater variety of crops, including fruit. Erosion has seriously impaired the quality of the soils, and is a major problem in the northwestern part of the state.

Knox—River Hills

The band of hill land along the Missouri River, extending from Atchison County to Howard and Saline counties, is the most fertile and also the most ravaged soil area in the State. It is an area thickly mantled by loess. The loess

varies from twenty to seventy feet in thickness. There are few places in the United States where it occurs in greater deposits. Unfortunately, its locations along the river floodplain has resulted in complete dissection by long-time erosion, so that now all the land has a hilly to steep topography. Nowhere is erosion more severe, and the process is continuing at an accelerated rate.

The Knox soils are uniform in their main physical features, because of the uniform loess material. The surface soil is a brown or dark brown deep, mellow silt loam. The subsoil, having a slightly higher clay content and a more distinct yellow-brown color, may extend downward for many feet. There are few soils that have more favorable texture or structure features. But for these same reasons, erosion is a constant menace. Surface soil has been removed from many slopes. The high fertility is indicated by the vigor of all plant growth. Clovers and deep rooting crops thrive with little or no fertilization, but nitrogen gives large returns.

Because of the rolling or rough topography, less than 50 percent of the land is in cultivated crops. Some of the steep bluffs are forested. The agriculture is varied, and in places specialized. Corn, wheat, and clover are the major crops. Commercial orchards are numerous. Tobacco is an important crop in Platte County.

No other soil area has a wider range in crop adaptation. No other soil has higher natural fertility or more desirable physical features. But, with it all, no other soil is deteriorating so rapidly by erosion or is more difficult to conserve.

Southwest Missouri— Plains Region

The plains region of southwestern Missouri contains the most varied soil conditions in the state. In the northern part of the region, the majority of the soils are dark in color and have clay subsoils. Moderately sandy loams of light color are extensive in Cedar and the surrounding counties. The level prairie soils usually have a clay subsoil. The many soil variations have been grouped into three general types, as indicated on the soil map.

Oswego-Dennis—Rolling Prairie

The predominating soils of the Oswego-Dennis area are dark brown silt loams that have silty clay and clay loam subsoils. Included are numerous but small areas of black clay loam and of brown fine sandy loam. All are fairly productive and this with the gently rolling topography makes the Oswego-Dennis soils a highly developed farming region. Corn, wheat, and oats are the major crops. Bluegrass thrives and is the basis for the extensive pastures. It should be noted that it does not thrive on the other soil areas of the plains region. Livestock is the main source of income on most farms. Fertilizer is extensively used on grain crops. Erosion is not severe, except on occasional slopes.

Bates-Boone—Sandstone and Shale

Moderately sandy soils derived from shale and sandstone occur in irregular areas extending northeastward from Barton to Henry County. In color, the soils range from gray to dark brown. The subsoil colors are some shade of brown, and usually are highly mottled red, yellow, and gray. The texture varies from silty clay to sandy clay loam and is friable. The soil mantle is deep, except on slopes where bedrock may be near the surface. The original vegetation was prairie and forest. Only the less desirable sites (usually over sandstone) are now forested. Black oak and other dry site species predominate. The Bates soils are darker in color, and usually contain less sand, than the light colored and shallower Boone soils.

The Bates-Boone soils are medium or below in productivity. They are not drought-resistant and erode easily. Wheat, corn, and cane are the cultivated crops. Lespedeza and red top are the pasture grasses. A type of farming that will not require frequent cultivation is most desirable for these soils.

Parsons-Gerald—Level Prairie

The Parsons-Gerald soil area includes the level prairie land in Barton and the surrounding

counties. The soils are not as varied as in other sections of the plains region and possess more distinct subsoil features. Parsons soil normally is a brown-gray silt loam that grades at about 10 inches into a lighter colored and more compact silty material. The most distinctive feature is the plastic, dark-brown or drab clay subsoil below 16 inches. It is defined as a claypan. The lower subsoil is a friable, yellow-gray, clay loam.

The Gerald soil is extensive in Jasper and Lawrence Counties. The surface soil is dark brown in color. The subsoil is friable and contains less clay than the Parsons. The lower subsoils consist of a mass of chert rock, imbedded in gray or red clay.

The Parsons soils are derived from shales. They are highly weathered and, therefore, are acid and low in some plant nutrients. They are less productive than the Gerald soils. Because of unfavorable subsoil structure, crop damage from drought is frequent.

Corn and wheat are the important crops. Grain-sorghum and soybeans are of secondary importance. Until recent years, there were large areas of virgin prairie sod, and some still remain. Farms are large. Lime and fertilizer are used on almost all grain crops. Forage crops are extensively grown, because the type of farming is based primarily on dairying and livestock production.

The Ozark Region

Generally, the soils of the Ozark region possess characteristics that distinguish them from all others in the State. They are light in color. Most of them are stony, and were derived from cherty limestone. They were formed under forest, and are low in organic matter and mineral plant food. They have been weathered to great depth. The topography varies from steep slopes near the large streams, to moderately hilly on the broad plateaus or interstream divides. On the basis of color, stone content, and character of the soil-forming material, the soils of the Ozark region have been grouped into nine general areas.

Baxter-Nixa— Western Ozark Border

The brown, stony limestone soils in southwestern Missouri form one of the most important soil resource areas in the State. The Baxter soil area constitutes the western Ozark border. The surface soils range in color from gray-brown to reddish brown. The subsoils are red to yellow-brown friable silty clay loam. Chert rock, two to four inches in diameter, is almost universally present throughout the soil mass. Most of the land is moderately stony—less than 25 percent stones—and nearly all of this is in cultivation.

Most of the western Ozark Border was originally forested, but there were numerous large prairie "openings". In these places the soil is dark brown in color, and usually contains less chert than elsewhere. The fertility is higher.

Clarksville—Ozark Region

The area of Clarksville soils includes most of the rough, hilly and stony land of the Ozark region. There are no level areas, and near the larger streams the slopes are steep. Chert stones, two to four inches in diameter, are almost universally present and make up from 20 to 60 percent of the soil mass. The surface soil is gray to light brown in color, changing at a depth of 6 inches to a gray-brown silt loam. The subsoil, beginning at a depth of about 12 inches, is a friable, yellow-brown silty clay. The lower subsoil varies from a brittle gray silt loam to a reddish brown clay loam, or may consist of a mass of chert rock.

A variation in the Clarksville area, are soils with a red clay subsoil. These are most extensive in Washington, Iron, and Reynolds Counties. The red color is associated with a somewhat higher fertility.

The agricultural use of the Clarksville soils is limited by topography, stone content and fertility. Most of the land is non-arable. More than 60 percent of the total area is forested, and in the more rugged sections forest covers practically all of the upland. Pine is an important component of the forest. As an area for forest production, the Clarksville soils rate high in the

Ozark region.

The cultivated land is confined mainly to the numerous valleys and small creek bottoms. Cleared upland is mainly used for pasture. Lespedeza and redtop are important forage crops. Livestock and forest products are the main source of income.

Clarksville-Lebanon— Ozark Plateau

This soil area includes the broad gently rolling to moderately hilly plateaus or divides of the Ozark region. The soils vary from stone free to stony, but usually contain less stone than the steeper hill land. The largest stone-free areas are in Laclede and Webster Counties. The color and profile features of the soils are similar to those of the Clarksville area. In Dent and Phelps Counties, the soil contains a moderate amount of sand to give a loam texture. The subsoil is characterized by a yellow or mottled red and yellow color.

Most of the soils in the Clarksville-Lebanon area have a dense, hard, lower subsoil designated as hardpan. The pan layer normally is at a depth below 24 to 30 inches, and is 6 to 10 or more inches in thickness. It is slowly pervious to water but is impervious to plant roots. Another minor variation, mainly in Laclede County, is a broad, shallow depression on the highest upland. The soil in these locations is stone free, and has a stiff, gray clay, slowly permeable subsoil.

The fertility and the moisture holding capacity of all the soils is low. The original forest vegetation consisted predominantly of post oak. The majority of the land is cleared and mainly used for pasture. The type of farming is based on dairying and the production of livestock.

Clarksville-Taney—Gladeland

In the southwestern part of the state, including Taney and parts of the surrounding counties, all in the White River drainage area, much of the land surface is limestone ledge rock. It is known as Glade, or Barrens, because ori-

ginally it was almost treeless. Usually, there is a thin veneer of dark brown soil, sufficient to support bluestem grasses, cedar and xerophytic shrubs. South and west slopes are more barren or have less vegetation than north slopes.

On the lower slopes below the glades, and in the valleys, the soils are very stony, containing chert stones, 1 to 10 inches in diameter. The subsoil is yellow-brown to gray clay loam. Very little of the land is arable. The oak forest is characterized by slow growth. In general, the entire area of glade soils is very stony, and suitable for range pasture and forestry.

Ashe—Granite Hills

The Ashe soil area is distinct because of its geologic and topographic features, and is locally known as "granite hills". The relief is characterized by high, rounded hills or knobs, that rise 200 to 400 feet above the intervening basins or valleys. The soil mantle over the granite is shallow and of low fertility. It may be stonefree or contain large boulders. Scrub oak, black-post and blackjack oak is the dominant forest type on the gladelike slopes, especially on south and west exposure. On the lower slopes, where the soil is deep, the forest is superior. The soil is gray to pale brown at the surface. The subsoil is yellow-brown silty clay. The cleared land is limited to the small basin-like valleys. Practically all of this is used for pasture.

Hagerstown-Tilsit— Farmington Basin

The Hagerstown-Tilsit soil area is known as the Farmington basin because it has lower elevation than the granite hill area to the south and west. The most distinctive feature is that the soils are essentially stone free, in contrast to the chert stone in most soils of the Ozark region. There are 3 general types of soils distinguished by their color. The most important of these is the "red-limestone soil". It has a reddish brown surface, and a red clay subsoil. It is one of the most productive in the Ozark region. It is most extensive near Farmington, Fredericktown, and Caledonia.

Associated with the red soil is a gray soil that has a compact, yellow-gray, silty clay subsoil. This type has low fertility. It occurs near Bismark, Ironton and elsewhere.

The most extensive type is yellow-gray silt loam with a yellow clay loam subsoil. The lower subsoil is compact, mottled and has the characteristics of a hardpan. Erosion is severe. Practically all the land in the Farmington basin is cleared. Corn, wheat and clover are grown on the red soils, but elsewhere most of the land is used for pasture.

Owensville

The Owensville soil area forms the high plateau or divide between the Gasconade and Meramec drainage basins. The topography is level to gently sloping. The original vegetation was prairie and open forest, consisting mainly of post oak. The surface geology, unlike that of other parts of the Ozark region, is composed of clay and sandstone of Pennsylvanian age.

The stone free soil is characterized by a dark gray to gray surface, that changes abruptly at 12 to 15 inches to a brown or yellow gray plastic clay or claypan. The lower subsoil is a friable gray clay that usually grades into a mass of clay and chert rock. The subsoil contains more clay than is characteristic of other soils in the Ozark region.

Most of the land is farmed. Corn, wheat and grass are the principle crops. The fertility of the soil is low, but fertilizer is extensively used with good results.

Union—Northeastern Ozark Border

The Union soil area is an ill-defined zone, fifteen to twenty miles wide, that extends from Moniteau County on the west to St. Louis County, and thence south to the southern edge of Bollinger County. It is a transition zone between the loess-covered hill land along the Missouri and Mississippi Rivers, and the light colored stony soils of the central Ozark region. The entire area is hilly. The ridges and valleys have a deep soil mantle, but many of the slopes are

stony with frequent rock outcrops. It is an area of sharp contrasts—improved farm land interspersed with forests.

The stone-free soils are characterized by light brown color and silty texture in the surface and yellow-brown silty clay subsoils. The soil-forming material was shallow loess, although in many places limestone is the source.

It is estimated that about 30 percent of the Union soil area is stony and forested, but this percentage varies in different sections. In general, the stony and forested land is most extensive where the Union soils blend into the more characteristic soils of the Ozark region. The majority of the stone-free land is on the ridges and gentle slopes. Most of it is cleared, but much of it is not suited for cultivation because of slope. Erosion is severe. Wheat and grass are the important crops. The numerous creek bottoms have a very productive soil that is largely used for corn. Dairy farming is important in some sections.

The Union soil area is a part of the oldest settled section of Missouri. There remains much land that can be brought into higher production, provided soil improvement and erosion control are applied. The light colored soils are of medium productivity, but are very responsive to fertilization. It is a resource area that will improve as the demand for land increases. Except for the stony south and west slopes, it is one of the better forest soil areas in the Ozark region.

Menfro—River Hills

The band of hill land, five to twenty miles in width, bordering the Missouri River from Boonville to St. Louis, and the Mississippi River from Hannibal to Cape Girardeau, is generally known as "river hills". It is an area covered by a thick mantle of loess that varies from ten to forty feet in thickness. The soils derived from this material are characteristically brown in color and silty in texture. The soils are deep, and the subsoils are open and friable; except for a higher clay content, they are similar to the surface soil. In its main features, therefore, it is a rather uniform soil area.

The topography of the "river hills", or Menfro soils, is hilly to steep. Only in St. Louis

County and parts of St. Charles, Perry, and Cape Girardeau Counties is the surface gently rolling. The combined effect of slope and the permeable nature of the soil is responsible for the severe erosion that prevails almost everywhere. It is one of the most severely eroded soil areas in the state. Slope and erosion are the limiting factors in the use of a large percentage of the land. The inherent fertility of the soils is good, but the productivity may be low because of the generally low content of organic matter.

Practically all land suitable for cultivation is used for crop production. In fact, steeper slopes than on other soils are cultivated because of the fertility. Wheat is a major crop. Clover and alfalfa are extensively grown. Near the cities and towns, commercial fruit and vegetable production is important. In these same locations dairy farming prevails. In general, the better Menfro soils are specially suited for small type farming because of the great variety of crops that can be grown and the responsiveness of the soils to fertilization.

Many of the steeper slopes are forested. The best maintained woodlots in the state are in Cape Girardeau and Perry Counties. There are many forest species. To retard erosion, it is highly desirable that some of the steep sloping land be used as forest woodlots.

The Menfro soils form one of the most valuable resource areas. In some sections the soils are intensively farmed and support a highly developed agriculture. In other sections they are deteriorating rapidly. Soil erosion is the major problem, and it is difficult to control.

Southeast Lowland Region

The Southeast Lowland is a distinct soil and geographic region. It includes all or part of eleven counties and totals about two and one-half million acres. Although the soils are of alluvial origin, they have extreme variations in color, texture, depth, drainage, fertility, and crop adaptation. The slogans, "A region where everything grows" and "Where North meets South," not only indicate the range in crops, but also imply the diversity of soils.

Under virgin conditions, a large part of the Lowland was covered with shallow surface water

during winter and spring. Drainage was very slow because of the level surface and the forest cover. The overflow areas were referred to as "swamp land," although actual swamp conditions did not exist except in a few small spots. The entire region has now been reclaimed by more than 1,500 miles of large drainage ditches. These are generally in parallel lines, about one mile apart. Most of the drainage has been done since 1910. The "swamp land" once considered worthless now forms some of the most valuable crop land in the state. No other region in Missouri has undergone such marked physical changes in such short time as has the Lowland.

The Lowland was originally covered with a magnificent forest of many species. This has been so completely removed (east of Crowley Ridge) that woodlots of more than forty acres are rare. Much of the clearing has been done since 1920. Failure to preserve even a remnant of virgin forest is one of the tragedies of the exploitive practices that have always characterized this region.

A conspicuous feature of the Lowland is Crowley Ridge. It is a narrow upland, extending from Scott County, through Stoddard County, to the Arkansas state line. The soil is uniformly a brown silt loam, derived from loess, and is similar to the Menfro soils in Cape Girardeau and other counties along the Mississippi River.

On the basis of color, texture, and drainage conditions, the soils of the Lowland have been placed into four general groups.

Sarpy—Mississippi River Bottom

Bordering the Mississippi River is a band of soils consisting dominantly of dark brown or gray-brown fine sandy loams and clay loams. The subsoil almost consistently is a brown sand, very fine in texture. This provides good under-drainage. The variations in the soils are associated with the numerous and irregular shallow swales and depressions formed by former meanders of the Mississippi River. The slight elevations usually are sandy and the depressions contain more clay. In general, these alluvial soils are similar to recent alluvial deposits along Mis-

issippi and Missouri River in other parts of the state.

This group of Sarpy soils is very productive and all are intensively farmed. Cotton, soybeans, corn, and alfalfa are the important crops. The possibilities for special and vegetable crops are more favorable than for any other soil group in the Lowland. Drainage is generally good. A levee along the river has practically eliminated the danger of overflow.

Sandy Terraces—"Ridge" or Bench Land

The sandy soils of the Lowland region are distinct soil areas because of their texture, but mainly because they form distinct terraces or ridges that are 10 to 20 feet higher than the adjacent bottom land. The Kennett and Sikeston ridges are the most distinct. The Bertrand sandy land includes the large area of loose sand in Scott and Mississippi Counties. The soils are brown in color with little change to a depth of 3 or more feet.

The soils on Kennett and Sikeston ridges are similar, except for a higher content of sand in the northern part of Kennett area. Much of the Bertrand area consists of deep, loose sand that tends to "blow". Within this sub-area, there are many elongated swales, filled with a dark soil locally known as "black sand". The loose sandy soils are of lower fertility and low moisture holding capacity.

The sandy terrace soils are well drained, and are characterized by a brown color throughout the profile. All are in cultivation. They were the first in the State to be settled and farmed. Except for the loose sands, they are very productive and suited to a variety of crops, including cotton.

Sharkey—Dark Clay

The Sharkey soil area occupies the central part of the Lowland region, and extends from Cape Girardeau County to the Arkansas state line. This area was formerly referred to as the "Little River overflow" and was considered "swamp land" because of poor drainage. The

dominant soil is a very dark and very heavy clay loam, with a deep, plastic clay subsoil. In Dunklin and Pemiscot Counties the clay land is spotted by many small mounds of sand, 10 to 50 feet in diameter and 1 foot in height, that are called "sand-blows". By cultivation, the sand becomes mixed with the clay to give the surface soil a sandy clay texture.

A distinct variation in the clay area is the gray-brown sandy loam soils in the eastern part of Stoddard County. They are not indicated on the soil map. These sandy soils are well drained, and were brought into cultivation long before the clay soils were cleared.

The Sharkey soil area is comparatively new land. Most of it has been reclaimed by draining and clearing in the last 50 years. All of it now is in cultivation. Large fields of cotton and soybeans characterize the landscape. Corn and wheat are important in the northern end of the area. Drainage is provided by numerous large ditches, but supplementary surface drainage is needed. Partial crop failures occur in wet seasons. The soils are inherently fertile, but are difficult to cultivate.

Waverly-Calhoun— St. Francois Bottom

The western part of the Lowland region, including all the area west of Crowley Ridge, is unlike the eastern part in soils and in agricultural development. The soils dominantly are gray silt loams, derived from loess washed from the surrounding uplands. The Waverly soils, most extensive in Butler County, have a gray color throughout the profile. Included in this area are the low sand ridges near Brosart and Neelyville. The sandy soil is similar to that in the eastern part of the Lowland region. The Calhoun soils occur on low terraces and include most of the land between the St. Francois River and Crowley Ridge. They are characterized by a gray clay subsoil.

Because of poor drainage, that has existed for a long time, the soils have been thoroughly leached and bleached. They tend to be hard and brittle when dry, and are difficult to cultivate. Tile drainage is not feasible. More surface drainage is needed.

The Waverly-Calhoun soil area has lagged in agricultural development in comparison to other parts of the Lowland region. It is a problem area because of the difficulty of reclaiming and improving the land. Most of it has been cleared—much of it in the last 25 years. Cotton, soybeans, corn, lespedeza are the important crops. In favorable seasons, fair yields are obtained.

Bottomland

The alluvial or bottomland soils along the rivers and streams in Missouri comprise about 15 percent of the total area of the state. The extent of the bottomland is not apparent because it is distributed along the 13,000 miles of streams.

The bottomland, from one to ten miles in width, along the Missouri River from the northwest corner of the State to St. Louis, a distance of almost 500 miles, forms the single most uniformly fertile soil area. It includes about 660,000 acres. All of it is in intensive cultivation. Crop yields are of the highest. The capacity of the Missouri River bottomland for still higher production and for more specialized farming makes this one of the most valuable resource areas in the State.

The bottomland along the Missouri side of the Mississippi River is not a continuous band because most of the floodplain is on the east side of the river. Much of the Mississippi alluvium contains a high percentage of clay. The resulting soils are, therefore, largely restricted in use to small grain crops.

One of the striking features of northern Missouri, particularly in the drainage area of the Grand and Chariton Rivers, is the great extent of the alluvial floodplains. Many of the bottoms range from one to four miles in width. Even the small lateral streams are bordered by comparatively wide alluvial valleys.

It is characteristic of the large bottomlands that much of the soil is clay in texture—locally known as "gumbo". Surface drainage of such areas is usually deficient, and flooding may occur. Because of this, many acres of gumbo are essentially idle, or still covered with virgin swamp vegetation of grass or forest. The reclamation of this potentially fertile land is depend-

ent on the establishment of flood control and the construction of drainage ditches. A large percentage of the bottomland that formerly was poorly drained is now farmed successfully because flood hazards have been reduced by straightening and improving the stream channels. All of the land that has adequate drainage is in cultivation.

The bottomland soils of northern Missouri are dark in color, of great depth, and therefore of high average fertility. They form a very important part of the Corn Belt region.

In the prairie section of western Missouri bottomland is not extensive except in the broad valleys along the Grand and Osage Rivers. In these locations much of the soil is of the gumbo type, and flooding is frequent. In Cedar and the surrounding counties much of the bottomland is sandy.

In the Ozark region the alluvial soils make up a relatively small but important part of the area. In the economy of the region they are important. In fact, they are the only soils in the rough and stony sections on which profitable grain and forage production can be carried on. Even along the larger streams, the belt of alluvial soils rarely exceeds one-fourth mile in width and usually is much less than this. They are dominantly brown silt loams or fine sandy loams, deep and of high productivity.

Soil Fertility

Wide variations in fertility, corresponding to diversity in physical properties, characterize the soils of Missouri. The state ranks high in total agricultural production, yet approximately 40 percent of the state's area is not used for the production of crops or grass. Obviously, much of the farmed land is of superior quality.

It should be recognized that basic differences in soil fertility are not man-made, but are inherent or natural. The soils that have been farmed most intensively and produced most abundantly are still the most productive today, and will remain so. Variations in fertility are due to many factors, but as indicated earlier, these are not easily changed. There are poor soils, but not exhausted soils in Missouri.

It is characteristic of soils in temperate regions to be capable of improvement for higher production. All Missouri soils are responsive to fertility treatment, but they vary widely in this capacity. In general, deep, open upland soils are the most responsive. Shallow soils, and those of unfavorable tilth or poor internal drainage, are usually erratic in response. Some require mainly organic matter or nitrogen, while others also require mineral elements to improve the productive level.

The majority of upland soils are more or less acid, or in need of lime for the successful production of clovers. This is caused by the humid climate and the consequent soil leaching, as well as to the low lime content of some of the soil-forming materials. In the northwestern quarter of the state, many of the soils from glacial and loessial materials are well supplied with lime, particularly in the subsoil. In general, the more highly weathered and light colored soils are the most deficient in this material. The soils of the Ozark region, although derived from limestone, are characteristically low in lime content. The same defect also exists in the level prairie land. The use of lime has greatly increased the production of clovers, and this in turn has had a marked beneficial effect on the organic matter content of the soils. A factor of great significance is the unlimited supply of limestone in almost every section of the state. Agricultural lime has been produced in 83 of the 114 counties in more than 200 quarries.

Commercial fertilizer has been used in Missouri for many years, and the amount is steadily increasing. More than 800,000 tons were used in 1960. In the same year, approximately 3,000,000 tons of limestone were used.

The average nitrogen content for all upland soils is about one-eighth of one percent. This is about one-half the amount contained in the better soils well supplied with organic matter. Good response from nitrogen fertilizers is, therefore, obtained on practically all soils. A low phosphorus content, in particular, characterizes the soils of the Ozark region. Phosphorus is the base of all mixed fertilizers used.

There is a wide variation in the potash content of Missouri soils. In general, the older soils in the southern half of the state are more deficient in this material than are the soils derived

from deep loess or glacial material. Potash is extensively used on cotton on the light colored soils of the Lowland region and is coming into rather general use on most of the upland soils which have been farmed for many years.

Soil Erosion

Soil erosion is a natural phenomenon that applies to practically all uplands and particularly to all sloping soil surfaces. It is a process that has always been in operation, but has been accentuated by the action of man. The degree of erosion, however, varies greatly in different regions and for different soil conditions. The severity is determined primarily by the character of the soil, the steepness of slope, and the vegetative cover or the use of the land. Erosion is one of the most serious factors in causing soil deterioration, but it is not the cause of the naturally low fertility of any Missouri soils.

Erosion is most active on deep, open friable soils. In general, it is associated with the better soil areas, since the physical features that are favorable to plant growth are also favorable to erosion. The most severely eroded soil areas are those derived from deep loess and from glacial till. The deep soils on the "loess hills" bordering the two major rivers and extending from the Iowa state line to Cape Girardeau on the south, form the most severely eroded area in the state. The dissected land surface in certain sections, notably in the Chariton River drainage area, includes many slopes where much of the surface soil has been removed. "Clay points" or exposed areas of subsoil, characterize many slopes, particularly in northwestern Missouri, and are the most striking evidence of man's failure to cope successfully with the destructive forces of nature.

Limitations to Soil Improvement and Use

Almost every Missouri soil has some limitation for crop production. The effect of the limitation may be slight or very great. The limiting factor may be one of fertility, topography,

stone content, drainage, erosion, soil tilth, moisture retention and permeability. Any one or more of these may prevail at any one place and in different degrees of intensity. They are inherent in the soil. Some can be modified by man; others cannot.

Many of the soils in the Ozark region are of low fertility and also are hilly and stony. In the extreme southwestern corner of the State, a high stone content characterizes the level as well as the rolling land. Completely dissected, the northern Ozark border has steep, eroded slopes. Erosion places severe limitations on the dark prairie soils. On the level prairies the clay pan subsoil retards internal drainage. The "blow-sands" in the Lowland do not retain organic matter. Gumbo soils dry slowly and hard. Fertile bottomlands may be idle because of floods.

Man's ingenuity to overcome some soil limitations has been successful to varying degrees. Lime and fertilizer have improved the productivity of many acres. Eroded slopes have been brought into use by good cropping systems and by contouring and terracing. New forage crops have replaced sprouts on much stony land. Drainage has converted swamp land into productive fields. Soil tilth has been improved by providing more organic matter and by better tillage practices. As new demands develop for greater crop production, increased efforts will be made to overcome the soil limitations.

Potential Qualities of Missouri Soils

While Missouri soils have limitations, they also have potential for increased and more varied crop production. This fact was revealed as never before during the recent years. Crop production was increased 25 percent, not by increasing the cultivated area, but by better soil and crop management practices. Only a beginning has been made because improved management has been applied to only a part of the farm land.

The greatest potential for improvement is possessed by those soils which are now producing most abundantly. In general, those soils having the most favorable physical properties, such

as medium texture, open permeable subsoil, good internal drainage, and aeration, have the highest potential. Light colored and shallow soils will require much greater effort, but even here better cultural and fertilization methods are providing much more satisfactory results. The inherent fertility of the soils from glacial material becomes apparent in much greater crop yields when abundant organic content is supplied and erosion reduced. The productivity of the brown limestone soils in parts of southern Missouri was immediately recognized by the early settlers. These areas are now among the most intensively farmed and most valuable in the state.

To reach the capacity for production of the many different soils will require the addition of organic matter application of fertilizer and lime, better cultural methods, erosion control, improved drainage, and even the establishment of irrigation. These are now in use to a greater or

lesser degree, and their application will be extended as the need of soil improvement and of greater crop production demands.

The great diversity of crops grown in Missouri contributes much to agricultural development. The many soils of medium texture are favorable for the growth of practically all crops. It is for this reason that the shift from one type of crop to another is so easily accomplished. Grasses have largely replaced wheat in southwestern Missouri. On the level prairies in the northeastern section of the state, soybeans now grow where once there were timothy meadows. In the lowland region, cotton and soybeans have been largely substituted for wheat. There were no special soil problems in establishing pastures on 1,000,000 acres formerly used for corn. Clovers, lespedeza, and grasses of many varieties are grown. These are factors of tremendous significance, and make possible a flexible type of farming.