SOIL SURVEY OF

Dixon County, Nebraska

United States Department of Agriculture
Soil Conservation Service
in cooperation with
University of Nebraska
Conservation and Survey Division

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1971–74. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1975. This survey was made cooperatively by the Soil Conservation Service and the Conservation and Survey Division of the University of Nebraska. It is part of the technical assistance furnished to the Lewis and Clark Natural Resources District and the Lower Elkhorn Natural Resources District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and reaction.

Locating Soils

All of the soils of Dixon County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Map Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the windbreak suitability group and range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use 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 discussions of the capability units and the range sites.

Foresters and others can refer to the section "Management of the soils for woodland and windbreaks," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Management of the soils for wildlife and recreation."

Ranchers and others can find, under "Management of the soils for range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about soil formation and classification in the section "Formation and classification of the soils."

Newcomers in Dixon County may be especially interested in the section "General soil map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "Environmental factors affecting soil use."

Cover: Terraces, grassed waterways and farmstead windbreak on soils of Moody-Nora-Crofton association.

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Issued June 1978

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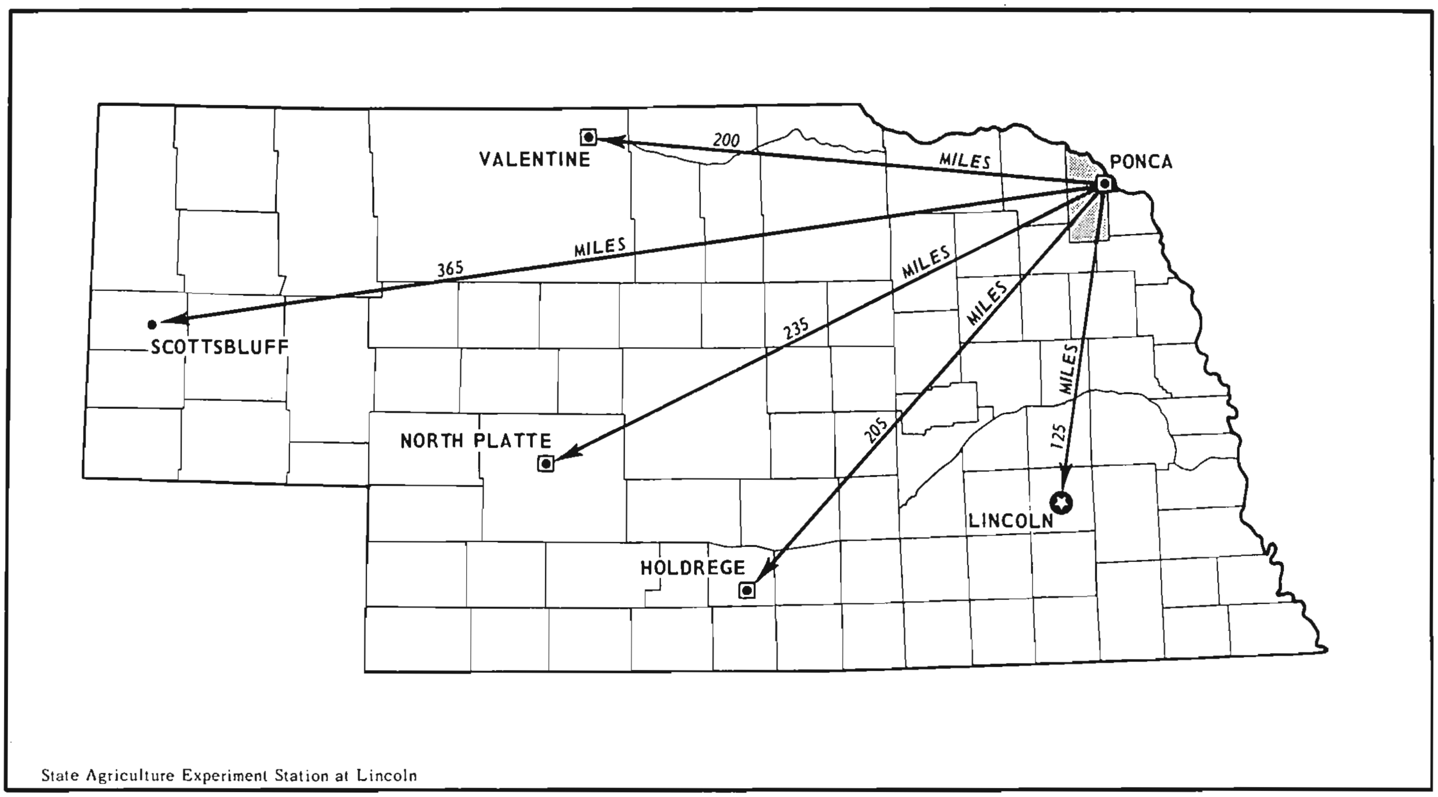

Location of Dixon County in Nebraska.

SOIL SURVEY OF DIXON COUNTY, NEBRASKA

By Norman L. Slama and Donald E. Kerl, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division

DIXON COUNTY is in the northeastern part of Nebraska (see facing page). It has a total land area of 475 square miles, or 304,000 acres. The county is nearly rectangular but the northern boundary follows the Missouri River in a northwest-southeast direction. The county is 34 miles long on the west boundary, and is approximately 19 miles across its widest part. The county is bounded on the north by Clay and Union Counties in South Dakota. It is bounded in Nebraska by Cedar and Wayne Counties on the west, Wayne and Thurston Counties on the south, and Dakota and Thurston Counties on the east. The state and county boundaries as shown on the maps in this publication are approximate along the Missouri River, and along the borders where the county lines are not well defined by roads.

The first settlements were at or near the site of Ponca in May, 1856. Dixon County was organized November 1, 1858, and Ponca was designated the county seat in December of that year.

The most serious hazard in Dixon County through the years has been erosion of soil on the sloping uplands, and flooding on the bottom lands. Damage from flooding has been widespread in the Missouri River Valley. Flooding of upland streams has also been common. Ponca is subject to flooding from Aowa Creek. Logan Valley is subject to occasional flooding in spring. Flooding of the Missouri River bottom lands was commonplace in former years, but large dams on the Missouri River and a flood control project in Dixon County have greatly reduced this hazard. Water erosion is the most common hazard where the strongly sloping and moderately steep soils of the uplands are cultivated.

The population of the county was approximately 8,106 in 1960 and 7,453 in 1970, according to the U.S. Census.

The county is currently served by railroads, trucking firms, and bus service. Federal Highway 20 crosses the county in the middle part. State Highways 12, 15, and 9 also serve Dixon County. Wakefield is the largest town.

Growing cultivated crops, raising and fattening livestock, and other related agricultural industries are important enterprises in the county. Feed grains are fed locally or are shipped to major terminals. Corn is the main crop, but soybeans are also important. Alfalfa hay is also a major crop. Most large pastures and wooded areas are in the steep uplands.

Most of the soils in Dixon County formed under grass. Some soils, however, are on uplands along the bluffs, where they are currently forming under deciduous trees. Peoria loess is the most common parent material of the uplands. Outcrops of sedimentary bedrock and glacial till are in the bluff areas and in some of the deeply entrenched drainageways. Sandy outwash material covers the upland area along the north side of Logan Creek. Alluvium is the parent material of soils of the bottom land. The suitability of a particular soil for crops depends mainly on its texture, structure, slope, organic matter, and drainage. Sandy or steeply sloping, silty soils that erode easily are less suited to various uses than other soils in the county. Poorly drained soils generally cannot be used for cultivated crops until drainage is improved.

The first survey of the soils in Dixon County was made in 1929 (*4*).[1]

The present survey provides additional information and larger maps than the earlier survey, and also the maps show the soils in greater detail.

How this survey was made

Soil scientists made this survey to learn what kinds of soils are in Dixon County, where they are located, and how they can be used. The soil scientists went into the county 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 nature 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

[1] Italic numbers in parenthesis refer to References, page 112.

series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Moody and Crofton, 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 layer 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, Moody silty clay loam, 2 to 6 percent slopes, is one of several phases within the Moody series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called map units. On most maps detailed enough to be useful in planning the management of farms and fields, a map unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some map units are made up of soils of different series, or of different phases within one series. One such kind of map unit is shown on the soil map of Dixon County: a soil complex.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Moody–Leisy complex, 2 to 6 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called miscellaneous land areas and are given descriptive names. Riverwash is a miscellaneous land area in this survey.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General soil map

The general soil map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations, but in different patterns.

A map showing soil associations is useful to people who want to have a general idea of the soils in a survey area, who want to compare different parts of that area, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for broad planning on a watershed, a wooded tract, or a wildlife area or for broad planning of recreational facilities, community developments and such engineering works as transportation corridors. It is not a suitable map for detailed planning for management of a farm or field or for selecting the exact location of a road or building or other structure, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The seven soil associations in this survey area are described on the pages that follow.

1. Sarpy-Onawa-Haynie association

Deep, excessively drained to somewhat poorly drained, nearly level and very gently sloping, sandy, silty and clayey soils on bottom lands of the Missouri River Valley

This association is made up of soils of the Missouri River Valley. These soils are generally level, but a few areas of sandy soils are gently undulating. In a few areas, swales mark abandoned river channels (fig. 1). Most of the banks along the Missouri River are not stabilized so the river is wide and gently meandering.

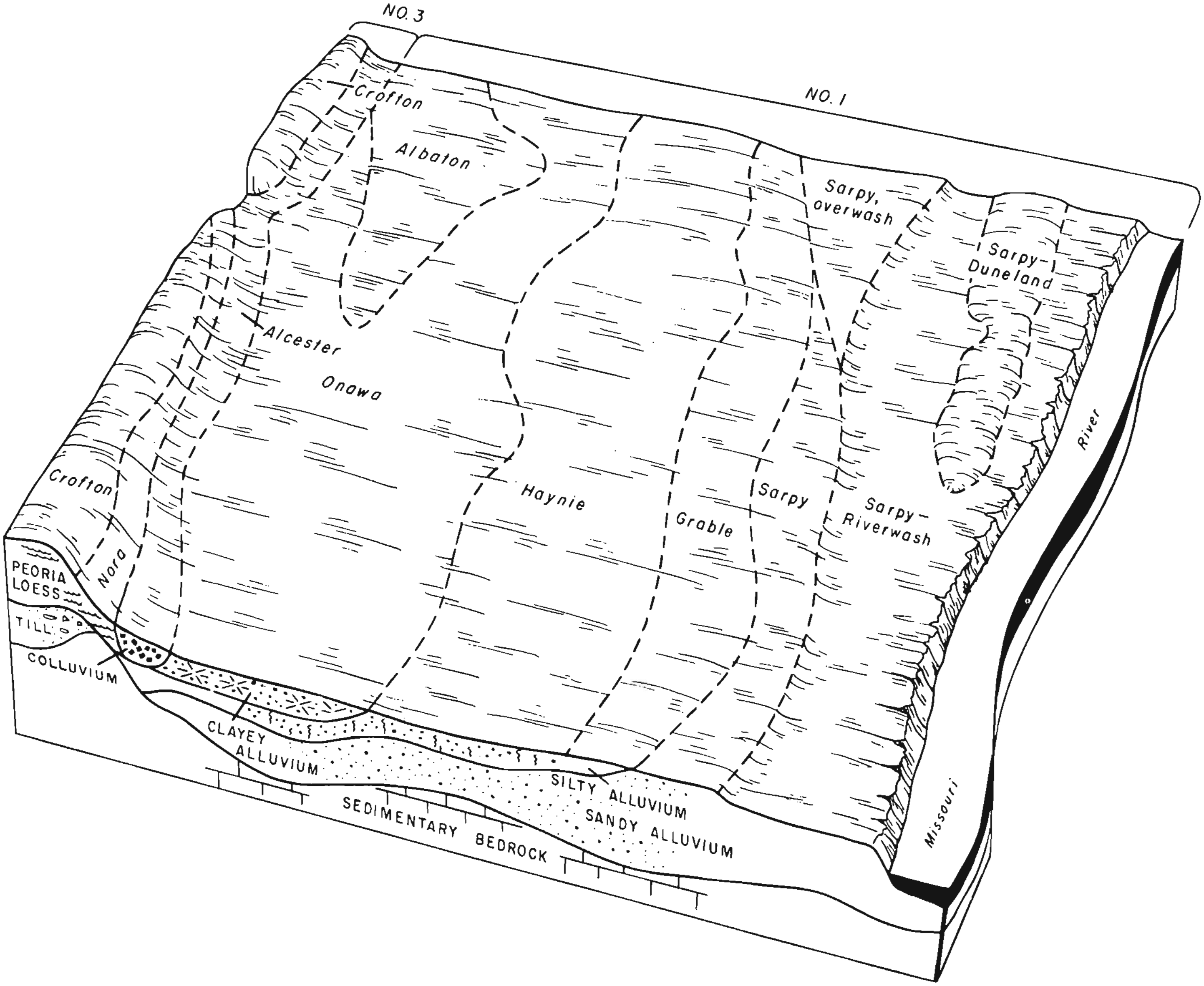

Figure 1.—**Typical pattern of soils in the Sarpy-Onawa-Haynie soil association, in the Crofton-Alcester-Nora soil association and the relationship of the soils to topography and parent material.**

It cuts along the banks and redeposits material in other areas.

This association makes up about 5 percent of the county. Sarpy soils make up about 30 percent of the association; Onawa soils, 13 percent; Haynie soils, 13 percent; and minor soils, 44 percent.

Sarpy soils consist of material that was recently deposited by the Missouri River. Most areas are stabilized with grass or trees. These soils are nearly level or very gently sloping. They are excessively drained. Typically, the surface layer is fine sand or loamy fine sand, but an overwash phase is recognized where the surface layer is silty clay. The underlying material is mainly fine sand.

Onawa soils are on broad, low bottom lands near the Missouri River. They are deep and nearly level. These soils are somewhat poorly drained. The upper part of the profile is silty clay. Silt loam is at a depth of about 2 to 3 feet.

Haynie soils are slightly higher in the landscape than the other soils of this association. They are deep and nearly level. These soils are friable and moderately well drained. They are silt loam and very fine sandy loam throughout the profile.

Grable, Albaton, Modale, and Percival soils and Riverwash and Duneland are of minor extent in this association. Riverwash is on islands and sandbars adjacent to channels of the Missouri River, and includes small areas of open water. Albaton and Percival soils are in swales and other low-lying areas. Grable and Modale soils are slightly higher in the landscape. Duneland occurs in complex with Sarpy soils, and is on hummocky landscapes of nearly barren sand.

Most areas of this association are in cultivated crops; mainly corn and soybeans. Alfalfa hay is also grown. Areas nearest the river channels are in native trees and grass, and are used for grazing, for recreation, and as wildlife habitat.

These soils generally have a high content of lime, and benefit from applications of nitrogen and phosphorous. Flooding from the Missouri River was a serious hazard in former years, but it is no longer. These soils are flooded infrequently by several upland streams. Surface drainage systems generally are used where artificial drainage is needed. The sandy soils are subject to soil blowing. Nearly all the crops are dryland farmed. A few farms are irrigated with sprinkler systems.

Most farms are 240 to 640 acres in size. A few are as large as 2,000 acres. Generally no roads are in the areas that were frequently flooded before large dams were constructed on the Missouri River. Roads in other areas are mainly dirt, but a few are gravelled. Some bottom land areas can only be reached by trails from the steep hills that parallel this association to the south. Farms are mainly the cash-grain type. Grain is marketed to elevators within the county, or is delivered to major grain terminals in Sioux City, Iowa.

2. Aowa-Alcester-Kennebec association

Deep, well drained and moderately well drained, nearly level to gently sloping, silty soils on bottom lands and on foot slopes

This association consists of narrow stream valleys and creeks that dissect the uplands, and narrow bands of colluvial slopes on the sides of valleys. The creek channels are generally small, and moderately deep. They meander through the bottom lands except where they have been straightened. Most of the creeks overflow and flood the bottom lands during periods of high runoff. Only a few small areas have a high water table.

This association makes up about 7 percent of the county. Aowa soils make up 42 percent of the association; Alcester soils, 41 percent; Kennebec soils, 16 percent; and minor soils, 1 percent.

Aowa soils are nearly level. They are on bottom lands. These soils are deep, well drained or moderately well drained. They are friable. They have a surface layer of silt loam and silty clay loam, and underlying material of silt loam.

Alcester soils are gently sloping. These soils are on bottom lands and foot slopes adjacent to steeper uplands. They are deep, well drained, friable soils, and are silt loam throughout.

Kennebec soils are nearly level. These soils are on bottom lands of drainageways. They are deep, moderately well drained, friable silt loam.

The minor soil in this association is in the Calco series. This soil is in upland drainageways. It is poorly drained and somewhat poorly drained.

Flooding along the creeks is the main hazard. Conserving water and maintaining soil fertility are the most important concerns of management.

Nearly all the acreage of this association is cultivated. All the crops commonly grown in the county can be grown successfully on this association. Corn, soybeans and alfalfa hay are the principal crops. Irrigation has not been developed in areas of this association because of the hazard of flooding and because some areas have a limited water supply. A few areas adjacent to creeks that flood or are wet are used for grazing. Small areas are used as wildlife habitat. Most farms are both the cash-grains and livestock type. Some of the grain is generally fed to cattle or hogs that are being fattened for market.

Farms in this area are generally 300 to 400 acres in size. Most roads cross the valley on section lines. The roads are improved dirt or gravel. Grain and livestock markets are readily available in the county and in Sioux City, Iowa. Grain that is not used to feed cattle and swine on the farm is shipped to major terminals outside the county. Fattened cattle are generally sold directly to packers.

3. Crofton-Alcester-Nora association

Deep, well drained, gently sloping to very steep, silty soils on loess-mantled uplands and on foot slopes

This association borders the Missouri River Valley (fig. 1). It consists mainly of narrow ridgetops and long, gently sloping to very steep side slopes. The area is dissected by small, narrow valleys that drain surface water in a northerly or northeasterly direction. The bluff area along the Missouri River Valley is deeply entrenched with ravines. The steepest hillsides have slopes of more than 30 percent and have miniature benchlike relief, or catsteps, that are prominent in the landscape. Major creeks that drain the area are Lime, Deer, Walnut, and Turkey.

This association makes up about 9 percent of the county. Crofton soils make up about 40 percent of the association; Alcester soils, 30 percent; Nora soils, 23 percent; and minor soils, 7 percent.

Crofton soils are strongly sloping to very steep. They are on narrow divides and the upper parts of convex side slopes. These soils are well drained and very friable. They are silt loam throughout their entire profile and are commonly calcareous at or near the surface.

Alcester soils are gently sloping to very steep. They are at the foot of slopes in the uplands and bluffs. These soils are well drained. The surface layer, subsoil, and underlying material are silt loam.

Nora soils are gently sloping to steep. They are on side slopes in uplands, generally below Crofton soils. These soils are well drained. The surface layer is silt loam or light silty clay loam, and the subsoil and underlying material are silt loam.

A minor soil in this association is Aowa soils, channeled. It consists of areas on bottom lands adjacent to upland drainageways.

The areas commonly have entrenched channels and are subject to frequent flooding. Many small outcrops of limestone and shale and a large gravel and limestone pit are in this association.

About half of this association is cultivated. Dryland corn, oats, and alfalfa hay are commonly grown in the valley and in areas where the soil is less sloping. The remainder of this area is in grass or native woodland. Most farms are of the grain-livestock type, and most of the grain is fed to cattle or hogs that are being fattened for market. Small herds of cows and calves are on most farms.

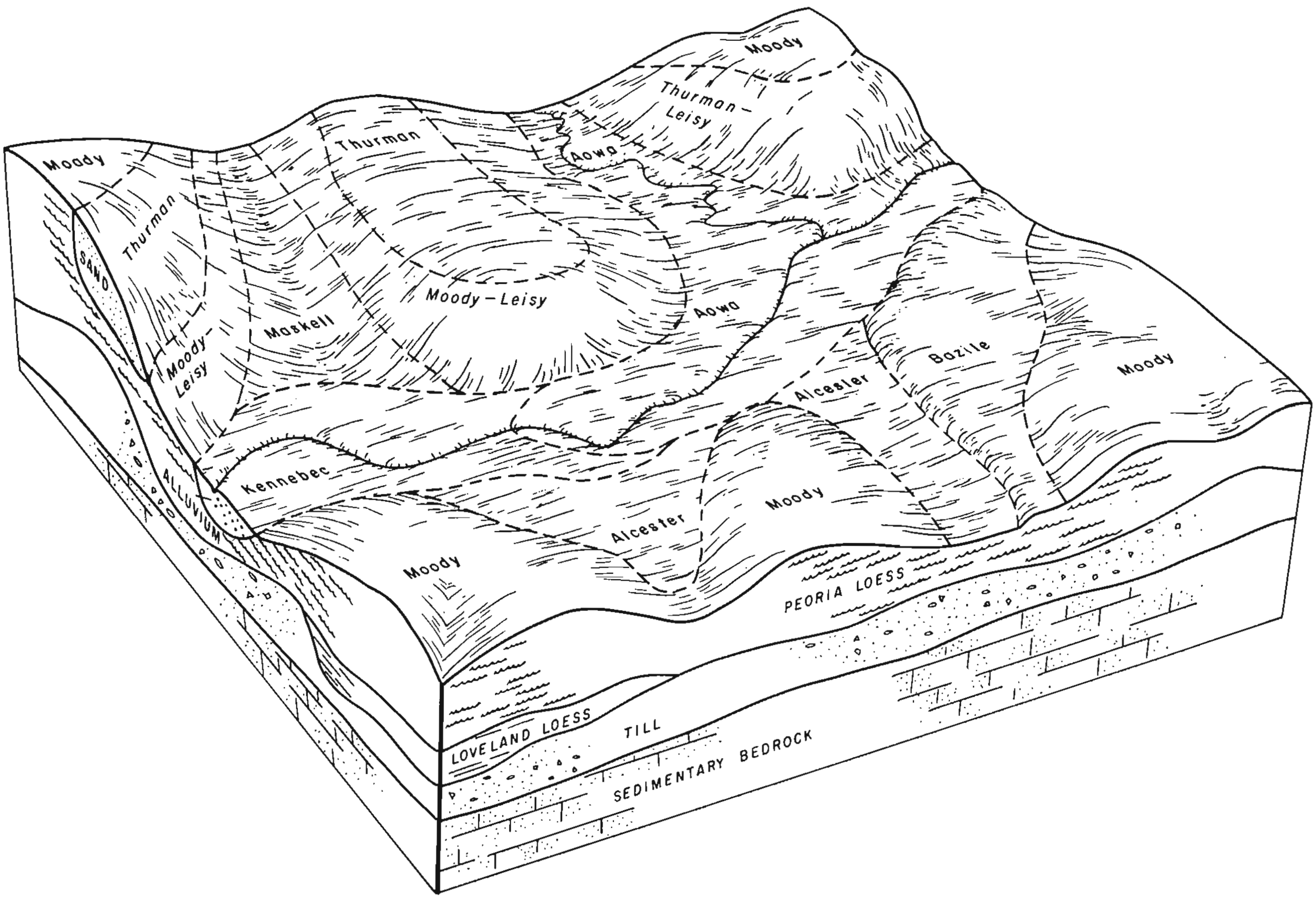

Figure 2.—**Typical pattern of soils in the Moody-Thurman-Aowa soil association and their relationship to topography and parent material.**

Reducing runoff and maintaining high fertility are the most important management needs. Also important are proper maintenance and improvement of the tame pastures, native range, and wooded areas. Erosion is the main hazard, especially in areas of cultivated soils on uplands.

The farms are 240 to 600 acres in size. Only a few of the roads between farms and markets are good ones. Some are on section lines, but many follow the ridgetops or valleys. The paved roads in this association are highways that cross the area. Grain and livestock markets are readily available within the county, as well as in Sioux City, Iowa.

4. Moody-Thurman-Aowa association

Deep, moderately well drained to somewhat excessively drained, nearly level to moderately steep, silty and sandy soils on uplands and on bottom lands of narrow drainageways

This association (fig. 2) is on uplands that have broad, nearly level to very gently sloping divides; strongly sloping side slopes; narrow, rounded ridgetops; and long, narrow areas of bottom lands along drainageways. Parts of the association have been covered with a deposit of medium and fine sand.

This association makes up about 22 percent of the county. Moody soils make up about 38 percent of the association; Thurman soils, about 11 percent; Aowa soils, about 9 percent; and minor soils, 42 percent.

Moody soils are on slightly convex ridgetops and smooth, concave lower parts of side slopes. They are gently sloping and strongly sloping. These soils are well drained. The surface layer is silty clay loam or silt loam, the subsoil is silty clay loam, and the underlying material is silt loam.

Thurman soils are on uplands. They are gently sloping to moderately steep. These soils are somewhat excessively drained. The surface layer is loamy sand, and the underlying material is loamy sand and sand.

Aowa soils are on the bottom lands of the narrow drainageways that cross this association. These soils are deep, nearly level, and well drained or moderately well drained. They have a surface layer of silt loam and silty clay loam, and underlying material of silt loam.

Among the minor soils in this association are Al-

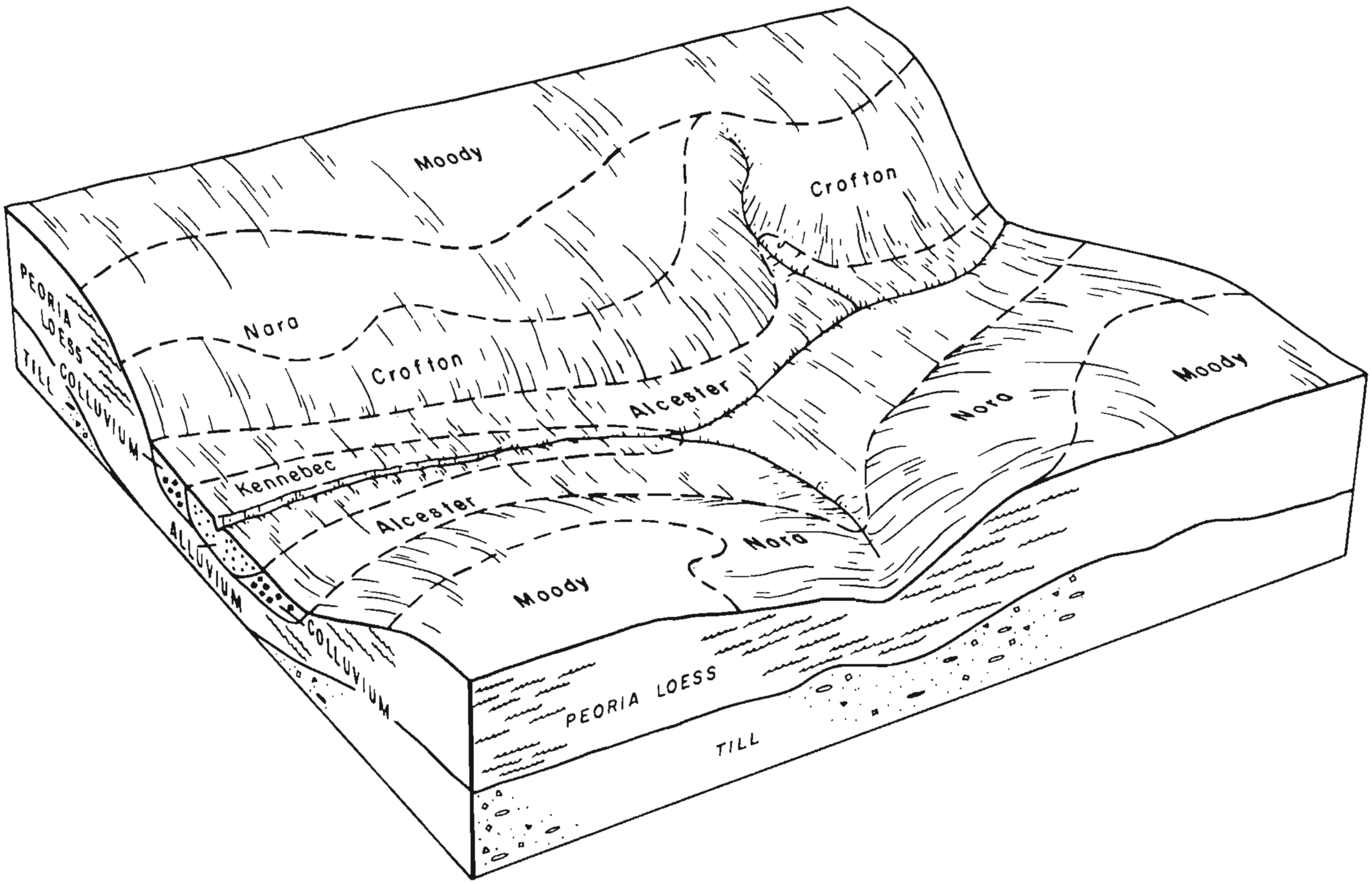

Figure 3.—**Typical pattern of soils in the Moody-Nora-Crofton soil association and the relationship of the soils to topography and parent material.**

cester, Calco, Maskell, Crofton, Bazile, Leisy, Nora, Kennebec, Ortello, and Blendon. Maskell and Ortello soils and most areas of Bazile soils are on high terraces and adjoining uplands. Alcester soils and sloping Maskell soils are on foot slopes along narrow upland drainageways. Crofton and Nora soils are in convex areas of uplands, and Blendon soils are in shallow depressions of the sandy uplands. Leisy soils are intermingled with Thurman and Moody soils. They are lower in the landscape than Thurman soils and higher in it than Moody soils. Calco soils are on bottom lands where flooding occurs. Kennebec soils are on broad bottom lands that are rarely flooded.

Most of the acreage of this association is cultivated. Dryland corn, soybeans, and alfalfa are commonly grown. Large areas of the sandy soils are in grass. The type of farming is generally a combination of cash grain and livestock. The farm crops are fed to cattle and swine, and the excess is sold for cash.

Reducing runoff, preventing soil blowing, maintaining high fertility are the most important management needs. Also important are proper maintenance and improvement of the existing tame pastures and native range. Erosion is the main hazard where soils of the uplands are cultivated.

The farms are 200 to 400 acres in size. Many of the roads between farms and market are good, but roads are not on all section lines. Paved highways that cross the area are State Highways 9, 15, 35, and Interstate Highway 20. Markets for grain and livestock are readily available within the county as well as in adjacent counties. The fattened livestock are generally sold directly to packers or shipped to stock yards in Sioux City.

5. Moody-Nora-Crofton association

Deep, well drained, nearly level to strongly sloping, silty soils on loess-mantled uplands

This association is on dissected uplands. It consists of gently sloping, narrow ridgetops, strongly sloping side slopes, and nearly level, broad divides (fig. 3). Numerous small drainageways start on the side slopes and merge into larger ones. In places the drainageways are several miles long before they merge with drainageways that have large bottom land areas.

This association makes up about 14 percent of the county. Moody soils make up about 49 percent of the association; Nora soils, 21 percent; and Crofton soils, 16 percent; and minor soils, 14 percent.

Moody soils are on uplands on slightly convex ridgetops and smooth, concave, lower parts of side slopes that merge into drainageways. They are nearly level to gently sloping. These soils are well drained. The surface layer is silt loam or silty clay loam. The subsoil is silty clay loam, and the underlying material is silt loam.

Nora soils are on uplands and they occupy ridgetops and side slopes. They are gently sloping and strongly sloping. These soils are well drained. The surface layer is silt loam or silty clay loam. The subsoil is silt loam or silty clay loam, and the underlying material is calcareous silt loam.

Crofton soils are on narrow, rounded ridgetops and convex side slopes on uplands. They are gently sloping and strongly sloping. These soils are well drained and very friable. They are silt loam throughout their profile. Crofton soils are generally lighter colored than the adjacent soils and they have many lime concretions on the surface.

Among the minor soils in this association are Alcester, Kennebec, Aowa and Calco. Alcester soils are on foot slopes that border the steeper loessial uplands. Kennebec, Aowa, and Calco soils are nearly level and are in the bottoms of narrow drainageways that extend into the uplands. Calco soils are on bottom lands. They have a high water table at a depth of 0 to 5 feet, and are poorly drained and somewhat poorly drained.

The farms are 200 to 400 acres in size. Most farms in this association are diversified and are mainly the combination cash grain-livestock type. Dryland corn, soybeans and alfalfa hay are commonly grown. The uplands and bottom lands are mainly cultivated, but some bottom-land areas are used for pasture.

Soil erosion is the main hazard on the cultivated soils. The hazard of flooding on bottom lands of the narrow upland drainageways is a concern of management. Conserving water and maintaining fertility are the most important management needs on cultivated soils. The organic-matter content needs to be improved and maintained on the eroded areas.

Roads in this association are mainly improved dirt or gravel. Improved roads are on most section lines. Farm produce is marketed mainly within the county, but some is sold in nearby Wayne and Cedar counties. Most fattened cattle are sold directly to packers or at stockyards in Sioux City, Iowa.

6. Kennebec-Baltic-Calco association

Deep, moderately well drained to very poorly drained, nearly level, silty and clayey soils on bottom lands

This association is in the valleys of the Logan Creek, South Logan Creek, and Middle Creek. The areas are generally level and the streams have a low gradient. Logan Valley is characterized by a dredge ditch that was built to straighten the creek and to improve the general drainage of the valley.

This association makes up about 4 percent of the county. Kennebec soils make up about 20 percent of the association; Baltic soils, 17 percent; Calco soils, 15 percent; and minor soils, 48 percent.

Kennebec soils are nearly level and on bottom lands. These soils are deep, friable, and moderately well drained. They have a profile that is silt loam. They are seldom flooded.

Baltic soils are nearly level and on bottom lands. They are deep, poorly drained soils. These soils are very high in carbonates throughout their profile. The surface layer, subsoil, and underlying material are silty clay. They are occasionally flooded.

Calco soils are nearly level and on bottom lands. They are deep, poorly drained and very poorly drained calcareous soils. They are silty clay loam throughout the profile except for an overwash phase that is silt loam on the surface.

Among the minor soils in this association are Zook, Alcester, Maskell, Colo, and Lamo. Alcester soils are on foot slopes adjacent to uplands. Colo and Lamo soils are on bottom lands adjacent to uplands. Maskell soils are on low stream terraces in the valleys. Zook soils are near the dredge ditch of Logan Creek. The deep entrenchment of the ditch has improved drainage on Zook soils.

The farms are 120 to 400 acres in size. Corn, soybeans, small grains, and alfalfa hay are the main crops grown in this association. The soils are medium or high in natural fertility, and moderate or high in organic-matter content. Farms in this association are mainly the diversified, cash grain-livestock type. Most areas of this association are cultivated. Farmsteads are generally located on high bottom lands or in the adjacent uplands.

Improving both surface and internal drainage and preventing the occasional flooding that occurs in spring are the most important management needs.

Some good roads cross the area, but roads are not on all section lines. Markets for grain and livestock are readily available within the county, as well as in adjacent counties.

7. Nora-Crofton-Alcester association

Deep, well drained, gently sloping to steep, silty soils on loess-mantled uplands and on foot slopes

This association consists mainly of uplands with narrow, gently sloping ridgetops and strongly sloping and steep side slopes. Intermittent drainageways are common on this association (fig. 4). A band of soils that developed on foot slopes is commonly present at the base of the uplands. The area is drained by several deeply entrenched creeks which flow in an east or northeast direction. Aowa and South Creeks are the largest of these creeks.

This association makes up about 39 percent of the county. Nora soils make up about 49 percent of the association; Crofton soils, 38 percent; Alcester soils, 10 percent; and minor soils, 3 percent.

Nora soils are on ridgetops and adjacent side slopes on uplands. They are gently sloping and strongly sloping. These soils are well drained. The surface layer and subsoil are silt loam or silty clay loam, and the underlying material is calcareous silt loam.

Crofton soils are on the steeper ridgetops and convex side slopes. They are gently sloping to steep. These soils are well drained, and their material is friable. They are silt loam throughout their profile. They are calcareous at the surface.

Alcester soils are on foot slopes adjacent to the up-

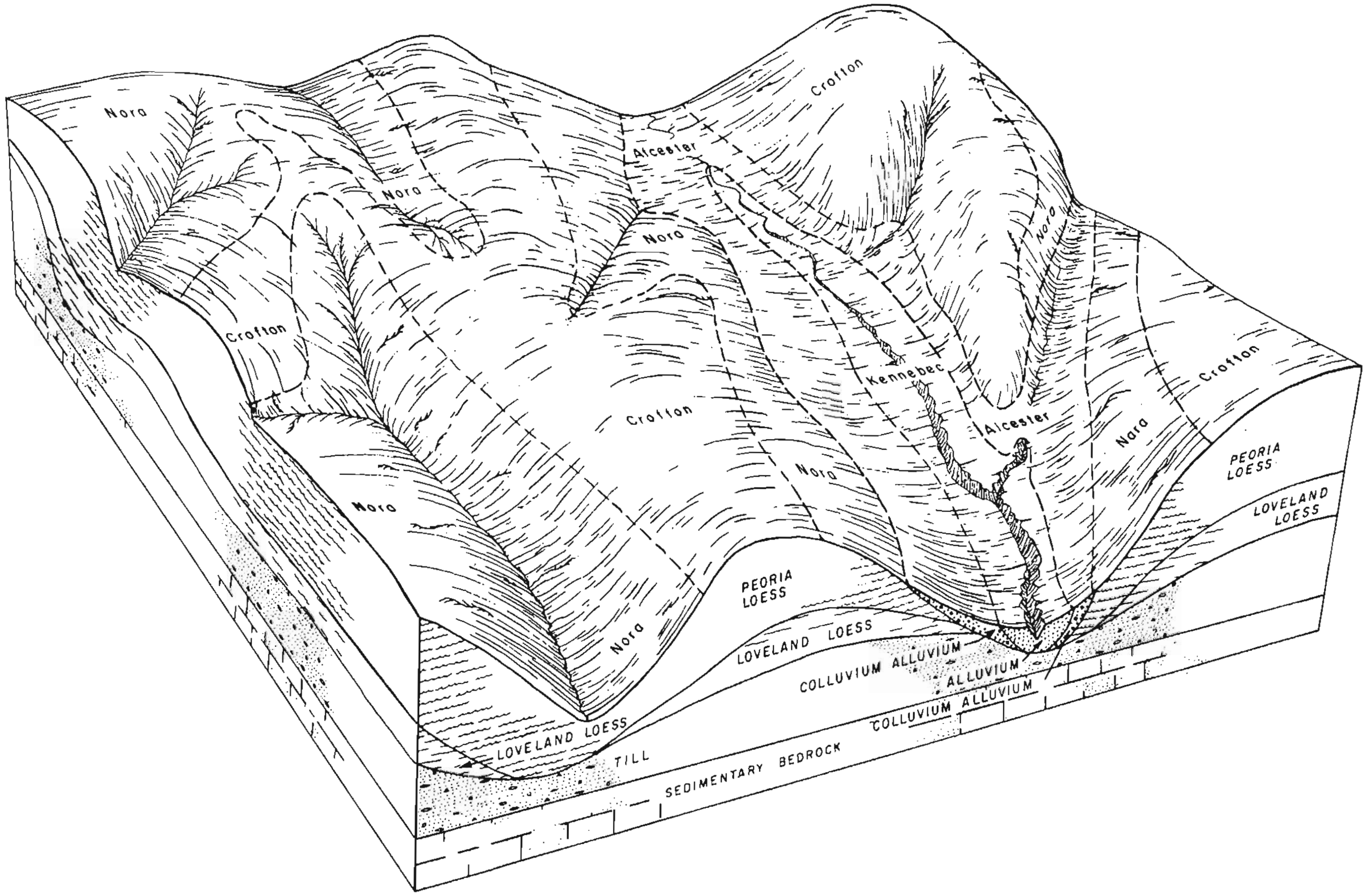

Figure 4.—**Typical pattern of soils in the Nora-Crofton-Alcester soil association, and relationship of the soils to topography and parent material.**

lands. They are gently sloping and strongly sloping. These soils are well drained. They are silt loam throughout the profile.

Among the minor soils in this association are Alcester silt loam, gullied, Aowa soils, channeled, Calco, and Kennebec. The Alcester soil is in deeply entrenched drainageways. Aowa soils, channeled, consist of frequently flooded areas and the accompanying channels. Calco soils are somewhat poorly drained and poorly drained and are on bottom lands. Kennebec soils are on high bottom lands.

The farms are 160 to 400 acres in size. Farms are mainly the diversified, cash grain and livestock type. Most crops are fed to cattle that are fattened in dry lots. Most areas are cultivated to dryfarmed corn, alfalfa hay, and soybeans. Some of the steepest soils and some eroded areas have been seeded to grasses and are used for pasture.

Soil erosion is the main hazard on soils in this association. Preventing runoff and maintaining fertility are the most important management concerns. The organic-matter content needs to be increased. It is low or moderately low on the eroded soils.

Many of the roads between farms and markets are good, but roads are not on all section lines. The roads are mostly of dirt construction or have a small amount of gravel on them. Paved highways that cross the area are State Highways 9 and 12, and Interstate Highway 20. Several markets for grain and livestock are readily available within the county as well as in adjacent counties. Many fattened cattle are sold directly to packers.

Descriptions of the soils

This section describes the soil series and mapping units in Dixon County. Each soil series is described in 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 is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

As mentioned in the section "How this survey was made," not all mapping units are members of a soil series. Riverwash for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol that identifies it on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each map unit and the capability unit and range site in which each soil has been placed can be found by referring to the "Guide to map units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the "Glossary" at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (5).

A given soil series in this county may be identified by a different name in a recently published soil survey of an adjacent county. Some soil boundaries may not match adjoining areas. Such differences result from changes in concepts of soil classification that have occurred since publication.

Albaton series

The Albaton series consists of deep, poorly drained soils. These nearly level soils are on bottom lands of the Missouri River Valley. They formed in recently deposited clayey alluvium. In places, they are in swales and depression-like areas. A seasonal high perched water table in spring is at a depth of 1 to about 3 feet where these soils are in former river channel areas. These soils are occasionally flooded.

In a representative profile the surface layer is dark gray and grayish brown, firm silty clay 7 inches thick. Below this is a grayish brown, firm silty clay transitional layer about 5 inches thick. The underlying material, to a depth of 60 inches, is light brownish gray silty clay. Mottles are at a depth of 12 inches and increase in size with depth. The soil is stratified below a depth of 28 inches.

Permeability is slow. Available water capacity is moderate. The organic-matter content is moderately low, and natural fertility is low. Moisture is released slowly to plants.

Albaton soils are suited to cultivated crops under both dryland and irrigation management. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Albaton silty clay, 0 to 2 percent slopes, in a cultivated field, 200 feet east of the southwest corner of NW¼ of sec. 30, T. 30 N., R. 7 E.:

Ap—0 to 7 inches; dark gray (10YR 4/1) and grayish brown (2.5YR 5/2) silty clay, very dark gray (10YR 3/1) and dark grayish brown (2.5Y 4/2) moist; moderate fine and very fine subangular blocky structure; extremely hard, firm; slight effervescence; mildly alkaline; abrupt smooth boundary.

AC—7 to 12 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and very fine subangular blocky structure; extremely hard, firm; strong effervescence; mildly alkaline; clear smooth boundary.

C1g—12 to 28 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common fine distinct reddish brown (5YR 4/4) and brown 7.5YR 4/4, moist) mottles; moderate and strong fine and very fine blocky structure; extremely hard, firm; few medium pores; violent effervescence; moderately alkaline; clear smooth boundary.

C2g—28 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common medium distinct yellowish brown (10YR 5/6) and brown (7.5YR 4/4, moist) mottles; fine to coarse horizontal planes of stratified material; violent effervescence; moderately alkaline.

The A horizon ranges from dark gray to very dark grayish brown and is 5 to 10 inches thick. It is mildly or moderately alkaline. In places there are buried Ab horizons less than 10 inches thick. The Cg horizon has strata of different colors that range from dark grayish brown to olive gray. It is clay or silty clay but in places the strata are less than 6 inches thick and have a lower clay content. Mottles are common to many.

Albaton soils are near Grable, Haynie, Onawa, Percival, and Sarpy soils. They formed in thicker clay deposits than Onawa and Percival soils and unlike those soils have a coarser textured IIC horizon. Albaton soils have more clay in the C horizon than Haynie, Grable, or Sarpy soils.

Ab—Albaton silty clay, 0 to 2 percent slopes. This clayey soil is on accretion land of the Missouri River bottom lands. The areas are 15 to 400 acres in size. On this soil are small areas that have sandy material below a depth of 42 inches, and other areas of soils that have a buried surface layer less than 10 inches thick, above a depth of 40 inches.

Included with this soil in mapping were small areas of Onawa and Percival soils.

Runoff is slow and this soil floods occasionally. Maintaining tilth and the timeliness of operations are important concerns of management. An inadequate supply of moisture and its uneven distribution can limit production. Land leveling is needed in most areas for gravity irrigation.

Most of the acreage of this soil is cultivated. Both dryland and irrigation management are used. Corn, alfalfa, and soybeans are the principal crops. Capa-

TABLE 1.—*Acreage and proportionate extent of the soils*

Map symbol	Soil name	Acres	Percent
Ab	Albaton silty clay, 0 to 2 percent slopes	1,220	0.4
AcC	Alcester silt loam, 2 to 6 percent slopes	31,065	10.2
AcD	Alcester silt loam, 6 to 11 percent slopes	5,100	1.7
AgG	Alcester silt loam, gullied, 11 to 60 percent slopes	5,015	1.6
Ao	Aowa silt loam, 0 to 2 percent slopes	15,505	5.1
Ap	Aowa soils, channeled, 0 to 2 percent slopes	1,540	0.5
Ba	Baltic silty clay, 0 to 2 percent slopes	2,230	0.7
BcC	Bazile silty clay loam, 2 to 6 percent slopes	2,890	0.9
BeB	Blendon sandy loam, 0 to 3 percent slopes	630	0.2
Ca	Calco silt loam, overwash, 0 to 2 percent slopes	2,160	0.7
Cb	Calco silty clay loam, 0 to 2 percent slopes	4,150	1.4
Cc	Calco silty clay loam, wet, 0 to 2 percent slopes	1,020	0.3
Ce	Colo silty clay loam, 0 to 2 percent slopes	1,075	0.4
CfC2	Crofton silt loam, 2 to 6 percent slopes, eroded	1,085	0.4
CfD2	Crofton silt loam, 6 to 11 percent slopes, eroded	9,905	3.3
CfE2	Crofton silt loam, 11 to 15 percent slopes, eroded	32,285	10.6
CfF	Crofton silt loam, 15 to 30 percent slopes	5,970	2.0
CfF2	Crofton silt loam, 15 to 20 percent slopes, eroded	12,535	4.1
CfG	Crofton silt loam, 30 to 60 percent slopes	4,025	1.3
Gb	Grable very fine sandy loam, 0 to 2 percent slopes	1,825	0.6
He	Haynie silt loam, 0 to 2 percent slopes	1,940	0.6
Ke	Kennebec silt loam, 0 to 2 percent slopes	8,090	2.7
La	Lamo silt loam, 0 to 2 percent slopes	880	0.3
Mh	Maskell loam, 0 to 2 percent slopes	1,140	0.4
MhC	Maskell loam, 2 to 6 percent slopes	3,780	1.2
Mk	Modale very fine sandy loam, 0 to 2 percent slopes	435	0.1
Mo	Moody silty clay loam, 0 to 2 percent slopes	975	0.3
MoC	Moody silty clay loam, 2 to 6 percent slopes	11,905	3.9
MoC2	Moody silty clay loam, 2 to 6 percent slopes, eroded	2,950	1.0
MoD	Moody silty clay loam, 6 to 11 percent slopes	19,615	6.5
MoD2	Moody silty clay loam, 6 to 11 percent slopes, eroded	5,055	1.7
MsC	Moody–Leisy complex, 2 to 6 percent slopes	5,045	1.7
MsD	Moody–Leisy complex, 6 to 11 percent slopes	4,900	1.6
NoE	Nora silt loam, 11 to 15 percent slopes	15,660	5.2
NoE2	Nora silt loam, 11 to 15 percent slopes, eroded	6,665	2.2
NoF	Nora silt loam, 15 to 30 percent slopes	2,570	0.8
NrC	Nora silty clay loam, 2 to 6 percent slopes	5,365	1.8
NrC2	Nora silty clay loam, 2 to 6 percent slopes, eroded	6,070	2.0
NrD	Nora silty clay loam, 6 to 11 percent slopes	18,305	6.0
NrD2	Nora silty clay loam, 6 to 11 percent slopes, eroded	12,870	4.2
NsE	Nora–Alcester silt loams, 11 to 15 percent slopes	4,600	1.5
NsF	Nora–Alcester silt loams, 15 to 30 percent slopes	2,645	0.9
On	Onawa silty clay, 0 to 2 percent slopes	1,945	0.6
OrC	Ortello sandy loam, 2 to 6 percent slopes	1,115	0.4
Pe	Percival silty clay, 0 to 2 percent slopes	325	0.1
Sa	Sarpy loamy fine sand, 0 to 2 percent slopes	775	0.3
Sc	Sarpy silty clay, overwash, 0 to 2 percent slopes	680	0.2
SdB	Sarpy–Duneland complex, 0 to 4 percent slopes	625	0.2
SrB	Sarpy–Riverwash complex, 0 to 3 percent slopes	5,165	1.7
TaE	Thurman sand, 3 to 20 percent slopes	270	0.1
ThC	Thurman loamy sand, 2 to 6 percent slopes	2,205	0.7
ThC2	Thurman loamy sand, 2 to 6 percent slopes, eroded	895	0.3
ThD	Thurman loamy sand, 6 to 11 percent slopes	1,320	0.4
ThD2	Thurman loamy sand, 6 to 11 percent slopes, eroded	1,190	0.4
TnC	Thurman–Leisy complex, 3 to 6 percent slopes	1,050	0.3
TnD	Thurman–Leisy complex, 6 to 11 percent slopes	1,800	0.6
Zo	Zook silty clay loam, 0 to 2 percent slopes	780	0.3
Zw	Zook silty clay, 0 to 2 percent slopes	830	0.3
	Water areas less than 40 acres in size	340	0.1
	Total	304,000	100.0

bility units IIIw–1 dryland and IIIw–1 irrigated; Clayey Overflow range site.

Alcester series

The Alcester series consists of deep, gently sloping to strongly sloping, well drained soils on foot slopes and in small intermittent drainageways in the uplands. These soils formed in colluvial-alluvial materials washed from nearby hillsides. They are steep in some deeply concave areas on hillsides. Runoff from higher lying soils occasionally floods some areas of these soils for short periods of time.

In a representative profile the surface layer is very dark grayish brown, very friable silt loam about 17 inches thick. The subsoil is very dark grayish brown and dark grayish brown very friable silt loam 23 inches thick. The underlying material, to a depth of 60 inches, is grayish brown silt loam.

Permeability is moderate. Available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. These soils are easily tilled and release moisture readily to plants.

Alcester soils are suited to cultivated crops in areas that are not too steep or gullied. Small, inaccessible areas are commonly in pasture or woodland. They are also suited to grass, wildlife habitat, and recreation. Except for the gullied areas, they are suited to trees and shrubs in windbreaks.

Representative profile of Alcester silt loam, 2 to 6 percent slopes, in a field of bromegrass pasture, 1,200 feet west and 400 feet north of the southeast corner in sec. 16, T. 30 N., R. 6 E.:

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak medium and fine granular structure; slightly hard, very friable; neutral; gradual smooth boundary.

A12—8 to 17 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak medium and fine subangular blocky structure parting to weak medium and fine granular; slightly hard, very friable; common fine pores; neutral; gradual smooth boundary.

B1—17 to 28 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak medium and fine subangular blocky structure; slightly hard, very friable; many fine pores; neutral; gradual smooth boundary.

B2—28 to 40 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium blocky structure; slightly hard, very friable; many fine pores; neutral; gradual smooth boundary.

C—40 to 60 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium blocky structure; slightly hard friable; many fine pores; neutral.

The A horizon is 14 to 20 inches thick. It is neutral or slightly acid. In places, there is a mildly alkaline silt loam overwash that is 6 to 12 inches thick. The B1 horizon is very dark grayish brown or dark brown. The B2 horizon is silt loam or light silty clay loam. The soils are noncalcareous to depths of 54 inches in the very gently sloping areas, and to a depth of 36 inches in the sloping areas.

Alcester soils are near Kennebec and Aowa soils on the bottom land, and near Moody and Nora soil on the adjoining uplands. Alcester soils are not so dark in the lower part of the profile as Kennebec soils, and, unlike Kennebec soils, they have a B horizon. Alcester soils have a darker colored, less stratified profile than Aowa soils, and a thicker, darker surface layer than Moody or Nora soils. They are not so fine textured in the B horizon as Moody soils and depth to lime is greater than in Nora soils.

AcC—Alcester silt loam, 2 to 6 percent slopes. This deep, silty soil is on concave foot slopes and on alluvial fans. The areas are narrow and irregular in shape and are 10 to 40 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping were a few areas of Kennebec soils and areas of steeper Alcester soils. Also included in places was an overwash deposit of dark, grayish brown silt loam, 6 to 12 inches thick. This overwash material is calcareous at the surface in places.

Runoff is medium. These soils receive runoff from higher lying soils. Water erosion that forms rills is the principal hazard. Workability is excellent.

Most of the acreage of this soil is cultivated. Both dryland and irrigation management are used. Corn, soybeans, and alfalfa hay are the principal crops. A few areas are wooded or are in grass. Capability units IIe–1 dryland and IIIe–6 irrigated; Silty Lowland range site.

AcD—Alcester silt loam, 6 to 11 percent slopes. This deep, silty soil is on concave areas along drainageways. The areas are 10 to 20 acres in size.

This soil has a profile similar to the one described as representative for the series, except for a surface layer that is thinner and ranges from 10 to 17 inches thick.

Included with this soil in mapping were small areas of Nora soils near the upper parts of the slopes and Alcester soils along drainageways.

Water erosion is a severe hazard. Cropping patterns are generally the same as those of the nearby, associated soils. Small rills and gulleys form in places, and are plowed in with each successive tillage.

Most of the acreage of this soil is cultivated. Some areas are in pasture. Corn, soybeans, and alfalfa hay are the principal crops. Capability units IIIe–1 dryland and IVe–6 irrigated; Silty range site.

AgG—Alcester silt loam, gullied, 11 to 60 percent slopes. Areas of this mapping unit are on foot slopes and bottom lands in narrow drainageways of the uplands. The gullied part of this mapping unit is made up of channels that have been severely eroded by moving water. Most areas have active, small, side gullies. The gullies are generally stabilized by mixed grasses, trees, and shrubs. Some gullies are as wide as 40 feet and as deep as 15 feet. Springs are present in some gullies. The gullied part has slopes of 25 to 60 percent and makes up about 55 percent of the mapping unit. About 35 percent of the area is Alcester silt loam that has slopes of 11 to 25 percent and is not gullied. The remaining 10 percent of this mapping unit consists of nearly level Aowa soils in narrow bottom lands.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is slightly darker and slightly thicker.

Runoff is rapid or very rapid. Water erosion is a very severe hazard in some areas of this soil, and there is a tendency for the small side gullies to become larger. Management practices that can prevent erosion are expensive and difficult to install. Although the gullies are stabilized by vegetation, the heads of the gullies are still active, and the gullies are increasing in size. The nearly level areas within gullies flood occasionally.

Nearly all the acreage of this soil is grazed, and serves as excellent habitat for open-land and rangeland wildlife. Capability unit VIIe–7 dryland; Silty range site.

Aowa series

This series consists of deep, nearly level, well drained and moderately well drained soils. They are commonly in narrow upland drainageways but some are in wider valleys that receive flood waters and silty sediment from upland areas. These soils formed in silty alluvium on bottom lands. These soils flood occasionally and the channeled Aowa soils also flood frequently.

In a representative profile the surface layer is dark gray, very friable silt loam about 7 inches thick. The upper part of the underlying material is stratified, very dark grayish brown and grayish brown silt loam. The lower part is stratified dark gray and pale brown silt loam. The soil is calcareous throughout the profile.

Permeability is moderate and available water capacity is high. The organic-matter content is moderate, and fertility is medium. These soils absorb moisture easily and release it readily to plants.

Aowa soils are suited to growing cultivated crops, grass, trees and shrubs. They are also suited to wildlife habitat and recreation.

Representative profile of Aowa silt loam, 0 to 2 percent slopes, in cultivated cropland, 150 feet north of the southwest corner of the SE¼ of sec. 4, T. 27 N., R. 4 E.:

Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

C1—7 to 16 inches; stratified very dark grayish brown (10YR 3/2) and grayish brown (10YR 5/2) silt loam, very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—16 to 60 inches; stratified dark gray (10YR 4/1) and pale brown (10YR 6/3) silt loam, very dark gray (10YR 3/1) and brown (10YR 5/3) moist; weak fine subangular blocky structure with some platiness due to stratification; slightly hard, very friable; slight effervescence; moderately alkaline.

The A horizon is dark gray to pale brown and is 7 to 10 inches thick. It is mildly to moderately alkaline. The C horizon is stratified silt loam and ranges in color from very dark gray to thin strata of pale brown. Dark silt loam or buried soils are commonly within a depth of 24 to 60 inches.

Aowa soils are near Kennebec and Calco soils. They are more stratified than Kennebec soils, and are not so fine textured or as poorly drained as Calco soils.

Ao—Aowa silt loam, 0 to 2 percent slopes. This soil is on narrow bottom lands of upland drainageways. It is also on the outer edges of wide bottom lands where the soil receives runoff from higher drainageways. The areas are 20 to 100 acres in size.

This soil has the profile described as representative of the series. Areas of this soil in Logan Creek Valley, however, contain from 3 to 7 percent more clay above a depth of 40 inches than in the rest of the county.

Included with this soil in mapping were small areas of Kennebec soils, some of which have a water table at depths of 4 to 6 feet.

Runoff is slow. Flooding in high-rainfall periods, especially late in spring and early in summer, is a hazard to crop production. Occasional flooding delays planting and tillage operations.

Most areas of these soils are cultivated. Corn and soybeans are the main crops. Oats are not well suited to this soil. Both dryland and irrigation management are used. Capability units IIw–3 dryland and IIw–6 irrigated; Silty Overflow range site.

Ap—Aowa soils, channeled, 0 to 2 percent slopes. This soil is on bottom land areas of upland drainageways. These areas are occasionally flooded or frequently flooded.

These soils have a profile similar to the one described as representative of the series, but they are more stratified than the representative soil. Silty alluvium deposits are added by floods almost yearly. The surface layer is silt loam, very fine sandy loam, or silty clay loam.

Included in mapping were stream channels and steep banks of former stream channels. Runoff is slow.

Nearly all of the acreage of this unit is in trees, pasture, or waste areas. The vegetation consists mainly of bluegrass or bromegrass. Eastern cottonwood, willow, boxelder, and green ash grow along the stream channels and on the adjoining steep banks. A few areas are cultivated but most areas are too small and overflow too frequently to be profitably used as cultivated land.

Aowa soils, channeled, provide grazing and shelter for livestock. They are suitable for use as wildlife and recreation areas. Capability unit VIw–7 dryland; Silty Overflow range site.

Baltic series

The Baltic series consists of deep, nearly level, poorly drained soils on bottom lands and flood plains of North Logan Creek. These soils formed in clayey alluvium. They commonly have a seasonal high perched water table at a depth of 1 to 3 feet, and are occasionally flooded by water from adjacent uplands.

In a representative profile the surface layer is friable, very dark gray silty clay 15 inches thick. The subsoil is dark gray, firm silty clay about 18 inches thick. The underlying material, to a depth of 60 inches, is dark gray silty clay. The entire profile is calcareous. A few small accumulations of gypsum are below a depth of 15 inches.

Permeability is slow. Available water capacity is moderate. The organic-matter content is high, and natural fertility is medium. These soils release moisture slowly to plants.

Baltic soils are suited to cultivated crops, grass, trees, and shrubs. The more poorly drained areas, however, are better suited to less intensive uses. Baltic soils are also suited to wildlife habitat and for recreation.

Representative profile of Baltic silty clay, 0 to 2 percent slopes, in a cultivated field, 1,700 feet north and 150 feet east of the southwest corner of sec. 27, T. 28 N., R. 4 E.:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

A12—7 to 15 inches; very dark gray (5Y 3/1) silty clay, black (5Y 2/1) moist; strong medium and fine blocky structure; slightly hard, friable; slight effervescence; moderately alkaline; gradual smooth boundary.

B21—15 to 25 inches; dark gray (5Y 4/1) silty clay, black (5Y 2/1) moist; moderate medium granular structure; hard, firm; few fine accumulations of gypsum; violent effervescence (8.4 percent calcium carbonate); few fine lime accumulations; moderately alkaline; gradual smooth boundary.

B22g—25 to 33 inches; dark gray (5Y 4/1) silty clay, black (5Y 2/1) moist; moderate medium subangular blocky structure parting to moderate medium granular; hard, firm; few fine accumulations of gypsum; violent effervescence; moderately alkaline; gradual smooth boundary.

C—33 to 60 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; moderate medium and fine granular structure; hard, firm; many large prominent accumulations of carbonates; violent effervescence (9.5 percent calcium carbonate) ; moderately alkaline.

The A horizon is mainly silty clay but areas of silty clay loam are common. It is 12 to 18 inches thick and ranges in color from very dark gray to dark gray. In nearly all areas, accumulations of lime are visible, and in most places salt accumulations are present. The clay content of the B horizon ranges from 40 to 50 percent. A zone of lime accumulation and fossil snail shells are in the subsoil in most places. The C horizon is silty clay or silty clay loam. It has few to many reddish brown, strong brown, or gray mottles. The intensity of mottling ranges from distinct to prominent.

Baltic soils are near Lamo, Calco, and Kennebec soils. They formed in finer textured material than these soils, and are not as well drained as Kennebec soils.

Ba—Baltic silty clay, 0 to 2 percent slopes. This soil is on alluvial bottom lands of North Logan Creek in areas that are poorly drained. The areas are 40 to 300 acres in size.

Included with this soil in mapping were small areas of Zook silty clay, and areas of Lamo silt loam.

Slow runoff, occasional ponding on the surface, and the high water table are the principal hazards. Tilling the clayey surface layer and maintaining good tilth are difficult in this soil. Timeliness of operations is an important concern of management. An inadequate supply and the uneven distribution of moisture throughout the growing season can limit production. Some land leveling is needed in gravity irrigation.

Most areas of this soil are cultivated. Both dryland and irrigation management are used. Corn, soybeans, and alfalfa hay are the main crops. Capability units IIIw-1 dryland and IIIw-1 irrigated; Clayey Overflow range site.

Bazile series

The Bazile series consists of deep, gently sloping, well drained soils on old stream terraces and uplands. These soils are made up of silty soil material deposited over sandy soil material.

In a representative profile the surface layer is friable silty clay loam about 12 inches thick. It is very dark grayish brown in the upper part and dark grayish brown in the lower part. The friable subsoil is about 19 inches thick. The upper part is brown silty clay loam and the lower part is pale brown silty clay loam. The pale brown underlying material is at a depth of 31 inches. It is sandy loam in the upper part and loamy sand in the lower part to a depth of 60 inches.

Permeability is moderately slow in the upper silty part of the profile and rapid in the lower sandy part. Available water capacity is high. The organic-matter content is moderate, and fertility is medium. These soils absorb moisture easily and release it readily to plants.

Bazile soils are suited to cultivated crops under both dryland and irrigation management. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Bazile silty clay loam, 2 to 6 percent slopes, in a cultivated field, 350 feet south and 160 feet west of the northeast corner of sec. 8, T. 28 N., R. 4 E.:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, friable; slightly acid; abrupt smooth boundary.

A12—7 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam, dark brown (10YR 3/3) moist; weak medium granular structure; hard, friable; few fine pores; slightly acid; gradual wavy boundary.

B21t—12 to 19 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable; few fine pores; neutral; gradual wavy boundary.

B22t—19 to 31 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine pores; neutral; abrupt smooth boundary.

IIC1—31 to 38 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral; gradual wavy boundary.

IIC2—38 to 60 inches; pale brown (10YR 6/3) loamy sand with thin strata of finer textured material, brown (10YR 4/3) moist; single grained; slightly hard, very friable; neutral; gradual wavy boundary.

The A horizon is very dark brown to dark gray, and is 7 to 16 inches thick. It is silty clay loam, but small areas of loam are included. The B horizon is 12 to 30 inches thick and is dark grayish brown to pale brown. The B2 horizon is silty clay loam and commonly has thin strata of loam or clay loam in the lower part. A loamy or sandy loam IIC1 horizon is present in some profiles. Depth to the underlying IIC2 horizon is 22 to 40 inches. It is sand or coarse sand and, less commonly, loamy fine sand or fine sand.

Bazile soils are near Ortello, Moody, and Nora soils. They have more clay in the B horizon than Ortello soils, and have less clay and silt in the C horizon than Moody and Nora soils.

BcC—Bazile silty clay loam, 2 to 6 percent slopes. This gently sloping, silty soil is on loess-mantled old stream terraces. Slopes are long and slightly convex. The areas are 10 to 80 acres in size.

Included with this soil in mapping were areas of soils where the depth to the sandy underlying material is greater than in the representative soil. Small areas of glacial till outcrops above the valley landscape occur on this soil. These outcrops are indicated on the soil map by a special spot symbol. Also included were small areas of Ortello soils.

Water erosion is the principal hazard. Reducing runoff and water erosion are the main concerns of management.

Almost all areas of this soil are cultivated. Corn, oats, and alfalfa hay are the main crops. Capability units IIIe-1 dryland and IIIe-3 irrigated; Silty range site.

Blendon series

The Blendon series consists of deep, nearly level and very gently sloping, well drained soils. They are on foot slopes, alluvial fans, and in concave depressions in the uplands. These soils formed in wind-reworked deposits of glacial outwash.

In a representative profile the surface layer is very friable, very dark gray sandy loam about 14 inches thick. The very friable subsoil is about 28 inches thick. It is very dark grayish brown and dark brown, sandy loam. The underlying material, to a depth of 60 inches, is brown loamy sand.

Permeability is moderately rapid. Available water capacity is moderate. The organic-matter content is moderate, and natural fertility is medium. Moisture is released readily to plants. These soils are easy to till.

Blendon soils are suited to cultivated crops under both dryland and irrigation management. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Blendon sandy loam, 0 to 3 percent slopes, in a field of native grasses, 300 feet west and 600 feet north of the southeast corner of sec. 18, T. 29 N., R. 6 E.:

A11—0 to 8 inches; very dark gray (10YR 3/1) sandy loam, black (10YR 2/1) moist; weak medium and fine granular structure; soft, very friable; neutral; gradual smooth boundary.

A12—8 to 14 inches; very dark gray (10YR 3/1) sandy loam, black (10YR 2/1) moist; weak medium and fine granular structure; soft, very friable; neutral; gradual smooth boundary.

B2—14 to 30 inches; very dark grayish brown (10YR 3/2) sandy loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; soft, very friable; neutral; gradual smooth boundary.

B3—30 to 42 inches; dark brown (10YR 3/3) sandy loam, very dark grayish brown (10YR 3/2) moist; weak and moderate prismatic structure; soft, very friable; neutral; gradual smooth boundary.

C1—42 to 58 inches; brown (10YR 4/3) loamy sand, dark brown (10YR 3/3) moist; weak fine prismatic structure; soft, very friable; mildly alkaline; clear smooth boundary.

C2—58 to 60 inches; brown (10YR 5/3) loamy sand, brown (10YR 4/3) moist; single grained; loose; mildly alkaline.

The A horizon ranges from very dark gray to gray and is 10 to 16 inches thick. The B horizon is 15 to 30 inches thick. The C horizon is brown to pale brown loamy sand. In places, finer textured layers are present below a depth of 40 inches.

Blendon soils are near Ortello, Moody, and Thurman soils. They have a thicker, darker colored A horizon than Ortello soils. They are coarser textured than Moody soils and are finer textured than Thurman soils.

BeB—Blendon sandy loam, 0 to 3 percent slopes. This soil is mainly in upland depressions. It also occurs on concave foot slopes and alluvial fans. The areas are 10 to 40 acres in size.

Included with this soil in mapping were a few areas of soils where the surface layer is loam or loamy fine sand, and a few depressional areas where the underlying material is silty below a depth of 40 inches.

Runoff is slow. Soil blowing is the main hazard. Water erosion is a hazard, particularly in areas adjacent to drainageways. This soil is droughty.

Most upland areas of this soil are in grass. Areas on foot slopes and colluvial areas are cultivated. Corn, alfalfa, and oats are the main crops. Capability units IIe-3 dryland and IIe-8 irrigated; Sandy range site.

Calco series

The Calco series consists of deep, nearly level, poorly drained and very poorly drained soils on bottom lands of major stream valleys. These soils formed in calcareous silty alluvium. The seasonal high water table is at a depth of 0 to 3 feet in spring. These soils are occasionally flooded.

In a representative profile the surface layer is firm, very dark gray and grayish brown silty clay loam 40 inches thick. The subsoil, to a depth of 60 inches, is dark gray, firm silty clay loam. A few fragments of snail shells are at a depth of 12 to 20 inches. Small carbonate segregations are below a depth of 20 inches. These soils are calcareous below a depth of 6 inches.

Permeability is moderately slow. Available water capacity is high. The organic-matter content is moderate, and natural fertility is high. Moisture is released readily to plants.

Calco soils are suited to cultivated crops. The more poorly drained areas, however, are better suited to grass and other less intensive uses. Calco soils are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Calco silty clay loam, 0 to 2 percent slopes, in grassland 1,320 feet south and 100 feet west of the northeast corner of sec. 17, T. 27 N., R. 6 E.:

A1—0 to 6 inches; very dark gray (10YR 3/1) and grayish brown (10YR 5/2) silty clay loam, mixed black (10YR 2/1) and very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; mildly alkaline; clear smooth boundary.

A12—6 to 12 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; moderate medium and fine subangular blocky structure; hard, firm; few fine pores; slight effervescence; moderately alkaline; gradual smooth boundary.

A13—12 to 20 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak coarse blocky structure parting to moderate medium and fine granular; hard, firm; few fine pores; few fragments of snail shells; slight effervescence; moderately alkaline; gradual smooth boundary.

A14—20 to 25 inches; very dark gray (10YR 3/1) heavy silty clay loam, black (10YR 2/1) moist; weak coarse blocky structure parting to moderate fine subangular blocky; hard, firm; few fine pores; few small rounded concretions of calcium carbonate; slight effervescence; moderately alkaline; gradual smooth boundary.

A15—25 to 40 inches; very dark gray (10YR 3/1) heavy silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure; hard, firm; few fine pores; many rounded small and medium concretions of calcium carbonate; slight effervescence; moderately alkaline; gradual smooth boundary.

Bg—40 to 60 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; few fine distinct dark grayish brown (2.5YR 4/2, moist) mottles; weak medium subangular blocky structure; hard, firm; many rounded small and medium concretions of calcium carbonate; strong effervescence; moderately alkaline.

The A horizon is 24 to 40 inches thick. It is typically black to very dark gray silty clay loam or light silty clay loam, but a 10 to 18 inch layer of silt loam material is on the surface in places. Fragments of snail shells are in the Ap horizon in places. The C horizon is black to dark gray silty clay loam where present. Few to common, distinct grayish brown, yellowish brown or strong brown mottles are below a depth of 18 inches in some areas. Average clay content of the upper 40 inches is 30 to 35 percent, but some thin layers are higher or lower.

Calco soils are near Lamo and Baltic soils. The dark color of the A horizon extends to a greater depth than in these soils. Calco soils are not so fine textured as Baltic soils, and are more poorly drained than Kennebec soils.

Ca—Calco silt loam, overwash, 0 to 2 percent slopes. This poorly drained deep, silty soil is on bottom lands along small, upland drainageways that have low gradients and that commonly lack a well defined channel. A silt desposit that washed from the adjoining uplands has covered the original soil. This deposit is typically 8 to 20 inches thick but is 30 inches thick in some areas. The areas range from 10 to 30 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is very dark grayish brown, calcareous, stratified silt loam. It is very friable when moist and slightly hard when dry. It can be tilled over a fairly wide range of moisture content. Few to common, distinct, gray and dark reddish brown mottles are present in some strata.

Included with this soil in mapping were wet areas where the water table is near the surface. These areas are indicated on the map by a spot symbol. The seasonal high water table is at a depth of 2 to 3 feet early in spring.

Slow runoff, a fluctuating water table, and occasional flooding are the main limitations. A light colored silty material is deposited on the surface layer by occasional flooding. Tillage and planting are commonly delayed by wetness. Young crop plants can be damaged by the flood water and resulting siltation. Suitable drainage outlets are difficult to obtain.

The intake rate for moisture is moderately low. A sprinkler system can be used for row crops on this soil.

Almost all areas of this soil are cultivated. Some areas are in pasture. Capability units IIw–3 dryland and IIw–4 irrigated; Silty Overflow range site.

Cb—Calco silty clay loam, 0 to 2 percent slopes. This poorly drained silty soil is on bottom lands of major streams that drain the uplands. The areas are 10 to 40 acres in size.

This soil has the profile described as representative of the series. The seasonal high water table is at a depth of 1 to 3 feet in spring.

Included with this soil in mapping were a few small areas with a calcareous silt loam surface layer 2 to 6 inches thick. Small areas that are excessively wet, and small areas of Baltic soils are also included.

Wetness from the water table and occasional flooding are the principal hazards. These soils can, however, be artificially drained. Excessive wetness delays tillage and planting in cultivated areas. Some areas in narrow valleys that have deeply entrenched drainageways are naturally drained and have improved tillage. Runoff is slow.

Almost all areas of this soil are cultivated. The remainder is in pasture. Corn, soybeans, and alfalfa hay are the main crops. Capability units IIw–4 dryland and IIw–3 irrigated; Subirrigated range site.

Cc—Calco silty clay loam, wet, 0 to 2 percent slopes. This soil is on bottom lands in narrow, upland drainageways that have low gradients and very poor surface drainage. They are also in depressional areas that were former stream channels.

This soil has a profile similar to the one described as representative of the series except the surface layer is thinner and the subsoil is gray in color. The subsoil is more strongly mottled than the one in the representative soil. This soil is more poorly drained than the soil that is representative of the series. The seasonal high water table is normally at a depth of 0 to 2 feet in spring.

Included with this soil in mapping were areas of Calco silt loam, overwash, and areas of Calco silty clay loam. Also included were small areas of Baltic soils in large drainageways.

Lack of adequate surface drainage, frequent ponding from flood waters, and lack of suitable outlets are the principal limitations of this soil. Runoff is very slow.

This soil is too wet for the common cultivated crops. Almost all areas of this soil are in grass and are used for pasture. A few areas are used for native hay. Capability unit Vw–7 dryland; Wet Land range site.

Colo series

The Colo series consists of deep, somewhat poorly drained soils that formed in silty alluvium. These nearly level soils are on bottom lands of major streams that drain the uplands. The seasonal high water table is at a depth of 2 to 3 feet in the spring. Some areas of this soil are occasionally flooded.

In a representative profile the surface layer is friable, very dark gray silty clay loam about 28 inches thick. The underlying material is dark gray, mottled silty clay loam with brown mottles below a depth of 28 inches. The soil is noncalcareous throughout the profile.

Permeability is moderately slow. Available water capacity is high. The organic-matter content is moderate, and natural fertility is high. Moisture is released readily to plants.

Colo soils are suited to cultivated crops under both dryland and irrigated management. Flooded areas are used mainly for pasture. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Colo silty clay loam, 0 to 2 percent slopes, in a cultivated field 2,040 feet east and 120 feet north of the southwest corner of sec. 30, T. 27 N., R. 5 E.:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure; hard, friable; neutral; abrupt smooth boundary.

A12—7 to 18 inches; very dark gray (10YR 3/1) light silty clay loam, black (10YR 2/1) moist; weak medium granular structure; hard, friable; neutral; diffuse smooth boundary.

A13—18 to 28 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine subangular blocky structure parting to moderate fine granular; hard, friable; neutral; diffuse smooth boundary.

AC—28 to 32 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; few fine faint brown (7.5YR 5/4) moist mottles; moderate fine subangular blocky structure; hard, friable; neutral; clear smooth boundary.

C1g—32 to 37 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; few fine distinct brown (7.5YR 5/4, moist) mottles; moderate medium subangular blocky structure; hard, friable; neutral; diffuse smooth boundary.

C2g—37 to 43 inches; dark gray (10YR 4/1) heavy silty clay loam, dark (10YR 3/1) moist; common fine distinct brown (7.5YR 5/4, moist) mottles; moderate medium subangular blocky structure; hard, friable; neutral; clear smooth boundary.

C3g—43 to 60 inches; dark gray (10YR 4/1) heavy silty clay loam, very dark gray (10YR 3/1) moist; many fine distinct brown (7.5YR 5/4, moist) mottles; massive; hard, friable; neutral.

The A horizon is silty clay loam, but includes areas of heavy silt loam. It is 26 to 40 inches thick. The A horizon averages between 27 to 35 percent clay below a depth of 10 inches. The Ap and A12 horizons are generally neutral, but in places they are slightly acid and range from dark gray to very dark grayish brown. Dark brown, strong brown, and yellowish brown mottles are present in the more poorly drained areas, and the intensity of mottling ranges from faint to prominent. Depth to mottles is 24 to 36 inches. The C1g and C2g horizons average between 32 and 35 percent clay.

Colo soils are near Kennebec, Calco, and Zook soils. They are finer textured throughout their profiles than Kennebec soils and are not so fine textured as Zook soils. Colo soils lack the B horizon that Zook soils have, and they are not so calcareous as Calco soils.

Ce—Colo silty clay loam, 0 to 2 percent slopes. This soil is on bottom lands along major streams of the uplands. The areas are 20 to 100 acres in size.

Included with this soil in mapping were small areas of Zook silty clay, 0 to 2 percent slopes. Also included were areas with 4 to 10 inches of recently deposited, very dark grayish brown silt loam on the surface.

The moderately high water table causes wetness and delays seeding and cultivation in the spring. Runoff is slow, and some areas of this soil pond occasionally.

Almost all areas of this soil are cultivated. Some areas are in grass. Both dryland and irrigation management are used. Capability units IIw-4 dryland and IIw-3 irrigated; Subirrigated range site.

Crofton series

The Crofton series consists of deep, gently sloping to very steep, well drained soils on narrow ridgetops and upper side slopes in uplands. These soils formed in loess. The slopes are mainly convex.

In a representative profile (fig. 5) the surface layer is very friable, brown silt loam 7 inches thick. Many lime concretions are on the surface and throughout the surface layer. Beneath this is a very friable, pale brown, silt loam transition layer about 9 inches thick. The underlying material is pale brown silt loam to a depth of 60 inches. The soil is calcareous throughout.

Permeability is moderate. Available water capacity is high. The organic-matter content is low or very low, and natural fertility is low. Moisture is released readily to plants.

Crofton soils are suited to cultivated crops under both dryland and irrigation management in gently sloping to strongly sloping areas. Because of the very severe hazard of erosion, the steep and very steep soils are suited to native grass and to less intensive uses. Crofton soils are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Crofton silt loam, 11 to 15 percent slopes, eroded, in a cultivated field, 850 feet south and 150 feet west of the northeast corner of sec. 33, T. 30 N., R. 7 E.:

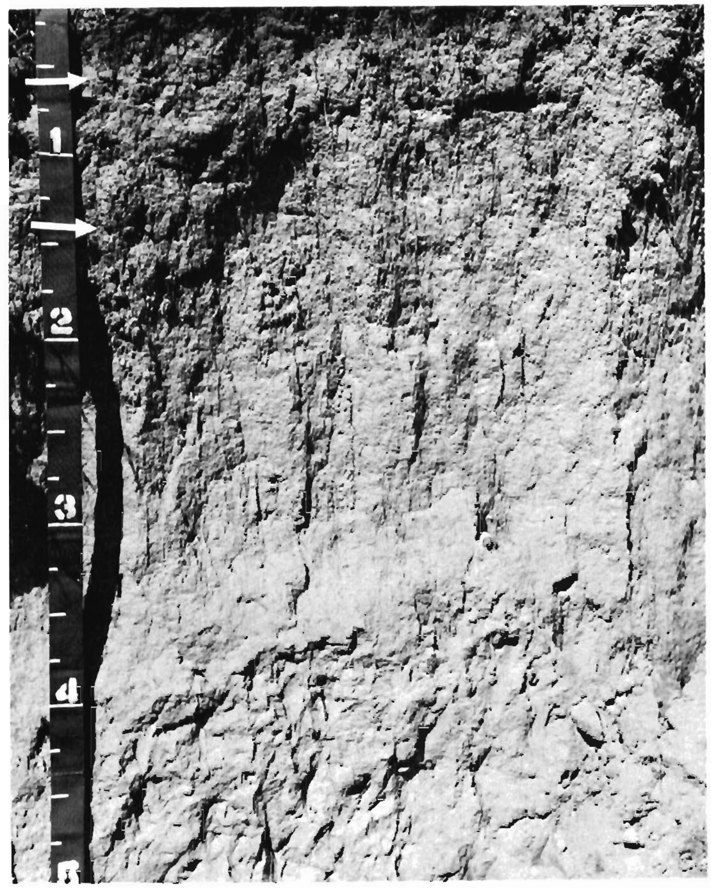

Figure 5.—**Profile of Crofton silt loam. This loessial soil is weakly developed and has lime throughout the profile.**

Ap—0 to 7 inches; brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; many lime concretions on surface; strong effervescence; moderately alkaline; abrupt smooth boundary.

AC—7 to 16 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; many medium prominent yellowish red (5YR 5/6, moist) relic mottles; weak medium and coarse subangular blocky structure; soft, very friable; common fine lime concretions; many fine lime threads; violent effervescence; moderately alkaline; clear wavy boundary.

C1—16 to 34 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 4/4) moist; few fine faint gray (2.5YR N 5/0, moist) mottles; massive; slightly hard, friable; few medium lime concretions; common medium dark reddish brown mottles; many fine vesicular pores; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—34 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; few fine faint gray (2.5YR N 5/0, moist) mottles; massive; slightly hard friable; disseminated lime; many fine vesicular pores; many fine prominent dark reddish brown mottles; violent effervescence; moderately alkaline.

The A horizon is 6 to 8 inches thick. It is dark grayish brown to pale brown in cultivated areas, and very dark brown to very dark grayish brown in uneroded areas. Lime concretions ranging from few to many, and from small to large, are on the surface in most places. The AC horizon is 5 to 9 inches thick and is dark brown to dark grayish brown. The AC horizon is absent in some of the most severely eroded areas. The C horizon is silt loam or light silty clay loam. Lime occurs as concretions or is disseminated in the soil material. Few medium distinct strong brown and light, brownish gray mottles are commonly present below a depth of 15 inches.

Crofton soils are near Nora and Moody soils. Crofton soils have a thinner, lighter colored A horizon than Nora soils. They are not so fine textured in the A horizon, and have lime nearer to the surface than in Moody soils. Unlike Moody and Nora soils, Crofton soils do not have a B horizon.

CfC2—Crofton silt loam, 2 to 6 percent slopes, eroded. This gently sloping soil is mainly on narrow convex ridgetops in the loess uplands. The areas are 10 to 30 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is slightly darker.

Included with this soil in mapping were small areas of eroded Nora silty clay loam.

This very friable soil is subject to sheet and rill erosion because of the slope, silty texture, and very low organic-matter content. This is the principal hazard in areas where this soil is cultivated. Improving the organic-matter content is a concern of management. Runoff is medium.

Almost all areas of this soil are cultivated. Corn, oats, and alfalfa hay are the main crops. Some small areas are in pasture. Both dryland and irrigation management are used. Capability units IIIe–9 dryland and IIIe–6 irrigated; Limy Upland range site.

CfD2—Crofton silt loam, 6 to 11 percent slopes, eroded. This strongly sloping soil is on rounded ridgetops and convex side slopes of drainage divides in the loess uplands.

This soil has a profile similar to the one described as representative for the series except the surface layer is lighter colored and is only as thick as the tilled layer.

Included with this soil in mapping were small areas of Nora silt loam and Nora silty clay loam. Also included were small areas of Crofton soil that are slightly eroded.

This very friable soil is subject to water erosion because of the slope, silty texture, and very low organic-matter content. Sheet and rill erosion are the main hazards in areas where this soil is cultivated. Workability is good, but management practices that increase the infiltration rate of moisture are needed. Runoff is medium.

Almost all areas of this soil are cultivated. Small areas are in grass. Corn, soybeans, oats, and alfalfa are the main crops. Both dryland and irrigation management are used. Capability units IVe–9 dryland and IVe–6 irrigated; Limy Upland range site.

CfE2—Crofton silt loam, 11 to 15 percent slopes, eroded. This moderately steep soil is on sharp ridgetops and convex sides of drainage divides that drain the loess uplands. The areas are 50 to 200 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping were a few areas of Crofton silt loam with steeper slopes, and areas that are slightly eroded. These areas are most common along upper areas of small drainageways. Also included were a few small areas of eroded Nora silt loam in concave areas.

Water erosion is a very severe hazard on this soil. Small ditches and rills form during intense rainstorms, but these are generally plowed in as part of regular tillage operations. Very low organic-matter content and an inadequate supply of moisture commonly limit production. Maintaining tilth is not a serious problem, but maintaining organic-matter content and fertility are management concerns. Runoff is rapid.

Most areas of this soil are cultivated or have been reseeded to grass. A few areas are in native grass. Corn, oats, and alfalfa hay are the main crops. Both dryland and irrigation management are used. Capability unit IVe–9 dryland; Limy Upland range site.

CfF—Crofton silt loam, 15 to 30 percent slopes. This steep soil is on irregular, narrow convex ridgetops in the loess uplands. Irregular catstep slopes are in the most steeply sloping areas. The areas are 20 to 200 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is slightly lighter in color. The soil is calcareous at the surface or within a depth of 10 inches.

Included with this soil in mapping were small areas of Nora silt loam and Alcester silt loam in concave positions or with east-facing slopes. Alcester silt loam, gullied, occurs along drainageways in some areas. Shale and glacial till outcrops are indicated on the soil map by spot symbols.

Runoff is rapid and organic-matter content is low.

Most areas of this soil are in native grass or woodland. It is too steep to successfully cultivate the crops commonly grown in the county. The native grasses consist mainly of big bluestem, little bluestem, sideoats grama, and switchgrass. Yucca plants are in the drier sites. Bur oak is the most common species of trees. A few areas of this soil are cultivated. Capability unit VIe–9 dryland; Limy Upland range site.

CfF2—Crofton silt loam, 15 to 20 percent slopes, eroded. This steep soil is on eroded, convex, narrow ridgetops and smooth side slopes in the loess uplands. The areas are 20 to 200 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is lighter in color. In this soil are a few small areas that are not eroded.

Included with this soil in mapping were small areas of Nora silt loam. Also included were a few uneroded areas. Glacial till and shale outcrops are indicated on the detailed soil map by spot symbols.

Water erosion is the main hazard. Small rills and gulleys form in places and are plowed in with each successive tillage. Fertility is low, and organic-matter content is very low. Runoff is rapid.

Almost all areas of this soil have been cultivated. Because of the severe erosion hazard, however, some areas are now seeded to native grass. A few areas are still cultivated. Capability unit VIe-9 dryland; Limy Upland range site.

CfG—Crofton silt loam, 30 to 60 percent slopes. This very steep soil consists of upland areas on bluffs bordering the Missouri River Valley. These areas are commonly characterized by irregular land slips or by catsteps.

This soil has a profile similar to the one described as representative for the series except for a surface layer that is only 3 to 6 inches thick.

Included with this soil in mapping were small outcrops of shale and limestone bedrock on some of the low-lying slopes.

Water erosion is a very severe hazard. Small rills form in places. Runoff is very rapid and organic-matter content is low.

Almost all areas of this soil are in native grass. Some areas are wooded. Yucca plants are numerous on this site. Capability unit VIIe-9 dryland; Thin Loess range site.

Duneland series

Duneland is made up of excessively drained, sandy soil material on bottom lands. The landscape is mostly hummocky but includes some large dunes. In the hummocky areas, the water table is at a depth of about 3 or 4 feet in the lowest areas when the level of the river is highest. The water table is below a depth of 10 feet beneath the large dunes.

Duneland formed in areas where the soil material was deposited by water and then later reworked by wind. This material is fine sand and medium sand to a depth of 5 feet. There is almost no soil development in this material, as there is little darkening of the surface layer. It is mildly alkaline. Permeability is rapid, available water capacity is low, and natural fertility is low.

Duneland is best suited to recreation, and as wildlife habitat. The areas are almost devoid of vegetation. Soil blowing is a very severe hazard and needs to be controlled before any permanent vegetation can be established.

In Dixon County, Duneland is mapped with Sarpy soils, which are nearly level to undulating and support vegetation.

Grable series

The Grable series consists of deep, nearly level or slightly undulating well drained soils on bottom lands of the Missouri River Valley. These soils formed in alluvium. They flood occasionally where they are not protected.

In a representative profile the surface layer is very friable, grayish brown very fine sandy loam 7 inches thick. The underlying material is light brownish gray and grayish brown very fine sandy loam and silt loam. It is light brownish gray fine sand at a depth of 24 inches. The soil is calcareous throughout the profile.

Permeability is moderate to a depth of 24 inches, and rapid below that depth. Available water capacity is moderate. The organic-matter content is moderately low, and natural fertility is low. Moisture is released readily to plants.

Grable soils are suited to cultivated crops under both dryland and irrigation management. Crops show the effects of short droughty periods when they are dryfarmed. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Grable very fine sandy loam, 0 to 2 percent slopes, in a cultivated field 1,320 feet east and 150 feet south of the center of sec. 2, T. 90 N., R. 50 W.:

Ap—0 to 7 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—7 to 12 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak medium and fine granular; soft, very friable; violent effervescence; mildly alkaline; abrupt smooth boundary.

C2—12 to 24 inches; grayish brown (2.5Y 4/2) and light brownish gray (2.5Y 6/2) stratified very fine sandy loam and silt loam, dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) moist; few fine distinct brown (7.5YR 4/4) mottles; weak very fine platy structure; soft, very friable; few fine pores; violent effervescence; moderately alkaline; abrupt smooth boundary.

IIC3—24 to 60 inches; light brownish gray (2.5Y 6/2) fine sand, grayish brown (2.5Y 5/2) moist; single grained; loose; violent effervescence; moderately alkaline.

The Ap horizon is 6 to 10 inches thick and is very fine sandy loam, but includes some areas of silt loam. It is generally mildly alkaline and calcareous, but is noncalcareous in places. The C1 and C2 horizons are silt loam or very fine sandy loam. The composite texture is very fine sandy loam. Depth to the IIC3 horizon is 18 to 30 inches. It is loamy sand or fine sand.

Grable soils are near Haynie, Onawa, Percival, and Sarpy soils. The IIC horizon is coarser textured than the corresponding depth in Haynie soils. Grable soils are not as fine textured in the A horizon and upper part of the C horizon as Onawa and Percival soils. They are finer textured in the upper part of the C horizon than Sarpy soils.

Gb—Grable very fine sandy loam, 0 to 2 percent slopes. This deep soil is on recent accretion land of bottom lands. It is underlain by sandy material. This soil is slightly undulating or in narrow, convex areas that are closely associated with nearby sandy and clayey soils. The areas are 10 to 50 acres in size.

Included with this soil in mapping were a few small areas of Haynie, Onawa, and Percival soils.

This soil is droughty late in the growing season, because of the moderate available water capacity. Droughtiness is the main limitation when this soil is dryfarmed. Soil blowing and occasional flooding are hazards in areas where the surface layer is unprotected. The limitations of the associated soils commonly determine the farming operations on this soil.

Almost all areas of this soil are cultivated. Corn, soybeans, and alfalfa hay are the main crops. A few areas near the Missouri River have not been cleared of trees. Both dryland and irrigation management are used. Capability units IIs–5 dryland and I–6 irrigated; Silty Lowland range site.

Haynie series

The Haynie series consists of deep, nearly level, moderately well drained soils on bottom lands of the Missouri River Valley. These soils formed in alluvium. They are subject to occasional flooding if unprotected.

In a representative profile the surface layer is very friable, grayish brown silt loam 7 inches thick. The underlying material, to a depth of 15 inches, is light gray silt loam. Beneath this is light gray, stratified, very fine sandy loam to a depth of 60 inches. The soil is calcareous throughout the profile.

Permeability is moderate. Available water capacity is high. The organic-matter content is moderately low, and natural fertility is low. Moisture is released readily to plants.

Haynie soils are suited to cultivated crops commonly grown in the county under both dryland and irrigation management. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation. These soils are among the better suited to cultivated crops in the Missouri River Valley.

Representative profile of Haynie silt loam, 0 to 2 percent slopes, in a cultivated field, 1,300 feet south and 100 feet east of the northwest corner of sec. 21, T. 31 N., R. 6 E.:

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—7 to 15 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; few fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6, moist) mottles; weak medium and fine granular structure; soft, very friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C2—15 to 30 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; few fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6, moist) mottles; massive; thin strata of silt loam and fine sand; soft, very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

C3—30 to 60 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; common fine distinct dark yellowish brown (10YR 4/4) moist mottles; weak fine platy structure; soft, very friable; stratified lenses of silt loam and fine sand; strong effervescence; moderately alkaline.

The Ap horizon is 6 to 10 inches thick. It is dark gray to light gray and is silt loam or very fine sandy loam. The C horizon is light gray to light brownish gray and is silt loam or very fine sandy loam. The lower part of the C horizon has thin strata of coarser and finer material in many places. These individual strata are generally less than one inch thick. Few to common, strong brown, yellowish brown, reddish brown, or gray mottles occur in stratification planes in the C horizon. Haynie soils are mildly alkaline or moderately alkaline throughout their profile.

Haynie soils are near Albaton, Grable, Onawa, Percival, and Sarpy soils. They are coarser textured throughout their profile than Albaton, Onawa, or Percival soils. Unlike the Grable and Sarpy soils, the Haynie soils have no fine sand in their lower C horizon.

He—Haynie silt loam, 0 to 2 percent slopes. This deep soil is on bottom lands. Most areas are long and narrow, and parallel former stream channels. They are 10 to 40 acres in size.

Some small areas of this soil have a very fine sandy loam surface layer.

Included with this soil in mapping were slightly convex, higher areas with a loamy, very fine sand surface layer, and small areas of Onawa and Grable soils. Also included were soils in swales where the surface layer is silty clay loam and the soil is wetter than this Haynie soil.

Soil blowing is a hazard in areas where the surface layer is coarser textured. Some land leveling is needed for gravity irrigation. Runoff is slow. In places, large areas have a network of poorly drained swales that delay field operations earlier in the season. These areas are subject to occasional flooding if not protected.

Almost all areas of this soil are cultivated. Corn, soybeans, and alfalfa hay are the main crops. Some areas are irrigated and they respond well to the additional moisture. Some small areas of trees are in places close to the river. Capability units I–1 dryland and I–6 irrigated; Silty Lowland range site.

Kennebec series

The Kennebec series consists of deep nearly level, moderately well drained soils. These soils formed in silty alluvial sediment deposited by streams or that washed from nearby hillsides. They are on bottom lands of upland drainageways that have entrenched channels. The channels provide a natural drain for the areas. Flooding is occasional and brief. The seasonal high water table is at a depth of 4 or 5 feet in spring.

In a representative profile the surface layer is dark grayish brown, friable silt loam 15 inches thick. Beneath this is a buried layer of dark gray, grayish brown and very dark gray silt loam 34 inches thick. The underlying material is at a depth of 49 inches and is dark gray silty clay loam.

Permeability is moderate. Available water capacity is high. The organic-matter content is moderate, and natural fertility is high. Moisture is released readily to plants. These soils are subject to flooding in some areas.

Kennebec soils are suited to the cultivated crops commonly grown in the county under both dryland and irrigation management. They are among the most productive and most easily tilled bottom land soils in Dixon County. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Kennebec silt loam, 0 to 2 percent slopes, in a cultivated field, 1,150 feet west and 150 feet south of the northeast corner of sec. 2, T. 29 N., R. 5 E.:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; neutral; slightly hard, friable; abrupt smooth boundary.

A12—7 to 15 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak very fine granular; slightly hard, friable; slight effervescence; neutral; abrupt smooth boundary.

A11b—15 to 22 inches; dark gray (10YR 4/1) and grayish brown (10YR 5/2) silt loam, black (10YR 2/1) and dark gray (10YR 4/1) moist; weak medium subangular blocky structure parting to weak very fine granular; slightly hard, friable; neutral; gradual smooth boundary.

A12b—22 to 49 inches; very dark gray (10YR 3/1) silt loam; black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; neutral; gradual smooth boundary.

C—49 to 60 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine prismatic structure parting to weak fine subangular blocky; hard, friable; neutral.

The A horizon is 36 to 50 inches thick. It is silt loam to light silty clay loam. The Ap or A1 horizon is very dark brown to very dark grayish brown. The A11b horizon is dark gray or black. The boundary between the A and C horizon is dark gray or black. The boundary between the A and C horizon is somewhat arbitrary and is indistinct in most places. The C horizon ranges from dark gray to very dark gray. It is silt loam or silty clay loam. The A and C horizons are about 24 to 30 percent clay.

Kennebec soils are near Calco and Alcester soils. Kennebec soils are not as fine textured, lime is deeper, and they are better drained than Calco soils. Unlike Alcester soils, Kennebec soils do not have a B horizon. They are not as well drained as Alcester soils.

Ke—Kennebec silt loam, 0 to 2 percent slopes. This deep, silty soil is on bottom lands along major streams and drainageways throughout the uplands. The areas are 10 to 100 acres in size.

Included with this soil in mapping were a few small areas of Aowa silt loam, 0 to 2 percent slopes, and areas of Alcester soils. Also included were small areas that are more poorly drained than this soil, and some areas that receive silty overwash and that are calcareous at or near the surface.

Flooding occurs occasionally on this soil. Some runoff from adjoining drainageways drains onto this soil. Runoff is slow. This soil does not generally have serious limitations. Some land leveling is needed for gravity irrigation.

Most areas of this soil are cultivated. This is one of the better suited soils to cultivated crops in Dixon County. Corn, alfalfa, and soybeans are the main crops. Some small areas are in pasture. Both dryland and irrigation management are used. Capability units I–1 dryland and I–6 irrigated; Silty Lowland range site.

Lamo series

The Lamo series consists of deep, nearly level, somewhat poorly drained soils on bottom lands. These soils formed in silty alluvium. The water table is at a high of about 2 or 3 feet in spring and at a low of about 6 feet in summer. Flooding is occasional. This soil is adjacent to upland areas.

In a representative profile the surface layer is very friable, dark gray silt loam 17 inches thick. Below the surface layer is a transitional layer of friable gray silty clay loam 8 inches thick. The underlying material is gray silty clay loam in the upper part, and light gray silt loam in the lower part. Many fine, prominent, yellowish red mottles are present below a depth of 25 inches. Calcium carbonate accumulation is below a depth of 25 inches. The soil is calcareous throughout the profile.

Permeability is moderately slow. Available water capacity is high. Organic-matter content is moderate and natural fertility is high.

Lamo soils are suited to cultivated crops commonly grown in the county under both dryland and irrigation management. Some areas are used for pasture. These soils are suited to certain species of grasses, trees, and shrubs that can tolerate the moderately high water table. They are well suited as habitat for openland wildlife.

Representative profile of Lamo silt loam, 0 to 2 percent slopes, in a field of alfalfa, 150 feet east of the northwest corner of the SW¼ of sec. 34, T. 28 N., R. 4 E.:

Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, very friable; violent effervescence; abrupt smooth boundary.

A12—7 to 17 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, very friable; violent effervescence; clear smooth boundary.

AC—17 to 25 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate fine subangular blocky structure; hard, friable; violent effervescence, (11 percent calcium carbonate); clear smooth boundary.

C1g—25 to 36 inches; gray (2.5Y 6/1) silty clay loam, dark gray (5Y 4/1) moist; many fine prominent yellowish red (5YR 4/6, moist) mottles; moderate very fine subangular blocky structure; few lime concretions; hard, friable; violent effervescence, (11 percent calcium carbonate); mildly alkaline; gradual smooth boundary.

C2g—36 to 40 inches; gray (2.5Y 6/1) light silty clay loam; gray (5Y 5/1) moist; common fine prominent yellowish red (5YR 4/6, moist) mottles; weak very fine subangular blocky structure; hard, friable; many fine lime concretions; violent effervescence; moderately alkaline; gradual smooth boundary.

C3g—40 to 46 inches; light gray (5Y 6/1) silt loam, gray (5Y 5/1) moist; many fine prominent yellowish red (5YR 4/6, moist) mottles; massive structure; hard, friable; many lime concretions; many black segregations; violent effervescence; moderately alkaline; gradual smooth boundary.

C4G—46 to 60 inches; light gray (5Y 6/1) silt loam, gray (5Y 5/1) moist; many coarse prominent yellowish red (5Y 4/6) moist mottles; massive; slightly hard, friable; many lime concretions; slight effervescence; moderately alkaline.

The A horizon is silt loam or light silty clay loam and is 12 to 25 inches thick. The AC horizon is 8 to 15 inches thick. In places, the C horizon has thin strata of silt and sand within a depth of 60 inches. The C horizon ranges from gray to very dark gray in 2.5Y or 5Y hue. Fragments of snail shells occur in places, and other places have very dark brown or black segregations of iron and manganese. The C horizon may have gray to yellowish brown mottles. The intensity of mottling ranges from faint to prominent.

Lamo soils are associated with Kennebec, Zook, Baltic, Calco, and Colo soils. They are more poorly drained than Kennebec and are not so fine textured as Zook or Baltic soils. They have gray underlying material at a shallower depth and contain more lime than Calco soils.

La—Lamo silt loam, 0 to 2 percent slopes. This silty soil formed in alluvium on bottom lands of North Logan Creek. Areas are 20 to 100 acres in size.

Included with this soil in mapping were small areas of Baltic soils in small depressions. Also included were areas with sand at a depth of more than 42 inches.

Slow surface drainage and the moderately high water table are the main limitations in areas where this soil is cultivated. Ponding on the surface occurs occasionally. A good, mellow, firm seedbed is difficult to obtain.

Most areas of this soil are in pasture. Some areas are cultivated. Pastures consist mainly of bluegrass and bromegrass. Corn, soybeans, and alfalfa hay are the main crops. Both dryland and irrigation management are used. Capability units IIw–4 dryland and IIw–4 irrigated; Subirrigated range site.

Leisy series

The Leisy series consists of deep, gently sloping to strongly sloping, well drained soils on stream terraces and uplands. The upper part of the profile formed in eolian sand and the lower part formed in loess.

In a representative profile the surface layer is very friable, dark gray and dark grayish brown sandy loam 16 inches thick. The subsoil, about 23 inches thick, is friable silty clay loam. It is grayish brown in the upper part and brown in the lower part. The underlying material is pale brown silty clay loam in the upper part and pale brown silt loam in the lower part. The soil is mottled below a depth of about 39 inches and it is calcareous below a depth of about 48 inches.

Permeability is moderately slow. Available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. Moisture is released readily to plants.

Leisy soils are suited to cultivated crops under both dryland and irrigation management. They are suited to grass, trees and shrubs, wildlife habitat, and recreation.

In Dixon County, Leisy soils are mapped only in complex with Moody soils.

Representative profile of Leisy sandy loam in an area of Moody-Leisy complex, 2 to 6 percent slopes, in a cultivated field, 160 feet south and 180 feet east of the northwest corner of the SW¼, sec. 2, T. 28 N., R. 4 E.:

Ap—0 to 7 inches; dark gray (10YR 4/1) sandy loam, very dark gray (10YR 3/1) moist; weak medium and fine granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.

A12—7 to 16 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium and fine granular; slightly hard, very friable; slightly acid; clear smooth boundary.

B21t—16 to 21 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, friable; slightly acid; gradual smooth boundary.

B22t—21 to 33 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots and few fine pores; pressure faces on sides of peds; slightly acid; gradual smooth boundary.

B23t—33 to 39 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, friable; few fine roots and few fine pores; slightly acid; gradual smooth boundary.

C1—39 to 44 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; few fine faint strong brown (7.5YR 5/6) and few fine faint gray (5Y 5/1) moist mottles; weak coarse subangular blocky structure parting to weak medium and fine subangular blocky; slightly hard, very friable; pressure faces on peds; neutral; gradual smooth boundary.

C2—44 to 48 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; few fine faint strong brown (7.5YR 5/6) and few fine faint gray (5Y 5/1, moist) mottles; weak coarse subangular blocky structure; slightly hard, very friable; neutral; gradual smooth boundary.

C3—48 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; few fine faint strong brown (7.5YR 5/6) and few fine faint gray (5Y 5/1, moist) mottles; massive structure; soft, very friable; violent effervescence; mildly alkaline.

The A horizon is sandy loam or loam and is 12 to 20 inches thick. The B horizon is 23 to 42 inches thick and is 27 to 35 percent clay. Calcium carbonate concretions or disseminated lime is within a depth of 40 to 60 inches. The C horizon is brown to pale brown and has few to many, faint to prominent gray and reddish brown mottles. The C horizon is silty clay loam or silt loam.

These Leisy soils in Dixon County have a B horizon that is entirely in the silty material and have more silt in the control section than is defined in the range for the series.

Leisy soils are near Moody and Thurman soils. They have more sand and less silt than Moody soils, and have less sand and more clay in the lower part of the profile than Thurman soils.

Maskell series

The Maskell series consists of deep nearly level to gently sloping, well drained soils. These soils formed in loamy colluvial-alluvial sediment on low, broad, stream terraces, and on foot slopes along upland drainageways.

In a representative profile the surface layer is friable and is 17 inches thick. It is dark gray loam in the upper part, dark gray clay loam in the middle part, and dark grayish brown loam in the lower part. The brown subsoil is friable and is 17 inches thick. It is loam in the upper part and clay loam in the lower part. At a depth of 34 inches is a buried, surface layer that is dark gray loam about 10 inches thick. Below this is a buried subsoil that is brown silt loam to a depth of 60 inches.

Permeability is moderate. Available water capacity is high. The organic-matter content is moderate, and natural fertility is high. Moisture is released readily to plants.

Maskell soils are suited to all crops commonly grown in the county under both dryland and irrigation management. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Maskell loam, 0 to 2 percent slopes, in a cultivated field, 1,640 feet north and 150 feet west of the southeast corner of sec. 20, T. 27 N., R. 5 E.:

Ap—0 to 7 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak very fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A12—7 to 12 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure parting to weak very fine granular; slightly hard, friable; neutral; clear smooth boundary.

A13—12 to 17 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) crushed, moist; weak coarse subangular blocky structure parting to weak very fine granular; slightly hard, friable; neutral; clear smooth boundary.

B21—17 to 26 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) crushed, moist; weak coarse subangular blocky structure parting to weak very fine subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

B22—26 to 34 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; slightly hard, friable; neutral; abrupt smooth boundary.

Ab—34 to 44 inches; dark gray (10YR 4/1) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak very fine granular; slightly hard, friable; neutral; clear smooth boundary.

Bb—44 to 60 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable; neutral.

The A horizon is 12 to 20 inches thick. Typically it is loam, but in places is clay loam, or sandy loam. The B21 horizon ranges from brown to dark brown. Typically, it is loam, but in places is sandy loam. Typically, the B2 horizon is clay loam or loam. The control section is 24 to 32 percent clay. Depth to the Ab horizon ranges from 30 to 40 inches in many places. Another Ab horizon is below a depth of 40 inches in many places. The buried horizons are loam, silt loam, silty clay loam, and clay loam. Grains of fine sand are common on the ped faces throughout the profile.

Maskell soils are near Ortello, Thurman, Colo, and Kennebec soils. They have more clay throughout the profile than Ortello or Thurman soils. They have a thinner A horizon, and a B horizon that is not present in Colo and Kennebec soils. Maskell soils have more sand and generally less silt than Alcester soils.

Mh—Maskell loam, 0 to 2 percent slopes. This deep, nearly level soil is on stream terraces of Logan Creek. These soils formed in alluvial sediment that washed from nearby silty and sandy uplands. The areas are 20 to 300 acres in size.

This soil has the profile described as representative of the series. It includes small areas that have a silt loam surface layer, and a few areas where the buried soil is below a depth of 40 inches.

Included with this soil in mapping were a few small areas of Ortello soils on higher convex areas. Also included were a few wet soils in slight depressions.

Runoff is slow and the hazard of erosion is slight. Workability is good.

Most areas of this soil are cultivated. Corn, soybeans, oats, and alfalfa hay are the main crops. Both dryland and irrigation management are used. Capability units I-1 dryland and I-4 irrigated; Silty Lowland range site.

MhC—Maskell loam, 2 to 6 percent slopes. This deep, gently sloping soil is on colluvial foot slopes along narrow drainageways in the mixed sandy and silty uplands. The areas are 30 to 100 acres in size.

This soil has a profile similar to the one described as representative for the series except for a surface layer that is slightly browner than the one in the representative soil.

Included with this soil in mapping were areas that have a sandy loam surface layer.

Rill and gully erosion, and siltation are the main hazards on this soil. Runoff moves across the adjacent uplands and deposits sandy material in the drainageways during hard rains. This coarse material is tilled into the existing soil. Runoff is medium. This soil is not as suitable for cultivation as the nearly level Maskell soil.

Almost all the areas of this soil are cultivated. Corn, soybeans, oats, and alfalfa hay are the main crops. Both dryland and irrigation management are used. Capability units IIe-1 dryland and IIIe-4 irrigated; Silty Lowland range site.

Modale series

The Modale series consists of deep, stratified, moderately well drained soils that are underlain with clayey material at a depth of about 2 feet. These nearly level soils are on bottom lands of the Missouri River Valley where flooding occurs occasionally. A perched water table is present in the spring at a depth of 2 to 3 feet.

In a representative profile the surface layer is very friable, grayish brown very fine sandy loam about 7 inches thick. The upper part of the underlying material is light brownish gray and grayish brown very fine sandy loam. It is about 15 inches thick. The middle part is mottled, stratified silt loam and silty clay about 6 inches thick. The lower part, below a depth of 28 inches, is mottled, light brownish gray silty clay to a depth of 60 inches. The soil is calcareous throughout the profile.

Permeability is moderate in the upper part of this soil and slow in the lower part. Available water capacity is high. The organic-matter content is moderately low, and natural fertility is medium. Moisture is released readily to plants. Root growth is somewhat restricted by the clayey underlying material in excessively wet years. Workability is good, and tilth is easy to maintain.

Modale soils are suited to cultivated crops under both dryland and irrigated management. They also are suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Modale very fine sandy loam, 0 to 2 percent slopes, in a cultivated field, 1,280 feet south and 1,280 feet east of the northwest corner of sec. 21, T. 31 N., R. 6 E.:

Ap—0 to 7 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

C1—7 to 15 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; soft, very friable; stratified; strong effervescence; moderately alkaline; clear smooth boundary.

C2—15 to 22 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; few fine faint yellowish brown (10YR 5/4, moist) mottles; weak coarse subangular blocky structure; soft, very friable; stratified; strong effervescence; moderately alkaline; abrupt smooth boundary.

C3—22 to 28 inches; gray (10YR 5/1) and (10YR 6/1) stratified silt loam and silty clay, dark gray (5Y 4/1) and olive gray (5Y 4/2) moist; few fine faint yellowish brown (10YR 5/4 and 5/6, moist) mottles; weak fine platy structure; soft, very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

IIC4g—28 to 60 inches; light brownish gray (2.5YR 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; few fine faint yellowish brown (10YR 5/4 and 5/6, moist) mottles; moderate and coarse blocky structure; hard, friable; few fine soft dark brown (10YR 3/3) segregations; strong effervescence; moderately alkaline.

The A horizon ranges from light brownish gray to dark grayish brown and is 6 to 10 inches thick. It is mildly or moderately alkaline. Typically, the C1 and C2 horizons are stratified very fine sandy loam, but in places thin layers of silt loam are present. These horizons range in color from light gray to dark grayish brown. The stratified silty material is 20 to 30 inches thick. Typically, the IIC4g horizon is silty clay, but areas where this horizon is clay are present. Few to many mottles of faint yellowish brown to brown are in the C2, C3, and IICg horizons. They are most numerous where there are thin strata of contrasting soil textures.

Modale soils are near Albaton, Haynie, and Onawa soils. The A horizon and upper part of the C horizon in Modale soils contain less clay than those horizons in Albaton soils. Modale soils contain more clay below a depth of 24 inches than Haynie and Onawa soils.

Mk—Modale very fine sandy loam, 0 to 2 percent slopes. This deep, nearly level soil is on bottom lands. Most areas have narrow, alternating low ridges and swales. The soil occurs where flooding stream channels deposited silty sediment that covered the older, clayey underlying material. The areas are 20 to 40 acres in size.

Included with this soil in mapping were a few small areas where the clayey underlying material is within a depth of 12 inches. Depth to the clayey material varies considerably between depths of 12 and 40 inches.

Few serious limitations exist where this soil is cultivated. During the wettest season, however, a perched water table is above the clayey underlying material. In places this results in a wetness problem for a short period of time. Runoff is slow. Runoff from higher soils causes occasional flooding.

Most areas are cultivated. Both dryland and irrigation management are used. Corn, soybeans, and alfalfa hay are the main crops. A few areas near channels of the Missouri River are wooded. Capability units I–1 dryland and I–6 irrigated; Silty Lowland range site.

Moody series

The Moody series consists of deep, nearly level to strongly sloping, well drained soils on uplands (fig. 6). These soils formed in loess.

In a representative profile the surface layer is firm, very dark grayish brown silty clay loam 11 inches thick. The subsoil is brown, firm silty clay loam about 31 inches thick. The underlying material is brown silty clay loam in the upper part and brown silt loam below this to a depth of 60 inches. Mottles are at a depth of about 42 inches. A few lime concretions are at a depth of 52 inches or more.

Permeability is moderately slow. Available water capacity is high. The organic-matter content is low to moderate depending on the amount of erosion. Fertility is medium in areas of slightly eroded soil and low in areas where the soil is more than slightly eroded. Moisture is released readily to plants.

Moody soils are suited to cultivated crops under both dryland and irrigated management. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Moody silty clay loam, 2 to 6 percent slopes, in a field of alfalfa, 1,420 feet north and 750 feet east of the southeast corner of sec. 32, T. 27 N., R. 4 E.:

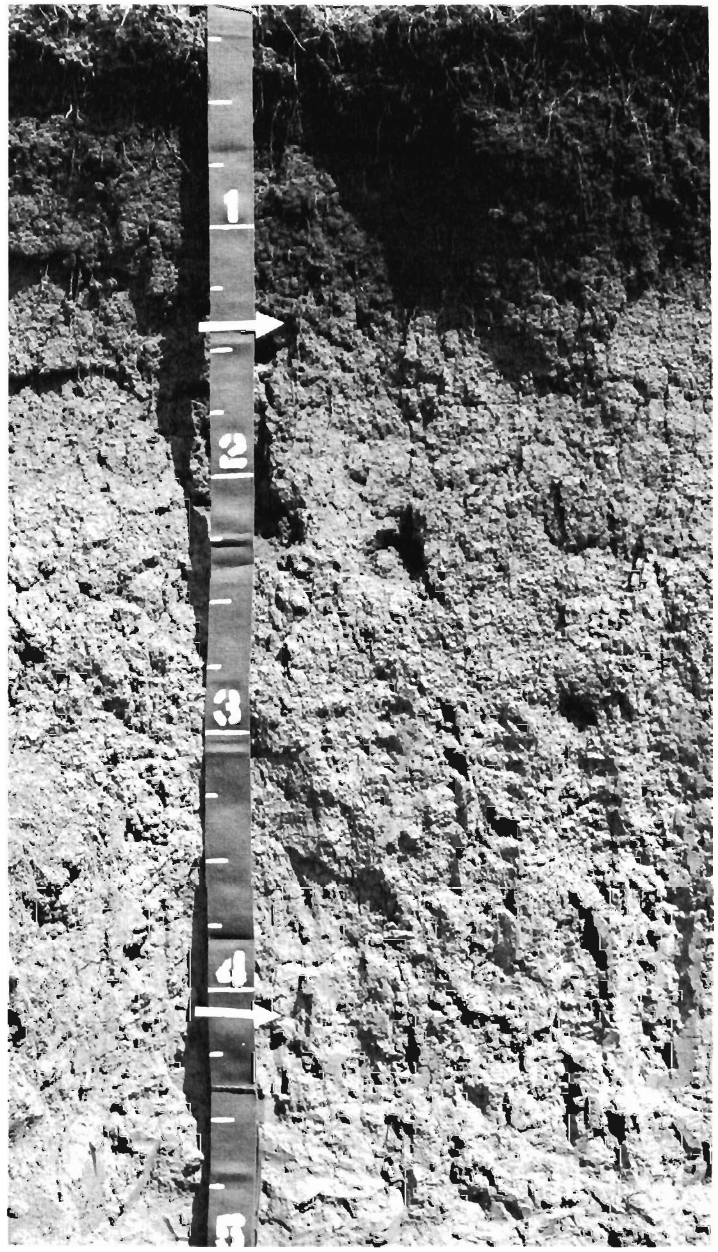

Figure 6.—**Profile of Moody silty clay loam, a deep soil easily penetrated by roots.**

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam; very dark brown (10YR 2/2) moist; weak moderate and fine granular structure; hard, firm; neutral; abrupt smooth boundary.

A12—6 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam; very dark brown (10YR 2/2) moist; weak coarse blocky structure parting to moderate medium and fine granular; hard, firm; few fine pores; slightly acid; gradual smooth boundary.

B21—11 to 22 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure parting to moderate medium and fine granular; hard, firm; few fine pores; slightly acid; gradual smooth boundary.

B22—22 to 32 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; faint coatings common in voids and on vertical faces of peds; common fine pores; neutral; gradual smooth boundary.

B23—32 to 42 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm; few fine pores; faint coatings common in voids and on vertical faces of peds; mildly alkaline; gradual smooth boundary.

C1—42 to 52 inches; brown (10YR 5/3) light silty clay loam, pale brown (10YR 6/3) moist; few fine faint strong brown (7.5YR 5/6) and gray (5Y 5/1, moist) mottles; weak medium and fine subangular blocky structure; hard, friable; faint coatings common in voids and on vertical faces of peds; few fine pores; violent effervescence; mildly alkaline; gradual smooth boundary.

C2—52 to 60 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) moist; few fine faint gray (5Y 5/1) and strong brown (7/5YR 5/6, moist) mottles; massive; hard, very friable; segregated lime deposits in root channels and a few lime concretions; few fine pores; moderately alkaline; violent effervescence.

The A horizon is 6 to 14 inches thick. Typically, it is silty clay loam but in places texture is silt loam. Where a part of the B horizon is mixed into the plowed layer by cultivation, the Ap horizon is brown or dark brown. An A3 horizon 4 to 8 inches thick is in some profiles. The B horizon is 24 to 42 inches thick. The Ap, A12, B21, and B22 horizons are 35 to 38 percent clay. No B3 horizon is present in some areas. Calcium carbonate concretions or disseminated lime is within a depth of 30 to 50 inches. Concretions are not present in all areas. The C horizon has gray and strong brown mottles.

The eroded Moody soils (MoC2 and MoD2) have a lighter colored, thinner surface layer than is in the defined range for the Moody series.

Moody soils are near Crofton and Nora soils. They have a thicker and more clayey B horizon than Nora soils, and lime is deeper in the profile of Moody soils than it is in the profile of Nora and Crofton soils. Moody soils contain more clay between depths of 10 and 40 inches than Crofton soils and, unlike Crofton soils, Moody soils have a B horizon.

Mo—Moody silty clay loam, 0 to 2 percent slopes. This deep soil is in the loess uplands. It is on level to nearly level, wide ridgetops. The areas are irregular in shape and are 10 to 40 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is very dark brown and slightly thicker. The subsoil contains slightly more clay than the one in the representative soil, and the depth to lime is slightly greater.

Included with this soil in mapping were a few small areas of Moody soils that have a surface layer 6 inches thick. Small swalelike or depressional areas are indicated on the soil map by a special symbol.

Runoff is slow. Permeability is moderately slow. The erosion hazard is moderate. All crops suited to the county grow well in this soil. The organic-matter content is moderate, and fertility is medium. Workability is good.

Most areas of this soil are cultivated. Only a few areas are in grass. Both dryland and irrigation management are used. Corn, oats, soybeans, and alfalfa hay are the main crops. Capability units I–1 dryland and I–3 irrigated; Silty range site.

MoC—Moody silty clay loam, 2 to 6 percent slopes. This deep, gently sloping soil is in the loess uplands. It is on smooth, very slightly convex, wide ridgetops. The areas are 20 to 60 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping were a few small areas of eroded Crofton silt loam that has convex slopes and Nora silty clay loam on narrow ridgetops.

Runoff is medium. The erosion hazard is moderate. In places small rills form that are plowed in with each successive tillage. Workability is fair. The organic-matter content is moderate, and fertility is medium.

Most areas of this soil are cultivated. Both dryland and irrigation management are used. Corn, oats, soybeans, and alfalfa hay are the main crops. Capability units IIe–1 dryland and IIIe–3 irrigated; Silty range site.

MoC2—Moody silty clay loam, 2 to 6 percent slopes, eroded. This deep, gently sloping soil is in the loess uplands. It is on slightly convex, narrow ridgetops. The areas are 10 to 40 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is dark brown silty clay loam and is about 6 inches thick. Material from the surface layer and upper part of the subsoil have been mixed during tillage. This soil has more clay in the surface layer than the uneroded Moody soils. Depth to lime is 36 to 48 inches. Included in mapping were small areas of Crofton silt loam.

Runoff is medium on this soil, and erosion is the principal hazard. Fertility is medium. Workability is not as good as in the uneroded Moody soils because of the low organic-matter content and fertility. Preventing further loss of soil and plant nutrients through erosion is the main concern of management.

Most areas of this soil are cultivated. Both dryland and irrigation management are used. Corn, oats, soybeans, and alfalfa hay are the main crops. Capability units IIe–8 dryland and IIIe–3 irrigated; Silty range site.

MoD—Moody silty clay loam, 6 to 11 percent slopes. This deep, strongly sloping soil is in the loess uplands. It is on slightly concave side slopes that parallel intermittent drainageways and also at the heads of drainageways. The areas are generally long and narrow and are 20 to 40 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is slightly thinner and is dark brown. The subsoil contains slightly less clay than the representative soil. Some small areas have lime below a depth of 50 inches.

Included with this soil in mapping were small areas of Crofton silt loam and Nora silty loam that have slightly convex slopes and areas of Alcester silt loam, 2 to 6 percent slopes, along drainageways. In a few small areas the soil is eroded and has low fertility.

Runoff is medium. The erosion hazard is severe. Fertility is medium, and organic-matter content is moderate. Workability is good over most of the areas, but it is only fair where material of the subsoil has mixed with that of the plowed layer.

In most areas this soil is cultivated. Both dryland and irrigation management are used. Corn, oats, soybeans, and alfalfa hay are the main crops. Capability units IIIe-1 dryland and IVe-3 irrigated; Silty range site.

MoD2—Moody silty clay loam, 6 to 11 percent slopes, eroded. This soil is in the loess uplands. It is on ridgetops that are slightly convex and at the heads of drainageways. Areas are 10 to 30 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is dark brown silty clay loam about 7 inches thick and a subsoil that is slightly less clayey. Material from the upper part of the subsoil has been mixed with the remaining material of the surface layer during cultivation. This soil has a more clayey surface layer than the uneroded Moody soils. Depth to lime is 36 to 48 inches.

Included with this soil in mapping were small areas of Crofton silt loam. Runoff is rapid, and erosion is the principal hazard. Fertility and organic-matter content are low. Workability is fair. Preventing loss of soil and plant nutrients by erosion is the main concern of management.

Most areas of this soil are cultivated. Both dryland and irrigation management are used. Corn, oats, soybeans, and alfalfa hay are the principal crops. A few areas are in pasture. Capability units IIIe-8 dryland and IVe-3 irrigated; Silty range site.

MsC—Moody-Leisy complex, 2 to 6 percent slopes. These gently sloping soils are on broad divides. They are in the sand-loess transition area adjacent to Logan Valley. The areas are 20 to 100 acres in size. This mapping unit contains two main soils: Moody silty clay loam on the lower areas and Leisy sandy loam on the higher areas. The proportions of each vary from one area to another. In most individual areas the Moody soil occupies 50 to 70 percent of the landscape, but in a few areas the Leisy soil occupies the larger percentage of the landscape.

The profiles of the Moody and Leisy soils in this unit are similar to the ones described as representative of their respective series. The surface layer of the Moody soil in this complex, however, contains more sand than the one in the profile that is representative of the Moody series.

Included with this complex in mapping were small areas of Ortello sandy loam and Thurman loamy sand, both at slightly higher elevations than the nearby Moody and Leisy soils.

Runoff is medium on these soils. Soil blowing is a hazard where the surface layer is not adequately protected. Erosion is the main hazard in cultivated areas. Workability is good. Fertility is medium, and organic-matter content is moderate.

Most areas of this soil are cultivated. Both dryland and irrigated management are needed. Corn, oats, and alfalfa hay are the main crops. Capability units IIe-3 dryland and IIe-5 irrigated; Silty range site.

MsD—Moody-Leisy complex, 6 to 11 percent slopes. These soils are along side slopes of the uplands. This mapping unit contains two main soils: Moody silty clay loam and Leisy sandy loam. These soils are in mixed patterns, and most areas of the individual soils are too small to be mapped separately. The proportions of each vary from one area to another. The Moody soil is dominant, however, and makes up 40 to 60 percent of each individual area. Relationship of the Moody soil to the Leisy soil is not consistent in the landscape.

These soils have a profile similar to the one described as representative of their respective series. The surface layer of these soils varies in texture and thickness, however, from one area to another. In this mapping unit are small areas where the soil is eroded. In these areas the surface layer is lighter colored than the one described in the representative profile. Most of the original surface layer has been removed by erosion. The present surface layer is a mixture of the original surface layer and the upper part of the subsoil.

Included with this complex in mapping were small areas of Thurman loamy sand, generally on the highest part of the landscape.

Runoff is medium on these soils. Erosion is a severe hazard in cultivated areas. Soil blowing is a hazard where the surface layer is not adequately protected. Workability is good. Small rills form readily where the surface layer is sandy loam, but successive cultivations remove them readily. Fertility is medium, and organic-matter content is moderate.

Most areas of these soils are cultivated. Smaller areas are in pasture. Corn, oats, and alfalfa hay are the main crops. Capability units IIIe-3 dryland and IIIe-5 irrigated; Silty range site.

Nora series

The Nora series consists of deep, gently sloping to steep, well drained soils on uplands. These soils formed in loess (fig. 7).

In a representative profile the surface layer is friable, dark grayish brown silt loam 12 inches thick. The subsoil, 18 inches thick, is brown, friable silt loam in the upper part and grayish brown, friable silt loam in the lower part. A zone of calcium carbonate accumulation is at a depth of 20 inches. It is grayish brown silt loam, 10 inches thick. The underlying material is brown, calcareous silt loam to a depth of 60 inches.

Permeability is moderate. Available water capacity is high. The organic-matter content is moderate or low, and natural fertility is medium. Workability is good. Moisture is released readily to plants.

The gently sloping and strongly sloping Nora soils are suited to cultivated crops under both dryland and irrigation management. They are also suited to trees and shrubs in windbreaks. All areas of Nora soils are suited to grass, wildlife habitat, and recreation.

Representative profile of Nora silt loam, 11 to 15 percent slopes, in a cultivated field, 1,220 feet west, 1,350 feet north of southeast corner of sec. 29, T. 30 N., R. 6 E.:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, friable; moderately alkaline; abrupt smooth boundary.

A12—7 to 12 inches; dark grayish brown (10YR

Figure 7.—**Profile of Nora silt loam. Lime occurs at a depth of about 15 inches.**

4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; moderately alkaline; clear smooth boundary.

B2—12 to 20 inches; brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; moderately alkaline; clear smooth boundary.

B3ca—20 to 30 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; slightly hard, friable; many medium lime concretions; violent effervescence; moderately alkaline; clear smooth boundary.

C—30 to 60 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable; common fine lime segregations; violent effervescence; moderately alkaline.

The A horizon is very dark grayish brown, dark grayish brown, or very dark brown and is 7 to 16 inches thick. It is light silty clay loam or silt loam. The B2 horizon is brown or very dark grayish brown to dark brown. It is silt loam or light silty clay loam and is 18 to 32 percent clay. The B3ca horizon is dark grayish brown to dark brown. Concretions are few to many. The B3ca horizon, however, has few lime concretions but contains much disseminated lime. The B horizon is 9 to 24 inches thick. Depth to calcareous material is 12 to 30 inches.

In map units Nora silt loam, 11 to 15 percent slopes; Nora silty clay loam, 2 to 6 percent slopes, eroded; and Nora silty clay loam, 6 to 11 percent slopes, eroded; the surface layer is lighter colored than the defined range of the series.

Nora soils are near Crofton and Moody soils. Unlike the Crofton soils the Nora soils have a B horizon, and lime is at a greater depth. Nora soils have a thinner B horizon with less clay, and depth to lime is less than in Moody soils.

NoE—Nora silt loam, 11 to 15 percent slopes. This deep, moderately steep soil is generally below Crofton soils on side slopes of the loess uplands. Slopes are concave. The areas are irregular in shape and 100 to 300 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Alcester and Moody soils at the base of slopes, and Crofton soils on upper convex ridges. Glacial till outcrops are indicated on the soil map by a special spot symbol.

Sheet erosion and rills are serious hazards on this soil. Runoff is rapid. Organic-matter content is moderate, and fertility is medium.

Most areas of this soil are cultivated. Corn, soybeans, and alfalfa hay are the main crops. Capability unit IVe–1 dryland; Silty range site.

NoE2—Nora silt loam, 11 to 15 percent slopes, eroded. This deep, moderately steep soil is on smooth uplands. It is on side slopes below Crofton soils. The areas are 20 to 40 acres in size.

This soil has a profile similar to the one described as representative of the series except that erosion has thinned and lightened the surface layer in 60 percent of the areas. The brown silt loam surface layer is only about 6 inches thick in these areas. Elsewhere in this mapping unit, the surface layer is 6 to 12 inches thick. Depth to lime ranges from 10 inches in convex areas to 24 inches in concave areas.

Included with this soil in mapping were small areas of Crofton soil that have higher, more convex slopes; Moody soils that have lower slopes; and Alcester soils on concave foot slopes. Glacial till outcrops are indicated on the detailed soil map by a spot symbol.

Water erosion is a very severe hazard on this soil. Rills and small gullies are commonly plowed in with each successive tillage. Organic-matter content and fertility are low. Runoff is rapid.

Most areas of this soil are cultivated. Corn, soybeans, oats, and alfalfa hay are the main crops. Capability unit IVe–8 dryland; Silty range site.

NoF—Nora silt loam, 15 to 30 percent slopes. This deep, steep soil is on ridgetops in the loess uplands. The areas are irregular in shape and 20 to 70 acres in size.

This soil has a profile similar to the one described as representative for the series except for a surface layer and subsoil that are slightly thinner. The surface layer ranges from 6 inches thick in convex areas to 20 inches in concave areas. Depth to lime is 12 to 30 inches. A zone of lime accumulation is not present in all areas.

Included with this soil in mapping were small areas of Alcester soils with concave slopes. Also included were areas of Nora soils with very steep north- or east-facing slopes, and areas of Crofton soils with sharply convex slopes.

Water erosion is the principal hazard on this soil. Organic-matter content is moderate. Fertility is medium in most areas of this soil, but it is low in small, eroded areas. Runoff is rapid. Maintaining and improving vegetative cover is an important concern of management.

Almost all areas of this soil are in native grass or deciduous trees. Capability unit VIe–1 dryland; Silty range site.

NrC—Nora silty clay loam, 2 to 6 percent slopes. This soil is on narrow, convex ridgetops of the loess uplands. The areas are 10 to 20 acres in size.

This soil has a profile similar to the one described as representative for the series except for a surface layer that is darker and is silty clay loam. The subsoil contains more clay than the one in the representative soil, and lime is deeper. It ranges from a depth of 15 to 35 inches. In areas of this soil in the northern part of the county, the surface layer and subsoil contain from 3 to 7 percent more clay and are more friable than in areas in the southern part.

Included with this soil in mapping were small areas of Moody soils that have lower, more concave slopes, and Crofton soils that have upper, more convex slopes.

Water erosion is the principal hazard on this soil. Organic-matter content is moderate, and fertility is medium. Workability is only fair because of the moderately high clay content in the surface layer. Reducing runoff, water erosion, and increasing organic-matter content are the main concerns of management.

Almost all areas of this soil are cultivated. Corn, oats, and alfalfa hay are the main crops. Both dryland and irrigation management are used. Capability units IIe–1 dryland and IIIe–3 irrigated; Silty range site.

NrC2—Nora silty clay loam, 2 to 6 percent slopes, eroded. This gently sloping soil is on ridgetops in the loess uplands. Slopes are short and convex. The areas are 10 to 20 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is silty clay loam, is lighter, and is only about 6 inches thick. The subsoil contains slightly more clay than the one in the representative soil. Part of the subsoil is mixed into the plow layer, and is grayish brown in color. The plow layer contains more clay than in uneroded Nora soils. Depth to lime is 10 to 20 inches. In areas of this soil in the northern part of the county, the surface layer and subsoil are 3 to 7 percent more clay and are more friable than in areas in the southern part.

Included with this soil in mapping were small areas of Moody soils on broad drainage divides, and areas of Crofton soils with rounded, convex slopes. Little or no erosion has occurred on about 20 percent of the area.

Water erosion is the principal hazard. Fertility and organic-matter content are low. Workability is only fair because of the moderately high amount of clay in the surface layer. Reducing runoff and water erosion and increasing the organic-matter content are the main concerns of management. Small rills caused by water erosion are commonly plowed in with each successive tillage.

Almost all areas of this soil are cultivated. Corn, oats, and alfalfa are the main crops. Both dryland and irrigation management are used. Some small areas are in soybeans. Capability units IIe–8 dryland and IIIe–3 irrigated; Silty range site.

NrD—Nora silty clay loam, 6 to 11 percent slopes. This strongly sloping soil is on ridgetops in the loess uplands. The areas are irregular in shape and 10 to 20 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is silty clay loam. The subsoil contains slightly more clay than the one in the representative soil. Depth to lime ranges from 10 to 20 inches. In areas of this soil in the northern part of the county, the surface layer and subsoil contain 3 to 7 percent more clay and are more friable than in areas in the southern part.

Included with this soil in mapping were small areas of Crofton soils that have convex slopes, and that are generally on the highest part of the landscape.

Erosion is a severe hazard in cultivated areas. In places, small rills form after rains and these are plowed in with each successive tillage. Organic-matter content is moderate, and fertility is medium. Runoff is medium. Reducing runoff and maintaining the organic-matter content are the main concerns of management.

Most areas of this soil are cultivated. Corn, oats, and alfalfa are the main crops. Both dryland and irrigation management are used. Capability units IIIe–1 dryland and IVe–3 irrigated; Silty range site.

NrD2—Nora silty clay loam, 6 to 11 percent slopes, eroded. This deep, strongly sloping soil is on ridgetops of drainage divides in the loess uplands. Slopes are short and convex. The areas are irregular in shape and are 10 to 25 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is thinner, about 6 inches thick, and is silty clay loam. The subsoil contains more clay than the one in the representative soil. In areas of this soil in the northern part of the county, the surface layer and subsoil contain from 3 to 7 percent more clay and are more friable than in areas in the southern part. Part of the upper subsoil is mixed into the plow layer giving it a dark grayish brown to brown color. Depth to lime is 10 to 24 inches.

Included with this soil in mapping were small areas of Moody soils on lower parts of the landscape, and areas of Crofton soils with convex slopes on higher parts.

Water erosion is the principal hazard on this soil. Fertility and organic-matter content are low. Workability is fair because of the moderately high clay content in the surface layer. Increasing the organic-matter content and reducing runoff are the main concerns of management. Runoff is medium.

Almost all areas of this soil are cultivated. Corn, oats, and alfalfa hay are the main crops. Both dryland and irrigation management are used. Some areas are in tame grasses and are used for pasture. Capability units IIIe–8 dryland and IVe–3 irrigated; Silty range site.

NsE—Nora-Alcester silt loams, 11 to 15 percent slopes. These soils are on side slopes in the loess uplands, in the bluff area along the Missouri River Valley. They are in slightly concave areas below Crofton soils but they are above the gently sloping Alcester soils. The areas are 5 to 50 acres in size. This mapping unit contains two main soils: Nora silt loam and Alcester silt loam. The Nora soil makes up about 65 percent of each individual area and is on the upper convex part of moderately steep slopes. The Alcester soil makes up about 35 percent of each area, and is at lower elevations along small, short side slopes.

The Nora soil has a profile similar to the one described as representative of the series except for a surface layer that is thicker. The Alcester soil has a profile similar to the one described as representative of the series except that lime is nearer the surface, from 20 to 40 inches in depth.

Included with this unit in mapping were small areas of Crofton soils that have convex slopes. Also included were outcrops of shale. These are indicated on the soil maps by a spot symbol.

Water erosion is a severe hazard on areas of this mapping unit. Small rills form in places, and are plowed in with each successive tillage. Runoff is rapid. Fertility is medium, and organic-matter content is moderate.

Some areas of these soils are cultivated. Oats, corn, and alfalfa hay are the main crops. The remainder is in grass or trees. Capability unit IVe–1 dryland; Silty range site.

NsF—Nora-Alcester silt loams, 15 to 30 percent slopes. These soils are along side slopes that drain the bluff area of the uplands along the Missouri River Valley. The areas are steep and irregular in shape.

Nora silt loam and Alcester silt loam are the main soils in this mapping unit. The proportions of each soil vary from one area to another. Nora soils make up about 30 to 60 percent of each mapped area and are on the upper, convex part of the landscape. The Alcester soils make up about 30 to 50 percent of each area and are on the lower part of the landscape that is generally not so steep as the part Nora soils are on.

The Nora soil has a thicker surface layer than is described in the representative profile. Depth to lime in the Alcester soils is shallower than is described in the representative profile of that series; the depth to lime ranges from 15 to 30 inches.

Included with this unit in mapping were small areas of Crofton soils that have convex slopes. Small outcrops of shale are indicated on the soil map by a spot symbol.

Water erosion is the principal hazard. Fertility is medium over most areas of this unit, but is low in a few eroded areas. Runoff is rapid. Organic-matter content is moderate.

Almost all areas of this unit are in native grass or deciduous trees. Capability unit VIe–1 dryland; Silty range site.

Onawa series

The Onawa series consists of deep, nearly level, somewhat poorly drained soils on bottom lands of the Missouri River Valley. A seasonal water table is at a high of about 3 or 4 feet in spring. These soils flood occasionally.

In a representative profile the surface layer is firm, dark gray silty clay 7 inches thick. The underlying material is light gray, silty clay in the upper part; light brownish gray, silty clay loam in the middle part; and light brownish gray, mottled, light silt loam in the lower part. The soil is calcareous below a depth of 7 inches.

Permeability is slow in the upper part, and moderate below a depth of about 21 inches. Available water capacity is high. The organic-matter content is moderately low, and natural fertility is medium. Moisture is released readily to plants.

Onawa soils are suited to cultivated crops under both dryland and irrigated management. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Onawa silty clay, 0 to 2 percent slopes, in a cultivated field, 1,400 feet east and 150 feet north of the southwest corner of sec. 21, T. 31 N., R. 6 E.:

Ap—0 to 7 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium granular structure; hard, firm; slight effervescence; moderately alkaline; abrupt smooth boundary.

C1g—7 to 18 inches; light gray (10YR 6/1) silty clay, dark grayish brown (2.5Y 4/2) moist, crushed; common fine prominent dark yellowish brown (10YR 4/4) and dark reddish brown (5YR 3/4, moist) mottles; hard, firm; violent effervescence; moderately alkaline; clear smooth boundary.

C2g—18 to 21 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist, crushed; few fine distinct yellowish brown (10YR 5/6) and dark brown (7.5YR 4/4, moist) mottles in root channels; moderate medium granular structure; slightly hard, firm; violent effervescence; moderately alkaline; abrupt smooth boundary.

IIC2g—21 to 60 inches; light brownish gray (2.5Y 6/2) light silt loam, grayish brown (2.5Y 5/2) moist; few fine distinct yellowish brown (10YR 5/6) and dark brown (7.5YR 4/4, moist) mottles in root channels and in horizontal strata; massive; a few lenses of very fine sand; soft, very friable; violent effervescence; moderately alkaline.

The Ap horizon is 6 to 8 inches thick and is very dark gray or very dark grayish brown. It is mildly to moderately alkaline. The C1g horizon ranges from grayish brown to light gray and is 8 to 24 inches thick. Typically, it is silty clay but includes areas of clay. In places, a layer of silty clay loam, generally less than 6 inches thick, is between the C1g and IIC2g horizons. The IIC2g horizon is light brownish gray or grayish brown in the upper part and light yellowish brown or light brownish gray in the lower part. Depth to the IIC2g horizon ranges from 18 to 30 inches. These horizons are calcareous and contain few to common, fine to medium, and faint to distinct dark brown mottles. The lower part of the C horizon is typically silt loam, but includes very fine sandy loam. Thin strata, less than 6 inches thick, of finer or coarser textures occur in places.

Onawa soils are near Albaton and Haynie soils. They are silt loam below a depth of about 21 inches, whereas Albaton soils are clay or silty clay below this depth. Onawa soils have more clay in the upper part of the profile than Haynie soils.

On—Onawa silty clay, 0 to 2 percent slopes. This deep, nearly level soil is in swales which were formerly stream channels and in large, broad areas of accretion land. The areas are 20 to 70 acres in size.

Included with this soil in mapping were small areas that have a layer of silty clay loam overwash material less than 10 inches thick. Also included were a few areas of Albaton soils.

Wetness is a hazard on this soil. The high water table is at a depth of 3 or 4 feet in low-lying areas in spring. Even with improved drainage, cultivation is delayed by soil wetness and occasional flooding in some seasons. The clayey surface layer is difficult to work and a good seedbed is difficult to obtain. These soils can be cultivated satisfactorily only within a narrow range of moisture content. Maintaining good tilth is a major concern of management. Runoff is slow.

Most areas of this soil are cultivated. Corn, soybeans, and alfalfa hay are the main crops. A few areas are in grass and some are in trees. Both dryland and irrigated management are used. Capability units IIw–1 dryland and IIw–1 irrigated; Clayey Overflow range site.

Ortello series

The Ortello series consists of deep, gently sloping, well drained soils on uplands of sand-loess transition areas and on stream terraces along North Logan Creek. These soils formed in wind deposited material that is reworked from deposits of glacial outwash.

In a representative profile the surface layer is very friable, dark grayish brown sandy loam about 12 inches thick. The subsoil is very friable sandy loam about 30 inches thick. It is dark grayish brown in the upper part; grayish brown in the middle part; and brown in the lower part. The underlying material is brown loamy sand, to a depth of 60 inches.

Permeability is moderately rapid. Available water capacity is moderate. Organic-matter content is moderate, and the natural fertility level is medium. These soils absorb moisture easily and release it readily to plants.

Ortello soils are suited to cultivated crops, grass, trees and shrubs. They are also suited to wildlife habitat and recreation.

Representative profile of Ortello sandy loam, 2 to 6 percent slopes, in native grass, 1,400 feet east and 90 feet south of the northwest corner of sec. 11, T. 28 N., R. 4 E.:

A11—0 to 6 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak medium blocky structure parting to weak medium and fine granular; slightly hard, very friable; slightly acid; clear smooth boundary.

A12—6 to 12 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak medium and fine granular; slightly hard, very friable; slightly acid; clear smooth boundary.

B1—12 to 17 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; slightly acid; clear smooth boundary.

B2—17 to 30 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; slightly acid; clear smooth boundary.

B3—30 to 42 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; neutral; clear smooth boundary.

C—42 to 60 inches; brown (10YR 5/3) loamy sand, brown (10YR 4/3) moist; single grained; loose; neutral.

The A horizon is 10 to 16 inches thick. Typically it is sandy loam but ranges to fine sandy loam. It is dark grayish brown to very dark grayish brown. The B horizon is 16 to 32 inches thick and ranges from dark grayish brown in the upper part to brown in the lower part. It is light to heavy sandy loam that commonly becomes coarser as depth increases. Typically, the C horizon is loamy sand and ranges to sandy loam and fine sandy loam.

Ortello soils are near Bazile and Thurman soils. They have more sand and less clay in the B horizon than Bazile soils. They have less sand at depths of 10 to 40 inches than Thurman soils.

OrC—Ortello sandy loam, 2 to 6 percent slopes. This gently sloping soil is on stream terraces on the north side of North Logan Creek and also on the adjoining uplands. The areas are convex, long, and narrow in shape, and 5 to 20 acres in size.

Included with this soil in mapping were small areas of Bazile and Thurman soils. Also included were small areas where most of the surface layer has been removed by soil blowing. These areas are on the highest parts of the landscape.

The moderately coarse surface layer and a moderate available water capacity are the main limitations in cultivated areas. Soil blowing is the main hazard. This soil is droughty where dryfarmed.

Most areas of this soil are cultivated, mainly with the adjoining Bazile or Moody soils. Because areas of this soil are small and occur in intricate patterns, this soil is ordinarily farmed or managed with other soils. Both dryland and irrigated management are used. Capability units IIIe–3 dryland and IIIe–8 irrigated; Sandy range site.

Percival series

The Percival series consists of deep, nearly level, somewhat poorly drained soils that formed in clayey and sandy alluvium. These soils are clayey in the upper part of the profile, and sandy in the lower part. They are on recent accretion land on bottom lands of the Missouri River Valley. These soils have a fluctuating seasonal water table that is at a high of about 1 to 3 feet in spring and at a low of about 6 feet late in summer. The water table is slightly higher in former river channels and flooding is occasional.

In a representative profile the surface layer is firm, gray silty clay about 6 inches thick. The underlying material, to a depth of 22 inches, is grayish brown, mottled silty clay. Below this, to a depth of 60 inches, is light brownish gray, mottled fine sand. The soil is calcareous throughout the profile.

Permeability is slow in the upper clayey part and rapid in the lower, sandy part. Available water capacity is low. The organic-matter content is moderately low, and natural fertility is low. Moisture is released slowly to plants. These soils are droughty during periods of low rainfall.

Percival soils are suited to cultivated crops under both dryland and irrigation management. They are also suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Percival silty clay, 0 to 2 percent slopes, in a cultivated field, 4,000 feet north and 3,000 feet east of the southwest corner of sec. 31, T. 32 N., R. 5 E.:

Ap—0 to 6 inches; gray (10YR 5/1) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; very hard, firm; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1g—6 to 22 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; few fine distinct, dark reddish brown (5YR 3/4) and strong brown (7.5YR 5/6, moist) mottles; weak fine blocky and strong very fine subangular blocky structure; very hard, firm; very few fine pores; violent effervescence; moderately alkaline; abrupt smooth boundary.

IIC2—22 to 60 inches; light brownish gray (2.5Y 6/2) fine sand, grayish brown (2.5Y 5/2) moist; few fine distinct strong brown (7.5YR 5/6) and dark brown (7.5YR 4/4, moist) mottles; single grained; loose; violent effervescence; moderately alkaline.

The A horizon is 5 to 8 inches thick and is dark gray or gray silty clay. It is mildly or moderately alkaline. The C1g horizon is dark grayish brown or grayish brown. The C1g horizon has common and fine or medium and faint mottles that are dark reddish brown or dark brown. Typically, it is silty clay, but ranges to clay. The clayey material is abruptly underlain by a IIC horizon of loamy very fine sand to fine sand at a depth of 15 to 30 inches. The IIC horizon is grayish brown or light brownish gray.

Percival soils are near Onawa and Sarpy soils. Percival soils have more sand in the lower C horizon than Onawa soils. They are more poorly drained than Sarpy soils and have more clay in the upper part of the profile than those soils.

Pe—Percival silty clay, 0 to 2 percent slopes. This deep soil is on recent accretion land on bottom lands of the Missouri River Valley. This soil is near former channels of the Missouri River, and many areas are in swales. The areas are 20 to 40 acres in size.

Included with this soil in mapping were a few areas that have as little as 12 inches of clayey material over the underlying fine sand, and areas that have a silty layer, about 12 inches thick, between the clayey and sandy underlying material. Also included were a few areas that have very slow surface drainage, and a few areas where the water table is near the surface in spring. These areas are in old swales of former channels.

The moderately high water table makes this soil wet in spring. Occasional flooding is also a hazard. A clayey surface layer, slow runoff, ponding of water on the surface in some areas and the low available water capacity are limitations of this soil in cultivated areas. The water table subsides during the growing season, and droughtiness is a hazard in summer. Tilth is poor. Workability is difficult because this soil is hard when dry and sticky when wet.

Almost all areas of this soil are cultivated. Corn, soybeans, and alfalfa hay are the main crops. Both dryland and irrigated management are used. Capability units IIw–1 dryland and IIw–1 irrigated; Clayey Overflow range site.

Riverwash

Riverwash consists of very poorly drained, nearly level and very gently sloping, sandy material. These areas occur as sand bars in channels of the Missouri River Valley. They are subject to frequent flooding. The water table fluctuates between a depth of 0 to 2 feet in early spring to a depth of 4 feet in late fall. Low areas that are former stream channels have water on the surface during most of the year, and all areas are subject to frequent flooding.

This material is typically fine sand and medium sand to a depth of 5 feet. Stable areas have a slightly darkened surface layer, generally only 3 or 4 inches thick. This material varies in color and texture. Permeability is rapid and available water capacity is low in most areas. The organic-matter content is very low, and fertility is low. The unsaturated profile is moderately alkaline.

Almost all areas are used for wildlife habitat. Most areas are barren of vegetative growth. Sparse to thick areas of small willow trees and small cottonwood trees are on the higher, drier areas. The low areas that are former stream channels have a marsh-type vegetation, mainly cattails, rushes, and reedgrass.

Riverwash provides areas for wildlife habitat. It is too wet to grow the commonly cultivated crops. The potential for recreation is fair.

In Dixon County, Riverwash is mapped only in a complex with Sarpy soils. Sarpy soils are better drained and have a darker surface layer. Unlike areas of Riverwash, most areas of Sarpy soils support vegetation.

Sarpy series

The Sarpy series consists of deep, nearly level to gently sloping, excessively drained soils on bottom lands of the Missouri River Valley. These soils formed in calcareous alluvium (fig. 8). The topography is dune-like in places. Flooding is frequent on low-lying areas of the soil.

In a representative profile the surface layer is loose, pale brown loamy fine sand about 6 inches thick. The upper part of the underlying material is pale brown loamy fine sand 6 inches thick. Beneath this is pale brown fine sand to a depth of 60 inches. The soil material is calcareous throughout the profile.

Permeability is rapid. Available water capacity is low. The organic-matter content is low or very low, and natural fertility is low.

Some areas of Sarpy soils are suited to cultivated crops under both dryland and irrigated management. The areas that are associated with Riverwash, however, are not suited to cultivated crops. Sarpy soils are suited to grass, trees and shrubs, wildlife habitat, and recreation.

Representative profile of Sarpy loamy fine sand, 0 to 2 percent slopes, in tame grass, near the center of sec. 2, T. 90 N., R. 50 W.:

Ap—0 to 6 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; loose; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—6 to 12 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak medium subangular blocky structure; loose; strong effervescence; moderately alkaline; abrupt smooth boundary.

C2—12 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; strong effervescence; moderately alkaline.

The A horizon is 4 to 10 inches thick. It ranges from pale brown to dark brown and is loamy fine sand or fine sand. The A horizon is mildly or moderately alkaline and is calcareous. The C1 horizon is pale brown or grayish brown, loamy fine sand or fine sand. The C2 horizon is pale brown or brown loamy fine sand, or fine sand. In some places, thin layers of finer textured material are in the underlying material.

In Dixon County, Sarpy soils have slightly less rainfall than is defined as the range for the series.

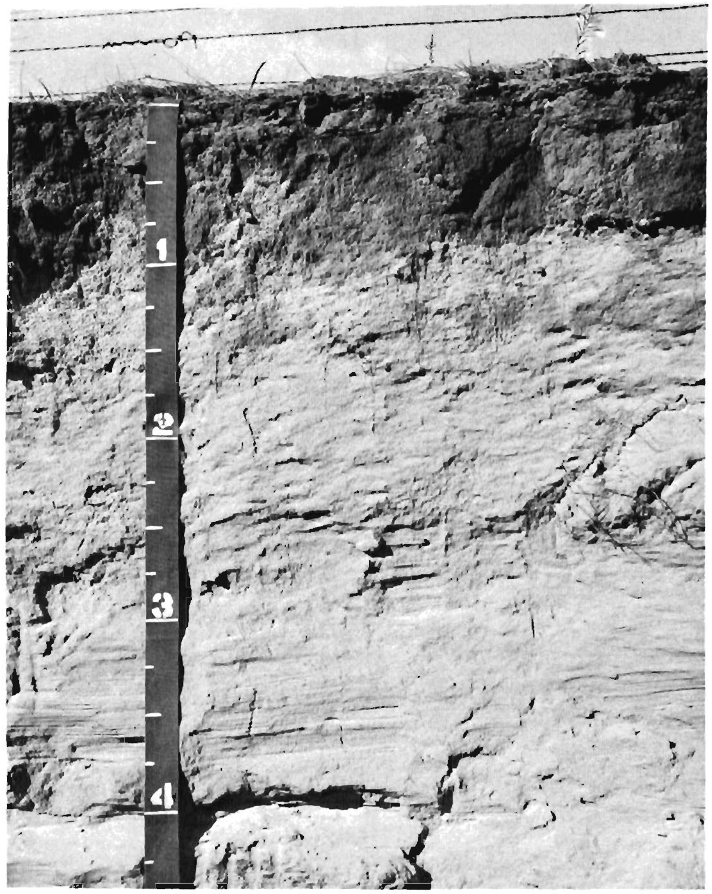

Figure 8.—**Profile of Sarpy soil. This excessively drained sandy soil is calcareous at the surface.**

Sarpy soils are near Haynie, Grable, and Percival soils, and are also near Duneland and Riverwash. They have more sand in the C horizon than Haynie soils. Except for the overwash phase, Sarpy soils have more sand in the upper part of the profile than Percival and Grable soils. Unlike Duneland and Riverwash, Sarpy soils have a darkened surface layer, and they are not so wet or flooded as frequently as Riverwash.

Sa—Sarpy loamy fine sand, 0 to 2 percent slopes. This deep, nearly level sandy soil is on bottom lands of the Missouri River Valley. Most areas are smooth, but a few have a low hummocky landscape. The areas are 10 to 40 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Grable soils. Also included were soils in low swales that have a thin, silty or clayey surface layer. Runoff is slow.

Because the soil material is coarse and cannot hold much available water, droughtiness is the main hazard to crops. This soil is susceptible to blowing. Flooding is frequent in low-lying areas. Maintaining a vegetative cover and increasing the low organic-matter content are main concerns of management.

Almost all areas of this soil are in grass. A few areas are cultivated. Corn and alfalfa hay are the main crops. Capability units IVs–7 dryland and IIIs–11 irrigated; Sandy Lowland range site.

Sc—Sarpy silty clay, overwash, 0 to 2 percent slopes. This deep, nearly level or gently undulating soil is on bottom lands of the Missouri River Valley. This soil formed in recent alluvium. The soil is in narrow strips that are closely associated with sandy or clayey soils. The areas are 10 to 80 acres in size.

This soil has a profile similar to the one described as representative of the series except for a very dark grayish brown silty clay surface layer that is 6 to 12 inches thick.

Included with this soil in mapping were a few areas of Haynie, Onawa, and Percival soils in lower, more poorly drained areas.

The low available water capacity results in a lack of adequate moisture for crops during the growing season. This is the main limitation when this soil is dryfarmed. Maintaining tilth is difficult because of the high clay content of the surface layer. The organic-matter content is low. Timeliness of tillage operations is an important concern of management. Farming operations are commonly determined by the limitations of the associated soils. Flooding is frequent.

Almost all areas of this soil are cultivated. Corn, soybeans, and alfalfa are the main crops. Both dryland and irrigated management are used. A few areas are still in native trees. Capability units IVs–2 dryland and IVs–1 irrigated; Clayey Overflow range site.

SdB—Sarpy-Duneland complex, 0 to 4 percent slopes. This complex is on bottom lands of the Missouri River Valley. The soil material was originally deposited by water and then later reworked by wind. Some small areas are nearly level but in others, the soil material has been blown about to form gently undulating and undulating knolls and low dunes. Slopes are short and irregular. The areas are 10 to 100 acres in size. The Sarpy soil makes up 70 percent of the mapping unit, and Duneland makes up about 30 percent.

The Sarpy soil has a profile similar to the one described as representative of the series except for a surface layer that is fine sand, is lower in organic-matter content and is lighter in color. Duneland is described under the heading Duneland. It makes up the highest areas on the landscape and is generally barren of vegetation. The Sarpy soils make up the lower, nearly level areas, and support thin stands of grasses and deciduous trees, mainly willows and eastern cottonwood.

Included with this complex in mapping were small areas that have a thin, clayey surface layer. A few areas are made up of sand mixed with fine gravel, and a few areas have small pebbles scattered on the surface.

The sandy texture of the soil, the very low organic-matter content, and the low available water capacity are the principal limitations of the soils in this complex. Soil blowing is a very severe hazard. Flooding is frequent on the Sarpy soils. Runoff is slow on these soils.

All areas of this complex serve as wildlife habitat and are used for recreation. Capability unit VIs–7 dryland; Sarpy soil is in Sandy Lowland range site and Duneland is in Sands range site.

SrB—Sarpy-Riverwash complex, 0 to 3 percent slopes. This complex is on bottom lands of the Missouri River Valley. In most places, it is adjacent to the present channel of the Missouri River. It is also in old channel areas that have been cut off from the river. Riverwash is in low areas and in sandbars that are surrounded by water and that are generally barren of vegetation. Sarpy soils are on relatively high parts of the landscape. Vegetation consists of grass and deciduous trees. Sarpy soils make up about 50 percent of the mapping unit, Riverwash makes up 30 percent and water areas make up the remaining 20 percent. These soils are so intermingled that it was not practical to map them separately. The areas are 40 to 500 acres in size.

The Sarpy soil has a profile similar to the one described as representative of the Sarpy series. Riverwash is described under the heading Riverwash.

Included with this complex in mapping were small areas that have a dark grayish brown, silty clay surface layer, 6 to 10 inches thick.

Frequent flooding on these areas and the high water table in the Riverwash are the main hazards. The frequency of flooding and the depth to the water table is controlled by large upstream dams that regulate the flow of water in the Missouri River. The organic-matter content is low on Sarpy soils and very low on Riverwash. Fertility is low in both soils.

Almost all the acreage of this complex is used as wildlife habitat or is in waste areas. About 50 percent of the acreage is vegetated, about 30 percent is barren, and the remaining 20 percent is areas of water. A few small areas are cultivated, but these soils are not suited to the commonly grown crops. These areas have good potential for recreation and habitat for wetland wildlife. Capability unit Vw–7 dryland; Sarpy soil is in Sandy Lowland range site; Riverwash is not assigned to a range site.

Thurman series

This series consists of deep, gently sloping to moderately steep somewhat excessively drained soils on uplands (fig. 9). These soils formed in material from glacial outwash that has been reworked by wind. Most areas of Thurman soils are on broad divides and areas that border upland drainageways. They are in the sand-loess transition area of the county. A few areas are on stream terraces.

In a representative profile the surface layer is very friable loamy sand, about 14 inches thick. The upper part is very dark grayish brown and the lower part is dark brown. The transition layer, between the surface layer and the underlying material, is brown loamy sand about 6 inches thick. The underlying material is pale brown sand to a depth of 60 inches.

Permeability is rapid. Available water capacity is low. The organic-matter content is low or very low, and fertility is low. These soils absorb moisture rapidly and release it readily to plants.

Thurman soils are well suited to native range. They are suited to cultivated crops under dryland management in areas where the surface layer is loamy sand and nearly level. They are suited to irrigated crops in areas where the surface layer is loamy sand and the slope is strongly sloping or less. Thurman soils are also

Figure 9.—**Profile of Thurman loamy sand. This sandy soil is weakly developed and leached of lime.**

suited to trees and shrubs, wildlife habitat, and recreation.

Representative profile of Thurman loamy sand, 2 to 6 percent slopes, in native grass 100 feet north and 100 feet west of the southeast corner of sec. 18, T. 29 N., R. 5 E.:

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, very dark brown (10YR 2/2) moist; weak medium granular structure; soft, very friable; slightly acid; gradual smooth boundary.

A12—8 to 14 inches; dark brown (10YR 3/3) loamy sand, very dark grayish brown (10YR 32) moist; weak coarse blocky structure parting to weak medium granular; soft, very friable; slightly acid; clear smooth boundary.

AC—14 to 20 inches; brown (10YR 5/3) loamy sand, dark grayish brown (10YR 4/2) moist; single grained; loose; slightly acid; gradual smooth boundary.

C—20 to 60 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grained; loose; neutral.

The A horizon is very dark grayish brown to grayish brown and is 10 to 20 inches thick. The AC horizon is 5 to 10 inches thick and ranges from brown to dark gray. The C horizon is sand or loamy sand to a depth of 60 inches.

Thurman sand (TaE), and the eroded Thurman loamy sands (ThC2 and ThD2) have a thinner and lighter colored surface layer than is defined as the range for the series.

Thurman soils are near Bazile, Leisy, and Ortello soils in the landscape. Thurman soils are sandy between depths of 10 and 40 inches, and have more sand throughout their profiles than Ortello soils. Unlike the sandy Thurman soils, Bazile and Leisy soils have a silty B horizon.

TaE—Thurman sand, 3 to 20 percent slopes. This undulating to hilly soil is in the sand-loess transition area of the uplands. Large dunes and swales are in some areas. The surface is unstable in places and soil blowing is common.

This soil has a profile similar to the one described as representative of the series except the surface layer is dark brown, contains more sand, and is about 10 inches thick. The texture commonly becomes slightly coarser with depth, but in places it is uniform to a depth of 60 inches.

Soil blowing is a very severe hazard in unvegetated areas of this soil. This soil is also droughty, as the available water supply is low and soil dries rapidly. Runoff is slow or medium, depending on the kind of vegetation that is present and the intensity of the rainfall. The organic-matter content is very low, and natural fertility is low. The profile is neutral throughout.

Almost all areas of this soil are used for wildlife habitat or are in native grass. The areas are generally grazed. The vegetation consists mainly of a sparse growth of grasses and weeds, and a sparse to thick growth of trees is common. Reseeding these soils to more desirable grasses is difficult because of the irregular and excessive slopes. Cultivating this soil would result in severe erosion. Capability unit VIIe–5; Sands range site.

ThC—Thurman loamy sand, 2 to 6 percent slopes. This deep, gently sloping soil is on stream terraces of Logan Creek and in upland areas.

This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Ortello soils in lower parts of the landscape and areas of Leisy soils that have convex slopes, in higher parts. Also included was a large area north and east of Wakefield where this soil is underlain by clayey material at a depth of 40 to 80 inches. A few springs that flow early in the year, and a few areas that have a perched water table at a depth of 2 to 3 feet are also in this area.

Soil blowing and water erosion are hazards on this soil. This soil is droughty because of the low available water capacity. Organic-matter content and natural fertility are low. Runoff is slow.

Almost all areas of this soil are cultivated. Corn and alfalfa hay are the main crops. Areas that have a clayey underlying material are somewhat better suited to crops, and deep rooted crops benefit from the additional moisture held in the soil above this layer. Both dryland and irrigation management are used. Capability units IVe–5 dryland and IVe–11 irrigated; Sandy range site.

ThC2—Thurman loamy sand, 2 to 6 percent slopes, eroded. This deep, undulating soil is on stream terraces and uplands. These soils are generally on elongated ridges that are oriented in a northwest-southeast direction. The areas are 5 to 15 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is about 7 inches thick, and contains less organic matter and more fine and medium sized grains of sand. These profile differences are caused by soil blowing.

Included in mapping were small areas of Leisy soils on lower parts of the landscape.

Managing the individual areas of this mapping unit is difficult because of their intricate pattern and close proximity to areas of silty soils. They are generally managed with other nearby soils. This soil is highly susceptible to soil blowing if it is not well protected. Runoff is slow. Organic-matter content is very low, and natural fertility is low.

Most areas of this soil are cultivated. Corn, oats, and alfalfa hay are the main crops. Both dryland and irrigation management are used. Capability units VIe–5 dryland and IVe–11 irrigated; Sands range site.

ThD—Thurman loamy sand, 6 to 11 percent slopes. This deep, strongly sloping soil is on uplands. This soil is closely associated on the landscape with soils that formed in loess, and it commonly occurs in intricate patterns with those soils.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is slightly thinner.

Included with this soil in mapping were small areas of Leisy soils that are generally lower on the landscape than this Thurman soil.

The hazard of soil blowing is very severe. This soil is droughty because of the low available water capacity. Water erosion is also a hazard on this soil. Runoff is slow or medium depending mainly on the kinds and amount of vegetation. Organic-matter content and natural fertility are low.

This soil is either cultivated with the adjacent silty soil or is in grass when it is in large areas. A few small gullies are in areas of this soil. Both dryland and irrigation management are used, but the soil is generally not suited to dryland crops because of the severe erosion hazard. Capability units VIe–5 dryland and IVe–11 irrigated; Sands range site.

ThD2—Thurman loamy sand, 6 to 11 percent slopes, eroded. This deep, strongly sloping soil is on the sides of drainage divides. Most areas of this soil are in cultivated areas and have been severely eroded. The areas are small and are 10 to 20 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is only 6 inches thick, lighter colored, and that contains less organic matter. The surface layer has a higher content of medium and coarse sand than the one in the representative soil.

Included with this soil in mapping were small areas of Leisy soils that can occur anywhere on the landscape, and Ortello soils that are in lower positions.

Soil blowing is a very severe hazard on these soils where the surface layer is unprotected. Water erosion is also a hazard. This soil is droughty because of the low moisture-holding capacity. Maintaining a vegetative and mulch cover is the main concern of management. Runoff is medium. Organic-matter content is very low, and natural fertility is low.

Almost all areas of this soil are cultivated. This soil is normally managed as individual fields. Some areas are reseeded to grass. Both dryland and irrigation management are used, but the soil is generally not suited to dryland crops because of the severe erosion hazard. Capability units VIe–5 dryland and IVe–11 irrigated; Sands range site.

TnC—Thurman-Leisy complex, 3 to 6 percent slopes. This complex is on divides and side slopes in uplands. The areas are 5 to 10 acres in size. This complex consists of Thurman loamy sand and Leisy sandy loam. The proportions vary from one area to another. In most areas the Thurman soil is dominant, and makes up 50 to 80 percent of the area. The Leisy soil, however, is dominant in some areas. In places the Thurman soil is on the highest parts of the landscape and the Leisy soil is on the hillsides and lower parts, but this pattern is reversed in other places.

These soils have a profile similar to the one described as representative of their respective series. The surface layer, however, varies in thickness.

Included with this complex in mapping were small areas of Bazile soils on upland divides and areas of Ortello soils on lower positions on the landscape.

Soil blowing is the principal hazard in areas of this complex. The Thurman soil, in particular, is a droughty soil. Runoff is medium. Organic-matter content is low in the Thurman soil, and is moderate in the Leisy soil. Fertility is low in the Thurman soil, and is medium in the Leisy soil.

Almost all areas of these soils are cultivated. Corn, small grains, and alfalfa hay are the main crops. Both dryland and irrigation management are used. Capability units IVe–5 dryland and IVe–11 irrigated; Thurman is in the Sandy range site and Leisy soil is in the Silty range site.

TnD—Thurman-Leisy complex, 6 to 11 percent slopes. This complex is on uplands. These soils are strongly sloping, and slopes are convex.

This complex consists mainly of Thurman loamy sand and Leisy sandy loam. The proportions vary from one area to another. Most areas, however, are about 50 to 70 percent Thurman soil, and 30 to 50 percent Leisy soil. The Thurman soil is generally on the highest part of the landscape, and the Leisy soil is generally on the lower part. The areas are small and irregular in shape.

These soils have a profile similar to the one described as representative of their respective series. The surface layer of these soils, however, varies from place to place.

Included with this complex in mapping were small areas of Bazile and Ortello soils.

Managing areas of these soils as individual units is difficult because most areas are small and are generally farmed with the adjacent soils. The Thurman soils are droughty. Both soils are subject to severe soil blowing. Water erosion is a moderate hazard. Runoff is medium. Organic-matter content is low in the Thurman soil and is medium in the Leisy soil. Natural fertility is low in the Thurman soil and is medium in the Leisy soil.

Almost all areas of these soils are cultivated. Corn, small grains, and alfalfa hay are the main crops. A few areas are in grass. Both dryland and irrigation management are used. Capability unit IVe–5 dryland and IVe–11 irrigated; Thurman soil is in the Sands range site and the Leisy soil is in the Silty range site.

Zook series

This series consists of deep, nearly level, poorly drained soils on bottom lands of Logan Creek Valley. The seasonal perched water table ranges from 1 to 3 feet in early spring. These soils are occasionally flooded. Zook soils formed in clayey alluvium.

In a representative profile, the surface layer is firm, very dark gray silty clay 30 inches thick. The subsoil is very firm silty clay 20 inches thick. It is very dark gray in the upper part and dark gray in the lower part. The underlying material is dark gray silty clay to a depth of 60 inches. Mottles are below a depth of 42 inches.

Permeability is slow. Available water capacity is moderate. The organic-matter content is moderate, and natural fertility is high. Moisture is released slowly to plants.

Zook soils are suited to cultivated crops. They are also suited to grass, trees and shrubs, wildlife habitat and recreation.

Representative profile of Zook silty clay, 0 to 2 percent slopes, in native grass, 1,300 feet south and 200 feet east of the northwest corner of sec. 36, T. 27 N., R. 5 E.:

A11—0 to 12 inches; very dark gray (10YR 3/1) light silty clay, black (10YR 2/1) moist; moderate very fine granular structure; hard, firm; slightly acid; gradual smooth boundary.

A12—12 to 30 inches; very dark gray (N 3/0) silty clay, black (N 2/0) moist; moderate very fine subangular blocky structure; hard, firm; slightly acid; gradual smooth boundary.

B21g—30 to 42 inches; very dark gray (N 3/0) silty clay, black (N 2/0) moist; strong very fine blocky structure; very hard, very firm; many thick shiny coatings on faces of peds; neutral; gradual smooth boundary.

B22g—42 to 50 inches; dark gray (N 4/0) silty clay, very dark gray (N 3/0) moist; few fine faint dark reddish brown (5YR 3/3, moist) mottles masked by organic matter; strong very fine blocky structure; very hard, very firm; many thick coatings on faces of peds; common slickensides; neutral; gradual wavy boundary.

Cg—50 to 60 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; moderate fine angular blocky structure; very hard, firm; few slickensides; neutral.

The A horizon is silty clay loam to silty clay and is 26 to 36 inches thick. It is black or very dark gray. The B21g and B22g horizons are between 38 and 46 percent clay. The Cg horizon is silty clay or heavy silty clay loam. The soil is slightly acid to mildly alkaline throughout the profile. Mottles are few to many, faint to prominent, and are reddish brown to yellowish brown.

Zook soils are associated with Colo and Calco soils. They have more clay than those soils and unlike the Colo soils have a B horizon.

Zo—Zook silty clay loam, 0 to 2 percent slopes. This soil is in large depressional areas on bottom lands along Logan Creek. The areas are 60 to 100 acres in size.

This soil has a profile similar to the one described as representative of the series except for a surface layer that is silty clay loam about 26 inches thick.

Included with this soil in mapping were a few areas of Colo soils on higher elevations. Also included were a few soils that have thin, finer or coarser textured layers in the underlying material.

Flooding is an occasional hazard, but generally only a small amount of sediment remains after flooding. Because of the slow permeability and runoff, this soil dries slowly after rains and warms up slowly in spring, and seeding and cultivation are delayed. This soil can be worked satisfactorily only in a narrow moisture range. Runoff is slow or very slow. The surface layer is slightly low in content of lime.

Almost all areas of this soil are cultivated. Corn, soybeans, and alfalfa hay are the main crops. Both dryland and irrigation management are used. Capability units IIw–4 dryland and IIw–1 irrigated; Clayey Overflow range site.

Zw—Zook silty clay, 0 to 2 percent slopes. This soil is in low, depressional areas that are a part of the bottom lands along Logan Creek. Most of the areas were once wet and are now drained. The areas are 20 to 100 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Colo soils on slightly higher positions in the landscape. Also included were small areas that have lime concretions within a depth of 36 inches.

The clayey surface layer and slow surface drainage cause water to pond on some areas of this soil. This wetness can delay seeding and cultivation in spring. Maintaining tilth is difficult. Timeliness of operations is an important concern in managing this soil. An inadequate supply of moisture, as well as its even distribution during the growing season are also factors that can limit production. This soil swells and shrinks considerably upon wetting and drying. Flooding is an occasional hazard. Runoff is slow.

Most areas of this soil are cultivated. Corn, alfalfa, and soybeans are the main crops. Both dryland and irrigation management are used. Capability units IIIw–1 dryland and IIIw–1 irrigated; Clayey Overflow range site.

Use and management of the soils

This section explains how the soils in Dixon County can be used for crops and pasture. This is followed by a discussion of management practices on dryland and irrigated soils. The capability classification used by the Soil Conservation Service is explained, and information on the yields of the principal dryfarmed and irrigated crops is given for each arable soil. Next, management of rangeland is discussed and soils are grouped into range sites, each of which is a distinctive type of rangeland. A discussion of the suitability of soils for growing trees, particularly in windbreaks follows. The capacity of the soil associations to produce food and cover for wildlife are also discussed. The section concludes with a discussion of the engineering systems in classifying soils for engineering purposes, soil properties significant to engineering, interpretations of engineering properties for each of the soil series, and the use of test data provided for certain soils in the county.

Use of the soils for crops and pasture

About 70 percent of Dixon County is cultivated cropland. According to the Nebraska Agricultural Statistics for 1974, the most important crops were corn (103,000 acres), soybeans (27,500 acres), oats (26,900 acres), and alfalfa hay (18,600 acres).

Barley and sorghum are grown on a few acres of these soils. Sweet clover is grown with oats and used primarily to improve the soil. There are mainly two kinds of pasture: (1) a mixture of bromegrass, alfalfa, and other cool-season grasses, and (2) a mixture of warm-season, native grasses. The warm-season grasses are planted mainly on the steeper, less desirable areas. A combination of cool- and warm-season grasses can provide a long season of green grazing for the livestock owner. In these types of pasture, the cool-season grasses are grazed early in spring and early in summer, and again late in the fall growing season. The warm-season grasses are grazed during June, July, and August. Some of the pasture land is part of a long-time cropping system and is alternated with row crops.

Most soils of Dixon County are fertile and well suited to cultivated crops and other agricultural uses. Water erosion, flooding in areas adjacent to streams, damage to the crops and soil from blowing, and the loss of fertility by erosion and leaching are the main problems and hazards on these soils.

Managing dryfarmed cropland

Conservation practices such as terraces and contour farming, grassed waterways, and a cropping system that includes conservation tillage and limited use of row crops are suited to the gently sloping and moderately steep Moody, Nora, and Crofton soils. These practices help keep soil losses to a minimum. Soils on bottom lands, such as Kennebec and Aowa soils, generally need some protection from runoff water. The use of diversions above the flooded areas and good water conservation practices on the adjacent areas help to reduce the hazard of flooding.

A management system that includes pasture and hayland crops is suited to moderately steep and steep soils that are more erosive, such as Crofton and Nora soils. Because an abundance of crop residue is not always possible on these soils, grass or hay crops are needed to help control erosion.

Crop residue left on the surface during tillage operations is valuable for reducing soil losses from soil blowing and from water erosion. Much tillage and till-plant systems of seedbed preparation are good management practices that reduce runoff and sediment losses. Pasture land needs an adequate growth of grasses as protection against water erosion on the steeper soils of the county. Grasses in tame pasture and range can provide good protection from erosion when grazing systems and grazing management leave at least a 4 inch height of grass at all times.

Approximately 10 percent of the soils of Dixon County have slopes over 15 percent, and 16 percent of the soils have slopes less than 2 percent. Some areas of moderately steep and steep soils have been cultivated but are now in grass and are used for pasture and hay. Water erosion is a serious hazard and, in many areas, both sheet and gully erosion are evident. The excessive runoff from the steeper slopes after heavy rains causes flooding on the bottom lands and reduces soil fertility.

Only a small percent of the cultivated cropland in Dixon County is irrigated. According to the Nebraska Agricultural Statistics for 1974, approximately 3,000 acres of cropland in Dixon County were irrigated. Water supply for irrigation comes mainly from wells, and to a minor extent, from creeks. Irrigation water is used primarily to supplement natural rainfall during dry years. Irrigating sloping lands creates such serious problems as erosion and the loss of water by excessive runoff.

Where suitable quantities of underground water are available, there is a potential for increasing the amount of irrigated land. A potential also exists for increasing the acreage of pasture and range, and for a greater use of conservation practices, particularly on the strongly sloping soils.

Insects, plant diseases, and weeds need to be controlled for maximum production. The timely application of insecticides and herbicides is important. Plant diseases can be controlled by planting disease-free seed or by using the appropriate sprays. Some insects and plant diseases can be controlled by a cropping sequence.

Grassed waterways are natural drainageways that have been smoothed, leveled, and seeded to grass to protect them from erosion. They need to be maintained to help control erosion. Grassed waterways can be used to produce hay or grass seed, and as cover for upland game birds.

Both level and gradient terraces are used in Dixon County. Level terraces are used mainly on soils that have a moderate permeability, and gradient terraces are used on the less permeable soils. A level terrace is an earth embankment or a ridge and channel constructed across the slope at suitable spacing and with no grade. The ends of the level terrace are closed so that as much water as possible is held and enters the soil. The gradient terrace is an earth embankment or a ridge and channel constructed across the slope at suitable spacing, built with one end slightly lower than the other so that water drains from the field, preferably to a grassed waterway.

Cultivated soils in Dixon County need to be tested to determine their need for commercial fertilizers.

There is a relationship between the amount of available water stored in the soil and the amount of fertilizer that can be used efficiently. Soils that are dry in the subsoil need a lower rate of fertilizer application during periods of low rainfall than during periods of normal or above average rainfall. Nearly all soils respond to nitrogen fertilizer. Most soils respond to phosphorus, and the eroded soils of the Moody, Nora, and Crofton series commonly respond to zinc.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitation of groups of soils for range, for forestry, or for engineering, land valuation, or conversion to nonagricultural uses.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs:

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I soils have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, or wildlife.
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.
- Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.
- Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes. (None in Dixon County)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless closegrowing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage) ; *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry. The *c* subclass is not assigned to any soils in Dixon County.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management and to have similar 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, IIe–1 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitations; the small letter indicates the subclass or kind of limitation as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The name of the soil series and land types represented are mentioned in the description of each unit, but this does not mean that all the soils of a given series are in that unit. The capability unit designation for each soil in the county can be found in the "Guide to Map Units."

In the following pages the capability units in Dixon County are described and suggestions for the use and management of the soils are given.

Management by capability units

Each of the capability units in Dixon County is discussed in this section. Common features of the soil in each unit are described and properties useful to management are given.

The capability units described here are based on both the dryland system of management and the irrigated system of management. The dryland and irrigated crops grown under each system are given, together with the hazards and limitations that pertain to the soils under each kind of management. Next is discussed the practices that can be used to overcome the problems involved in the management of soils of each capability unit.

Capability unit I–1, dryland

The soils in this unit are deep, nearly level, well drained and moderately well drained on bottom lands and uplands. These soils have a surface layer of very fine sandy loam, silt loam, loam, clay loam, or silty clay loam. The subsoil is very fine sandy loam, silt loam, clay loam, or silty clay loam, and the underlying material is very fine sandy loam, silt loam, or silty clay. Reaction in the surface layer ranges from slightly acid to moderately alkaline.

Runoff is slow on the soils of this unit, and permeability is moderate or moderately slow, except in a few areas where it is slow in the lower part of the profile. Available water capacity is high. The organic-matter content is moderately low to moderate, and the natural fertility is medium to high. These soils absorb moisture easily and release it readily to plants. Under dryland management, natural rainfall meets crop needs in most years. These soils are easily penetrated by roots, air, and water. They are easy to till and are suited to intensive farming.

The soils of this unit are suited to all crops commonly grown in the county. Corn, soybeans, and grain sorghum, however, are the main crops. They are also suited to grass, trees, and garden crops. Row crops can be grown year after year if the proper amount of plant nutrients is applied, and if weeds, diseases, and insects are controlled. Crops on these soils respond well to additions of nitrogen fertilizer. Alternating row crops with small grain and legumes helps control disease, insects, and weeds. Returning crop residue to the soil helps maintain tilth and fertility, and increases the permeability.

Grassed waterways and diversion ditches are used to conduct runoff water across these soils from higher areas and to protect them from damage by runoff.

Capability unit IIe–1, dryland

The soils in this unit are deep, gently sloping, and well drained. They are on ridgetops, and colluvial foot slopes. These soils have a surface layer and subsoil of silt loam, loam, clay loam, or silty clay loam. Reaction in the surface layer is slightly acid to mildly alkaline.

Runoff is medium on soils in this unit, and permeability is moderate or moderately slow. Available water capacity is high. The organic-matter content is moderate or high, and natural fertility is medium or high. These soils respond well to additions of fertilizer. They absorb moisture easily and release it readily to plants. Areas on foot slopes receive additional moisture from adjacent, steeply sloping areas. Workability is good and these soils are easily and deeply penetrated by roots.

Erosion is a moderate hazard. Ditches form in some natural waterways where runoff from adjacent land moves across the foot slopes.

The soils of this unit are suited to all crops commonly grown in the county, including corn, oats, soybeans, rye, and barley. They are also suited to grass, trees, and garden crops. Terraces, contour farming, conservation tillage, and grassed waterways help to control water erosion on long slopes in cultivated areas.

A cropping system that includes grasses and legumes helps to control erosion and to build a supply of organic matter, maintain fertility, and improve tilth. The soil should be tested the year before establishing a legume crop, to determine the amount of lime needed to neutralize the acidity in some areas of these soils. Incorporating crop residues and using commercial fertilizer also improve fertility.

Capability unit IIe–3, dryland

The soils in this unit are deep, nearly level to gently sloping, and well drained. They are on broad drainage divides in the mixed sand and loess upland. These soils have a sandy loam or silty clay loam surface layer and a sandy loam or silty clay loam subsoil. The underlying material is loamy sand or silt loam. Reaction in the surface layer is slightly acid or neutral.

Runoff is medium on soils of this unit. Permeability is moderately rapid or moderately slow. Available water capacity is moderate or high. The organic-matter content is moderate, and natural fertility is medium. These soils absorb moisture easily and release it readily to plants. Workability is good, but in some areas the surface layer becomes loose when it is excessively tilled. These soils are droughty.

Soil blowing and water erosion are the principal hazards if the crop residue is removed and the soils are left bare. The soil can be tested the year before seeding, and lime applied if needed. The seed needs to be properly inoculated. Lime is also needed in places to establish alfalfa or sweet clover.

These soils are suited to all crops commonly grown in the county. A cropping system that includes grasses and legumes improves the organic-matter content and fertility, and reduces the hazard of erosion. Returning crop residues to the soil helps control soil blowing, improves soil structure, and helps maintain fertility. Terracing, contour farming, conservation tillage, and planting grass in waterways also helps control erosion on these soils.

Capability unit IIe–8, dryland

The soils in this unit are deep, gently sloping, and well drained. They are on loess uplands. These soils are eroded. The surface layer and subsoil are silty clay loam, and the underlying material is silt loam. Reaction in the surface layer is slightly acid to mildly alkaline.

Runoff is medium on soils of this unit. Permeability is moderate or moderately slow. Available water capacity is high. The organic-matter content is low, and natural fertility is medium. These soils release moisture readily to plants. They tend to become cloddy if tilled when wet. They are easily penetrated by plant roots, water, and air.

Water erosion is the principal hazard when managing these soils. Improving fertility and organic-matter content are concerns of management. Conserving the available moisture in these soils is important to good management. Lime is generally needed to establish legumes.

These soils are suited to crops commonly grown in the county, including corn, oats, soybeans, barley, and rye. They are also suited to grass, trees, and garden crops. Terraces, contour farming, and grassed waterways help prevent erosion on these soils. Conservation tillage practices such as minimum tillage help increase the organic-matter content, improve fertility, and prevent soil blowing. Growing soil-building crops such as legumes, and returning crop residue to the soil help to restore a granular structure and improve the intake of moisture.

Capability unit IIs–5, dryland

Grable very fine sandy loam, 0 to 2 percent slopes is the only soil in this unit. This deep, well drained soil is on bottom lands of the Missouri River Valley. The surface layer is very fine sandy loam. The underlying material is very fine sandy loam in the upper part, and fine sand in the lower part. This soil is moderately alkaline throughout the profile.

Runoff is slow on this soil. Permeability is moderate in the upper part, and rapid in the lower part. Available water capacity is moderate. The organic-matter content is moderately low, and natural fertility is low. This soil absorbs moisture easily and releases it readily to plants. Workability is good and this soil is easily and deeply penetrated by roots, air, and water.

Soil blowing is a minor hazard if this soil is cultivated. This soil is droughty, and conserving moisture is a major concern of management. Natural rainfall is ordinarily not distributed uniformly enough throughout the growing season to meet all crop needs.

This soil is suited to all crops commonly grown in the county. Legumes, grasses, or a mixture of these in the cropping system help to replenish the organic-matter content, maintain fertility, and aid in controlling soil blowing. Keeping a cover of growing crops or returning crop residue to the soil in a conservation tillage system helps to conserve soil moisture.

Capability unit IIw–1, dryland

The soils in this unit are deep, nearly level, and somewhat poorly drained. They are on bottom lands of the Missouri River Valley. These soils have a silty clay surface layer. The underlying material is silty clay, silty clay loam, silt loam, and fine sand. Reaction is moderately alkaline in the surface layer.

Runoff is slow on soils of this unit, and they are subject to some ponding. Permeability is slow in the upper part of the underlying material, and moderate or rapid in the lower part. Available water capacity is high in some areas and low in others. The organic-matter content is moderately low, and natural fertility is low or medium. These soils absorb moisture slowly. They have poor workability, and good tilth is difficult to maintain. These soils are sticky when wet and hard when dry. Tillage needs to be done at the proper moisture content, which has a narrow range.

These soils crack considerably when dry, and the damage to plant roots can be extensive. Wide cracks in the soil also allow excessive evaporation of soil moisture. Soil blowing in winter is a hazard if these soils are plowed in the fall. These soils are wet in spring, planting is delayed, and plant germination is irregular. Under dryland management, natural rainfall is inadequate to meet crop needs in some years.

The soils of this unit are suited to all crops commonly grown in the county. Excess water can be drained in areas where the surface drainage is inadequate. A conservation tillage system of row crops helps prevent the soil from compacting and from blowing. Returning crop residues to the soil in fall tillage helps prevent these soils from blowing. The use of legumes in a rotation helps to maintain organic matter and to keep the clayey soil material open to roots, water, and air.

Capability unit IIw–3, dryland

The soils in this unit are deep, nearly level, moderately well drained and poorly drained. They are on bottom lands of upland drainageways. These soils have a surface layer of silt loam and underlying material of silt loam or silty clay loam. Reaction in the surface layer is mildly or moderately alkaline.

Runoff is slow on soils of this unit. Permeability is moderate or moderately slow. Available water capacity is high. The organic-matter content is moderate, and natural fertility is high. These soils absorb moisture easily and release it readily to plants. They have good workability.

Erosion of stream banks and flooding are the main concerns of management. Deeply entrenched drainageways and occasional flooding that leave silt deposits occur in some areas. Other areas are rarely flooded. Damage to crops is seldom severe, but the silt damages fences and can eventually fill drainageways and roadside ditches. Flooding can benefit crops in years with below normal rainfall, if it is not too severe. Under a dryland system of management, normal amounts of rainfall are generally adequate to meet crop needs on these soils.

These soils are suited to all crops commonly grown in the county. Legumes are damaged by thick deposits of sediment unless erosion control measures are taken. Management practices that control erosion and reduce runoff are needed in areas on the adjacent uplands. Terracing the adjacent uplands, diversions, returning crop residues to the soil as mulch material, and a system of conservation tillage help retain sediment. Grassed waterways can be constructed to confine runoff water and to prevent flooding over the entire field.

Capability unit IIw–4, dryland

The soils in this unit are deep, nearly level, and somewhat poorly drained and poorly drained. They are on bottom lands along upland drainageways that have low gradients. These soils have a surface layer of silt loam or silty clay loam and a subsoil of silty clay loam or silty clay. Reaction in the surface layer ranges from slightly acid to moderately alkaline.

Runoff is slow on soils in this unit, and permeability is moderately slow or slow. Available water capacity is moderate. The organic-matter content is moderate, and natural fertility is high. These soils absorb moisture at a moderately slow rate and release it readily to plants. They have fair workability.

The principal concerns of management are wetness caused by a high water table, occasional flooding, and siltation. At times entrenched channels are filled with water in spring. Deeply entrenched channels have improved the surface drainage in some areas, and the soils in these areas are cultivated. The other areas of soils in this unit are in native or tame grasses.

The soils of this unit are well suited to all crops commonly grown in the county. Corn and soybeans, however, are the main crops. Spring sown small grain

Figure 10.—**Land in grass provides excellent grazing for livestock.**

generally is not grown on these soils because of excessive wetness early in spring. Alfalfa production varies because in some years root growth is restricted by a moderately high water table. In other years production is increased or improved by subirrigation in areas where alfalfa is planted. In places, areas of these soils are in grass and provide excellent grazing (fig. 10). Tile drains help to control wetness where suitable outlets are available, and shallow drains can be used to remove impounded surface water.

Capability unit IIIe-1, dryland

The soils in this unit are deep, well drained, and gently sloping to strongly sloping. They are on foot slopes, stream terraces, and uplands. The surface layer and subsoil are silt loam or silty clay loam. The underlying material is silt loam. In some areas sandy underlying material is beneath the subsoil. The soils have a slightly acid to mildly alkaline surface layer.

Runoff is medium on soils of this unit. Permeability is moderate or moderately slow. Available water capacity is high. The organic-matter content is moderate to high, and natural fertility is medium or high. The soils absorb moisture easily and release it readily to plants. They have good workability and are easily penetrated by roots, water, and air. The soils that have a surface layer of silty clay loam tend to become cloddy if tilled when wet. Maintaining soil structure and high fertility, controlling runoff, and conserving moisture are the chief concerns of management.

These soils are well suited to most crops commonly grown in the county. The hazards of erosion, however, are more severe where soybeans are grown than where other tilled or row crops are planted. Erosion can be controlled by terraces, contour farming, grassed waterways, and conservation tillage systems that leave 3,000 pounds or more of crop residues on the surface as a protective mulch (fig. 11). A cropping system that includes grasses and legumes improves the organic-matter content, fertility, and tilth. Fertility can be maintained by using commercial fertilizers.

Capability unit IIIe-3, dryland

The soils in this unit are on stream terraces and in uplands. The surface layer and subsoil are sandy loam or silty clay loam. The underlying material is sandy loam or silt loam. Reaction in the surface layer is slightly acid or neutral.

Runoff is medium on soils of this unit, and permeability is moderately rapid to moderately slow. Available water capacity is high or moderate. The organic-matter content is moderate or low, and natural fertility is medium. These soils absorb moisture easily and release it readily to plants. They have good workability.

Soil blowing and water erosion are hazards in cultivated areas of these soils. These soils are droughty and conserving moisture is a main concern of management. Natural rainfall is generally not distributed uniformly enough throughout the growing season to meet all the needs of crops grown on these soils.

These soils are suited to most crops commonly grown

Figure 11.—**Terraces, contour farming, and a good cropping sequence are used to control erosion in this area of Moody silty clay loam, 6 to 11 percent slopes (Capability unit IIIe–1 dryland).**

in the county, but erosion is a hazard in areas of these soils that are planted to soybeans. Tillage operations should be minimal on these soils. A cropping system that alternates close-growing crops with row crops and includes grasses and legumes helps control soil blowing and maintain the organic-matter content and fertility. Returning crop residue to the soil improves the soil and helps control erosion. Terracing, contour farming, and grassed waterways, along with a system of conservation tillage, help control water erosion and soil blowing.

Capability unit IIIe–8, dryland

The soils in this unit are deep, strongly sloping, and well drained. They are on uplands. The surface layer and subsoil are silty clay loam. The underlying material is silt loam. The reaction in the surface layer ranges from slightly acid to mildly alkaline. These soils are eroded.

Runoff is medium to rapid on soils of this unit, depending on the slope and vegetative cover. Permeability is moderate or moderately slow. Available water capacity is high. The organic-matter content is low, and natural fertility is medium. These soils release moisture readily to plants. They become cloddy if tilled when wet, and are easily penetrated by plant roots, water, and air.

Erosion is the principal hazard when managing these soils. Conserving soil and water is the main concern of management. Additions of lime are needed to establish legumes on some areas of these soils.

These soils are suited to most crops commonly grown in the county, but erosion is a hazard when they are used for soybeans. Growing soil-building crops such as grasses and legumes, and returning crop residues to the soil helps to restore soil structure, improve organic-matter content, and increase the speed of water intake. Contour farming, terraces, waterways, field borders, and conservation tillage help prevent erosion, conserve moisture, restore fertility, and control runoff on these soils. In some sloping areas, stripcropping helps control erosion. The loss of part of the surface layer is serious on these eroded soils. Commercial fertilizer is commonly needed for good crop growth on these soils.

These soils are well suited to pasture. Seeding cool season grasses in one area and warm season grasses in another provides green grasses for the entire grazing season. Cover crops can be used when establishing the grass to help prevent erosion. Additions of commercial nitrogen and phosphate fertilizer will help fertilize pasture grasses.

Capability unit IIIe–9, dryland

Crofton silt loam, 2 to 6 percent slopes, eroded, is the only soil in this unit. This deep, well drained soil is on uplands. The surface layer and underlying material are silt loam. The surface layer is thin, has a high content of lime, and is moderately alkaline throughout the profile. This soil has many lime concretions on the surface.

Runoff is medium on this soil, and permeability is moderate. Available water capacity is high. The organic-matter content and natural fertility are low. This soil absorbs moisture easily and releases it readily to plants. Intense rainfall, however, breaks down the soil structure, causing a slow rate of moisture absorption, and puddling on the surface. This soil has good workability.

Erosion is the principal hazard when managing this soil. Maintaining fertility and good soil structure in the surface layer are the main concerns of management. This soil responds well to applications of fertilizer, because it is low in nitrogen and available phosphorus. Natural rainfall is commonly adequate to meet crop needs on this soil under dryland management.

This soil is suited to most crops commonly grown in the county, except soybeans. Some areas of this soil are in grass and are used for pasture or hayland. Erosion is a serious hazard if this soil is planted to row crops. Growing soil-building crops such as grasses and legumes and returning crop residue to the soil help improve the soil structure and organic-matter content. Conservation tillage, contour farming, terraces, grassed waterways, and field borders help prevent erosion, conserve moisture, restore fertility, and control runoff. The loss of fertility from erosion is a serious hazard on this soil. Additions of fertilizer, particularly phosphorus and nitrogen, are needed for good crop growth.

Capability unit IIIw–1, dryland

The soils in this unit are deep, poorly drained, and nearly level. They are on bottom lands of Logan Creek and the Missouri River Valley. The surface layer, the subsoil, and the underlying material are silty clay.

Runoff is slow on soils of this unit, and permeability is slow. Available water capacity is moderate. The organic-matter content is moderately low to high, and natural fertility is low to high. These soils absorb moisture very slowly and release it slowly to plants. Good soil tilth is difficult to maintain. The soils are sticky when wet, and very hard when dry. Tillage should be done at the proper moisture content. Excessive tillage causes the soils to compact, resulting in slower speed of water intake and less movement of air in the soil.

The productivity of these soils is limited by the moderate available water capacity. Wetness restricts the movement of air in the soil, which restricts deep root development. Runoff from adjoining land, ponds on the surface in places. Water moves downward slowly unless these soils are dry. Moisture causes the clay minerals to expand and close the natural openings in the soil. Excess water in the spring delays cultivation and restricts root growth so that crops on these soils do not always have enough moisture in summer. These soils crack when dry and damage to plant roots is extensive. The wide cracks also allow evaporation and loss of soil moisture.

Maintaining good tilth is a main concern of management. These soils are suited to fall tillage, but crop residues need to be returned to the soil to prevent soil blowing in winter. Under dryland management, natural rainfall is seldom adequate or distributed uniformly enough throughout the growing season to meet crop needs on these soils.

These soils are suited to most crops grown in the county. They are better suited to fall-sown, small grain crops such as wheat than to spring-sown crops, because they are planted when these soils are most likely to be dry. Landshaping helps improve surface drainage on these soils. Tile drains or open ditches can be used to lower the water table, but they need a suitable outlet at a lower elevation than the field. These soils are well suited to hay or pasture in areas where adequate outlets are not available. Not operating heavy machinery or grazing livestock during wet periods help reduce the danger of compaction. Fall plowing, when moisture conditions are likely to be favorable, allows these soils to mellow into better tilth over winter, if they are protected from blowing. Planting legumes, such as alfalfa, also helps increase the permeability of these soils.

Capability unit IVe–1, dryland

The soils in this unit are deep, moderately steep, and well drained. They are on uplands. The surface layer, the subsoil, and the underlying material are silt loam. Reaction is slightly acid or neutral in the surface layer.

Runoff is rapid on the soils of this unit. Permeability is moderate. Available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. These soils absorb moisture easily and release it readily to plants. They generally have good workability, but some soils can become cloddy if tilled when wet.

Erosion is a serious hazard if these soils are used for cultivated crops. In areas managed for dryland, natural rainfall is generally adequate for crop needs on these soils if tilth is good and if runoff is reduced to allow better absorption of water.

These soils are suited to most crops commonly grown in the county. They are well suited to permanent grass or hay, but are poorly suited to soybeans. Because of the erosion hazard, the use of row crops needs to be limited. Growing grasses or legumes on these soils helps control erosion and improve fertility and tilth. Conservation tillage reduces runoff, increases the speed of water intake, and helps control erosion. Contour farming, terracing, and use of grass in waterways and turn rows also help control erosion.

Capability unit IVe–5, dryland

The soils in this unit are deep, gently sloping and strongly sloping and well drained. They are on uplands. The surface layer is loamy sand or sandy loam. The subsoil is mainly loamy sand, but is silty clay loam in a few places. The underlying material is loamy sand or silt loam. The reaction is slightly acid in the surface layer.

Runoff is medium on soils of this unit. Permeability is moderately slow or rapid. Available water capacity is low or high. The organic-matter content is moderate or low. Natural fertility is medium or low and these soils are deficient in many of the important plant nutrients. These soils absorb moisture easily and release it readily to plants. They have good workability.

Soil blowing and water erosion are hazards if these soils are cultivated. The sandy soils are droughty, and conserving moisture is a main concern of management.

Natural rainfall is generally not distributed uniformly enough throughout the growing season to meet all the needs of crops on these soils.

These soils are used for cultivated crops and grass, but areas of the deep sandy soils are very marginal for cultivated crops. Close growing crops, such as alfalfa, grass, and small grain, are better suited than row crops on sandy soils because they provide greater protection against soil blowing and they grow most in the wetter part of the growing season. They also provide ground cover during most of the year. Where row crops are grown, soil blowing and water erosion can be reduced by a conservation tillage system of planting and contour farming. Trees in windbreaks, where feasible, also help to reduce soil blowing. From 2,000 to 4,000 pounds of crop residue maintained on the soil surface helps control nearly all the water erosion and soil blowing.

Capability unit IVe–8, dryland

Nora silt loam, 11 to 15 percent slopes, eroded, is the only soil in this unit. This deep, moderately steep, well drained soil is on uplands. The surface layer and the underlying material are silt loam. Reaction in the surface layer is slightly acid or neutral.

Runoff is rapid on this soil. Permeability is moderate. Available water capacity is high. The organic-matter content and natural fertility are low. This soil releases moisture readily to plants. Workability is generally good, but some areas of this soil become cloddy if tilled when wet.

Water erosion is the principal hazard if this soil is used for cultivated crops. It is also subject to sheet, rill, and gulley erosion. Rainfall is commonly adequate for crop growth if tilth is good and if runoff is reduced to allow the soil to absorb water.

This soil is suited to most crops commonly grown in the county. It is unsuited, however, to soybeans. This soil is well suited to close-growing crops, hay, and pasture. Row crops need to be grown infrequently, and as part of a cropping system that includes grass and legumes. This soil is highly erodible if planted to soybeans. Returning crop residue to the soil helps control erosion and improve fertility. Other management practices, such as conservation tillage, contour farming, terracing, and planting grass in waterways, turnrows, and field borders help conserve soil and water. Keeping a cover of permanent vegetation, such as grass, on these soils also helps conserve soil and water. A combination of cool- and warm-season grasses, each in separate areas, provides season-long grazing for livestock. Applications of nitrogen fertilizer increases the production of both grasses.

Capability unit IVe–9, dryland

The soils in this unit are deep, strongly sloping and moderately steep, and well drained. They are on uplands on narrow, convex ridgetops and on the upper part of side slopes. The surface layer, transitional layer, and underlying material are silt loam. Small lime concretions are scattered on the surface of these eroded soils. These soils are moderately alkaline throughout the profile.

Runoff is rapid on soils of this unit, and permeability is moderate. Available water capacity is high. The organic-matter content and natural fertility are low. These soils absorb moisture easily if the surface layer has good tilth. Intense rainfall and excessive cultivation can destroy the granular structure of these soils, cause puddling on surface layer, and reduce the absorption of moisture. These soils release moisture readily to plants. They have good workability.

Sheet erosion is the principal hazard where these soils are cultivated. They respond well to applications of fertilizer. These soils are especially low in nitrogen and available phosphorus. Natural rainfall is commonly inadequate to meet crop needs on these soils under dryland management.

These soils are suited to most crops commonly grown in the county in areas where these soils are cultivated. Soybeans should not be grown here, however, because these soils are excessively eroded. Management practices such as conservation tillage, contour farming, terracing, grassed waterways, grassed turn rows, and seeded turn rows conserve soil moisture and control water erosion on these soils. A cropping sequence that uses row crops and close-sown and grass crops most of the time also helps reduce soil losses.

Capability unit IVs–2, dryland

Sarpy silty clay, overwash, 0 to 2 percent slopes, is the only soil in this unit. This deep, excessively drained soil is on bottom lands of the Missouri River Valley. It has a thin layer of silty clay overwash material on the surface. The underlying material is fine sand. This soil is moderately alkaline throughout the profile.

Runoff is slow on this soil. Permeability is slow in the upper part and rapid in the lower part. Available water capacity is low. The organic-matter content and natural fertility are low. This soil absorbs moisture slowly. Workability is poor, and this soil becomes cloddy if it is not worked under the proper moisture conditions. Water ponds in some areas for brief periods.

This soil is wet in spring; planting is delayed, and germination of seed is irregular. Natural rainfall is inadequate to meet crop needs on this soil during some years under dryland management.

Maintaining good tilth in the surface layer is an important concern of management. This soil is droughty. Grasses and legumes grown in a cropping sequence increase the organic-matter content and improve the tilth of this soil. A conservation tillage system that returns crop residue to the soil also helps maintain good tilth and improves the organic-matter content. Applications of commercial fertilizers and barnyard manure can improve the fertility of this soil.

Capability unit IVs–7, dryland

Sarpy loamy fine sand, 0 to 2 percent slopes, is the only soil in this unit. This deep, excessively drained soil is on bottom lands of the Missouri River Valley. Slopes are mainly smooth to hummocky. The surface layer is loamy fine sand. The underlying material is loamy fine sand and fine sand. This soil is moderately alkaline throughout the profile.

Permeability is rapid and available water capacity is low. The organic-matter content and natural fertility are low. This soil absorbs moisture easily. Moisture moves easily through the soil material because of its coarse texture, and this soil is droughty. It is difficult to cultivate because of the loose, sandy surface layer.

Soil blowing is a major hazard if the surface layer is unprotected. Natural rainfall is commonly inadequate to meet crop needs on this soil under dryland management.

This soil is well suited to range and pasture, because of the severe hazard of soil blowing, and is only marginally suited to cultivated crops. It is better suited to close-growing crops such as alfalfa, grass, and small grain. A conservation tillage system that keeps 3,000 pounds of crop residue on the surface is needed in areas where row crops are planted. Narrow strips or fields can be alternated with strips of close-sown crops. Close-sown crops are more dependable because they grow the most in spring, when rainfall is the highest.

Cropping or tillage systems that keep the soil covered with residue is good management on this soil. Planting row crops in spring and interplanting with rye in fall gives an abundance of crop residue at all times. Narrow plantings of trees that act as a field windbreak help reduce soil blowing on large areas of this soil.

Capability unit Vw–7, dryland

The soils of this unit are deep, and excessively drained to very poorly drained. They are on bottom lands of the Missouri River and Logan Creek. The surface layer, subsoil, and underlying material are silty clay loam on the bottom lands of Logan Creek and its tributaries. Soils on the Missouri River bottom lands have a loamy fine sand surface layer and an underlying material of fine sand.

Permeability is moderately slow or rapid. Available water capacity is low to high. The organic-matter content is moderate or low, and natural fertility is low to medium. These soils absorb moisture slowly in places and rapidly in others. Surface drainage is very slow and water commonly is ponded on the surface. The seasonal high water table is at a depth of 0 to 3 feet in most years, except on the hummocky sandy areas where it is below a depth of 6 feet.

Areas of these soils are well suited for use as wildlife habitat and protection of wildlife. They have only limited use for grazing. Vegetative growth on these areas is affected by excess water. Water-tolerant species of trees and grass are the principal kinds of vegetation. The drainage of some areas can be improved by straightening the channels and confining water flow to them. In a few areas, drainage can be improved sufficiently for some cultivated crops. Some areas are too wet for good grazing land during heavy rainfall seasons. In some areas surface and tile drains help lower the water table so that the more desirable grasses can be established. Installing drainage systems on these soils depends on locating suitable outlets. If the main use of these soils is for wetland wildlife, drainage practices are not needed.

Capability unit VIe–1, dryland

The soils in this unit are deep, steep, and well drained. They are on uplands on the lower, slightly concave parts of the landscape. The surface layer, subsoil and underlying material are silt loam. Reaction is mildly alkaline in the surface layer.

Runoff is rapid on soils of this unit. Permeability is moderate. Available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. These soils absorb moisture easily where the surface layer has a granular structure. They release moisture readily to plants.

Sheet and rill erosion are serious hazards on these soils. Increasing the intake rates of water is an important concern of management. These soils respond well to applications of fertilizer. Natural rainfall is commonly adequate to meet crop needs under dryland management.

These soils are not suited to cultivated crops because of their steep slopes. They are well suited to grass and trees. These soils are used mainly for pasture or range. Small areas that are now cultivated can be established for pasture by planting them to cool-season grasses. Other areas can be planted to warm-season grasses to provide a season-long grazing of green forage for livestock.

Cover crops can be used to prepare the land before seeding to grasses because they help reduce erosion while the grasses are becoming established. Where these soils are used for grazing, mowing or spraying helps control weeds and undesirable plants. Where small, isolated areas of these soils are surrounded by cropland or are adjacent to cropland, they can be used for hay or grazing along with the crop aftermath. These soils are also suited to trees and shrubs that can be planted and managed for wildlife cover. Drainageways make good sites for watering areas for livestock or are good sites for recreational dams. Drainageways are also possible sites for flood control structures.

Capability unit VIe–5, dryland

The soils in this unit are deep, gently sloping and strongly sloping and well drained to somewhat excessively drained. They are on uplands. The surface layer is loamy sand and the underlying material is loamy sand and sand. Reaction is slightly acid in the surface layer. Many areas of these soils are eroded.

Runoff is medium to rapid on soils of this unit. Permeability is rapid. Available water capacity, organic-matter content, and natural fertility are low. These soils absorb moisture easily and release it readily to plants. They have good workability. They are deficient in many of the major plant nutrients.

Soil blowing and water erosion are serious hazards if these soils are cultivated. They become loose when worked excessively. Most areas are droughty, and conserving moisture is the main concern of management. Natural rainfall is generally not distributed uniformly enough throughout the growing season to meet all needs of crops on these soils.

The soils of this unit are poorly suited to cultivated crops because they are sandy, droughty, and erodible. They are well suited to grass. Proper use, deferred grazing, planned grazing, and control of weeds and brush are needed to maintain a good stand of grass. Most areas of these soils are in permanent hay or pasture. The soils are also suited to trees and to wild-

Figure 12.—**Proper land use on an area of Crofton silt loam, 15 to 30 percent slopes. This is in capability unit VIe–9 dryland.**

life habitat and recreation uses. Cultivated areas can be seeded to grass and used for hay or pasture.

Capability unit VIe–9, dryland

The soils in this unit are deep, steep, and well drained. They are on uplands on narrow ridgetops and the upper parts of side slopes. The surface layer, transitional layer, and underlying material are silt loam. These soils are moderately alkaline throughout the profile. Small lime concretions are on or immediately below the surface layer. Many areas of these soils are eroded.

Runoff is rapid on soils of this unit, and permeability is moderate. Available water capacity is high. The organic-matter content and natural fertility are low. These soils release moisture readily to plants.

Sheet erosion is the principal hazard when managing these soils. Areas that are used for grass are subject to gulley erosion that can begin in cattle trails. These soils respond to applications of fertilizer. Natural rainfall is generally adequate to meet crop needs on these soils under dryland management.

These soils are unsuited to cultivated crops because of their steep slopes and the severe hazard of erosion. Areas that are now cultivated can be reseeded to grasses to convert the land to range. The principal native grasses are bluestem, side-oats grama, and switchgrass. Some areas are wooded, and oak and elm are the most common trees.

Grazing needs to be regulated if these soils are used as rangeland. Only one-half of the current year's growth of the desirable species can be safely removed. Mowing or spraying helps control weeds and other undesirable plants. Good sites for livestock water or recreational dams are along some drainageways in areas of these soils (fig. 12).

Capability unit VIs–7, dryland

Sarpy-Duneland complex, 0 to 4 percent slopes, is the only soil in this unit. The Sarpy soil is deep and excessively drained. It is on islands and sandbars of the Missouri River Valley. Duneland is composed mainly of barren sands. Slopes are smooth to hummocky, and high dunes are in places. The surface layer and underlying material are fine sand. The Sarpy soil is moderately alkaline throughout the profile.

Runoff is slow on this soil because the soil material is coarse and it absorbs most of the precipitation. Permeability is rapid. Available water capacity is low. The organic-matter content is very low, and natural fertility is low. These soils absorb moisture easily, but most of the moisture is lost by downward percolation through the profile.

The droughty conditions caused by the low moisture-holding capacity of this soil is the principal hazard when it is used for range, recreation, or woodland. Many areas are barren, and the dune surface is caused by soil blowing. Control of blowing is needed before this soil can be effectively stabilized with grass.

These areas are not suitable for use as cultivated land or for tame grass under dryland management. This soil is better suited to range, recreation, or trees. Areas that lack a ground cover can be reseeded to grass or planted to trees. A mulch cover is needed to reduce soil blowing to help establish a vegetative cover. Wooded and brushy areas provide excellent wildlife habitat.

Capability unit VIw–7, dryland

Aowa soils, channeled, 0 to 2 percent slopes, is the only soil in this unit. These soils are deep. They are on bottom land areas adjacent to upland drainageways. The soils are mainly stratified silt loam, but include thin layers of silty clay loam. Reaction is moderately alkaline throughout the profile.

Runoff is slow on soils of this unit. Permeability is moderate. Available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. These soils release moisture readily to plants.

Frequent flooding and meandering stream channels are the principal hazards when managing this soil. Sediment deposited during flooding can cover existing grass, and weeds become a problem.

Almost all areas of this soil are in trees, pasture, or natural areas. Bluegrass or bromegrass are on about 60 percent of the area. Eastern cottonwood, willow, boxelder, and green ash on stream channels and on the adjoining steep banks grow on the remaining 40 percent of the area. Spraying controls weeds so that more desirable grasses can be established. Removing some of the tree canopy allows grass to become established more readily. Areas of this unit are better suited for pasture, woodland, and wildlife habitat. The areas serve as natural drainageways for excess runoff water from large areas of upland.

Capability unit VIIe–5, dryland

Thurman sand, 3 to 20 percent slopes, is the only soil in this unit. It is in the transition area of sand-loess uplands. This soil is somewhat excessively drained. The surface layer and underlying material are sand and are noncalcareous. Vegetation is sparse, but consists mainly of scattered weeds and trees.

Permeability is rapid, and available water capacity is low. Organic-matter content is very low, and natural fertility is low. This soil provides habitat for upland wildlife if grazing is restricted.

This soil is not suited to cultivated crops because it is too sandy, droughty, and erodible. It is suited to grass, trees, and to wildlife habitat and recreation areas.

A limited amount of grass grows on this soil. Vegetation is established in most areas, and blowout areas can be stabilized by fencing and reseeding. Deferred grazing and a planned grazing system are needed to keep the grass healthy and to prevent soil blowing from recurring.

Capability unit VIIe–7, dryland

Alcester silt loam, gullied, 11 to 60 percent slopes, is the only soil in this unit. This soil is deep. It is on foot slopes and uplands. The surface layer, subsoil, and underlying material are silt loam.

Runoff is rapid or very rapid on this soil, depending on the slope and vegetative cover. Permeability is moderate. Available water capacity is high. The organic-matter content is moderate, and natural fertility is medium.

Water erosion is the principal hazard in areas of this soil. Stream-bank erosion is common in places. Most areas are vegetated and are naturally stabilized.

The soil in this unit can be used for limited grazing. It is also well suited to use as recreational areas. It provides both food and cover for upland game. Some areas provide flood-detention sites and grade-control structures that impound water.

Capability unit VIIe–9, dryland

Crofton silt loam, 30 to 60 percent slopes, is the only soil in this unit. These soils are deep and well drained. They are on bluffs of the uplands adjacent to the Missouri River Valley. The surface layer, transitional layer, and underlying material are silt loam. These soils are moderately alkaline throughout.

Runoff is rapid on these soils. Permeability is moderate. Available water capacity is high. The organic-matter content and natural fertility are low. These soils are droughty because of the excessive slope.

These soils are in grass or are wooded. They are too steep to be cultivated. They are used mainly for grazing and have limited use for recreation. They provide good wildlife habitat. Soil erosion in areas where cattle trails and land slips have formed are the main concerns of management. Proper use, deferred grazing, and a planned grazing system are needed to keep the grasses healthy and to maintain a good cover.

Management of irrigated soils

Most areas of irrigated soils in Dixon County are in the Logan and Missouri River Valley. A smaller acreage is in the uplands, where irrigation water is available. Water for irrigation is almost entirely derived from deep wells.

Different irrigation methods are generally needed when the kind of crop grown on a particular field is changed. For example, the method used to irrigate a row crop is generally different than that used to irrigate a close-sown, or pasture crop.

Furrow irrigation is the most common surface method of irrigating row crops. Gated pipes bring water to furrows that are between the plant rows. On nearly level soils, such as Kennebec and Haynie, the furrows are generally straight, and follow field boundaries. While furrow irrigation can be used on steeper soils such as Alcester silt loam, 2 to 6 percent slopes, the furrows are generally on the contour, however, and carry the water across, rather than down the slope. This system is commonly used with clean-tilled crops.

In the border irrigation method, water is applied by flooding between small dikes. The irrigation water flows as a thin, uniform sheet and is absorbed by the soil as it flows across the field. The strips need to be level and of uniform grade. This irrigation method is well suited to alfalfa on loamy or silty soils.

In the sprinkler irrigation method, water is applied by sprinklers at a rate that the soil can absorb without runoff. Sprinklers can be used on the more sloping soils as well as on the nearly level soils.

Soils such as Moody silty clay loam, 6 to 11 percent slopes, are suited to the sprinkler method. Because the water can be carefully controlled, sprinklers have a special use in conservation farming, such as establishing new pastures on moderately steep slopes. In summer, however, some water is lost through evaporation, and wind drift can cause an uneven application of water under some sprinkler systems.

There are two general kinds of sprinkler systems. One system operates in sets; sprinklers are set at a certain location and operate until a specified amount of water is applied. The other system, a center-pivot type, is a moving system that revolves around a central point.

Soils hold a limited amount of water, and water can be applied only as fast as the soil can absorb it. Irrigation water is applied at intervals so that the soil profile is wet at all times. The interval varies according to the crop, and the time of year. A deep soil in Dixon County holds about 2 inches of available water per foot of soil depth. A soil that is 4 feet deep and planted to a crop that sends its roots to that depth, can hold about 8 inches of available water for that crop.

Irrigation systems are most efficient if irrigation is begun when about one-half of the stored water has been used by the plants. Thus, if a soil holds 8 inches of available water, irrigation can be started when about 4 inches has been removed by the crop. Irrigation sets or systems need to be planned to replace the amount that is used by the crops.

Management for irrigated fields is needed to control or regulate the application of water in such a way that good crop growth is obtained without wasting water or eroding the soil. The size of the furrow streams or the sprinkler rate needs to be adjusted so that the application of water thoroughly moistens the soil without excessive runoff or erosion. An irrigation re-use system temporarily holds runoff water at the end of the field. Pumps then redistribute the water on the land. This practice conserves water by recycling excess irrigation water.

Irrigated soils generally produce higher yields than dryfarmed soils. Irrigation, however, removes more plant nutrients from the soil. To keep irrigated soils fertile, crop residues need to be returned to the soil, and mineral fertilizers need to be added to replace lost nutrients. Most grain crops in Dixon County respond to nitrogen fertilizer. Phosphorus can be added to calcareous soils on bottom lands. Soils disturbed in land leveling, particularly where topsoil has been removed, commonly respond to applications of phosphorus, zinc, and iron. The kind and amount of fertilizer needed for specific crops can be determined from soil tests.

Corn, soybeans, and alfalfa are the principal irrigated crops in Dixon County. Corn and soybeans are grown in rows that are 30 to 40 inches apart. Irrigation water can be applied to furrows between the rows. Alfalfa and pasture grasses are irrigated by sprinkler systems. Corn and soybeans can also be irrigated by sprinkler systems.

The cropping sequence on soils that are well suited to irrigation consists mainly of row crops. A change from corn to soybeans, and then to an alfalfa or grass crop helps to control the cycle of disease and insects that commonly occur when the same crop is grown year after year. Gently sloping soils such as Nora silt loam, 2 to 6 percent slopes, eroded, are subject to water erosion when irrigated. These soils are better suited to a cropping sequence that includes several years of row crop, followed by 3 to 5 years of hay or pasture. Close-grown crops such as alfalfa or a mixture of alfalfa and grass can be grown on these soils. Soils such as the strongly sloping Crofton silt loam, 6 to 11 percent slopes, are better suited to irrigated pasture crops than to row crops.

Assistance in planning and laying out an irrigation system is available through the local office of the Soil Conservation Service or the County Agricultural Agent. Estimates on the cost of equipment can be obtained from local irrigation equipment dealers and from manufacturers.

In the paragraphs that follow, the irrigation capability units in Dixon County are described. Each unit includes soils that have similar management requirements. Soil hazards, limitations, and concerns of management are discussed. Finally, suitable ways to help overcome the problems are given.

The names of all the soils in any given capability unit can be found in the "Guide to Map Units" at the back of the survey. All soils in Nebraska are placed in irrigation design groups. These design groups are described in the "Irrigation Guide for Nebraska". Arabic numbers in the irrigation capability unit indicate the irrigation design group to which the included soils belong.

Capability unit I–3, irrigated

Moody silty clay loam, 0 to 2 percent slopes, is the only soil in this unit. This soil is deep, nearly level, and well drained. It is on uplands. The surface layer and subsoil are silty clay loam. The underlying material is silt loam. Reaction in the surface layer is slightly acid or neutral.

Runoff is medium on this soil. Permeability is moderately slow. Available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. These soils release moisture readily to plants. The intake rate is slow. They have good workability, but form clods if they are tilled when excessively moist. The soils in this unit have few restrictions under irrigation.

This soil is suited to most of the irrigated crops commonly grown in the county. Corn, and to a limited extent, soybeans are the principal crops. Border, furrow, and sprinkler systems of irritation are suited to this soil. Land leveling is generally needed for satisfactory furrow and border systems. Fertilizers, and returning crop residues to the soil help obtain sustained production. Returning crop residues also helps improve tilth. Proper plant populations and an efficient irrigation system that controls the amount and time of water applications are also important. Runoff from adjacent higher soils can be controlled by diversions and terraces. A tailwater recovery system improves efficiency and helps conserve water resources.

Capability unit I–4, irrigated

Maskell loam, 0 to 2 percent slopes, is the only soil in this unit. This soil is deep and well drained. It is on stream terraces of Logan Creek Valley. The surface layer is loam and clay loam, and the subsoil is loam, clay loam, and silt loam. Reaction in the surface layer is slightly acid or neutral.

Permeability is moderate, and available water capacity is high. The organic-matter content is moderate, and natural fertility is high. Moisture is released readily to plants. The intake rate is moderately slow. Workability is good because of good tilth.

This soil is well suited to the irrigated crops commonly grown in the county. Corn and soybeans are the principal crops. Border, furrow, and sprinkler systems are suited to this soil. Land leveling is generally needed for satisfactory furrow or border systems. Applying a proper balance of plant nutrients through use of fertilizers, and returning crop residues to the soil to maintain tilth help to obtain sustained production. Proper plant populations and time of water applications are also important. An irrigation tailwater recovery system will improve efficiency and reduce the amount of water pumped from the water resource.

Capability unit I–6, irrigated

The soils in this unit are deep, nearly level, and well drained or moderately well drained. They are on bottom lands. The surface layer is silt loam or very fine sandy loam. The underlying material ranges from clay to sand.

These soils have a moderate intake rate. Runoff is slow on the soils of this unit. Permeability is generally moderate, but it is slow in the lower part of the underlying material in some areas, and rapid in that part in others. The available water capacity is moderate or high. The organic-matter content is moderately low or moderate, and natural fertility is low to high. These soils release moisture readily to plants. They have good workability. These soils have few restrictions under irrigation.

These soils are suited to all crops commonly grown in the county. Corn and alfalfa are the main crops. Returning crop residue to the soil, and applying commercial fertilizers and barnyard manure maintain fertility on these soils. Diversions and grassed waterways prevent flood waters from adjacent lands from flooding these soils. Land leveling helps maintain an even distribution of irrigation water, allows uniform drainage, and reduces the hazard of waterlogging in the lowest areas of these soils. Leveling is commonly needed for border and furrow irrigation. Sprinkler systems are also suited to these soils. An irrigation tailwater recovery system will improve irrigation efficiency.

Capability unit IIe–5, irrigated

Moody–Leisy complex, 2 to 6 percent slopes, is the only mapping unit in this capability unit. These soils are deep and well drained. They are on stream terraces and the adjoining uplands. The surface layer is sandy loam on the Leisy soil and silty clay loam on the Moody soil. Both soils have a subsoil of silty clay loam, and an underlying material of silt loam. Reaction is slightly acid to neutral in the surface layer.

The Moody soil has a slow intake rate and the Leisy soil has a moderate intake rate. Permeability is moderately slow. The available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. These soils release moisture readily to plants. The Leisy soils have good workability. The Moody soils have few restrictions under irrigation, except those posed by slope.

These soils are suited to all crops commonly grown in the county. Corn, soybeans, and alfalfa are the main crops. Returning crop residue to the soil and applying commercial fertilizers and barnyard manure help maintain fertility. Returning crop residue to the soil also helps slow runoff and improve water intake.

Sprinkler irrigation systems are suited to these soils. The potential for soil erosion increases, however, when irrigation water is applied. Contour bench leveling, or using contour furrows with terraces control water erosion under a surface irrigation system. Terraces, contour farming, grassed waterways, and a conservation tillage system of planting that leaves crop residue on the surface, control water erosion under a sprinkler system. Additions of barnyard manure and commercial fertilizers maintain fertility on these soils.

Capability unit IIe–8, irrigated

Blendon sandy loam, 0 to 3 percent slopes, is the only soil in this unit. This soil is deep, nearly level, and well drained. It is on uplands. The surface layer and subsoil are sandy loam. The underlying material is loamy sand. Reaction is neutral in the surface layer.

Runoff is slow on this soil. Permeability is moderately rapid. Available water capacity is moderate. The organic-matter content is moderate, and fertility is medium. The water intake rate is moderately high. This soil releases moisture readily to plants. It has good workability. This soil has few restrictions under irrigation.

This soil is suited to most of the irrigated crops commonly grown in the county. Corn and, to a limited extent, soybeans are the principal crops. Sprinkler irrigation systems are well suited to this soil. Low fertility or an imbalance of plant nutrients commonly limit this soil. Applying fertilizer to achieve a balance of nutrients helps obtain sustained production. Proper plant population and an efficient irrigation system that controls the amount and time of water applications are also important. A conservation tillage system that leaves crop residue on the surface helps to reduce erosion and soil blowing.

Capability unit IIw–1, irrigated

The soils in this unit are deep, nearly level, and somewhat poorly drained and poorly drained. They are on the Missouri River bottom land. The surface layer is silty clay or silty clay loam. The upper part of the underlying material is silty clay in some places. At a depth of 15 to 30 inches, this layer grades to silt loam in some areas and to sand in other areas. Reaction in the surface layer is neutral to moderately alkaline.

These soils have a very slow intake rate. Runoff is slow on these soils and they are subject to ponding. Permeability is slow to rapid depending on the texture of the underlying material. The available water capacity is high in some areas but moderate or low in others. The organic-matter content is moderately low or moderate, and natural fertility is low to high. These soils release moisture slowly to plants. They are difficult to till. These soils need to be cultivated at the proper moisture content to prevent excessive compaction, which reduces the absorption rate. These soils are sticky when wet, and very hard or hard when dry. This wetness can result in delayed planting, uneven germination, and poor stands. The soils crack considerably when dry and damage to plant roots can be extensive. The wide cracks also lengthen the time needed for water to flow to the end of the row in furrow-type irrigation.

Under irrigation management, this soil needs to be protected from excessive drying before starting irrigation. Over-irrigation, however, can cause a waterlogged condition that can result in a loss of nitrogen by denitrification.

These soils are suited to most crops commonly grown in the county. Corn is the main crop. They are also suited to grass for irrigated pasture. Poor surface drainage and a restriction of air and water movement by soil compaction are the principal concerns of management. Returning crop residue to the soil, and use of a legume in the rotation helps maintain tilth and soil aeration; it also increases water intake, and helps maintain fertility. These soils are suited to sprinkler irrigation, but improvement of surface drainage is needed to keep crops from drowning in the low areas. Land leveling for furrow and border systems improves the surface drainage of these soils.

An irrigation tailwater recovery system improves irrigation efficiency and conserves water resources.

Capability unit IIw-3, irrigated

The soils in this unit are deep, nearly level, and poorly drained. They are on bottom lands that occur along drainageways with low gradients. These soils have a silty clay loam surface layer and underlying material. Reaction is neutral or mildly alkaline in the surface layer.

Runoff is slow on soils of this unit. These soils have a slow water intake rate, moderately slow permeability, and high available water capacity. The organic-matter content is moderate, and natural fertility is high. The soils absorb moisture easily and release it readily to plants. They have good workability but will clod if worked when wet.

Wetness caused by a high water table and occasional flooding is the principal hazard. The high water table causes these soils to dry slower and to warm up in spring later than the better drained soils. This results in delayed planting and slow germination. These soils are naturally subirrigated. Land leveling is not always practical, because flooding in some areas and the resulting deposits of sediment is detrimental to the leveled areas.

Corn and soybeans are suited to this soil, if the water table problems are corrected. Drainage systems can be used to lower the water table where suitable outlets are available. Installing tiles or an open ditch drainage system helps to improve the drainage. The hazard of flooding can be reduced in places by using diversions that prevent runoff water from crossing these soils. In most years, wetness in spring delays preparation of the seedbed and planting of early crops. Smoothing and re-leveling are commonly needed after the soils have been flooded. This soil is also suited to irrigated pastures.

Capability unit IIw-4, irrigated

The soils in this unit are deep, nearly level, somewhat poorly drained and poorly drained. They are on bottom lands along drainageways with low gradients. These soils have a silt loam surface layer. The underlying material is silty clay loam. Reaction in the surface layer is moderately alkaline.

Runoff is slow on the soils of this unit. Permeability is moderately slow. Available water capacity is high. The organic-matter content is moderate, and natural fertility is high. These soils have a moderately slow water intake rate. They absorb moisture easily and release it readily to plants. They have good workability.

The principal hazards of these soils are wetness that is caused by a moderately high water table, occasional flooding, and siltation. Most of these areas are in grass. Cultivation of these soils in spring is difficult because of the excessive wetness. Land leveling can be impractical because flooding and the resulting deposits of sediment are detrimental to the leveled areas. These soils are naturally subirrigated.

Gravity, border, or sprinkler irrigation systems are suited to these soils. Installing a drainage system that lowers the water table can help to improve crop production. Tile drainage or an open ditch drainage system improves drainage on these soils, but suitable outlets are necessary. Diversions remove the danger of flooding by diverting runoff water from adjacent higher fields. These soils are suited to pasture grasses.

Capability unit IIw-6, irrigated

Aowa silt loam, 0 to 2 percent slopes, is the only soil in this unit. This soil is deep, nearly level, well drained and moderately well drained. It is on bottom lands that are occasionally flooded. The surface layer and underlying material are silt loam. The soil is calcareous and mildly alkaline throughout the profile.

Runoff is slow on this soil. Permeability is moderate, and available water capacity is high. The organic-matter content is moderate, and fertility is medium. This soil releases moisture readily to plants. It has good workability. Wetness from flooding sometimes delays planting, and silty deposits left by floodwaters sometimes damage plants. Damage to crops is seldom severe, but the sediment damages areas that have been leveled for irrigation, and releveling may be necessary.

These soils are suited to all irrigated crops commonly grown in the county. Corn is the main crop. Border, furrow, and sprinkler systems are suited to this soil. Land leveling is generally needed for the satisfactory operation of furrow and border systems. Diversions are needed to protect the soil from flooding. Sustained production can be obtained on this soil by applying fertilizer to properly balance plant nutrients. Proper plant population and an efficient irrigation system that controls the amount and time of water application are needed.

Capability unit IIIe-3, irrigated

The soils in this unit are deep, gently sloping, and well drained. They are on broad ridgetops and on side slopes of divides. The surface layer and subsoil are silty clay loam. The underlying material is silt loam, but a few areas are underlain by loamy sand. Reaction is slightly acid or neutral in the surface layer.

Runoff is medium on soils of this unit. Permeability is moderately slow or slow in the subsoil. Available water capacity is high. The organic-matter content is low or moderate, and natural fertility is low or medium. These soils have a slow intake rate. The soils respond well to applications of fertilizer or barnyard manure. In places, lime is needed to establish stands of some legumes. These soils absorb moisture easily and release it readily to plants. Soils in this unit have fair to good workability.

A gravity or sprinkler irrigation system is suited to these soils. The hazard of water erosion is as great or greater under irrigation as it is under dryland farming.

Contour bench land leveling with terraces controls water erosion on these soils, under a gravity irrigation system. This method, however, is not suited to all areas of these soils. Water erosion can be controlled by a conservation tillage system, terraces, contour farming, and grassed waterways in areas where a sprinkler system is used. Returning all crop residue to the soil, and avoiding soil compaction help increase water intake rates. These soils are suited to row crops and alfalfa, and to a mixture of grass and alfalfa for irrigated pastures.

A tailwater recovery system improves irrigation efficiency and conserves water resources.

Capability unit IIIe-4, irrigated

Maskell loam, 2 to 6 percent slopes, is the only soil in this unit. This soil is deep, well drained, and gently sloping. It is on foot slopes. The surface layer is loam, the subsoil is loam and clay loam, and the underlying material is silt loam. Reaction is neutral in the surface layer.

Runoff is medium on this soil. Permeability is moderate. Available water capacity is high. Organic-matter content is moderate, and natural fertility is high. This soil has a moderately slow intake rate. This soil absorbs moisture easily and releases it readily to plants. It has good workability.

Controlling erosion is not a serious problem on this soil. In places, however, small gulleys and ditches form in natural waterways where water from adjacent land flows across this soil. Soil blowing is a minor concern in some included areas with a sandy surface layer.

This soil has few restrictions under irrigation. A furrow or sprinkler irrigation system is suited to this soil. Land leveling is needed for furrow irrigation. This soil is suited to corn, soybeans, and grass for pasture. Proper plant population and an efficient irrigation system that controls the amount and time of water application is needed on these soils. A conservation tillage system of planting row crops reduces soil blowing and water erosion, and improves the water intake rate.

The hazard of water erosion is as great or greater under irrigation as it is for dryland farming.

Contour bench land leveling for irrigation, or contour furrow land leveling with terraces, control water erosion under a surface irrigation system.

Capability unit IIIe-5, irrigated

Moody-Leisy complex, 6 to 11 percent slopes, is the only mapping unit in this unit. These soils are deep, well drained, and strongly sloping. They are on side slopes of upland divides. The surface layer is sandy loam, in the Leisy soil, and silty clay loam in the Moody soils. The subsoils are silty clay loam, and the underlying material is silt loam. Reaction is slightly acid to neutral in the surface layer of both soils.

Runoff is medium on these soils. Permeability is moderately slow. Available water capacity is high. The organic-matter content is moderate, and natural fertility is medium. The Moody soil has a slow intake rate and the Leisy soil has a moderate intake rate. These soils release moisture readily to plants. The Leisy soils have good workability and Moody soils have fair workability. Except for slope, these soils have few restrictions under irrigation.

These soils are suited to all crops commonly grown in the county. They are also well suited to tame grasses for pasture. Corn, soybeans, and alfalfa are the main crops. Returning crop residues to the soil, and application of commercial fertilizers and barnyard manure maintain fertility of these soils. Leaving crop residue on the surface helps reduce runoff and improves water intake.

Sprinkler systems are suited to these soils. In areas where sprinklers are used, terraces, contour farming, conservation tillage, and grassed waterways help control erosion. Leaving crop residue on the surface, and avoiding excessive soil compaction help increase intake and improve tilth. A tailwater recovery system improves irrigation efficiency and helps conserve water resources.

Capability unit IIIe-6, irrigated

The soils in this unit are deep, gently sloping, and well drained. They are on side slopes in uplands and on foot slopes. The surface layer, subsoil, and underlying material are silt loam. Reaction is neutral to moderately alkaline in the surface layer.

Runoff is medium on the soils of this unit. Permeability is moderate, and available water capacity is high. The organic-matter content is low or moderate, and natural fertility is low or medium. These soils have a moderate intake rate. In areas with moderate organic-matter content, the soils absorb moisture easily and release it readily to plants. In areas where it is low, however, the soils puddle easily and do not absorb moisture so easily as the other soils in this unit. These soils have good workability.

These soils are suited to corn, alfalfa, and to a mixture of grain and alfalfa for irrigated pastures.

A surface or sprinkler irrigation system is suited to these soils. The hazard of water erosion is as great or greater under irrigation as it is for dryland farming. Contour bench land leveling for irrigation, or contour furrow land leveling with terraces, controls water erosion under a surface irrigation system. In areas where a sprinkler system is used, water erosion can be controlled by a conservation tillage system, terraces, contour farming, and grass waterways. Returning all crop residue to the soil and avoiding soil compaction help increase intake rates.

A tailwater recovery system improves the irrigation efficiency and helps conserve water resources.

Capability unit IIIe–8, irrigated

Ortello sandy loam, 2 to 6 percent slopes, is the only soil in this unit. This soil is deep and well drained. It is on stream terraces and uplands. It has a sandy loam surface layer and subsoil. The underlying material is loamy sand. Reaction is slightly acid or neutral throughout the profile.

Permeability is moderately rapid. Available water capacity is moderate. The organic-matter content is moderate, and natural fertility is medium. This soil has a moderately high intake rate.

Soil blowing and low moisture retention are the main concerns of management. Conserving moisture and maintaining the organic-matter content and fertility are also management concerns.

These soils are well suited to corn and alfalfa. They are also suited to small grains, grasses, and legumes. Furrows, borders, or a sprinkler system are suited to this soil. Leveling is needed if furrows and borders are used, but deep cuts need to be avoided because of the danger of exposing the sandy underlying material. Light and frequent applications of irrigation water are needed on this soil. An excessive amount of water leaches soluble plant nutrients below the roots of some crops. Returning crop residue to the soil reduces the hazard of soil blowing at planting time. Plant residue should be left on the surface of the soil after harvest. A conservation system of planting row crops, along with contour farming, control water erosion and soil blowing.

Capability unit IIIs–11, irrigated

Sarpy loamy fine sand, 0 to 2 percent slopes, is the only soil in this unit. This soil is deep and excessively drained. It is on bottom lands of the Missouri River Valley. The surface layer is loamy fine sand, and the underlying material is mainly fine sand. Reaction is mildly alkaline or moderately alkaline throughout the profile.

Permeability is rapid. Available water capacity is low. The organic-matter content and natural fertility are low. This soil has a very high intake rate. This soil is subject to severe soil blowing and lacks an abundance of the important plant nutrients such as nitrogen and phosphorus.

The hazard of soil blowing and the low moisture retention of this soil are the main concerns of management. The sprinkler system is much better suited to this soil than the other methods of irrigation.

Corn, soybeans, alfalfa, and grass are the main crops. A conservation tillage system that keeps crop residue on the surface helps prevent this soil from blowing. The water application rate of a sprinkler system can be high on this soil because it absorbs water rapidly, but applications need to be frequent because of the low moisture retention.

Capability unit IIIw–1, irrigated

The soils in this unit are deep, nearly level, and poorly drained. They are on bottom lands of the Missouri River Valley. The surface layer and underlying material are silty clay. Reaction is mildly or moderately alkaline in the surface layer.

Runoff is slow or ponded on the soils of this unit. Permeability is slow. Available water capacity is moderate. The organic-matter content is moderately low or high, and natural fertility is low to high. These soils have a very slow intake rate. They release moisture slowly to plants. Good tilth is difficult to maintain. Because these soils are generally sticky when wet and very hard when dry, they need to be tilled at the proper moisture content. Water runs in from adjoining land and ponds on the surface in places.

High levels of production are difficult to obtain on these soils. Crop growth is limited by the excess water, and wetness commonly delays cultivation in spring and restricts root growth. Moisture moves downward slowly in most areas. Moisture causes the clayey part of the soil to expand, and closes the natural openings in the soil. This reduces water intake and soil aeration. These soils crack badly when dry, and damage to plant roots can be extensive. A high level of management is needed when irrigating these soils. The proper amount of water, and the correct rate and frequency of application are important on these soils. A conservation tillage system reduces soil compaction and the amount of tillage required to plant a crop.

Poor surface drainage and the restricted movement of air and water in these soils are the main concerns of management. Returning crop residue to the soil and applications of fertilizer help maintain fertility. This soil is suited to furrow, border, or sprinkler irrigation. Land leveling is needed for the furrow and border systems.

These soils are suited to most crops commonly grown in the county. Corn is the main crop. These soils are also suited to grass for irrigated pasture. Planting alfalfa on these soils increases the movement of water through the profile because the roots open the clay layer.

Capability unit IVe–3, irrigated

The soils in this unit are deep, strongly sloping, and well drained. They are on uplands. These soils have a silty clay loam surface layer and subsoil. Reaction is slightly acid in the surface layer. The underlying material is silt loam. In some areas the soils are eroded.

Runoff is medium on soils of this unit. Permeability is moderate or moderately slow. Available water capacity is high. The organic-matter content is moderate to low, and natural fertility is medium or low. Moisture is released readily to plants. The intake rate is slow. It is slighlty less in areas of eroded soil than it is in areas where the soil is uneroded. Soils of this unit tend to become cloddy if tilled when wet.

Erosion is the principal hazard when managing these soils. In places lime is needed to establish such legumes as clover or alfalfa.

Because of the erosion hazard, the crops better suited to irrigation are close sown ones such as small grain, alfalfa, and grass. Row crops can be grown successfully if all crop residues are returned to the soil and erosion is controlled by terracing, contour farming, and using grassed waterways.

These soils are suited to either surface or sprinkler systems of irrigation. Most areas, because of irregular and short slopes, are not readily shaped for a surface irrigation system. The hazard of water erosion is as great or greater in irrigated areas as it is in areas used for dryland farming.

Contour bench land leveling or leveling for contour furrows with terraces are conservation practices used to control erosion where there is a surface irrigation system. Where a sprinkler system is used, erosion can be controlled by conservation tillage, terracing, contour farming, and using grassed waterways. Returning all crop residue to the soil and avoiding soil compaction help to increase the speed of water intake. A tailwater recovery system will improve irrigation efficiency and conserve water resources.

Capability unit IVe–6, irrigated

The soils in this unit are deep, strongly sloping, and well drained. They are on concave foot slopes and convex side slopes of the uplands. The soils have a silt loam surface layer. The subsoil and underlying material are silt loam. Reaction is neutral to moderately alkaline in the surface layer. In some areas the soils of this unit are eroded.

Runoff is medium on the soils of this unit. Water intake rates are moderate. Permeability is moderate. Available water capacity is high. The organic-matter content is moderate in areas of uneroded soil and low in areas of eroded soil. Moisture is released readily to plants. The intake rate is slightly slower in areas of eroded soil. The eroded silt soils tend to puddle, and this reduces the intake rate. Workability is good.

Erosion is the principal hazard. The soils of this unit are suited to a surface or sprinkler system of irrigation. In most areas slopes are short and complex, and surface irrigation systems require extensive land shaping. The erosion hazard is as great or greater in irrigated areas as it is where areas are used for dryland farming.

Contour bench land leveling for irrigation or contour furrow land leveling with terraces are conservation practices used to control erosion under a surface irrigation system. Where a sprinkler irrigation system is used, erosion can be controlled by conservation tillage, terracing, contour farming, and using grassed waterways. Returning all crop residue to the soil and avoiding soil compaction help to increase the speed of water intake.

These soils are suited to alfalfa and to grass and alfalfa for irrigated pasture. Fertilizer should be applied as indicated by soil tests. Insects and plant diseases need to be controlled. A tailwater recovery system will improve the irrigation efficiency and conserve water resources.

Capability unit IVe–11, irrigated

The soils in this unit are deep, gently sloping to strongly sloping, and somewhat excessively drained and well drained. These soils are on uplands. The surface layer is sandy loam or loamy sand. The underlying material is loamy sand in most areas. In others, the subsoil is silty clay loam and the underlying material is silt loam. Reaction is slightly acid or neutral in the surface layer.

Permeability is moderately slow to rapid. Available water capacity is high to low. The organic-matter content is low to moderate, and natural fertility is low or medium. These soils have a very high intake rate. They are subject to severe blowing and commonly lack some of the important plant nutrients.

Soil blowing and the low moisture retention of these soils are the main concerns of management. A sprinkler system is the only suitable irrigation method for these soils. A conservation tillage system that keeps crop residue on the surface will control soil blowing. Adequate applications of fertilizer insure enough crop residue to control blowing and to improve fertility. Soil tests are needed to determine the kinds and amounts of minor elements needed to maintain fertility.

These soils are suited to all crops commonly grown in the county. Corn is the main crop. Light and frequent applications of irrigation water are needed on these soils. Fertilizer can be applied in split application to avoid leaching of water-soluble nutrients during periods of excessive rainfall.

Capability unit IVs–1, irrigated

Sarpy silt clay, overwash, 0 to 2 percent slopes, is the only soil in this unit. This soil is deep and excessively drained. It is on bottom lands of the Missouri River Valley. The surface layer is thin and is silty clay. The underlying material is loamy fine sand in the upper part, and fine sand in the lower part. Reaction is moderately alkaline throughout the profile.

Permeability is rapid in the coarse underlying material. Available water capacity, organic-matter content, and natural fertility are low. This soil has a slow intake rate. It is subject to ponding in low areas.

The low intake rate and the low moisture retention of this soil are the main concerns of management. A sprinkler system is well suited to this soil. Land leveling needed for the furrow and border systems could expose the sandy underlying material in some areas.

This soil is suited to the crops commonly grown in the county, especially corn and alfalfa. Applications of irrigation water need to be frequent and light to maintain an adequate supply of moisture in the soil. Applications of commercial fertilizer and barnyard manure help improve tilth and maintain fertility. Fertilizer needs to be applied in split applications to avoid leaching water soluble nutrients.

Predicted yields

Crop yield predictions are an important interpretation that can be made from a soil survey. Table 2 lists the predicted yields per acre for the principal crops grown on soils of Dixon County. These predictions are based on the average yield of seeded acres over the most recent 5-year period. They do not represent anticipated yields that might be obtainable in the future under a new, and possible different, technology.

Yields for various crops were derived from information obtained in interviews with farmers, directors of

TABLE 2.—*Yields per acre of crops and pasture*

[Yields in columns N are for nonirrigated soils; those in columns I are for irrigated soils. All yields were estimated for a high level of management in 1975. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn		Soybeans		Oats		Alfalfa hay	
	N	I	N	I	N	I	N	I
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Ton*	*Ton*
Albaton:								
Ab	80	115	34	---	56	---	4.0	---
Alcester:								
AcC	95	125	35	---	75	---	4.0	---
AcD	85	110	30	---	65	---	3.8	---
AsG	---	---	---	---	---	---	---	---
Aowa:								
Ao	100	125	38	---	65	---	4.0	---
Ap	---	---	---	---	---	---	---	---
Baltic:								
Ba	65	100	28	---	48	---	3.7	---
Bazile:								
BcC	70	110	30	---	62	---	3.2	---
Blendon:								
BeB	60	125	20	---	50	---	3.0	---
Calco:								
Ca	90	125	35	---	80	---	4.0	---
Cb	87	115	34	---	70	---	4.0	---
Cc	---	---	---	---	---	---	---	---
Colo:								
Ce	92	120	35	---	70	---	4.5	---
Crofton:								
CfC2	65	95	22	---	35	---	3.0	---
CfD2	60	80	20	---	30	---	3.0	---
CfE2	50	---	---	30	---	---	2.5	---
CfF, CfF2	---	---	---	---	---	---	---	---
CfG	---	---	---	---	---	---	---	---
Grable:								
[1]Gb	68	120	22	---	50	---	2.0	---
Haynie:								
[1]He	96	140	34	---	65	---	4.0	---
Kennebec:								
Ke	110	130	38	---	65	---	4.3	---
Lamo:								
La	70	95	25	---	---	---	4.0	---
Maskell:								
Mh	110	135	38	45	75	---	4.3	---
MhC	90	125	32	42	70	---	4.0	---
Modale:								
[1]Mk	90	125	35		60	---	4.0	---
Moody:								
Mo	90	125	38	---	70	---	4.0	---
MoC	87	120	35	---	68	---	3.8	---
MoC2	82	110	32	---	65	---	3.7	---
MoD	80	110	28	---	62	---	3.3	---
MoD2	72	100	26	---	52	---	3.0	---
MsC	80	115	28	---	60	---	3.2	---
MsD	75	115	26	---	54	---	3.0	---

TABLE 2.—*Yields per acre of crops and pasture*—Continued

Soil name and map symbol	Corn		Soybeans		Oats		Alfalfa hay	
	N	I	N	I	N	I	N	I
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Ton*	*Ton*
Nora:								
NoE	60	---	---	---	50	---	3.0	---
NoE2	55	---	---	---	42	---	2.8	---
NoF	---	---	---	---	---	---	---	---
NrC	75	115	30	---	65	---	3.0	---
NrC2	72	105	28	---	62	---	2.9	---
NrD	70	105	25	---	55	---	2.8	---
NrD2	65	95	22	---	50	---	2.7	---
NsE	60	---	22	---	50	---	2.7	---
NsF	---	---	---	---	---	---	---	---
Onawa:								
On	82	110	34	---	60	---	4.2	---
Ortello:								
OrC	52	120	22	---	34	---	2.5	---
Percival:								
Pe	62	110	24	---	50	---	3.0	---
Sarpy:								
Sa	35	60	12	---	25	---	1.5	---
Sc	60	75	20	---	40	---	2.0	---
SdB	---	---	---	---	---	---	---	---
SrB	---	---	---	---	---	---	---	---
Thurman:								
TaE	---	---	---	---	---	---	---	---
ThC	35	100	---	---	30	---	1.5	---
ThC2	---	---	---	---	---	---	---	---
ThD	---	---	---	---	---	---	---	---
ThD2	---	---	---	---	---	---	---	---
TnC	60	110	---	---	30	---	1.5	---
TnD	50	100	---	---	---	---	1.2	---
Zook:								
Zo	85	115	35	---	55	---	4.5	---
Zw	75	110	32	---	50	---	4.5	---

[1] Yields are for areas protected from flooding.

the Natural Resource Districts, representatives of the Soil Conservation Service and Agricultural Extension Service, and others familiar with the soils and agriculture of the county. Yield information from the Agriculture Stabilization and Conservation Service and research data from Agricultural Experiment Stations were also used. Yield records, trends, research, and experience were taken into consideration.

Crop yields are influenced by many factors. Among the most influential are depth, texture, slope, and drainage. Erosion, available water capacity, permeability, and fertility are also important factors. Management practices such as the cropping pattern, timeliness of operations, plant population, and crop variety also affect crop yields. Weather is significant, on a day-to-day basis, and on a seasonal or yearly basis.

The yields listed in Table 2 are those predicted under a high level of management. Under this management level, fertility is maintained and fertilizer or lime is applied at rates indicated by soil tests and field experiments. Crop residues are returned to the soil to improve tilth and to maintain or increase the organic-matter content. Adapted varieties of seed are used, and plant populations are optimum. Weeds, insects, and diseases are controlled. Irrigation water is applied in a timely manner and in the proper amounts. Water erosion and soil blowing are controlled. The soil is drained in areas that are needed for crop production. Tillage and seeding practices are performed at the proper time and are adequate. The soil is protected from deterioration, and is used according to its capacity.

One of the uses for the yield table is to compare the productivity of one soil with other soils in the county. The table does not give recommendations and the yields given do not apply to specific farms or farmers.

The yields are long time averages, and the figures given may vary in any one year on a particular soil. This is due to climatic variations, infestations of diseases, insects, or other unpredictable hazards. Yield data can become obsolete and needs to be updated as more knowledge is gained about the soils, and improvements in agricultural technology become available.

Management of the soils for range [2]

Approximately 8 percent of the total agricultural acreage in Dixon County is rangeland. Areas of range are scattered throughout the county, but are mostly in the strongly sloping to steep uplands between Highway 12 and the Missouri River bottom lands. The major areas in range are in the Crofton-Alcester-Nora and the Nora-Crofton-Alcester associations.

Raising livestock, mainly cow and calf herds, with calves sold in the fall as feeders, is the third largest agricultural industry in the county. The range is generally grazed from late spring to early fall. The livestock graze on corn aftermath the remainder of the year. They are fed alfalfa and native grass hay from about April 1 to mid-May.

Management and improvement practices

The use of proper grazing, deferred grazing, and planned grazing maintains or improves the conditions of range. The distribution of livestock in a pasture can be improved by the correct location of fences, livestock water, and salt.

Seeding or reseeding of native grasses, either wild harvest or improved strains, improves the condition of range. Soils, such as Crofton silt loam, 15 to 20 percent slopes, eroded, and Thurman loamy sand, 6 to 11 percent slopes, eroded, that are still being used as cropland are better suited to use as range. Among the grasses suitable for seeding are big bluestem, little bluestem, indiangrass, switchgrass, and side-oats grama. After seeding, little care other than management of grazing is needed to maintain forage production.

Range site and condition classes

Different kinds of range produce different kinds and amounts of native grass. For proper range management, an operator needs to know the different kinds of land or range sites in his holding and the native plants each site can grow. Management that favors the growth of the best forage plants on each kind of soil can then be used.

Range sites differ from each other in their ability to produce a significantly different kind or amount of climax or original vegetation. A significant difference is one great enough to require some variation in management, such as a different stocking rate. Climax vegetation is the combination of plants that originally grew on a given site. The most productive combination of range plants on a site is generally the climax vegetation.

Range condition is classified according to the percent of original or climax vegetation on the site. This classification is used for comparing the kind and amount of present vegetation with that which the site can produce. Changes in range condition are caused mainly by the intensity of grazing and by drought.

Vegetation is altered by intensive grazing. Livestock graze selectively. They seek the more palatable and nutritious plants. Plants react to grazing in one of three ways. They decrease, increase, or invade. Decreaser and increaser plants are both part of the climax vegetation. Generally, *decreasers* are the most heavily grazed and, consequently, the first to be injured by overgrazing. *Increasers* withstand grazing better because they are less palatable to the livestock. They increase under grazing and replace the decreasers. *Invaders* are weeds that become established after the climax vegetation has been reduced by grazing.

Range condition indicates the degree to which the composition of the existing plant community differs from the climax vegetation. Four classes are recognized. The condition is *excellent* if 76 to 100 percent of the vegetation is climax; *good* if 51 to 75 percent is climax; *fair* if 26 to 50 percent is climax; and *poor* if 0 to 25 percent is climax.

Descriptions of range sites

The range sites in Dixon County are described in this section. The descriptions include the topography of each site, a brief description of the map units in each site, the dominant vegetation on the site when in excellent condition, the dominant vegetation in poor range condition, and the total annual production in pounds per acre, air-dry weight for years when the site is in excellent condition.

To find the names of all the soils in any given site, refer to the "Guide to Map Units" at the back of this survey. The range sites for each map unit are given in the "Guide to Map Units."

Wet land range site

Calco silty clay loam, wet, 0 to 2 percent slopes, is the only soil in this site. It is deep, nearly level, and very poorly drained. This soil is on bottom lands. Runoff is slow. This soil has a silty clay loam surface layer and underlying material. The water table is near the surface in spring and ponds at times in small microdepressions. These soils are seldom dry enough to cultivate. The type of vegetation is mainly a result of a water table that is above the surface for part of the growing season.

The climax plant cover is a mixture of grasses that decrease with season long overuse. These grasses include prairie cordgrass and reedgrass. They make up at least 75 percent of the total plant volume. The rest is other perennial grass-like plants and forbs. Members of the sedge family are the principal increasers. When the site is in poor condition, the typical plant community consists of Kentucky bluegrass, redtop, red clover, foxtail barley, dandelion, common ragweed, and sparse amounts of prairie cordgrass and members of the sedge family. When it is in excellent range condition, the total annual production ranges from a low of 5,500 pounds per acre, air-dry weight in unfavorable years, to a high of 6,500 pounds in favorable years.

Subirrigated range site

This site consists of nearly level, poorly drained and somewhat poorly drained soils on bottom lands of the major upland drainageways. These soils are deep and have a silty clay loam or silt loam surface layer. The underlying material is silty clay loam. Reaction is neutral to moderately alkaline in the surface layer. Fertility is high. The type of vegetation is mainly a result of a water table that fluctuates between depths

[2] Prepared by PETER N. JENSEN, range conservationist, Soil Conservation Service.

of 1 and 2 feet in spring and is at a depth of 4 feet late in summer. The water table is rarely at the surface, but it stays in the rooting zone during the growing season.

The climax plant cover is a mixture of grasses that decrease with season long overuse. These grasses include big bluestem, indiangrass, switchgrass, slender wheatgrass, prairie cordgrass, and Canada wildrye. They make up at least 75 percent of the total plant volume. The rest is other perennial grasses and forbs. Kentucky bluegrass, green muhly, and members of the sedge family are the principal increasers. When the site is in poor range condition, the typical plant community consists of Kentucky bluegrass, foxtail barley, timothy, redtop, dandelion, common ragweed, and members of the sedge family. When the site is in excellent range condition, the total annual production ranges from a low of 4,500 pounds per acre, air-dry weight in unfavorable years, to a high of 6,000 pounds per acre in favorable years.

Silty overflow range site

This site consists of deep, nearly level, well drained to poorly drained soils on bottom lands. They are occasionally or frequently flooded. These soils have a silt loam surface layer and silt loam or silty clay loam underlying material. They are calcareous at the surface. Vegetation is influenced by the additional moisture received as runoff from adjacent areas and the deposit of sediment on the surface. It is also influenced by the high available water capacity and the moderate or moderately slow permeability of the soils.

The climax plant cover is a mixture of grasses that decrease with season long overuse. These include big bluestem, little bluestem, indiangrass, switchgrass, and Canada wildrye. They make up at least 70 percent of the total plant volume. The rest is other perennial grasses and forbs. Western wheatgrass, sideoats grama, Kentucky bluegrass, and members of the sedge family are the principal increasers. When the site is in poor range condition, the typical plant community consists of Kentucky bluegrass, western wheatgrass, Baldwin ironweed, common ragweed, and members of the sedge family. When it is in excellent range condition, the total annual production ranges from a low of 4,000 pounds per acre, air-dry weight in unfavorable years, to a high of 5,000 pounds per acre in favorable years.

Clayey overflow range site

This site consists of deep, nearly level, and excessively drained to poorly drained soils on bottom lands. The surface layer is mainly silty clay, but it is silty clay loam in a few areas. The subsoil and underlying material ranges from silty clay to fine sand. Reaction in the surface layer ranges from slightly acid to mildly alkaline. The available water capacity is low to moderate. Natural fertility is low to high. The type of vegetation on this site is influenced by ponding of water following floods and by the slow or moderately slow permeability of the surface layer.

The climax plant cover is a mixture of grasses that decrease with season long overuse. These grasses include big bluestem, switchgrass, indiangrass, little bluestem, and Canada wildrye. They make up at least 50 percent of the total plant volume. The rest is other perennial grasses and forbs. Western wheatgrass, blue grama, buffalograss, and members of the sedge family are the principal increasers. When the site is in poor range condition, the typical plant community consists of Kentucky bluegrass, western wheatgrass, common ragweed, and members of the sedge family. When the site is in excellent range condition, the total annual production ranges from a low of 3,000 pounds per acre, air-dry weight in unfavorable years, to a high of 4,500 pounds in favorable years.

Sandy lowland range site

This site consists of nearly level or very gently sloping, excessively drained soils on bottom lands. These soils have a loamy fine sand surface layer and fine sand underlying material. They are calcareous and mildly alkaline in reaction. The type of vegetation is influenced by the rapid permeability, high intake rate, and the easy release of moisture to plants. In most years, the water table is at a high of about 6 to 7 feet in spring.

The climax plant cover is a mixture of grasses that decrease with season long overuse. These grasses include sand bluestem, little bluestem, switchgrass, and Canada wildrye. They make up at least 60 percent of the total plant volume. The rest is other perennial grasses and forbs. Prairie sandreed, blue grama, Scribner panicum, sand dropseed, needleandthread, and members of the sedge family are the principal increasers. When the site is in poor range condition, the typical plant community consists of sand dropseed, blue grama, Scribner panicum, and common ragweed. When the site is in excellent range condition the total annual production ranges from a low of 3,000 pounds per acre, air-dry weight in unfavorable years to a high of 4,500 pounds in favorable years.

Silty lowland range site

This site consists of nearly level to gently sloping, well drained to somewhat poorly drained soils on stream terraces and high bottom lands that are rarely flooded. These soils are deep and the surface layer is silt loam, loam, or very fine sandy loam. The subsoil ranges from silt loam to fine sandy loam. In a few areas, the lower part of the underlying material is silty clay. Reaction is neutral to moderately alkaline in the surface layer. The type of vegetation is influenced by the slow runoff, moderate to high available water capacity, and moderate permeability of the soils.

The climax plant cover is a mixture of grasses that decrease with season long overuse. These grasses include big bluestem, indiangrass, switchgrass, little bluestem, and Canada wildrye. They make up at least 70 percent of the total plant volume. The rest is other grasses and forbs. Western wheatgrass, blue grama, side-oats grama, and members of the sedge family are the principal increasers. When the site is in poor range condition, the typical plant community consists of Kentucky bluegrass, western wheatgrass, common ragweed, and various sedges. When the site is in excellent range condition, the total annual production ranges from a low of 3,500 pounds per acre, air-dry weight in unfavorable years to a high of 4,500 pounds in favorable years.

Sands range site

This site consists of gently undulating to hilly soils on uplands, stream terraces, and bottom lands. They are deep and somewhat excessively drained or excessively drained. Most areas of these soils have a loamy sand surface layer, but a few are fine sand and sand. The underlying material is loamy sand and sand. Reaction is slightly acid or neutral in the surface layer. The type of vegetation that grows on this site is mainly a result of the low available water capacity, and the coarse soil texture that allows plant nutrients to be leached. Over grazing in areas where cattle gather destroys the vegetation in places. Soil blowing is a very severe hazard in these areas. Because they can store only a small amount of available moisture, these soils are droughty.

The climax plant cover is a mixture of plants that decrease with season long overuse. These grasses include sand bluestem, switchgrass, indiangrass, porcupinegrass, prairie junegrass, and leadplant. They make up at least 65 percent of the total plant volume. The rest is other perennial grasses and forbs. Little bluestem, prairie sandreed, blue grama, hairy grama, Scribner panicum, sand dropseed, and sand paspalum are the principal increasers. When the site is in poor range condition the typical plant community consists of blue grama, hairy grama, sand dropseed, Scribner panicum, sand paspalum, brittle prickly-pear, and western ragweed. When the site is in excellent range condition, the total annual production ranges from a low of 2,000 pounds per acre, air-dry weight in unfavorable years to a high of 3,500 pounds in favorable years.

Sandy range site

This site consists of deep, nearly level to gently sloping, well drained and somewhat excessively drained soils on stream terraces and uplands. The surface layer is sandy loam or loamy sand. The subsoil is sandy loam, and the underlying material is sandy loam, loamy sand, or sand. Reaction in the surface layer is neutral or slightly acid. The available water capacity is moderate to low. Fertility is medium or low. The type of vegetation is influenced by the moderately rapid and rapid permeability of the soils, and the well drained to somewhat excessive natural drainage.

The climax plant cover is a mixture of plants that decrease with season long overuse. These grasses include bluestem, little bluestem, switchgrass, indiangrass, side-oats grama, prairie junegrass, and leadplant. They make up at least 65 percent of the total plant volume. The rest is perennial grasses and forbs. Needleandthread, blue grama, prairie sandreed, hairy grama, and sand dropseed are the principal increasers. When the site is in poor range condition, the typical plant community consists of blue grama, Kentucky bluegrass, sand dropseed, and western ragweed. When the site is in excellent range condition the total annual production ranges from a low of 2,000 pounds per acre, air-dry weight in unfavorable years to a high of 3,500 pounds in favorable years.

Silty range site

This site consists of deep, nearly level to steep, well drained soils on uplands. The surface layer is mainly silt loam or silty clay loam but it is sandy loam in a few areas. The subsoil is silt loam or silty clay loam, and the underlying material ranges from silty clay loam to loamy sand. Reaction range is neutral to moderately alkaline in the surface layer. The type of vegetation is influenced by the moderate or moderately slow permeability, and the high available water capacity.

The climax plant cover is a mixture of plants that decrease with season long overuse. These grasses include big bluestem, little bluestem, switchgrass, prairie dropseed, indiangrass, and leadplant. They make up at least 70 percent of the total plant volume. The rest is other perennial grasses and forbs. Side-oats grama, blue grama, Scribner panicum, Kentucky bluegrass, and members of the sedge family are the principal increasers. When the site is in poor range condition, the typical plant community consists of blue grama, Kentucky bluegrass, Scribner panicum, western ragweed, blue verbena, and members of the sedge family. When the site is in excellent range condition, the total annual production ranges from a low of 3,000 pounds per acre, air-dry weight in unfavorable years to a high of 4,000 pounds in favorable years.

Limy upland range site

This site consists of deep, gently sloping to steep, well drained soils on uplands. The surface layer, transitional layer, and underlying material are silt loam. These soils are calcareous near the surface. Fertility and organic-matter content are low. The type of vegetation is influenced by the moderate permeability, and the calcareous condition of the soils. Native grasses grow well on these soils. Lack of sufficient moisture is the principal hazard. Erosion that results in small gullies is a hazard in cattle trails. Species that can tolerate the high lime content of the soils do best on this site.

The climax plant community is a mixture of grasses that decrease with season long overuse. These include little bluestem, big bluestem, indiangrass, switchgrass, and porcupinegrass. They make up at least 65 percent of the total plant volume. The rest is other perennial grasses and forbs. Side-oats grama, blue grama, Scribner panicum, western wheatgrass, and Kentucky bluegrass are the principal increasers. When the site is in poor range condition, the typical plant community consists of blue grama, Kentucky bluegrass, Scribner panicum, blue verbena, and western ragweed. When the site is in excellent range condition, the total annual production ranges from a low of 2,000 pounds per acre, air-dry weight in unfavorable years to a high of 3,500 pounds in favorable years.

Thin loess range site

Crofton silt loam, 30 to 60 percent slopes, is the only soil in this site. It is deep, very steep, well drained, and on uplands. This soil is silt loam throughout the profile. It is calcareous near the surface. This site has many catsteps or landslips. The type of vegetation is influenced by the very steep slope, the very rapid runoff, the small amount of soil development, and the limy soil condition.

The climax plant community is a mixture of grasses that decrease with season long overuse. These include little bluestem, big bluestem, indiangrass, switchgrass, and side-oats grama. They make up at least 80 percent of the total plant volume. The rest is other perennial grasses and forbs. Western wheatgrass, blue grama, sand dropseed, and members of the sedge family are the principal increasers. This site is rarely in a poor range condition, because it is not accessible to livestock. When the site is in excellent range condition, the total annual production ranges from a low of 1,500 pounds per acre, air-dry weight in unfavorable years to a high of 2,500 pounds in favorable years.

The following list gives the common name and respective scientific name for those plants named in the range section.

Common Name	Scientific Name
Baldwin ironweed	*Vernonia baldwini Torr.*
Big bluestem	*Andropogon gerardi Vitman.*
Blue grama	*Bouteloua gracilis (H.B.K.) Lag. ex Steud.*
Blue verbena	*Verbena hastata L.*
Brittle pricklypear	*Opuntia fragilis (Nutt.) Haw.*
Canada wildrye	*Elymus Canadensis L.*
Common ragweed	*Ambrosia artemisiaefolia L.*
Dandelion	*Taraxacum officinale Weber in Wiggers*
Foxtail barley	*Hordeum jubatum L.*
Green muhly	*Muhlenbergia racemosa (Michx.) B.S.P.*
Hairy grama	*Boutelou hirsuta Lag.*
Indiangrass	*Sorghastrum nutans (L.) Nash.*
Kentucky Bluegrass	*Poa pratensis L.*
Leadplant	*Amorpha canescens Pursh*
Little bluestem	*Andropogon scoparius Michx.*
Needleandthread	*Stipa comata Trin. and Rupr.*
Porcupinegrass	*Stipa spartea Trin.*
Prairie cordgrass	*Spartina pectinata Link*
Prairie dropseed	*Sporobolus heterolepis (A. Gray) A. Gray*
Prairie junegrass	*Koeleria cristata (L.) Pers.*
Prairie sandreed	*Calamovilfa longifolia (Hook) Scribn.*
Red clover	*Trifolium pratense L.*
Redtop	*Agrostis alba L.*
Reedgrasses	*Calamagrostis spp. Adans.*
Sand bluestem	*Andropogon hallii Hack.*
Sand dropseed	*Sporobolus cryptandrus (Torr.) A. Gray*
Sand paspalum	*Paspalum stramineum Nash*
Scribner panicum	*Panicum scribnerianum Nash.*
Sedges	*Carex spp. L.*
Side-oats grama	*Bouteloua curtipendula (Michx.) Torr.*
Slender wheatgrass	*Agropyron trachycaulum (Link) Malte*
Switchgrass	*Panicum virgatum L.*
Timothy	*Phleum pratense L.*
Western ragweed	*Ambrosia psilostachya DC.*
Western wheatgrass	*Agropyron smithii Rydb.*

Management of the soils for woodland and windbreaks[3]

Native woodland in Dixon County is limited to relatively narrow strips along the Missouri River and its tributaries, and on the steep and very steep areas of the Crofton-Alcester-Nora soils association. Some of this acreage is capable of producing commercial quantities of wood; however, its value for use as scenery, recreation areas, wildlife habitat, and watershed protection is even greater.

Eastern cottonwood, American elm, hackberry, green ash, willow, and other trees that can tolerate wetness grow on the nearly level bottom lands. These areas have a greater growth potential than those on the steeper uplands. The kinds of trees that make up the woodlands on the bottom lands, however, have much less commercial value than the kinds of trees on areas of the uplands.

On the steeper soils, the native species are bur oak, red oak, basswood, black walnut, American elm, red elm, shagbark hickory, hackberry, green ash, ironwood, and Kentucky coffeetree with an understory of Missouri gooseberry, trailing raspberry, and greenbrier.

Early settlers in Dixon County planted trees for protection, shade, and fenceposts; and throughout the years, landowners have continued to plant trees to protect their crops, buildings, and livestock. Native trees and shrubs contribute a great deal to the natural beauty of the Dixon County landscape. They benefit wildlife by producing food and cover.

Windbreaks are established to protect livestock, buildings, and yards from winds and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of both broadleaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind, and at specific intervals across the field. The interval depends on the erodibility of the soil. They protect cropland and crops from wind, and they hold snow on the fields. They also provide food and cover for wildlife.

Environmental plantings help to beautify and screen homes and other buildings and to abate noise around them. The plants, mostly evergreen shrubs and trees, are closely spaced. Healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 3 shows the height that locally adapted trees and shrubs are expected to reach on various kinds of soils in 20 years. The estimates in table 3, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from the local office of the Soil Conservation Service, Extension Service, or local nurserymen.

The rate of growth of a windbreak varies widely with soil moisture conditions. Soil fertility, exposure of the soil, and arrangement of trees within the windbreak also have a marked effect on growth. Some species, such as Eastern cottonwood, Siberian elm, and Russian-olive grow faster than others, and some grow fast when young, but die early. Boxelder and Russian mulberry commonly freeze back during severe winters. Green ash is susceptible to damage by borers.

[3] Prepared by JAMES W. CARR, JR., forester, Soil Conservation Service.

TABLE 3.—*Windbreaks and environmental plantings*

[The symbol < means less than; the symbol > means greater than. Dashes indicate that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights in feet of —				
	<8	8–15	16–25	26–35	>35
Albaton: Ab	---	---	Eastern redcedar	Silver maple, green ash.	American sycamore.
Alcester: AcC, AcD, AgG	---	Common chokecherry, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Blue spruce, ponderosa pine.	Eastern cottonwood.
Aowa: Ao, Ap	---	Autumn-olive, Amur honeysuckle.	Eastern redcedar, Russian mulberry.	Austrian pine, ponderosa pine, green ash.	Eastern cottonwood.
Baltic: Ba	---	---	---	---	---
Bazile: BcC	---	---	Eastern redcedar, green ash, hackberry, honeylocust.	Austrian pine, ponderosa pine.	---
Blendon: BeB	American plum, Peking cotoneaster, lilac.	Eastern redcedar, common chokecherry.	Green ash, hackberry.	Ponderosa pine	---
Calco: Ca, Cb	---	---	---	Green ash, silver maple.	American sycamore, eastern cottonwood.
Cc	---	---	---	---	---
Colo: Ce	---	---	Eastern redcedar	Silver maple, green ash.	American sycamore, eastern cottonwood.
Crofton: CfC2, CfD2, CfE2	Skunkbush sumac	Russian-olive	Eastern redcedar, bur oak.	Ponderosa pine	---
CfF, CfF2, CfG	---	---	---	---	---
Grable: Gb	American plum, lilac.	Autumn-olive, Peking cotoneaster, Amur honeysuckle.	Austrian pine, eastern redcedar.	Ponderosa pine, hackberry, green ash.	Eastern cottonwood.
Haynie: He	---	---	Eastern redcedar	Austrian pine, ponderosa pine, green ash, hackberry.	---
Kennebec: Ke	---	American plum, lilac.	Eastern redcedar	Scotch pine, eastern white pine, blue spruce, Austrian pine, ponderosa pine, green ash.	Eastern cottonwood.

TABLE 3.—*Windbreaks and environmental plantings*—Continued

Soil name and map symbol	Trees having predicted 20-year average heights in feet of —				
	<8	8–15	16–25	26–35	>35
Lamo: La	Redosier dogwood		Eastern redcedar, Austrian pine.	Green ash, golden willow, honeylocust.	
Maskell: Mh, MhC		Peking cotoneaster	Eastern redcedar, Russian mulberry, boxelder.	Ponderosa pine, Austrian pine, green ash, honeylocust.	
Modale: Mk	American plum, lilac.	Amur honeysuckle, Peking cotoneaster.	Eastern redcedar	Ponderosa pine, Austrian pine, green ash, hackberry.	Eastern cottonwood.
Moody: Mo, MoC, MoC2, MoD, MoD2.	Lilac, American plum.	Silver buffaloberry, common chokecherry.	Eastern redcedar, green ash, hackberry, Russian-olive, Siberian crabapple, blue spruce.	Ponderosa pine	
MsC: Moody part	Lilac, American plum.	Silver buffaloberry, common chokecherry.	Green ash, hackberry, Russian-olive, Siberian crabapple, eastern redcedar, blue spruce.	Ponderosa pine	
Leisy part	Amur honeysuckle, American plum.		Eastern redcedar, Russian mulberry.	Ponderosa pine, Austrian pine, green ash, hackberry, honeylocust.	Eastern cottonwood.
MsD: Moody part	Lilac, American plum.	Silver buffaloberry, common chokecherry.	Eastern redcedar, green ash, hackberry, Russian-olive, Siberian crabapple, blue spruce.	Ponderosa pine	
Leisy part	Amur honeysuckle, American plum.		Eastern redcedar, Russian mulberry.	Ponderosa pine, Austrian pine, green ash, hackberry, honeylocust.	Eastern cottonwood.
Nora: NoE, NoF, NoE2, NrC, NrC2, NrD, NrD2.	Lilac	American plum, common chokecherry, silver buffaloberry.	Eastern redcedar, green ash, hackberry, Russian-olive, blue spruce.	Ponderosa pine	
NsE: Nora part	Lilac	American plum, common chokecherry, silver buffaloberry.	Eastern redcedar, green ash, hackberry, Russian-olive, blue spruce.	Ponderosa pine	

TABLE 3.—*Windbreaks and environmental plantings*—Continued

Soil name and map symbol	Trees having predicted 20-year average heights in feet of —				
	<8	8–15	16–25	26–35	>35
NsE: Alcester part		Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
NsF: Nora part	Lilac	American plum, common chokecherry, silver buffaloberry.	Eastern redcedar, green ash, hackberry, Russian-olive, blue spruce.	Ponderosa pine	
Alcester part		Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Onawa: On	Redosier dogwood		Eastern redcedar	Silver maple, green ash.	American sycamore, eastern cottonwood.
Ortello: OrC		Amur honeysuckle	Eastern redcedar, Russian mulberry.	Ponderosa pine, Austrian pine, green ash, honeylocust.	Eastern cottonwood.
Percival: Pe	Redosier dogwood		Eastern redcedar	Silver maple, green ash.	American sycamore.
Sarpy: Sa, Sc	American plum, lilac, common chokecherry.	Amur honeysuckle, autumn-olive.	Eastern redcedar, Russian mulberry.	Ponderosa pine, Austrian pine, green ash, honeylocust.	
SdB: Sarpy part	American plum, lilac, common chokecherry.	Amur honeysuckle, autumn-olive.	Eastern redcedar, Russian mulberry.	Ponderosa pine, Austrian pine, green ash, honeylocust.	
Duneland part.					
SrB: Sarpy part	American plum, lilac, common chokecherry.	Amur honeysuckle, autumn-olive.	Eastern redcedar, Russian mulberry.	Ponderosa pine, Austrian pine, green ash, honeylocust.	
Riverwash part.					
Thurman: TaE					
ThC, ThC2			Eastern redcedar	Austrian pine, green ash, honeylocust.	
ThD, ThD2			Eastern redcedar, Austrian pine, ponderosa pine.		
TnC: Thurman part			Eastern redcedar	Austrian pine, green ash, honeylocust.	

TABLE 3.—*Windbreaks and environmental plantings*—Continued

Soil name and map symbol	Trees having predicted 20-year average heights in feet of —				
	<8	8-15	16-25	26-35	>35
TnC: Leisy part			Eastern redcedar, Russian mulberry.	Ponderosa pine, Austrian pine, green ash, hackberry, honeylocust.	Eastern cottonwood.
TnD: Thurman part			Eastern redcedar, Austrian pine, ponderosa pine.		
Leisy part			Eastern redcedar, Russian mulberry.	Ponderosa pine, Austrian pine, green ash, hackberry, honeylocust.	Eastern cottonwood.
Zook: Zo, Zw	Redosier dogwood		Eastern redcedar	Green ash, silver maple.	American sycamore, eastern cottonwood.

Selecting trees to fit the soil

Soils of Dixon County are placed in windbreak suitability groups according to characteristics that affect tree growth. To find the name of the group in which a soil is placed, refer to the Guide to Mapping Units at the back of the survey. Soils in the same windbreak suitability group produce trees of similar size and survival rate under similar weather and management.

The soils of Nebraska are grouped into windbreak suitability groups according to a statewide system. Not all of the groups in the statewide system are in Dixon County. In the following paragraphs, the windbreak suitability groups in Dixon County are described.

Windbreak suitability group 1

This group consists of deep, nearly level soils on bottom lands. The soils are well drained or moderately well drained. The surface layer is silt loam or very fine sandy loam. The underlying material in most of the soils in this group is stratified and is very fine sandy loam, silt loam, or silty clay loam. A few areas have fine sand or clay in the lower part of the substratum. The available water capacity is moderate or high. Reaction ranges from neutral to moderately alkaline in the surface layer.

These soils generally provide good tree planting sites. Adapted species have capability for good survival rates and growth. Competition from weeds and grasses for moisture is the principal hazard. Cultivation, by use of conventional equipment between the tree rows and by use either of hand hoeing or of chemical herbicides in the row, can eliminate this hazard. Flooding of short duration is a hazard in some areas.

Windbreak suitability group 2

This group consists of deep, nearly level soils on bottom lands. The soils are mostly somewhat poorly drained or poorly drained, except a few areas which are excessively drained. Wetness is a limitation. Water ponds on the surface after rains. The surface layer is silt loam, silty clay loam, or silty clay, but in a few areas fine sand is below the surface layer. Most of the soils in this group have moderate or high available water capacity, and some have low available water capacity. Reaction is neutral to moderately alkaline in the surface layer. Natural fertility ranges from low to high.

These soils generally provide good tree planting sites. Trees have capability for good survival rates and growth, if species are selected that can tolerate occasional wetness. Using species listed in table 3 for soils in this group will minimize this limitation. When dry, these soils shrink and cracks appear. This allows air to enter and dry out the roots of newly established plantings. Also, the herbaceous vegetation that grows on this site is abundant and persistent; plant competition may be a management problem in establishing trees. Establishment of seedlings can be a problem during wet years.

Windbreak suitability group 3

This group consists of deep, nearly level to gently sloping soils on bottom lands, stream terraces, and uplands. The soils are well drained to excessively drained. The surface layer is sandy loam or loamy fine sand. The subsoil and underlying material are mainly sandy loam, loamy sand, fine sand, or sand, but in a few areas the subsoil is silty clay loam. The available water capacity ranges from low to high, and soil fertility is low or medium. Reaction in the surface layer ranges from slightly acid to moderately alkaline.

These soils provide good tree planting sites. Adapted species have fair survival rates and good growth. Lack of moisture and soil blowing are the principal hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Cultivation generally needs to be restricted to the tree rows.

Windbreak suitability group 4

This group consists of deep, nearly level to moderately steep soils on colluvial foot slopes and loessial uplands. All of the soils are well drained. The surface layer is mainly silt loam, loam, or silty clay loam, except in a few areas it is sandy loam. The subsoil and underlying material range from silt loam to silty clay loam and loam, except in some areas they are sandy. These soils have high available water capacity. Reaction is slightly acid to mildly alkaline in the surface layer. Soil fertility ranges from medium to high, but in eroded areas it is low.

These soils generally provide good tree planting sites. Adapted species have capability for good survival rates and fair growth. Drought and competition for moisture from weeds and grasses are the principal hazards. The hazard of drought can be minimized by using the species listed in table 3 for soils in this group. Competition from weeds and grasses can be eliminated by using conventional cultivation equipment between the tree rows, or by hand hoeing or using suitable herbicides in the tree rows. Erosion is a hazard on the sloping soils. Trees should be planted on the contour wherever possible. Tree growth may be somewhat slower on the steeper slopes because of rapid runoff.

Windbreak suitability group 5

This group consists of deep, gently sloping to moderately steep soils on loessial uplands. The soils are well drained and are calcareous at or near the surface. They have an erosion hazard because they are very friable and are sloping. The surface layer, transitional layer, and underlying material are silt loam. The available water capacity is high. Because these soils are sloping and runoff is medium or rapid, the amount of moisture retained in the soil is low. Fertility is low. Reaction is moderately alkaline. Many areas are eroded.

These soils provide fair to poor tree planting sites. Adapted species have fair survival rates and growth. Lack of adequate moisture is the main hazard, and the calcareous soil condition is the principal limitation. Water erosion is a hazard where cultivation is used to control weeds. If trees are planted on the contour, normal cultivation between the rows can be used to store moisture and control weeds. The effect of the calcareous soil condition can be minimized by using only those species that can tolerate a high lime content.

Windbreak suitability group 6

Calco silty clay loam, wet, 0 to 2 percent slopes, is the only soil in this group. This soil is nearly level and very poorly drained and is on bottom lands. Water ponds on the surface in spring, and the water table is near the surface throughout the rest of the year. This soil is seldom dry enough to cultivate. The surface layer, subsoil, and underlying material are moderately fine textured. The entire profile is moderately alkaline in reaction and is calcareous. The available water capacity and soil fertility are high.

This soil generally provides poor tree planting sites; however, survival rates and growth of adapted species are fair. The principal limitation of this soil is the high water table. This limitation can be minimized by using only those species listed in table 3 for soils in this group. Excessive wetness may prohibit planting in some years. Also, normal methods of preparing the soil for planting cannot be carried out in the spring because of the high water table.

Windbreak suitability group 7

This group consists of deep, gently sloping to strongly sloping soils on eolian uplands. The soils are somewhat excessively drained. They have an erosion hazard because of sandy surface texture and slope. The surface layer is loamy sand, except in a few areas it is sandy loam. The underlying material is loamy sand and sand, except in a few areas the subsoil and underlying material are silty clay loam. Available water capacity is low in the sandy areas but is high in areas where the subsoil is silty. Fertility is low or medium. Reaction is slightly acid to neutral in the surface layer. Some areas are eroded and have a low organic-matter content.

These soils provide fair tree planting sites. Adapted species have fair survival rates and growth. Soil blowing and the lack of adequate moisture are the principal hazards. The soils are so loose that trees cannot be successfully cultivated without increasing the hazard of erosion. Where cultivated, young trees can be damaged during high winds and may be covered by drifting sand. This hazard can be minimized, however, by planting the trees in a shallow furrow with no cultivation. Only conifers can be grown successfully on these soils with this method of planting.

Windbreak suitability group 10

This group consists of soils and miscellaneous land areas that have a wide range of characteristics. Many areas are excessively wet, frequently flooded, gullied, steep or very steep, or excessively drained.

The soils of this group are generally not suited to windbreak plantings of any kind because of their unfavorable characteristics. Some areas can be used for recreation, forestation, and wildlife plantings of tolerant species of trees or shrubs if they are hand planted or if special approved practices are used.

Management of the soils for wildlife and recreation[4]

The type of wildlife in Dixon County is determined by the kind and amount of vegetation the soils support. Cover, food, and water are necessary for abundant wildlife.

Soil characteristics such as relief and fertility determine the numbers and quality of both game and nongame species of wildlife. The game species are mainly discussed here, although nongame species are also im-

[4] By ROBERT O. KOERNER, biologist, Soil Conservation Service.

portant. Nongame species also benefit when the habitat for game species is improved.

Outdoor interpretation and an appreciation of the natural environment by persons other than hunters and fishermen help people to understand the relationship between plants, animals, and man, and how all depend on the soil.

Wildlife species can be used to evaluate the quality of the environment. It has been said that a "livable environment for wildlife is generally a quality environment for man."

Kinds of wildlife by soil associations

The Sarpy-Onawa-Haynie association is on bottom lands adjacent to the Missouri River. This association supports scattered areas of marsh that are useful for waterfowl. Dense stands of eastern cottonwood and willow provide escape cover for deer, and homes for squirrel, raccoon, hawks, owls, and songbirds. Alfalfa and other crops provide food and cover for deer as well as for pheasants and bobwhite quail.

Recreation, such as waterfowl hunting, fishing, and hiking, is common. Sauger, catfish, and carp are harvested from the Missouri River. This river is wide, carries much suspended sediment, and flows fairly rapidly. It is more suited to commercial fishing than to general recreation, such as boating and swimming.

The Aowa-Alcester-Kennebec association consists of many long creeks and drainageways where sediment has washed from the uplands. These areas are suited to many types of cover and many kinds of wildlife. This association provides food, water, or cover for all species of wildlife in this county. Ash and willow, wild rose bushes, and many other herbaceous and woody plants grow on this association. They serve as excellent cover and as travel lanes. This association supports a wide variety of plants that can be introduced if they do not grow naturally.

The Crofton-Alcester-Nora association consists of gently sloping to very steep soils in the uplands. This association supports deciduous trees such as bur oak, walnut, elm, ash, boxelder, and honeylocust. Narrow drainageways and fencerows commonly have trees and shrubs. Many odd-shaped areas of this association are not cultivated, but provide good habitat for pheasant, quail, and rabbit. More deer are in this association than in any other because of the abundance of natural escape cover. Coyote, fox, and squirrel are also in this association. Natural springs supply water for wildlife. Clumps of native plum bushes that provide escape cover and food for pheasants, bobwhite quail, and other kinds of wildlife are along roadside ditches.

Ponca State Park makes up 803 acres of this association. Recreational activities in the Park include swimming, bird watching, hiking, and camping. Cabins are available on a reservation basis. Wooded areas provide excellent habitat for white-tailed deer and many other wildlife species.

The Moody-Thurman-Aowa association and the Moody-Nora-Crofton association have similar potentials for wildlife habitat, but there are more trees in the Moody-Thurman-Aowa association. More plantings of woody species, however, would provide winter protection for upland game birds. Food from cultivated fields increases the quality of wildlife in these two associations.

The Kennebec-Baltic-Calco association is in the valleys of Logan Creek, South Logan Creek, and Middle Creek. The moderately high water table provides potential for subirrigated crops such as alfalfa. Excellent woody cover next to cultivated cropland areas provides food and makes an ideal habitat for deer. This association is suited to many other species of wildlife, including fox, owls, squirrels, pheasant, and bobwhite quail.

The Nora-Crofton-Alcester association is mostly steep, but some cultivated cropland is gently sloping. This association is used mainly for feeding areas, and the steeper areas are also used for cover.

In Dixon County, much of the woody cover occurs along creeks. These wooded areas provide cover for the larger forms of wildlife as they move from the Missouri River bottoms to higher elevations. They feed in the cultivated fields of the uplands at night and hide in the woody bottoms during the day.

A high population of mourning dove is in this association and throughout the entire county.

Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the development of water impoundments. The kind and abundance of wildlife that populate an area depends largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife will either be scarce or will not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by properly managing the existing plant cover, and by fostering the natural establishment of desirable plants.

In table 4 the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in—

1. Planning the use of parks, wildlife refuges, nature study areas, and other developments for wildlife.
2. Selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat.
3. Determining the intensity of management needed for each element of the habitat.
4. Determining areas that are suitable for acquisition to manage for wildlife.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention are required for satisfactory results. A rating of *poor* means that limitations are severe for the designated

TABLE 4.—*Wildlife habitat potentials*

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for—			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Albaton: Ab	Fair	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	Fair.
Alcester: AcC	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
AcD	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
AgG	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Aowa: Ao	Good	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
Ap	Poor	Fair	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.	Poor.
Baltic: Ba	Fair	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	Fair.
Bazile: BcC	Good	Good	Good	Fair	Good	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
Blendon: BeB	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Calco: Ca, Cb	Good	Good	Good	Poor	Poor	Fair	Good	Fair	Fair	Poor	Fair	Fair.
Cc	Poor	Fair	Fair	Very poor.	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Good	Very poor.
Colo: Ce	Good	Good	Good	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
Crofton: CfC2, CfD2, CfE2	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
CfF, CfF2, CfG	Poor	Fair	Good	Fair	Good	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Grable: Gb	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Haynie: He	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Kennebec: Ke	Good	Good	Good	Good	Good	Good	Poor	Good	Good	Good	Poor	Good.
Lamo: La	Good	Good	Good	Fair	Fair	Fair	Good	Fair	Good	Fair	Fair	Good.
Maskell: Mh, MhC	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Modale: Mk	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.

TABLE 4.—*Wildlife habitat potentials*—Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for—			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Moody:												
Mo	Good	Good	Good	Fair	Good	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
MoC, MoC2	Good	Good	Good	Fair	Good	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
MoD, MoD2	Good	Good	Good	Fair	Good	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
MsC:												
Moody part	Good	Good	Good	Fair	Good	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
Leisy part	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
MsD:												
Moody part	Good	Good	Good	Fair	Good	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
Leisy part	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Nora:												
NoE, NoE2	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
NrC, NrC2	Good	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
NrD, NrD2	Good	Good	Good	Fair	Good	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
NoF	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Poor.
NsE:												
Nora part	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Alcester part	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
NsF:												
Nora part	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Poor.
Alcester part	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Onawa:												
On	Fair	Fair	Fair	Poor	Very poor.	Poor	Good	Good	Fair	Poor	Good	Fair.

TABLE 4.—*Wildlife habitat potentials*—Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for—			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ortello: OrC	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Percival: Pe	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Sarpy: Sa, Sc	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
SdB: Sarpy part	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Duneland part.												
SrB: Sarpy part	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Riverwash part.												
Thurman: TaE, ThD, ThD2	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
ThC, ThC2	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
TnC: Thurman part	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Leisy part	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
TnD: Thurman part	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Leisy part	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Zook: Zo, Zw	Fair	Good	Good	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.

element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating. The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. Examples are corn, sorghum, wheat, oats, barley, soybeans, and sunflowers. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are fescue, bluegrass, lovegrass, switchgrass, bromegrass, timothy, orchardgrass, clover, alfalfa, trefoil, and crownvetch. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established herbaceous grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestem, indiangrass, goldenrod, wheatgrass, and grama. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, and flood hazard. Soil temperature and soil moisture are also considerations.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark or foliage that wildlife eat. Examples of native plants are oak, cottonwood, hawthorn, dogwood, willow, sumac, hickory, black walnut, blackberry, grape, and briers. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated good are coralberry, buckbrush and sumac. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness.

Coniferous plants are cone-bearing trees, shrubs, or ground cover that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Examples are pine, spruce, hemlock, fir, yew, cedar, and juniper. Major soil properties that affect the growth of coniferous plants are depth of the root zone, available water capacity, and wetness.

Shrubs are bushy woody plants that produce fruits, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Examples are coralberry, honeysuckle and sumac. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Examples of wetland plants are smartweed, rushes, sedges, reeds, saltgrass, cordgrass, and cattail. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity and slope.

Shallow water areas are bodies of surface water that have an average depth of less than 5 feet and are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control devices in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of croplands, pastures, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, killdeer, cottontail rabbit, red fox, and woodchuck.

Woodland habitat consists of hardwoods or conifers or a mixture of both, with associated grasses, legumes, and wild herbaceous plants. Examples of wildlife attracted to this habitat are wild turkey, grouse, woodchuck, thrushes, vireos, woodpeckers, tree squirrels, red fox, raccoon, deer, elk, and opossum.

Wetland habitat consists of water-tolerant plants in open, marshy, or swampy shallow water areas. Examples of wildlife attracted to this habitat are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink and beaver.

Rangeland habitat consists of wild herbaceous plants and shrubs on range. Examples of wildlife attracted to this habitat are antelope, white-tailed deer, chukar, quail, grouse, meadowlark and prairie chicken.

Recreation

The soils of the survey area are rated in table 5 according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration of flooding and the season when it occurs. Onsite assessment of height, duration, and frequency of flooding is essential in planning recreational facilities.

In table 5 the limitations of soils are rated as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 5 can be supplemented by additional information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 7, and interpretations for dwellings without basements and for local roads and streets, given in table 6.

Camp areas require such site preparation as shaping and leveling tent and parking areas, stabilizing roads and intensively used areas, and installing sani-

TABLE 5.—*Recreational development*

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Albaton:				
Ab	Severe: wetness, too clayey, floods.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey.
Alcester:				
AcC	Slight	Slight	Moderate: slope	Slight.
AcD	Moderate: slope	Moderate: slope	Severe: slope	Slight.
AgG	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Aowa:				
Ao	Severe: floods	Slight	Moderate: floods	Slight.
Ap	Severe: floods	Moderate: floods	Severe: floods	Moderate: floods.
Baltic:				
Ba	Severe: too clayey, floods, wetness.	Severe: too clayey, wetness.	Severe: too clayey, wetness.	Severe: too clayey, wetness.
Bazile:				
BcC	Slight	Slight	Moderate: slope	Slight.
Blendon:				
BeB	Slight	Slight	Slight	Slight.
Calco:				
Ca, Cb, Cc	Severe: wetness, floods	Severe: wetness	Severe: wetness	Severe: wetness.
Colo:				
Ce	Severe: floods, wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Crofton:				
CfC2	Slight	Slight	Moderate: slope	Slight.
CfD2, CfE2	Moderate: slope	Moderate: slope	Severe: slope	Slight.
CfF, CfF2	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
CfG	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Grable:				
Gb	Severe: floods	Slight	Moderate: floods	Slight.
Haynie:				
He	Severe: floods	Slight	Moderate: floods	Slight.
Kennebec:				
Ke	Severe: floods	Slight	Moderate: floods	Slight.
Lamo:				
La	Severe: wetness, floods	Moderate: wetness	Severe: wetness	Moderate: wetness.
Maskell:				
Mh	Slight	Slight	Slight	Slight.
MhC	Slight	Slight	Moderate: slope	Slight.
Modale:				
Mk	Severe: floods	Moderate: wetness, floods.	Moderate: percs slowly, floods.	Moderate: wetness.
Moody:				
Mo	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey.
MoC, MoC2	Moderate: too clayey	Moderate: too clayey	Moderate: slope, too clayey.	Moderate: too clayey.

TABLE 5.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Moody:				
MoD, MoD2	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
MsC:				
Moody part	Moderate: too clayey	Moderate: too clayey	Moderate: slope, too clayey.	Moderate: too clayey.
Leisy part	Slight	Slight	Moderate: slope	Slight.
MsD:				
Moody part	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope	Moderate: too clayey.
Leisy part	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Nora:				
NoE, NoE2	Moderate: slope	Moderate: slope	Severe: slope	Slight.
NoF	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
NrC, NrC2	Moderate: too clayey	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
NrD, NrD2	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope	Moderate: too clayey.
NsE:				
Nora part	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Alcester part	Moderate: slope	Moderate: slope	Severe: slope	Slight.
NsF:				
Nora part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Alcester part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Onawa:				
On	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Ortello:				
OrC	Slight	Slight	Moderate: slope	Slight.
Percival:				
Pe	Severe: too clayey, floods.	Severe: wetness, too clayey.	Severe: too clayey	Severe: wetness, too clayey.
Sarpy:				
Sa	Severe: floods, too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: floods, too sandy, soil blowing.	Moderate: floods, too sandy, soil blowing.
Sc	Severe: floods, too clayey.	Severe: too clayey	Severe: too clayey, floods.	Severe: too clayey.
SdB:				
Sarpy part	Severe: floods, too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: floods, too sandy, soil blowing.	Moderate: floods, too sandy, soil blowing.
Duneland part.				
SrB:				
Sarpy part	Severe: floods, too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: floods, too sandy, soil blowing.	Moderate: floods, too sandy, soil blowing.
Riverwash part.				

TABLE 5.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Thurman:				
TaE	Severe: too sandy, soil blowing.	Severe: too sandy	Severe: slope, too sandy.	Severe: too sandy.
ThC, ThC2	Moderate: too sandy, soil blowing.	Moderate: too sandy	Moderate: too sandy, slope.	Moderate: too sandy.
ThD, ThD2	Moderate: too sandy, slope, soil blowing.	Moderate: too sandy, slope.	Severe: slope	Moderate: too sandy.
TnC:				
Thurman part	Moderate: too sandy, soil blowing.	Moderate: too sandy	Moderate: too sandy, slope.	Moderate: too sandy.
Leisy part	Slight	Slight	Moderate: slope	Slight.
TnD:				
Thurman part	Moderate: too sandy, slope, soil blowing.	Moderate: too sandy, slope.	Severe: slope	Moderate: too sandy.
Leisy part	Moderate slope	Moderate: slope	Severe: slope	Slight.
Zook:				
Zo, Zw	Severe: wetness, floods.	Severe: wetness	Severe: wetness	Severe: wetness.

tary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet nor subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and not wet nor subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over rock should be sufficient to allow necessary grading.

The design and layout of paths and trails for walking, horseback riding, and bicycling should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, and water management. Among those who can benefit from this section are engineers, landowners, community decision makers and planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in tables in this section are based on test data and estimated data in the "Soil Properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior in various engineering uses.

Among the soil properties and site conditions identified by the soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to and hardness of bedrock within 5 feet of the surface, soil wetness characteristics, depth to a seasonal water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

Based on the information assembled about soil properties, ranges of value may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works.

The ranges of values can be used to: (1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.

The information is presented mainly in tables. Table 6 shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; table 7, for sanitary facilities; and table 9, for water management. Table 8 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have different meanings in soil science and in engineering; the Glossary defines many of these terms.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 6. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated *severe*, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by the soil wetness of a high seasonal water table, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and small commercial buildings referred to in table 6 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soil should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation do not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and the large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 6 have an all-weather surface that can carry light to medium traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load-supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The AASHTO and Unified Classifications of the soil and the soil texture, density, shrink-swell potential, and frost action potential are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones, all of which affect stability and ease of excavation, were also considered.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that deal with the ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 7 shows the degree and kind of limita-

TABLE 6.—*Building site development*

[Some of the terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Albaton:					
Ab	Severe: wetness, too clayey, floods.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.
Alcester:					
AcC	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, slope.	Severe: frost action, low strength.
AcD	Moderate: slope	Moderate: slope, low strength, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: slope	Severe: frost action, low strength.
AgG	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: frost action. low strength, slope.
Aowa:					
Ao, Ap	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods, frost action.
Baltic:					
Ba	Severe: too clayey, floods, wetness.	Severe: shrink-swell, floods.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods.	Severe: shrink-swell, low strength, floods.
Bazile:					
BcC	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Severe: frost action, low strength.
Blendon:					
BeB	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength, frost action.
Calco:					
Ca, Cb, Cc	Severe: wetness, floods.	Severe: floods, low strength, shrink-swell.	Severe: floods, low strength, shrink-swell.	Severe: floods, low strength, shrink-swell.	Severe: floods, low strength, shrink-swell.
Colo:					
Ce	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, low strength, frost action.
Crofton:					
CfC2	Slight	Slight	Slight	Moderate: slope	Moderate: frost action, low strength.
CfD2, CfE2	Moderate: slope	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, frost action, low strength.
CfF, CfF2, CfG	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 6.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Grable: Gb	Severe: cutbanks cave, floods.	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Haynie: He	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: frost action, floods.
Kennebec: Ke	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods, frost action, low strength.
Lamo: La	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: floods, shrink-swell, frost action.
Maskell: Mh, MhC	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.
Modale: Mk	Severe: wetness, floods, too clayey.	Severe: shrink-swell, low strength, floods.	Severe: wetness, shrink-swell, floods.	Severe: shrink-swell, low strength, floods.	Severe: floods, shrink-swell, low strength.
Moody: Mo, MoC, MoC2	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.
MoD, MoD2	Moderate: slope	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope	Severe: frost action, low strength.
MsC: Moody part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.
Leisy part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope	Moderate: low strength, frost action.
MsD: Moody part	Moderate: slope	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope	Severe: frost action, low strength.
Leisy part	Moderate: slope	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope	Moderate: low strength, slope, frost action.
Nora: NoE, NoE2, NrD, NrD2	Moderate: slope	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope	Severe: frost action, low strength.
NoF	Severe: slope	Severe: slope	Severe: slope	Severe: slope, frost action.	Severe: slope, frost action, low strength.

TABLE 6.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Nora:					
NrC, NrC2	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.
NsE:					
Nora part	Moderate: slope	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope	Severe: frost action, low strength.
Alcester part	Moderate: slope	Moderate: slope, low strength, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: slope	Severe: frost action, low strength.
NsF:					
Nora part	Severe: slope	Severe: slope	Severe: slope	Severe: slope, frost action.	Severe: slope, frost action, low strength.
Alcester part	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: frost action, low strength, slope.
Onawa:					
On	Severe: wetness, too clayey, floods.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.
Ortello:					
OrC	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Moderate: frost action, low strength.
Percival:					
Pe	Severe: wetness, too clayey, floods.	Severe: low strength, shrink-swell, floods.	Severe: low strength, shrink-swell, floods.	Severe: low strength, shrink-swell, floods.	Severe: low strength, shrink-swell, floods.
Sarpy:					
Sa, Sc	Severe: floods, cutbanks cave.	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
SdB:					
Sarpy part	Severe: floods, cutbanks cave.	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Duneland part.					
SrB:					
Sarpy part	Severe: floods, cutbanks cave.	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Riverwash part.					
Thurman:					
TaE, ThD, ThD2	Severe: cutbanks cave.	Moderate: slope	Moderate: slope.	Severe: slope	Moderate: slope.
ThC, ThC2	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Slight.

TABLE 6.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Thurman:					
TnC:					
Thurman part	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Slight.
Leisy part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope	Moderate: low strength, frost action.
TnD:					
Thurman part	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
Leisy part	Moderate: slope	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope	Moderate: low strength, slope, frost action.
Zook:					
Zo, Zw	Severe: wetness, floods.	Severe: floods, low strength, shrink-swell.	Severe: floods, low strength, shrink-swell.	Severe: floods, low strength, shrink-swell.	Severe: floods, low strength.

tions of each soil for these uses and for use of the soil as daily cover for landfills.

If the degree of soil limitation is indicated by the rating *slight,* soils are favorable for the specified use and limitations are minor and easily overcome; if *moderate,* soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe,* soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance are required.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Some soils are underlain by loose sand at a depth less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and as a result ground water supplies in the area may be contaminated. Soils having a hazard of inadequate filtration are indicated by footnotes in table 7.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

Sewage lagoons are shallow ponds constructed to hold sewage while bacteria decompose the solid and liquid wastes. Lagoons have a nearly level flow area surrounded by cut slopes or embankments of compacted, nearly impervious soil material. They generally are designed so that depth of the sewage is 2 to 5 feet. Impervious soil at least 4 feet thick for the lagoon floor and sides is required to minimize seepage and contamination of local ground water. Soils that are very high in organic matter and those that have stones and boulders are undesirable. Unless the soil has very slow permeability, contamination of local ground water is a hazard in areas where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce its capacity for liquid waste. Slope and susceptibility to flooding also affect the location of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill is solid waste (refuse) and soil material that is spread, compacted in layers, and covered with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Ease of excavation, risk of polluting ground water, and trafficability affect the suitability of a soil for this purpose. The best soils have a loamy or silty texture, have moderate or slow permeability, are deep to a seasonal water table, are free of large stones and boulders, and are not subject to flooding. In areas where the seasonal water table is

TABLE 7.—*Sanitary facilities*

[Some of the terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Albaton:					
Ab	Severe: percs slowly, wetness, floods.	Slight	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: wetness, too clayey.
Alcester:					
AcC	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
AcD	Moderate: slope, percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope.
AgG	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
Aowa:					
Ao, Ap	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Good.
Baltic:					
Ba	Severe: percs slowly, wetness, floods.	Slight	Severe: too clayey, floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
Bazile:					
BcC	Slight [1]	Severe: seepage	Severe: seepage.	Severe: seepage	Fair: thin layer.
Blendon:					
BeB	Slight [1]	Severe: seepage	Severe: seepage.	Severe: seepage	Fair: thin layer.
Calco:					
Ca, Cb, Cc	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Colo:					
Ce	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Crofton:					
CfC2	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
CfD2, CfE2	Moderate: slope	Severe: slope	Slight	Moderate: slope	Fair: slope.
CfF, CfF2	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
CfG	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor. slope.
Grable:					
Gb	Severe: floods	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: thin layer.
Haynie:					
He	Severe: floods	Moderate: seepage	Severe: floods	Severe: floods	Good.
Kennebec:					
Ke	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.

TABLE 7.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lamo:					
La	Severe: percs slowly, wetness.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Fair: too clayey.
Maskell:					
Mh	Moderate: percs slowly.	Moderate: seepage	Slight	Slight	Good.
MhC	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Modale:					
Mk	Severe: percs slowly wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Fair: thin layer, area reclaim.
Moody:					
Mo	Severe: percs slowly.	Moderate: seepage	Slight	Slight	Fair: too clayey.
MoC, MoC2	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Fair: too clayey.
MoD, MoD2	Severe: slope, percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope, too clayey.
MsC:					
Moody part	Severe: percs slowly.	Moderate: slope, seepage	Slight	Slight	Fair: too clayey.
Leisy part	Severe: percs slowly.	Moderate: slope	Moderate: too clayey.	Slight	Fair: too clayey.
MsD:					
Moody part	Severe: percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope, too clayey.
Leisy part	Severe: percs slowly.	Severe: slope	Moderate: too clayey.	Moderate: slope	Fair: too clayey, slope.
Nora:					
NoE, NoE2, NrD, NrD2	Moderate: slope, percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope.
NoF	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
NrC, NrC2	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
NsE:					
Nora part	Moderate: slope, percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope.
Alcester part	Moderate: slope, percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope.
NsF:					
Nora part	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
Alcester part	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
Onawa:					
On	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: too clayey.
Ortello:					
OrC	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Fair: thin layer.

TABLE 7.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Percival:					
Pe	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, floods, seepage.	Severe: floods, seepage.	Poor: too clayey.
Sarpy:					
Sa, Sc	Severe:[1] floods	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: too sandy, seepage.
SdB:					
Sarpy part	Severe:[1] floods	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: too sandy, seepage.
SrB:					
Sarpy part	Severe:[1] floods	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: too sandy, seepage.
Thurman:					
TaE, ThD, ThD2	Moderate:[1] slope	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage	Fair: too sandy, slope.
ThC, ThC2	Slight[1]	Severe: seepage	Severe: too sandy, seepage.	Severe: seepage	Fair: too sandy.
TnC:					
Thurman part	Slight[1]	Severe: seepage	Severe: too sandy, seepage.	Severe: seepage	Fair: too sandy.
Leisy part	Severe: percs slowly.	Moderate: slope	Moderate: too clayey.	Slight	Fair: too clayey.
TnD:					
Thurman part	Moderate:[1] slope	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage	Fair: too sandy, slope.
Leisy part	Severe: percs slowly.	Severe: slope	Moderate: too clayey.	Moderate: slope	Fair: too clayey, slope.
Zook:					
Zo, Zw	Severe: percs slowly, wetness, floods.	Severe: excess humus, wetness, floods.	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: wetness, too clayey.

[1] Hazard of polluting water supplies.

high, water seeps into the trenches and causes problems in excavating and filling the trenches. Also, seepage into the refuse increases the risk of pollution of ground water. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 7 apply only to soil properties and features within a depth of about 6 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the area-type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and stone content do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Daily cover for sanitary landfills should be soil that is easy to excavate and spread over the compacted fill during both wet and dry weather. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soils selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas, such as slope, erodibility, and potential for plant growth.

TABLE 8.—*Construction materials*

[Some of the terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Albaton:				
Ab	Poor: wetness, low strength, shrink-swell.	Unsuited	Unsuited	Poor: wetness, too clayey.
Alcester:				
AcC	Poor: frost action, low strength.	Unsuited	Unsuited	Good.
AcD	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: slope.
AgG	Poor: frost action, low strength.	Unsuited	Unsuited	Poor: slope.
Aowa:				
Ao, Ap	Poor: low strength, frost action.	Unsuited	Unsuited	Good.
Baltic:				
Ba	Poor: shrink-swell, low strength, wetness.	Unsuited	Unsuited	Poor: too clayey, wetness.
Bazile:				
BcC	Good	Fair: excess fines	Unsuited	Fair: thin layer.
Blendon:				
BeB	Good	Fair: excess fines	Unsuited	Good.
Calco:				
Ca, Cb, Cc	Poor: wetness, shrink-swell, low strength.	Unsuited	Unsuited	Poor: wetness.
Colo:				
Ce	Poor: wetness, shrink-swell, low strength.	Unsuited	Unsuited	Poor: wetness.
Crofton:				
CfC2	Poor: frost action, low strength.	Unsuited	Unsuited	Good.
CfD2, CfE2	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: slope.
CfF, CfF2	Poor: frost action, low strength.	Unsuited	Unsuited	Poor: slope.
Crofton:				
CfG	Poor: slope, frost action, low strength.	Unsuited	Unsuited	Poor: slope.
Grable:				
Gb	Fair: low strength	Poor: excess fines	Unsuited	Fair: area reclaim.
Haynie:				
He	Poor: frost action	Unsuited	Unsuited	Good.
Kennebec:				
Ke	Poor: excess humus, frost action, low strength.	Unsuited	Unsuited	Good.
Lamo:				
La	Poor: shrink-swell, frost action, low strength.	Unsuited	Unsuited	Good.

TABLE 8.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Maskell:				
Mh, MhC	Fair: frost action, shrink-swell.	Unsuited	Unsuited	Good.
Modale:				
Mk	Poor: low strength, shrink-swell, frost action.	Unsuited	Unsuited	Good.
Moody:				
Mo, MoC, MoC2	Poor: low strength, frost action.	Unsuited	Unsuited	Fair: too clayey.
MoD, MoD2	Poor: low strength, frost action.	Unsuited	Unsuited	Fair: slope, too clayey.
MsC:				
Moody part	Poor: low strength, frost action.	Unsuited	Unsuited	Fair: too clayey.
Leisy part	Poor: low strength	Unsuited	Unsuited	Good.
MsD:				
Moody part	Poor: low strength, frost action.	Unsuited	Unsuited	Fair: slope, too clayey.
Leisy part	Poor: low strength	Unsuited	Unsuited	Fair: slope.
Nora:				
NoE, NoE2	Poor: low strength, frost action.	Unsuited	Unsuited	Fair: slope.
NoF	Poor: low strength, frost action.	Unsuited	Unsuited	Poor: slope.
NrC, NrC2	Poor: low strength, frost action.	Unsuited	Unsuited	Fair: too clayey.
NrD, NrD2	Poor: low strength, frost action.	Unsuited	Unsuited	Fair: slope, too clayey.
NsE:				
Nora part	Poor: low strength, frost action.	Unsuited	Unsuited	Fair: slope.
Alcester part	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: slope.
NsF:				
Nora part	Poor: low strength, frost action.	Unsuited	Unsuited	Poor: slope.
Alcester part	Poor: frost action, low strength.	Unsuited	Unsuited	Poor: slope.
Onawa:				
On	Poor: wetness, low strength, shrink-swell.	Unsuited	Unsuited	Poor: wetness.
Ortello:				
OrC	Good	Poor: excess fines	Unsuited	Good.
Percival:				
Pe	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: too clayey.

TABLE 8.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Sarpy:				
Sa	Good	Poor: excess fines	Unsuited	Poor: too sandy.
Sc	Good	Poor: excess fines	Unsuited	Poor: too clayey.
SdB:				
Sarpy part	Good	Poor: excess fines	Unsuited	Poor: too sandy.
Duneland part.				
SrB:				
Sarpy part	Good	Poor: excess fines	Unsuited	Poor: too sandy.
Riverwash part.				
Thurman:				
TaE	Good	Fair: excess fines	Unsuited	Poor: too sandy, slope.
ThC, ThC2, ThD, ThD2	Good	Fair: excess fines	Unsuited	Poor: too sandy.
TnC:				
Thurman part	Good	Fair: excess fines	Unsuited	Poor: too sandy.
Leisy part	Poor: low strength	Unsuited	Unsuited	Good.
TnD:				
Thurman part	Good	Fair: excess fines	Unsuited	Poor: too sandy.
Leisy part	Poor: low strength	Unsuited	Unsuited	Fair: slope.
Zook:				
Zo, Zw	Poor: wetness, shrink-swell, low strength.	Unsuited	Unsuited	Poor: wetness, too clayey.

Construction materials

The suitability of each soil as a source of road fill, sand, gravel, and topsoil is indicated in table 8 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed and described as the survey is made, generally about 6 feet.

Roadfill is soil material used in embankments for roads. The ratings reflect the ease of excavating and working the material and the expected performance of the material after it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about soil properties that determine such performance is given in the descriptions of soil series.

The ratings apply to the soil profile between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within the profile. The estimated engineering properties in table 10 provide more specific information about the nature of each horizon that can help determine its suitability for road fill.

According to the Unified Soil Classification System, soils rated *good* have low shrink-swell potential, low potential frost action, and a few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as high shrink-swell potential, high potential frost action, steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*, regardless of the quality of the suitable material.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 10.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected

TABLE 9.—*Water management*

[Some of the terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Albaton:						
Ab	Favorable	Compressible, low strength, shrink-swell.	Percs slowly, poor outlets, wetness.	Wetness, percs slowly.	Not neeed	Not needed.
Alcester:						
AcC, AcD	Slope	Low strength, shrink-swell.	Not needed	Slope, erodes easily.	Favorable	Slope, erodes easily.
AgG	Slope	Low strength, shrink-swell.	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
Aowa:						
Ao, Ap	Seepage	Low strength, shrink-swell.	Floods	Floods	Not needed	Favorable.
Baltic:						
Ba	Favorable	Shrink-swell, compressible, low strength.	Percs slowly, poor outlets.	Floods, percs slowly, slow intake.	Not needed	Not needed.
Bazile:						
BcC	Seepage	Piping	Not needed	Erodes easily, slow intake.	Erodes easily, slope.	Slope, erodes easily.
Blendon:						
BeB	Seepage	Seepage, piping.	Not needed	Fast intake	Not needed	Favorable.
Calco:						
Ca, Cb, Cc	Favorable	Compressible, low strength, hard to pack.	Floods, wetness, frost action.	Floods, wetness.	Not needed	Wetness.
Colo:						
Ce	Favorable	Compressible, low strength, hard to pack.	Floods, wetness.	Floods, wetness.	Not needed	Wetness.
Crofton:						
CfC2, CfD2	Slope	Erodes easily	Not needed	Erodes easily, slope.	Favorable	Favorable.
CfE2, CfF, CfF2, CfG	Slope	Erodes easily	Not needed	Erodes easily, slope.	Erodes easily, slope.	Favorable.
Grable:						
Gb	Seepage	Low strength, piping.	Not needed	Floods, droughty.	Not needed	Not needed.
Haynie:						
He	Slope	Low strength, piping, erodes easily.	Not needed	Floods	Not needed	Not needed.
Kennebec:						
Ke	Seepage	Low strength, compressible, excess humus.	Floods, frost action.	Floods	Favorable	Favorable.
Lamo:						
La	Favorable	Compressible, erodes easily, shrink-swell.	Floods, percs slowly.	Percs slowly, floods, wetness.	Wetness	Not needed.

TABLE 9.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Maskell:						
Mh	Seepage	Piping, shrink-swell.	Not needed	Favorable	Not needed	Favorable.
MhC	Seepage	Piping, shrink-swell.	Not needed	Slope	Erodes easily, slope.	Erodes easily, slope.
Modale:						
Mk	Favorable	Low strength, piping, erodes easily.	Percs slowly, poor outlets, floods.	Wetness, floods.	Not needed	Not needed.
Moody:						
Mo	Seepage	Low strength	Not needed	Favorable	Not needed	Favorable.
MoC, MoC2	Slope, seepage.	Low strength	Not needed	Slope	Favorable	Slope, erodes easily.
MoD, MoD2	Slope, seepage.	Low strength	Not needed	Slope, erodes easily.	Favorable	Slope, erodes easily.
MsC:						
Moody part	Slope, seepage.	Low strength	Not needed	Slope	Favorable	Slope, erodes easily.
Leisy part	Slope, seepage.	Low strength	Not needed	Slope	Complex slope, soil blowing.	Erodes easily.
MsD:						
Moody part	Slope, seepage.	Low strength	Not needed	Slope, erodes easily.	Favorable	Slope, erodes easily.
Leisy part	Slope, seepage.	Low strength	Not needed	Erodes easily, slope.	Complex slope, soil blowing.	Erodes easily.
Nora:						
NoE, NoF, NoE2, NrD, NrD2	Slope, seepage.	Low strength	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
NrC, NrC2	Slope, seepage.	Low strength	Not needed	Slope	Slope	Slope, erodes easily.
NsE:						
Nora part	Slope, seepage.	Low strength	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
Alcester part	Slope, seepage.	Low strength, shrink-swell.	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
NsF:						
Nora part	Slope, seepage.	Low strength	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
Alcester part	Slope, seepage.	Low strength, shrink-swell.	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
Onawa:						
On	Favorable	Compressible, low strength, shrink-swell.	Percs slowly, poor outlets, wetness.	Percs slowly, wetness.	Not needed	Not needed.
Ortello:						
OrC	Seepage	Seepage, piping, erodes easily.	Not needed	Fast intake, slope.	Complex slope, piping, erodes easily.	Erodes easily, droughty.

TABLE 9.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Percival:						
Pe	Seepage	Compressible, low strength, shrink-swell.	Percs slowly, poor outlets, wetness.	Wetness, percs slowly.	Not needed	Not needed.
Sarpy:						
Sa, Sc	Seepage	Piping, unstable fill, seepage.	Not needed	Droughty, fast intake, soil blowing.	Not needed	Droughty.
SdB:						
Sarpy part	Seepage	Piping, unstable fill, seepage.	Not needed	Droughty, fast intake, soil blowing.	Not needed	Droughty.
Duneland part.						
SrB:						
Sarpy part	Seepage	Piping, unstable fill, seepage.	Not needed	Droughty, fast intake, soil blowing.	Not needed	Droughty.
Riverwash part.						
Thurman:						
TaE, ThC, ThC2, ThD, ThD2	Seepage	Seepage, piping.	Not needed	Fast intake, soil blowing.	Not needed	Not needed.
TnC:						
Thurman part	Seepage	Seepage, piping.	Not needed	Fast intake, soil blowing.	Not needed	Not needed.
Leisy part	Seepage	Low strength	Not needed	Erodes easily	Complex slope, soil blowing.	Erodes easily.
TnD:						
Thurman part	Seepage	Seepage, piping.	Not needed	Fast intake, soil blowing.	Not needed	Not needed.
Leisy part	Seepage	Low strength	Not needed	Erodes easily	Complex slope, soil blowing.	Erodes easily.
Zook:						
Zo, Zw	Favorable	Shrink-swell, low strength, hard to pack.	Floods, wetness, percs slowly.	Floods, wetness, percs slowly.	Not needed	Wetness.

mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to sustain the growth of plants. Also considered is the damage that would result to the area from which the topsoil is taken.

Soils rated *good* have at least 16 inches of friable loamy material in their surface. They are free of stones, are low in content of gravel and other coarse fragments, and are gently sloping. They are low in soluble salts, which can limit plant growth. They are naturally fertile or respond well to fertilization. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils; very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is based entirely on high content of organic matter a surface horizon is much preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter. Consequently, careful preservation and use of material from these horizons is desirable.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 9 soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for this use have low seepage potential, which is determined by the permeability and depth over fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and is of favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability, texture, structure, depth to claypan or other layers that influence rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, salinity and alkalinity, and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments, or a combination of channels and ridges, constructed across a slope to intercept runoff and allow the water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity of slope and steepness, depth to bedrock or other unfavorable material, permeability, ease of establishing vegetation, and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff at nonerosive velocities to outlets. Features that affect the use of soils for waterways are slope, permeability, erodibility, and suitability for permanent vegetation.

Soil properties

Extensive data about soil properties collected during the soil survey are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

When he makes soil borings during field mapping, the soil scientist can identify several important soil properties. He notes the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness of the soil and its color; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in-place under the existing soil moisture conditions. He records the root depth of existing plants, determines soil pH or reaction, and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many of the soil series are available from nearby areas.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classifications and in physical and chemical properties for each major horizon of each soil in the survey area. Also, pertinent soil and water features, engineering test data, and data obtained from laboratory analyses, both physical and chemical, are presented.

Engineering properties

Table 10 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area. These estimates are presented as ranges in values most likely to exist in areas where the soil is mapped.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Information is presented for each of these contrasting horizons. Depth to the upper and lower boundaries of each horizon in a typical profile of each soil is indicated. More information about the range in depth and in properties of each horizon is given for each soil series in "Descriptions of the soils."

Texture is described in table 10 in standard terms used by the United States Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms used by USDA are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (USCS) (*2*), and the American Association of State Highway and Transportation Officials Soil Classification System (AASHTO) (*1*). In table 10 soils in the survey area are classified according to both systems.

The USCS system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol for example CL–ML.

The AASHTO system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified as one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in Group A–1 are coarse grained and low in content of fines. At the other extreme, in group A–7, are fine-grained soils. Highly organic soils are classified as A–8 on the basis of visual inspection.

When laboratory data are available, the A–1, A–2, and A–7 groups are further classified as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or more for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parenthesis, is given in table 13. The estimated classification, without group index numbers, is given in table 10. Also in table 10 the percentage, by weight, of cobbles or the rock fragments more than 3 inches in diameter are estimated for each major horizon. These estimates are determined largely by observing volume percentage in the field and then converting it, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four standard sieves is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and plasticity index indicates the effect of water on the strength and consistency of soil. These indexes are used in both the USCS and the ASSHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior.

Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and chemical properties

Table 11 (pg. 96) shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the respresentative profile of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships between the soil characteristics observed in the field, particularly soil structure, porosity, and gradation or texture, that influence the downward movement of water in the soil. The estimates are for water movement in a vertical direction when the soil is saturated. Not considered in the estimates are lateral seepage on such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in the planning and design of drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops and ornamental or other plants to be grown, in evaluating soil amendments for fertility and stabilization, and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind of clay and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion, as used in table 11, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rating of soils for corrosivity to concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or for more resistant concrete help to avoid or minimize damage resulting from the corrosion. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

TABLE 10.—*Engineering properties*

[The symbol < means less than; > means greater than.

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Albaton:				
Ab	0-7	Silty clay	CH	A-7
	7-60	Silty clay, clay	CH	A-7
Alcester:				
AcC, AcD, AgG	0-28	Silt loam	ML, CL, CL-ML	A-4, A-6
	28-40	Silty clay loam, silt loam	CL	A-4, A-6, A-7
	40-60	Silty clay loam, silt loam	ML, CL, CL-ML	A-4, A-6, A-7
Aowa:				
Ao, Ap	0-7	Silt loam	CL	A-4, A-6
	7-60	Loam, silt loam, silty clay loam	CL-ML, CL	A-4, A-6
Baltic:				
Ba	0-15	Silty clay	CH, MH	A-7
	15-33	Silty clay, clay	CH, MH	A-7
	33-60	Silty clay	CL, CH, MH	A-7
Bazile:				
BcC	0-12	Silty clay loam	CL	A-6, A-7
	12-31	Silty clay loam	CL	A-6, A-7
	31-60	Sand, loamy fine sand, fine sand	SP-SM, SP, SM	A-2, A-3
Blendon:				
BeB	0-30	Sandy loam	SM, SM-SC	A-2, A-4
	30-42	Sandy loam	SM, SM-SC	A-2, A-4
	42-60	Loamy fine sand, loamy sand	SM, SM-SC	A-2
Calco:				
Ca	0-15	Silt loam	CL, CL-ML	A-6
	15-60	Silty clay loam	CH, CL, MH	A-7
Cb, Cc	0-40	Silty clay loam	ML, MH, CH, CL	A-7
	40-60	Silty clay loam	CH, CL, MH	A-7
Colo:				
Ce	0-32	Silty clay loam	CL, CH	A-7
	32-60	Silty clay loam	CL, CH	A-7
Crofton:				
CfC2, CfD2, CfE2 CfF, CfF2, CfG	0-7	Silt loam	ML, CL	A-6
	7-60	Silt loam	CL	A-6
Grable:				
Gb	0-7	Very fine sandy loam	CL, ML	A-4, A-6
	7-24	Silt loam, very fine sandy loam	CL, ML	A-4, A-6
	24-60	Fine sand, loamy sand	SM, SM-SC, SP-SM	A-2, A-3
Haynie:				
He	0-60	Silt loam, very fine sandy loam	ML, CL	A-4, A-6
Kennebec:				
Ke	0-15	Silt loam	CL, ML, CL-ML	A-6, A-7
	15-60	Silt loam, silty clay loam	CL, ML	A-6, A-7
Lamo:				
La	0-17	Silt loam	CL	A-6
	17-60	Silty clay loam, silt loam	CL, CH, ML	A-7, A-6
Maskell:				
Mh, MhC	0-17	Loam	ML, CL	A-4, A-6
	17-26	Loam, sandy loam	ML, SM	A-4
	26-60	Silt loam, loam, silty clay loam, clay loam	ML, CL	A-4, A-6

and classifications

Absence of an entry means data were not estimated]

Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	95–100	95–100	60–85	40–60
0	100	100	95–100	95–100	60–85	40–60
0	100	100	95–100	85–100	25–40	6–20
0	100	100	95–100	90–100	30–50	8–25
0	100	100	95–100	85–100	30–50	6–25
0	100	100	90–100	70–90	25–40	5–20
0	100	100	85–100	60–95	22–40	3–15
0	100	100	90–100	85–100	50–65	20–35
0	100	95–100	90–100	85–100	50–70	20–40
0	100	95–100	80–100	85–100	45–70	15–40
0	100	100	90–100	80–95	35–45	15–25
0	100	100	90–100	85–100	35–50	15–30
0	100	100	50–90	2–30	<20	NP
0	100	100	60–100	25–50	20–30	NP–5
0	100	100	60–100	25–50	20–30	NP–5
0	100	90–100	50–100	10–35	<30	NP–5
0	100	100	95–100	85–100	25–40	5–15
0	100	100	90–100	80–100	40–55	15–30
0	100	100	95–100	85–100	41–70	15–35
0	100	100	90–100	80–100	41–60	15–35
0	100	100	90–100	90–100	41–60	15–30
0	100	100	90–100	90–100	41–55	15–30
0	100	100	95–100	95–100	30–40	10–20
0	100	100	95–100	95–100	32–40	11–18
0	100	100	80–95	50–75	25–40	8–20
0	100	100	80–95	50–75	25–40	8–20
0	100	100	65–80	5–35	<20	NP–5
0	100	100	85–100	70–100	30–40	5–15
0	100	100	95–100	90–100	30–50	10–20
0	100	100	95–100	90–100	30–50	10–20
0	100	100	95–100	85–95	20–35	10–20
0	100	100	95–100	85–95	35–60	10–35
0	100	100	85–100	60–80	21–40	4–20
0	100	100	60–95	30–75	18–35	NP–10
0	100	100	85–100	60–95	21–40	4–30

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Modale:				
Mk	0-22	Very fine sandy loam	CL, ML	A-4, A-6
	22-60	Silty clay, clay	CH	A-7
Moody:				
Mo, MoC, MoC2, MoD, MoD2	0-11	Silty clay loam	CL	A-6, A-7
	11-52	Silty clay loam	CL, CH	A-6, A-7
	52-60	Silt loam	CL, CL-ML	A-4, A-6, A-7
MsC:				
Moody part	0-11	Silty clay loam	CL	A-6, A-7
	11-52	Silty clay loam	CL, CH	A-6, A-7
	52-60	Silt loam	CL, CL-ML	A-4, A-6, A-7
Leisy part	0-16	Sandy loam	SM	A-4
	16-44	Silty clay loam	ML, CL	A-6, A-7
	44-60	Silty clay loam, silt loam	CL, CL-ML	A-7, A-6
MsD:				
Moody part	0-11	Silty clay loam	CL	A-6, A-7
	11-52	Silty clay loam	CL, CH	A-6, A-7
	52-60	Silt loam	CL, CL-ML	A-4, A-6, A-7
Leisy part	0-16	Sandy loam	SM	A-4
	16-44	Silty clay loam	ML, CL	A-6, A-7
	44-60	Silty clay loam	CL, CL-ML	A-7, A-6
Nora:				
NoE, NoF, NoE2	0-12	Silt loam	CL, CL-ML, ML	A-4, A-6, A-7
	12-30	Silt loam, silty clay loam	CL	A-6, A-7
	30-60	Silt loam	CL, CL-ML, ML	A-4, A-6, A-7
NrC, NrC2, NrD, NrD2	0-12	Silty clay loam	CL	A-6, A-7
	12-30	Silt loam, silty clay loam	CL	A-6, A-7
	30-60	Silt loam	CL, CL-ML	A-4, A-6, A-7
NsE:				
Nora part	0-12	Silt loam	CL, CL-ML, ML	A-4, A-6, A-7
	12-30	Silt loam, silty clay loam	CL	A-6, A-7
	30-60	Silt loam	CL, CL-ML, ML	A-4, A-6, A-7
Alcester part	0-28	Silt loam	ML, CL, CL-ML	A-4, A-6
	28-40	Silty clay loam, silt loam	CL	A-4, A-6, A-7
	40-60	Silty clay loam, silt loam	ML, CL, CL-ML	A-4, A-6, A-7
NsF:				
Nora part	0-12	Silt loam	CL, CL-ML, ML	A-4, A-6, A-7
	12-30	Silt loam, silty clay loam	CL	A-6, A-7
	30-60	Silt loam	CL, CL-ML, ML	A-4, A-6, A-7
Alcester part	0-28	Silt loam	ML, CL, CL-ML	A-4, A-6
	28-40	Silty clay loam, silt loam	CL	A-4, A-6, A-7
	40-60	Silty clay loam, silt loam	ML, CL, CL-ML	A-4, A-6, A-7
Onawa:				
On	0-21	Silty clay	CH	A-7
	21-60	Silt loam, very fine sandy loam, loam	CL, ML, CL-ML	A-4, A-6
Ortello:				
OrC	0-17	Sandy loam	SM, ML	A-4
	17-42	Fine sandy loam, sandy loam	SM, ML	A-4
	42-60	Loamy sand	SP-SM, SM	A-3, A-2
Percival:				
Pe	0-22	Silty clay	CH	A-7
	22-60	Stratified fine sand to loamy very fine sand.	SM	A-2

and classifications—Continued

Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	95–100	70–90	25–40	8–18
0	100	100	95–100	95–100	65–85	40–60
0	100	100	95–100	90–100	35–50	13–28
0	100	100	95–100	85–100	32–55	11–33
0	100	100	95–100	85–100	25–45	6–25
0	100	100	95–100	90–100	35–50	13–28
0	100	100	95–100	85–100	32–55	11–33
0	100	100	95–100	85–100	25–45	6–25
0	100	100	70–85	35–45	----------	NP
0	100	100	95–100	85–95	30–45	10–25
0	100	100	95–100	85–95	35–50	16–30
0	100	100	95–100	90–100	35–50	13–28
0	100	100	95–100	85–100	32–55	11–33
0	100	100	95–100	85–100	25–45	6–25
0	100	100	70–85	35–45	----------	NP
0	100	100	95–100	85–95	30–45	10–25
0	100	100	95–100	85–95	35–50	16–30
0	100	100	95–100	85–100	28–45	6–23
0	100	100	95–100	85–100	30–50	11–27
0	100	100	95–100	85–100	27–45	6–24
0	100	100	95–100	95–100	35–50	12–27
0	100	100	95–100	85–100	30–50	11–27
0	100	100	95–100	85–100	27–45	6–24
0	100	100	95–100	85–100	28–45	6–23
0	100	100	95–100	85–100	30–50	11–27
0	100	100	95–100	85–100	27–45	6–24
0	100	100	95–100	85–100	25–40	6–20
0	100	100	95–100	90–100	30–50	8–25
0	100	100	95–100	85–100	30–50	6–25
0	100	100	95–100	85–100	28–45	6–23
0	100	100	95–100	85–100	30–50	11–27
0	100	100	95–100	85–100	27–45	6–24
0	100	100	95–100	85–100	25–40	6–20
0	100	100	95–100	90–100	30–50	8–25
0	100	100	95–100	85–100	30–50	6–25
0	100	100	95–100	95–100	60–85	40–60
0	100	100	95–100	85–100	25–40	5–20
0	100	100	70–85	40–55	<20	NP
0	100	100	70–85	40–55	<20	NP
0	100	100	50–75	5–35	----------	NP
0	100	100	95–100	95–100	60–85	35–60
0	100	100	80–95	12–30	<20	NP–5

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Sarpy:				
Sa	0–7	Loamy fine sand	SM	A–2
	7–60	Loamy fine sand, fine sand	SM	A–2
Sc	0–8	Silty clay	CH	A–7
	8–60	Loamy fine sand, fine sand	SM	A–2
SdB:				
Sarpy part	0–7	Fine sand	SM	A–2
	7–60	Loamy fine sand, fine sand	SM	A–2
Duneland part.				
SrB:				
Sarpy part	0–7	Fine sand	SM	A–2
	7–60	Loamy fine sand, fine sand	SM	A–2
Riverwash part.				
Thurman:				
TaE	0–14	Sand	SP–SM	A–3
	14–60	Loamy sand, sand	SM, SP–SM	A–2, A–3
ThC, ThC2, ThD, ThD2	0–14	Loamy sand	SM, SP–SM	A–2, A–3
	14–60	Loamy sand, sand	SM, SP–SM	A–2, A–3
TnC:				
Thurman part	0–14	Loamy sand	SM, SP–SM	A–2, A–3
	14–60	Loamy sand, sand	SM, SP–SM	A–2, A–3
Leisy part	0–16	Sandy loam	SM	A–4
	16–44	Silty clay loam	ML, CL	A–6, A–7
	44–60	Silty clay loam	CL, CL–ML	A–7, A–6
TnD:				
Thurman part	0–14	Loamy sand	SM, SP–SM	A–2, A–3
	14–60	Loamy sand, sand	SM, SP–SM	A–2, A–3
Leisy part	0–16	Sandy loam	SM	A–4
	16–44	Silty clay loam	ML, CL	A–6, A–7
	44–60	Silty clay loam	CL, CL–ML	A–7, A–6
Zook:				
Zo	0–26	Silty clay loam	MH, CH, CL, OL	A–7
	26–60	Silty clay, silty clay loam	CH	A–7
Zw	0–30	Silty clay	CH	A–7
	30–60	Silty clay, silty clay loam	CH	A–7

Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

Loamy soils that are 18 to 35 percent clay and less *and classifications*—Continued

Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	60-80	15-35	---	NP
0	100	100	60-80	15-35	---	NP
0	100	100	100	100	60-80	35-50
0	100	100	60-80	15-35	---	NP
0	100	100	60-80	15-35	---	NP
0	100	100	60-80	15-35	---	NP
0	100	100	60-80	15-35	---	NP
0	100	100	60-80	15-35	---	NP
0	100	100	50-85	5-40	---	NP
0	100	100	85-100	5-25	---	NP
0	100	100	60-80	5-30	---	NP
0	100	100	50-75	5-25	---	NP
0	100	100	60-80	5-30	---	NP
0	100	100	50-75	5-25	---	NP
0	100	100	70-85	35-45	---	NP
0	100	100	95-100	85-95	30-45	10-25
0	100	100	95-100	85-95	35-50	16-30
0	100	100	60-80	5-30	---	NP
0	100	100	50-75	5-25	---	NP
0	100	100	70-85	35-45	---	NP
0	100	100	95-100	85-95	30-45	10-25
0	100	100	95-100	85-95	35-50	16-30
0	100	100	95-100	95-100	45-70	20-40
0	100	100	95-100	95-100	60-85	40-60
0	100	100	95-100	95-100	60-85	40-60
0	100	100	95-100	95-100	60-85	40-60

than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

Soil and water features

Features that relate to runoff or infiltration of water, to flooding, to grading and excavation, and to subsidence and frost action of each soil are indicated in table 12. This information is helpful in planning land uses and engineering projects that are likely to be affected by the amount of runoff from watersheds, by flooding and a seasonal high water table, by the presence of bedrock or a cemented pan in the upper 5 or 6 feet of the soil, by subsidence, or by frost action.

Hydrologic groups are used to estimate runoff after rainfall. Soil properties that influence the minimum rate of infiltration into the bare soil after prolonged wetting are depth to a water table, water intake rate and permeability after prolonged wetting, and depth to layers of slowly or very slowly permeable soil.

Flooding is rated in general terms that describe the frequency, duration, and period of the year when flooding is most likely. The ratings are based on evidences in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; absence of distinctive soil horizons that form in soils of the

TABLE 11.—*Physical and chemical*

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Albaton:				
Ab	0-7	0.06-0.2	0.11-0.13	7.4-8.4
	7-60	0.06-0.2	0.11-0.13	7.4-8.4
Alcester:				
AcC, AcD, AgG	0-28	0.6-2.0	0.19-0.22	5.6-7.3
	28-40	0.6-2.0	0.19-0.22	6.1-7.3
	40-60	0.6-2.0	0.17-0.20	6.6-8.4
Aowa:				
Ao, Ap	0-7	0.6-2.0	0.20-0.24	7.4-8.4
	7-60	0.6-2.0	0.17-0.22	7.4-8.4
Baltic:				
Ba	0-15	0.06-0.2	0.13-0.18	7.4-8.4
	15-33	0.06-0.2	0.11-0.18	7.4-8.4
	33-60	0.06-0.6	0.08-0.17	7.4-8.4
Bazile:				
BcC	0-12	0.2-0.6	0.20-0.24	5.1-6.5
	12-31	0.2-0.6	0.15-0.20	5.6-7.8
	31-60	6.0-20	0.05-0.07	6.1-8.4
Blendon:				
BeB	0-30	2.0-6.0	0.11-0.17	5.6-7.3
	30-42	2.0-6.0	0.11-0.17	6.1-7.3
	42-60	2.0-20	0.08-0.15	6.6-8.4
Calco:				
Ca	0-15	0.6-2.0	0.21-0.23	7.9-8.4
	15-60	0.2-0.6	0.18-0.20	7.9-8.4
Cb, Cc	0-40	0.2-0.6	0.21-0.23	7.9-8.4
	40-60	0.2-0.6	0.18-0.20	7.9-8.4
Colo:				
Ce	0-32	0.2-0.6	0.21-0.23	5.6-6.5
	32-60	0.2-0.6	0.18-0.20	6.1-7.3
Crofton:				
CfC2, CfD2, CfE2, CfF, CfF2, CfG	0-7	0.6-2.0	0.22-0.24	7.4-8.4
	7-60	0.6-2.0	0.20-0.22	7.4-8.4
Grable:				
Gb	0-7	0.6-2.0	0.22-0.24	7.4-8.4
	7-24	0.6-2.0	0.20-0.22	7.4-8.4
	24-60	6.0-20	0.02-0.07	7.4-8.4
Haynie:				
He	0-60	0.6-2.0	0.21-0.23	7.4-8.4
Kennebec:				
Ke	0-15	0.6-2.0	0.22-0.24	5.6-6.5
	15-60	0.6-2.0	0.20-0.22	6.1-7.3
Lamo:				
La	0-17	0.6-2.0	0.22-0.24	7.4-8.4
	17-60	0.2-0.6	0.18-0.20	7.4-8.4
Maskell:				
Mh, MhC	0-17	0.6-2.0	0.17-0.22	6.1-7.8
	17-26	0.6-2.0	0.17-0.19	6.1-7.3
	26-60	0.6-2.0	0.17-0.22	6.1-7.3
Modale:				
Mk	0-22	0.6-2.0	0.21-0.23	7.4-8.4
	22-60	0.06-0.2	0.11-0.13	7.4-8.4

properties of soils

(T) is for the entire profile. Absence of an entry means data were not estimated]

Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodi-bility group
	Uncoated steel	Concrete	K	T	
High	High	Low			4
High	High	Low			
Moderate	Moderate	Low	0.28	5	6
Moderate	Moderate	Low	0.28		
Moderate	Moderate	Low	0.43		
Low	Moderate	Low			4L
Moderate	Moderate	Low			
High	High	Moderate			8
High	High	Moderate			
High	High	Moderate			
Moderate	Moderate	Low	0.32	4	7
Moderate	Moderate	Low	0.32		
Low	Low	Low	0.15		
Low	Moderate	Low	0.20	5	3
Low	Moderate	Low	0.20		
Low	Moderate	Low	0.20		
Moderate	High	Low			4L
High	High	Low			
High	High	Low			4L
High	High	Low			
High	High	Moderate			7
High	High	Moderate			
Low	Moderate	Low	0.43	5–4	4L
Low	Moderate	Low	0.43		
Low	Low	Low			4L
Low	Low	Low			
Low	Low	Low			
Low	Low	Low			4L
Moderate	Moderate	Low	0.32	5	6
Moderate	Moderate	Low	0.43		
Moderate	High	Low			6
High	High	Low			
Moderate	Moderate	Low	0.28	5	5
Low	Moderate	Low	0.28		
Moderate	Moderate	Low	0.28		
Moderate	Moderate	Low			4L
High	High	Low			

TABLE 11.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Moody: Mo, MoC, MoC2, MoD, MoD2	0–11 11–52 52–60	0.2–2.0 0.2–0.6 0.6–2.0	0.19–0.22 0.17–0.20 0.17–0.20	5.6–7.3 6.1–7.3 7.4–8.4
MsC: Moody part	0–11 11–52 52–60	0.2–2.0 0.2–0.6 0.6–2.0	0.19–0.22 0.17–0.20 0.17–0.20	5.6–7.3 6.1–7.3 7.4–8.4
Leisy part	0–16 16–44 44–60	2.0–6.0 0.6–2.0 0.2–0.6	0.16–0.18 0.17–0.19 0.18–0.20	6.1–6.5 6.1–7.3 6.1–7.8
MsD: Moody part	0–11 11–52 52–60	0.2–2.0 0.2–0.6 0.6–2.0	0.19–0.22 0.17–0.20 0.17–0.20	5.6–7.3 6.1–7.3 7.4–8.4
Leisy part	0–16 16–44 44–60	2.0–6.0 0.6–2.0 0.2–0.6	0.16–0.18 0.17–0.19 0.18–0.20	6.1–6.5 6.1–7.3 6.1–7.8
Nora: NoE, NoF, NoE2	0–12 12–30 30–60	0.6–2.0 0.6–2.0 0.6–2.0	0.19–0.22 0.17–0.20 0.17–0.20	6.1–7.3 6.6–7.8 7.4–8.4
NrC, NrC2, NrD, NrD2	0–12 12–30 30–60	0.6–2.0 0.6–2.0 0.6–2.0	0.19–0.22 0.17–0.20 0.17–0.20	6.1–7.3 6.6–7.8 7.4–8.4
NsE: Nora part	0–12 12–30 30–60	0.6–2.0 0.6–2.0 0.6–2.0	0.19–0.22 0.17–0.20 0.17–0.20	6.1–7.3 6.6–7.8 7.4–8.4
Alcester part	0–28 28–40 40–60	0.6–2.0 0.6–2.0 0.6–2.0	0.19–0.22 0.19–0.22 0.17–0.20	5.6–7.3 6.1–7.3 6.6–8.4
NsF: Nora part	0–12 12–30 30–60	0.6–2.0 0.6–2.0 0.6–2.0	0.19–0.22 0.17–0.20 0.17–0.20	6.1–7.3 6.6–7.8 7.4–8.4
Alcester part	0–28 28–40 40–60	0.6–2.0 0.6–2.0 0.6–2.0	0.19–0.22 0.19–0.22 0.17–0.20	5.6–7.3 6.1–7.3 6.6–8.4
Onawa: On	0–21 21–60	0.06–0.2 0.6–2.0	0.12–0.14 0.20–0.22	7.4–8.4 7.9–8.4
Ortello: OrC	0–17 17–42 42–60	2.0–6.0 2.0–6.0 6.0–20	0.16–0.18 0.15–0.17 0.05–0.10	6.1–6.5 6.6–7.3 6.6–7.8
Percival: Pe	0–22 22–60	0.06–0.2 6.0–20	0.12–0.14 0.06–0.08	7.4–8.4 7.4–8.4
Sarpy: Sa	0–7 7–60	6.0–20 6.0–20	0.05–0.09 0.05–0.09	6.6–8.4 7.4–8.4

properties of soils—Continued

Shrinkswell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
Moderate	Moderate	Low	0.32	5	7
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
Moderate	Moderate	Low	0.32	5	7
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
Low	Moderate	Low	0.20	5	3
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
Moderate	Moderate	Low	0.32	5	7
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
Low	Moderate	Low	0.20	5	3
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
Moderate	Moderate	Low	0.32	5–4	6
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
Moderate	Moderate	Low	0.32	5–4	7
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
Moderate	Moderate	Low	0.32	5–4	6
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
Moderate	Moderate	Low	0.28	5	6
Moderate	Moderate	Low	0.28		
Moderate	Moderate	Low	0.43		
Moderate	Moderate	Low	0.32	5–4	6
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
Moderate	Moderate	Low	0.28	5	6
Moderate	Moderate	Low	0.28		
Moderate	Moderate	Low	0.43		
High	High	Low			4
Moderate	High	Low			
Low	Moderate	Low	0.20	5	3
Low	Moderate	Low	0.20		
Low	Moderate	Low	0.20		
High	High	Low			4
Low	High	Low			
Low	Low	Low	0.15	5	2
Low	Low	Low	0.15		

TABLE 11.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Sarpy:				
Sc	0–8 8–60	0.06–0.2 6.0–20	0.13–0.15 0.05–0.09	6.6–8.4 7.4–8.4
SdB:				
Sarpy part	0–7 7–60	6.0–20 6.0–20	0.05–0.09 0.05–0.09	6.6–8.4 7.4–8.4
Duneland part.				
SrB:				
Sarpy part	0–7 7–60	6.0–20 6.0–20	0.05–0.09 0.05–0.09	6.6–8.4 7.4–8.4
Riverwash part.				
Thurman:				
TaE	0–14 14–60	6.0–20 6.0–20	0.07–0.09 0.06–0.11	6.1–7.3 6.1–7.3
ThC, ThC2, ThD, ThD2	0–14 14–60	6.0–20 6.0–20	0.10–0.12 0.06–0.11	6.1–7.3 6.1–7.3
TnC:				
Thurman part	0–14 14–60	6.0–20 6.0–20	0.10–0.12 0.06–0.11	6.1–7.3 6.1–7.3
Leisy part	0–16 16–44 44–60	2.0–6.0 0.6–2.0 0.2–0.6	0.16–0.18 0.17–0.19 0.18–0.20	6.1–6.5 6.1–7.3 6.1–7.8
TnD:				
Thurman part	0–14 14–60	6.0–20 6.0–20	0.10–0.12 0.06–0.11	6.1–7.3 6.1–7.3
Leisy part	0–16 16–44 44–60	2.0–6.0 0.6–2.0 0.2–0.6	0.16–0.18 0.17–0.19 0.18–0.20	6.1–6.5 6.1–7.3 6.1–7.8
Zook:				
Zo	0–26 26–60	0.2–0.6 0.06–0.2	0.21–0.23 0.11–0.13	5.6–7.8 5.6–7.8
Zw	0–60	0.06–0.2	0.11–0.13	5.6–7.8

area that are not subject to flooding; local information about floodwater heights and the extent of flooding; and local knowledge that relates the unique landscape position of each soil to historic floods. Most soils in low positions on the landscape where flooding is likely to occur are classified as fluvents at the suborder level or as fluventic subgroups. See the section "Classification of the Soils."

The generalized description of flood hazards is of value in land use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

A seasonal high water table is the highest level of a saturated zone more than 6 inches thick in soils for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed during the course of the soil survey. Indicated are the depth to the seasonal high water table; the kind of water table, whether perched, artesian, or the upper part of the ground water table; and the months of the year that the high water commonly is present. Only those saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not to construct basements and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Potential frost action refers to the likelihood of *properties of soils*—Continued

Shrinkswell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
High	Low	Low	0.32	5	4
Low	Low	Low	0.15		
Low	Low	Low	0.15	5	1
Low	Low	Low	0.15		
Low	Low	Low	0.15	5	1
Low	Low	Low	0.15		
Low	Low	Low	0.17	5	1
Low	Low	Low	0.17		
Low	Low	Low	0.17	5	2
Low	Low	Low	0.17		
Low	Low	Low	0.17	5	2
Low	Low	Low	0.17		
Low	Moderate	Low	0.20	5	3
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
Low	Low	Low	0.17	5	2
Low	Low	Low	0.17		
Low	Moderate	Low	0.20	5	3
Moderate	Moderate	Low	0.32		
Moderate	Moderate	Low	0.43		
High	High	Moderate			7
High	High	Moderate			
High	High	Moderate			4

damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action is defined as freezing temperatures in the soil and movement of soil moisture into the freezing zone, which causes the formation of ice lenses. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artifically drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Engineering test data

The results of analyses of engineering properties of several representative soils of the survey area are given in table 13.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are representative of the series discussed in "Descriptions of the soils." The soil samples were analyzed by the Nebraska Department of Roads.

The methods that were used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods codes assigned by the American Association of State Highway and Transportation Officials (AASHTO). The codes for Shrinkage, Unified classification, and California Bearing ratio are those assigned by the American Society for Testing and Materials.

The methods and codes are: AASHTO classification (M–145–66); Unified classification (D–2487–66T); Mechanical analysis (T88–57); Liquid limit (T89–60); Plasticity index (T90–56); Moisture-Density, method A (T99–57); and Specific gravity (T100–70).

TABLE 12.—*Soil and water features*

[Absence of an entry indicates the feature is not a concern. See text for description of the symbols and such terms as "brief" and "perched." The symbol > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	
					Ft			
Albaton: Ab	D	Occasional	Brief	Mar-Jun	1.0-3.0	Perched	Nov-May	Moderate.
Alcester: AcC, AcD, AgG	B	None			>6.0			High.
Aowa: Ao, Ap	B	Common	Very brief	Mar-Jun	>6.0			High.
Baltic: Ba	D	Occasional	Brief	Mar-Jun	1.0-3.0	Perched	Jan-Dec	High.
Bazile: BcC	B	None			>6.0			High.
Blendon: BeB	B	None			>6.0			Moderate.
Calco: Ca, Cb, Cc	B/D	Occasional	Brief	Mar-Jun	0-3.0	Apparent	Nov-May	High.
Colo: Ce	B/D	Occasional	Brief	Mar-Jun	2.0-3.0	Apparent	Nov-May	High.
Crofton: CfC2, CfD2, CfE2, CfF, CfF2, CfG	B	None			>6.0			Moderate.
Grable: Gb	B	Occasional	Very brief	Mar-Jun	>6.0			Low.
Haynie: He	B	Occasional	Very brief	Mar-Jun	>6.0			High.
Kennebec: Ke	B	Occasional	Brief	Mar-Jun	4.0-5.0	Apparent	Nov-May	High.
Lamo: La	C	Occasional	Brief	Mar-Jun	2.0-3.0	Apparent	Nov-May	High.
Maskell: Mh, MhC	B	None			>6.0			Moderate.
Modale: Mk	C	Occasional	Very brief	Mar-Jun	2.0-3.0	Perched	Nov-May	High.
Moody: Mo, MoC, MoC2, MoD, MoD2	B	None			>6.0			High.
MsC: Moody part	B	None			>6.0			High.
Leisy part	B	None			>6.0			Moderate.
MsD: Moody part	B	None			>6.0			High.
Leisy part	B	None			>6.0			Moderate.
Nora: NoE, NoF, NoE2, NrC, NrC2, NrD, NrD2	B	None			>6.0			High.

TABLE 12.—*Soil and water features*—Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	
					Ft			
Nora:								
NsE:								
Nora part	B	None			>6.0			High.
Alcester part	B	None			>6.0			High.
NsF:								
Nora part	B	None			>6.0			High.
Alcester part	B	None			>6.0			High.
Onawa:								
On	D	Occasional	Brief	Mar-Jun	3.0–4.0	Apparent	Nov-May	High.
Ortello:								
OrC	A	None			>6.0			Moderate.
Percival:								
Pe	C	Occasional	Brief	Mar-Jun	1.0–3.0	Perched	Nov-May	High.
Sarpy:								
Sa, Sc	A	Frequent	Brief to long	Mar-Jun	>6.0			Low.
SdB:								
Sarpy part	A	Frequent	Brief to long	Mar-Jun	>6.0			Low.
Duneland part.								
SrB:								
Sarpy part	A	Frequent	Brief to long	Mar-Jun	>6.0			Low.
Riverwash part.								
Thurman:								
TaE, ThC, ThC2, ThD, ThD2	A	None			>6.0			Low.
TnC:								
Thurman part	A	None			>6.0			Low.
Leisy part	B	None			>6.0			Moderate.
TnD:								
Thurman part	A	None			>6.0			Low.
Leisy part	B	None			>6.0			Moderate.
Zook:								
Zo, Zw	C/D	Occasional	Brief	Mar-Jun	1.0–3.0	Perched	Nov-May	High.

Formation and classification of the soils

This section consists of two main parts. The first part tells how the factors of soil formation have affected the development of soil in Dixon County. The second explains the system of soil classification currently used, and places each soil in the classes of that system.

Factors of soil formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural

TABLE 13.—*Engineering*

Soil name and location	Parent material	Nebraska report number S73—	Depth	Specific gravity [1]
			In	
Baltic silty clay: 1,700 feet north and 150 feet east of SW corner of sec. 27, T. 28 N., R. 4 E. (Modal.)	Clayey alluvium	1107 1108 1109	0–7 15–25 33–60	2.63 2.67 2.71
Bazile silty clay loam: 350 feet south and 160 feet west of NE corner of sec. 8, T. 28 N., R. 4 E. (Modal.)	Loess over sand	1110 1111 1112	0–7 19–31 38–60	2.64 2.73 2.67
Calco silty clay loam: 2,590 feet north and 110 feet east of SW corner of sec. 21, T. 27 N., R. 4 E. (Modal.)	Loamy alluvium	1113 1114 1115	0–8 8–18 18–42	2.56 2.62 2.65
Crofton silt loam: 850 feet south and 150 feet west of NE corner of sec. 33, T. 30 N., R. 5 E. (Modal.)	Peoria loess	1116 1117 1118	0–7 7–16 34–60	2.68 2.69 2.69
Kennebec silt loam: 1,150 feet west and 150 feet south of the NE corner of sec. 2, T. 29 N., R. 5 E. (Modal.)	Silty alluvium	1122 1123 1124	0–7 15–22 22–49	2.66 2.63 2.62
Nora silt loam: 1,220 feet west and 1,350 feet north of the SE corner of sec. 29, T. 30 N., R. 6 E. (Modal.)	Peoria loess	1125 1126 1127	0–7 12–20 20–30	2.61 2.68 2.69
Thurman loamy sand: 200 feet west and 100 feet north of the SE corner of sec. 18, T. 29 N., R. 5 E. (Modal.)	Eolian sand	1119 1120 1121	0–7 7–12 18–60	2.62 2.62 2.67

[1] Specific gravity based on standard procedure, AASHTO Designation T 100–70.
[2] Mechanical analyses according to the American Association of State Highway Officials Designation T 88–47 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material including that coarser than 2 mm. in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 mm. in diameter is excluded from

body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. The time required for differentiation of soil horizons may be short or long, but usually a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent material

Parent material is the unconsolidated earth material from which a soil forms. It determines the chemical and mineralogical composition of the soil. The soils of Dixon County formed in alluvium, sandy glacial outwash, and loess.

A few outcrops of sedimentary sandstone bedrock and glacial till are in the bluffs or on slopes of deeply entrenched drainageways. The largest area of these outcrops is near Ponca and on bluffs adjacent to the Missouri River Valley.

About 78 percent of the total area of Dixon County has soils that formed in Peoria loess. It is a brown or pale brown, wind-deposited material that consists mainly of silt particles but includes smaller amounts of clay and sand. This loess contains no pebbles or stones but has numerous lime concretions that have formed since it was deposited. Crofton, Nora, and Moody soils formed in loess of the uplands. They have a friable or very friable surface layer and express varying degrees *test data*

Percentage passing sieve—[2]			Percentage smaller than—[2]				Liquid limit	Plasticity index	Classification	
No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO[3]	Unified[4]
							Pct			
------------	100	98	93	71	48	40	61	31	A-7-5 (21)	CH
100	98	95	90	67	44	38	56	33	A-7-6 (20)	CH
100	99	96	92	66	39	35	51	30	A-7-6 (18)	CH
100	97	81	75	53	30	27	35	12	A-6 (9)	CL
------------	100	98	93	66	40	34	50	26	A-7-6 (16)	CL
100	90	26	22	12	9	8	NP	NP	A-2-4 (-1)	SM
------------	100	99	94	67	45	34	67	31	A-7-5 (22)	MH
------------	100	99	94	63	44	37	59	31	A-7-6 (20)	CH
------------	100	99	94	70	47	40	60	35	A-7-6 (22)	CH
------------	100	99	93	50	29	23	36	11	A-6 (8)	ML
------------	100	98	92	52	30	24	37	14	A-6 (10)	CL
------------	100	100	92	50	27	18	35	11	A-6 (8)	CL
------------	100	99	92	47	30	23	38	12	A-6 (9)	ML
------------	100	99	93	58	33	27	44	17	A-7-6 (12)	ML
------------	100	99	94	64	37	26	50	19	A-7-5 (14)	ML
------------	100	99	92	46	28	23	39	12	A-6 (9)	ML
------------	100	99	93	50	28	24	40	15	A-6 (10)	CL
100	100	97	91	50	28	23	39	14	A-6 (10)	ML
100	69	31	27	43	8	6	25	NP	A-2-4 (-1)	SM
100	63	17	16	9	6	4	NP	NP	A-2-4 (-2)	SM
100	61	5	5	4	4	3	NP	NP	A-3 (-3)	SP-SM

calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M 145-49.

Based on the Unified Soil Classification System, Technical Memo No. 3-357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953.

of development. Depth to calcareous, undeveloped loess varies with the soils. Deep, loessial soils provide an unrestricted rooting zone for plants. They have a high available water capacity and are generally well aerated.

Graneros shale, Greenhorn limestone, and Dakota sandstone outcrop in a few places. These sedimentary rock formations are of Cretaceous age. There are no soils that formed from these materials in Dixon County, but the outcrops are indicated with spot symbols on the soil map.

Glacial till from the Kansan glaciation also occurs as outcrops in Dixon County. It is firm, calcareous clay loam that contains pebbles and boulders. Pockets of sand and gravel are associated with the till in a few areas. The till areas are small. Although no soils in Dixon County formed in this till, these areas are shown on the soil map by a spot symbol.

Soils on bottom lands and foot slopes in the county formed in alluvium. About 18 percent of the soils in Dixon County formed in alluvium of different origins and age. The largest area of alluvial soil is in the upland drainageways. Alluvium consists of sediment deposited by water along major streams and in narrow drainageways of the uplands. The texture varies greatly because of the differences in the material from which the alluvium was originally derived and because of the manner in which it was deposited. Some of the alluvial material, referred to as colluvium, was transported for only a short distance and retains many of the characteristics of the soils from which it was washed. The material from which Alcester soils formed is a good example.

Alluvium on the Missouri River bottom lands originated mainly in sources outside the county. Alluvium on bottom lands of Logan Creek and other upland creeks originated in sources within or close to the county. Soils that developed in alluvium that has been in place a long time are dark colored, have a greater accumulation of organic matter, and have more soil development than soils that formed in more recent alluvium. Aowa, Calco, Colo, Baltic, Kennebec, Lamo, and Zook soils are examples. Albaton, Haynie, Modale, Onawa, and Percival soils formed in more recent alluvium. The recent alluvium and the soils that formed in it vary widely in texture. Albaton soils formed entirely in clayey alluvium. Sarpy soils formed in sandy alluvium. Some soils, such as Grable and Modale, formed in materials with different and contrasting textures. Soil material from higher elevations deposited at the base of slopes by the action of gravity and by local wash is called colluvium. This material is generally silty or loamy. Alcester and Maskell soils formed in colluvium.

About 7 percent of the county is an upland area that is made up of eolian sandy and loamy material. This area is mostly north and east of Logan Creek. The material was deposited by water in a glaciation period and then reworked by wind. The sand is 1 foot to about 20 feet thick. In some areas the sand is above deposits of loess, and in other areas a layer of sand is between layers of loess. Bazile, Blendon, Leisy, Ortello, and Thurman are the most common soils in this area.

Climate

Dixon County has a mid-continental climate characterized by wide seasonal variations. It is nearly uniform throughout the county. Rainfall, however, varies slightly from north to south.

Climate works with other soil-forming factors in developing soils of the county. The influence of climate is modified, however, by local conditions in or near the developing soils. For example, much of the water runs off the surface of steeply sloping Crofton soils. This results in a warmer and drier micro-climate than in nearby areas where the soils are not so steep. Soils that tend to have ponded water, such as the poorly drained Albaton soils, are colder and wetter than the adjacent, moderately well drained Haynie soils. Soils with north- and east-facing slopes tend to be cooler and more moist than those with south-facing slopes. These soils are also more likely to be more deeply leached of lime and support natural stands of trees.

Soil micro-organisms have a temperature range in which they are most active, and that determines the rate organic matter is decomposed to form humus. Weathering of parent material by water and air is activated by changes in temperature. Weathering also activates changes caused by physical and chemical actions. Rainfall influences the formation of the soils by its effect on the amount of vegetation that grows and by the resulting leaching that occurs in the soil.

Plant and animal life

Plants, animals, micro-organisms, earthworms, and other organisms are active factors in the soil-forming process. The kind of plants and animals that live in and on the soil are affected by the climate, the parent material, relief, and the age of the soil.

When Dixon County was settled, tall grasses were the dominant vegetation. Trees covered only a small area along the bluff, along major streams, and areas along the Missouri River. Trees have had only a slight influence on soil development. They are most common on the steeply sloping soils in the bluff area along the Missouri River Valley. Some of these stands have been in place long enough to cause slight but noticeable changes in the soils. Trees growing in alluvial areas, however, have not been in place long enough to have a significant influence on soil development.

Grasses have been more important than trees in developing the soils of Dixon County. As the grasses developed a new growth above ground each year, their fibrous root systems grew in the upper few feet of the soil. In time an upper layer that was moderately high in content of organic matter formed in the soils and made them darker in color. Grass roots help develop good structure and tilth in the soil, and they also bring plant elements to the surface. This redistribution process keeps the soils productive and keeps the plants growing. The decomposition of organic materials forms various organic acids that, in solution, hasten the leaching processes and aid soil development.

Soil organisms also have an important role in the soil-forming process. Worms and small burrowing animals help mix the soil material with organic matter. This mixing speeds up soil development and helps make the soil more friable and aerated. Micro-organisms also play an important part in soil formation. Many kinds of micro-organisms use the residues of plant material as food. They break down the residues to humus, and when they die, they become an available form of nitrogen for plants.

Man changes soil mainly by causing accelerated erosion. Less obvious are chemical changes in the soil caused by additions of lime and fertilizer, or changes in microbial activity and organic-matter content caused by returning crop residue to the soil.

Relief

The uplands of Dixon County are mainly gently sloping to very steep. The bottom lands are nearly level or depressional. Sandy areas on bottom lands are very gently sloping, and are gently undulating in a few areas. Relief is an important factor in the formation of soils because of its effect on drainage, aeration, and erosion.

Even though soils have formed in the same parent material, the influence of relief is seen in the color, thickness, and horizon distinction in the soils. The degree, shape, direction, and length of slope influence the amount of moisture in the soil. The steeper the topography, the greater the runoff and the less moisture is left to penetrate the soil. As water moves through the soil, it leaches certain elements into the lower horizons. Soils such as Crofton, that formed on steeper landscapes and have medium or rapid runoff, have lime near the surface and little soil development. In Moody soils, formed in areas not so steep, lime is deeper and soil development is more evident.

Soils in Dixon County have a thicker surface layer and more profile development on north- and east-facing slopes. Soils on south- and west-facing slopes receive more sunlight and have warmer temperatures that increase the activity of micro-organisms and the decomposition rate of organic matter. Erosion is also the greatest on these slopes. Water erosion removes soil material faster than horizons can form on some soils.

Relief affects the color of the subsoil through its effect on drainage and soil aeration. The subsoil of a soil that has good drainage is generally brownish because iron compounds are well distributed throughout the horizon and are oxidized. The subsoil of soils with restricted drainage are poorly aerated, and they are generally grayish and mottled. Examples are the Albaton and Zook soils. Nearly level soils on bottom lands may be wet because of slow runoff or a high water table. In areas where the soil is poorly drained, the decay of organic matter is slow or incomplete, and soil development is slower.

Time

Time enables the factors of relief, climate, and plant and animal life to bring about the formation of soils from the parent material. Where parent material has been in place or exposed for only a short time, the factors of soil formation have not had time to act on the soil material. Soils of the Moody and Bazile series are mature, have well-developed subsoils, and are leached of lime.

The younger, immature soils have not had time to develop such definite subsoil horizons or, in many instances, the soluble calcium carbonate has not been leached from their upper layers. Albaton and Haynie soils that formed in recent alluvium are examples. Further examples are the Aowa soils on bottom land that still receive deposits, and the moderately steep to very steep Crofton soils, where erosion is removing the soil at a faster rate than the soils can develop.

The degree of profile development depends on the intensity of the different soil-forming factors, the length of time they have been active, and the nature of the material from which the soils are derived. Differences in the length of time that geologic material has been in place are commonly reflected in the degree of horizon distinction in the soil profile.

Classification of soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available (*3*, *6*).

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system, the bases for classification are the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 14 the soils of the survey area are classified according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in sol. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and that are important to plant growth or that were selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Haplaquents (*Hapl*, meaning simple horizons, plus *aquent*, the suborder of Entisols that have an aquic moisture regime).

SUBGROUP. Each great group is divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades that have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective *Typic* is used for the subgroup that is thought to typify the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, nonacid, mesic, Typic Haplaquents.

SERIES. The series consists of a group of soils that formed in a particular kind of parent material and have horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Physical and chemical analyses

One profile of Crofton silt loam, two of Moody silty clay loam, one of Nora silty clay loam, one of Nora silt loam, and two of Thurman loamy sand were collected from Dixon County for physical and chemical analyses. Each of these soils was sampled at the Northeast Nebraska Experiment Station. The analyses were made by the Soil Conservation Service, and the resulting data are presented in "Soil Survey Investigations

TABLE 14.—*Classification of the soils*

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Albaton	Fine, montmorillonitic (calcareous), mesic Vertic Fluvaquents
Alcester	Fine-silty, mixed, mesic Cumulic Haplustolls
Aowa	Fine-silty, mixed (calcareous), mesic Mollic Ustifluvents
Baltic	Fine, montmorillonitic (calcareous), mesic Cumulic Haplaquolls
Bazile	Fine-silty over sandy or sandy-skeletal, mixed mesic Udic Argiustolls
Blendon	Coarse-loamy, mixed, mesic Pachic Haplustolls
Calco	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Crofton	Fine-silty, mixed (calcareous), mesic Typic Ustorthents
Grable	Coarse-silty over sandy or sandy-skeletal, mixed (calcareous), mesic Mollic Udifluvents
Haynie	Coarse-silty, mixed (calcareous), mesic Mollic Udifluvents
Kennebec	Fine-silty, mixed, mesic Cumulic Hapludolls
Lamo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
*Leisy	Fine-loamy, mixed, mesic Udic Argiustolls
Maskell	Fine-loamy, mixed, mesic Cumulic Haplustolls
Modale	Coarse-silty over clayey, mixed (calcareous), mesic Aquic Udifluvents
Moody	Fine-silty, mixed, mesic Udic Haplustolls
Nora	Fine-silty, mixed, mesic Udic Haplustolls
Onawa	Clayey over loamy, montmorillonitic (calcareous), mesic Mollic Fluvaquents
Ortello	Coarse-loamy, mixed, mesic Udic Haplustolls
Percival	Clayey over sandy or sandy-skeletal, montmorillonitic (calcareous), mesic Aquic Udifluvents
*Sarpy	Mixed, mesic Typic Udipsamments
Thurman	Sandy, mixed, mesic Udorthentic Haplustolls
Zook	Fine, montmorillonitic, mesic Cumulic Haplaquolls

Report No. 5" (7). One profile of Moody silty clay loam was sampled in Wayne County, and the resulting data for it are also presented in Report No. 5.

Laboratory data are useful to soil scientists in classifying soils and in developing concepts of soil genesis. It is helpful in estimating available water capacity, susceptibility to soil blowing, fertility, tilth, and other soil characteristics that affect management.

Environmental factors affecting soil use

This section was prepared mainly for those who are not familiar with Dixon County. It contains information on geology, relief, climate, water, transportation facilities, school facilities, manufacturing and business services of agriculture, general facilities, and trends and history of soil uses.

Geology

The oldest geologic materials exposed in the county are from the Cretaceous age. They are Greenhorn limestone, Graneros shale, and Dakota sandstone. These materials crop out in the bluff areas near Ponca and in isolated areas along the deeply dissected bluffs. These outcrop areas are indicated on the soil map by a symbol for bedrock. The Dakota sandstone is of economic importance in some areas as a source of water for domestic and livestock use.

Continental glaciers of the Nebraska and Kansan stages entered the county and state from the northeast. They covered the Cretaceous-age bedrock with glacial debris that is a heterogenous mass of sand, clay, silt, and some gravel and boulders. Peoria loess and Loveland formation were deposited over the glacial material. Glacial till is at the surface in only a few places where drainage entrenchment and erosion have removed the overlying loess. In Dixon County there are no areas of soils that formed in Cretaceous-age materials or glacial till that are of sufficient extent to be shown on the soil maps.

Three main topographic areas are in Dixon County. The loess-covered upland includes the bluff area that borders the Missouri River Valley and is in the northern part of the rolling hills topographic region of Nebraska. It makes up about 75 percent of the county. The sand outwash-loess area makes up about 7 percent of the county. The other 18 percent of the county consists of the bottom lands of the Missouri River Valley and the valleys of creeks and drainageways that originate in the uplands.

Loess has a high silt content and a low sand content. Most soils on the uplands in Dixon County formed in this material. After the loess was deposited, erosion created ridges and alternating narrow valleys that form the present topography. Soils of the Crofton, Moody, and Nora series formed in loess.

Although glacial till occurs as outcrops, it is not parent material for any of the soils in Dixon County. The glacial till is firm, calcareous clay loam that contains pebbles and boulders. Pockets of sand are associated with the till in a few areas. The till areas are small and are shown on the detailed soil map by a symbol for glacial till.

Sandy and loamy material that originated from glacial outwash entered the county from the northwest and parallels North Logan Creek and Logan Creek. It covers an area 12 miles wide where it entered the county. The area narrows as it extends through the county and is only about 1 mile wide where the glacial outwash left the county. The sand has been reworked by wind and generally covers an older deposit of loess. The sand is about 1 to 20 feet thick. Blendon, Thurman, Leisy, and Ortello soils formed in this sandy and loamy material.

The narrow stream valleys of the upland drainageways are mainly made up of local silty alluvium that accumulated on foot slopes and bottom lands. Soils of the Alcester, Aowa, Baltic, Calco, Colo, Kennebec, Lamo, Maskell, and Zook series formed in this material.

Alluvial deposits that originated from many areas outside the county are on the bottom lands of the Missouri River Valley. The varied origin of the deposits is reflected in the wide range of material in which the soils developed. Grable, Haynie, and Modale soils formed in alluvium that is mainly fine textured. Sarpy soils formed in alluvium that is mainly coarse textured. Modale, Onawa, and Percival soils formed in alluvium of varied and mixed textures.

Relief and drainage

The relief in the southern part of Dixon County is less than in any other part of the uplands. Drainageways in this area have low gradients, and streams are not deeply entrenched. In the rest of the uplands, particularly in the bluff area, the surface is strongly dissected, and almost all drainageways have steep gradients and entrenched streams.

The difference between the lowest and highest elevation in the county is about 536 feet. The lowest elevation, 1,104 feet above sea level, is on the Missouri River near the Dakota County line. The highest elevation is in the northwest part of Dixon County, about five miles south of Maskell. The approximate elevation of the towns in Dixon County are: Allen, 1,500 feet above sea level; Concord, 1,434 feet; Dixon, 1,440 feet; Emerson, 1,426 feet; Martinsburg, 1,252 feet; Newcastle, 1,310 feet; Ponca, 1,143 feet; Wakefield, 1,382 feet; and Waterbury, 1,434 feet.

About two-thirds of Dixon County is drained by the Missouri River and its tributaries. Aowa Creek and South Creek flow into the Missouri River in the county. These creeks are fed by many smaller streams, such as Daily, Silver, and Powder Creek, and by drainageways that divide and subdivide the upland part of the county. These creeks drain the uplands in a northeasterly direction. South Creek joins Aowa Creek at the turn of Ponca and turns east and southeast where it enters the Missouri River Valley. Minnow and Otter Creeks drain the east-central part of the county. North Logan Creek joins South Logan Creek above Wakefield. The Logan and Middle Creek drainageways flow in a southeasterly direction.

The bottom lands of the Missouri River Valley are nearly level but are broken in places by oxbows of former channels. The bottom lands of the valley were frequently flooded before large dams were constructed on the Missouri River. Dams upstream have reduced serious flooding. The reduction of flooding has improved the drainage in some areas. Almost all areas that have been cleared of trees are cultivated. Almost all drainageways in the county have low gradients and limited channel capacity because of past flooding.

Climate [5]

Dixon County has a continental climate, with warm summers and cold winters. Rainfall is moderate. The temperatures and rainfall vary greatly from day to day and from season to season. Most of the precipitation that falls in Dixon County originates in the Gulf of Mexico and the Caribbean Sea. The rapid changes in temperature are caused by an interchange of warm air from the south and southwest and cold air from the north and northwest. That area of the Missouri River that forms the northern boundary of the county is small and has very little influence on the climate.

About three-fourths of the average annual precipitation normally falls from April to September, during the growing season. Precipitation early in the spring is slow, steady, and well distributed. As the season advances, more and more of the precipitation falls during the erratic thundershowers, and by the latter part of May nearly all of it falls as showers. Thunderstorms in spring and early summer are severe at times; some of them are accompanied by heavy local downpours, hail, and damaging winds. A tornado occasionally occurs. Heavy rain is likely to fall in one area while a nearby area is receiving little or no rain. Droughts develop when precipitation is deficient, poorly distributed, or poorly timed. Large deviations from the average annual precipitation occur. According to records kept at Wakefield, precipitation in the driest year, 1936, was 12.99 inches. In the wettest year, 1923, it was 43.60 inches. Data on temperature and precipitation are given in table 15.

Fall usually has abundant sunshine and mild days and cool nights. Most of the winter precipitation falls as snow that is generally light, but it is occasionally heavy. Low temperatures and strong northerly winds frequently accompany the snow, blowing it into huge drifts. The average annual snowfall is about 32 inches, but the annual amount varies. The snow frequently melts between falls. Snow covers the ground for 59 days in an average winter.

Temperature records, which began in Wakefield in 1898, show the highest temperature ever recorded there was 115 degrees on July 17, 1936, and the lowest reading ever recorded was 41 degrees below zero on January 12, 1912.

The average date of the last 32-degree air temperature in the spring is May 7. The average date of the first 32-degree air temperature in the fall is October 2.

Local topography has little effect upon average temperatures over a long period. Long-term average temperatures recorded on flatland, for example, do not differ greatly from those recorded on rolling hills or in valleys in the immediate area. Records based on dates when specific temperatures were reached may, however, differ markedly over short distances.

[5] Furnished by Climatology Office, Conservation and Survey Division, University of Nebraska.

TABLE 15.—*Temperature and precipitation*

[All data from Wakefield]

Month	Temperature: Average daily maximum[1]	Temperature: Average daily minimum[1]	Temperature: 2 years in 10 will have[2] at least 4 days with— Maximum temperature equal to or higher than—	Temperature: 2 years in 10 will have[2] at least 4 days with— Minimum temperature equal to or lower than—	Precipitation: Average monthly total[1]	Precipitation: 1 year in 10[3] will have— Equal to or less than—	Precipitation: 1 year in 10[3] will have— Equal to or more than—	Precipitation: Days with 1 inch or more snow cover[1]	Precipitation: Average depth of snow on days with snow cover[1]
	F	F	F	F	In	In	In		In
January	30	7	49	-12	.6	.1	1.4	19	5
February	36	13	55	-11	1.0	.2	1.9	13	6
March	45	23	65	2	1.6	.4	2.4	11	6
April	63	36	81	20	2.2	.7	4.1	1	4
May	74	47	89	34	3.9	1.5	6.2	(4)	4
June	83	58	91	44	4.5	2.1	7.2		
July	87	62	97	51	3.5	1.1	6.1		
August	86	60	96	49	2.9	1.3	6.4		
September	77	50	94	34	2.5	.6	6.2		
October	67	39	84	24	1.6	.3	3.6	(4)	2
November	49	25	70	7	1.0	.1	2.8	3	5
December	35	13	55	-14	.8	.1	1.8	12	4
Year	61	36	102[5]	-22[6]	26.1	20.3	34.7	59	5

[1] Based on period 1944–73.
[2] Based on computer study for period 1948–63.
[3] Based on period 1895–73.
[4] Less than 0.5 day.
[5] Average annual highest maximum.
[6] Average annual lowest minimum.

Probabilities of the last freezing temperatures in spring and first in fall are given in table 16. When freeze data are used, dates should be adjusted to fit the particular exposure. Less exposed areas will have the last spring freeze at an earlier date and the first fall freeze at a later date.

Annual evaporation from the free surface of the water in small lakes and farm ponds averages 39 inches. About 78 percent of this occurs from May through October.

Water supply and natural resources

Wells provide water for domestic and livestock purposes throughout most of the county. The wells in the western part of the county obtain water from sand and gravel pockets in or at the base of the glacial till. In the bluff area, water is available in the sandstone of the Dakota formation from wells that are 75 to 350 feet deep. The water is usable, but it is very hard, and in some localities sulphates or chlorides give the water an unpleasant taste. Shallow wells, usually less than 50 feet deep, in the narrow stream valleys and on the Missouri River bottom lands provide good quality water. Farm ponds and streams are used to supplement wells for livestock water.

Wells yielding water for irrigation can be developed in Missouri River Valley alluvium. Test drilling is necessary to locate the most favorable site for developing a well. The quality of the water generally is good, the pumping lift is not excessive, and the recharge is adequate to prevent rapidly declining water levels. The potential for developing irrigation wells in the uplands is very limited.

Irrigation in Logan Creek Valley has developed considerably. This area is well suited to development of irrigation. Test drilling is needed to locate the most favorable site. Most irrigation wells are 50 to 120 feet deep. Static water level is 15 to 30 feet. The quality of the water is good, and recharge of water level is good. The recharge of water in wells along South Logan Creek is somewhat poorer than that on Logan Creek.

The water and soils of Dixon County are its greatest natural resources. The bottom lands of the Missouri River and Logan Creek Valleys have the potential to further expand irrigation. The geographic location favors the development of agricultural and associated industries.

Natural vegetation

The native vegetation in Dixon County was tall grass. Woodland areas are on the bluffs, along streams, and in and around old channels of the Missouri River. The most important grasses were big bluestem, little bluestem, switchgrass and indiangrass. Swampgrasses and rushes were in marshlike areas. The composition of the vegetation varies with the drainage characteristics of the areas.

Approximately 4 percent of the county is wooded. The largest area is on the bluffs along the Missouri River Valley. Red elm, black oak, hackberry, black walnut, white elm, bur oak and basswood are the com-

TABLE 16.—*Probabilities of last freezing temperatures in spring and first in fall* [1]

[All data from Wakefield]

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	Apr. 12	Apr. 19	May 1	May 13	May 23
2 years in 10 later than	Apr. 6	Apr. 14	Apr. 26	May 8	May 18
5 years in 10 later than	Mar. 27	Apr. 4	Apr. 15	Apr. 27	May 7
Fall:					
1 year in 10 earlier than	Oct. 20	Oct. 17	Oct. 6	Sep. 24	Sep. 17
2 years in 10 earlier than	Oct. 26	Oct. 22	Oct. 12	Sep. 29	Sep. 22
5 years in 10 earlier than	Nov. 6	Nov. 1	Oct. 22	Oct. 9	Oct. 2

[1] All freeze data are based on temperatures which are measured in a standard National Weather Service thermometer shelter; the thermometers are placed approximately five feet above the ground; the exposure is believed representative of the surrounding area. Lower temperatures will exist at times nearer the ground and in local areas subject to extreme air drainage on calm nights.

mon tree species in this area. The underbrush in these areas is mainly sumac, dogwood, and ironwood. The low bottoms along streams of the narrow upland drainageways support a fairly dense growth of elm, ash, oak, cottonwood, and willow. Cottonwood, willow, elm, and boxelder are along the abandoned channels of the Missouri River, and a fairly dense growth of small willows is on the alluvial floodplains.

Transportation facilities

One railroad enters the county from the east, along Otter Creek, and continues west to the towns of Allen and Dixon. Another railroad enters the county from the southeast corner near Emerson, and joins the towns of Wakefield and Concord. These railroads provide service to the county from South Sioux City, Nebraska, and Sioux City, Iowa. State Highways 9, 35, and 12 and U.S. Highway 20 are the main roads to markets. All rural mail routes are graveled. There is an airport near South Sioux City, Nebraska, and one near Wayne, Nebraska. Both have asphalt runways. The larger major air terminal is in nearby Sioux City, Iowa. Grain elevators are in nearly all towns of Dixon County, and they handle most of the locally grown grains that are marketed.

School facilities

The five high schools in the county are in Allen, Emerson, Newcastle, Wakefield, and Ponca. Nearly every town in the county has an elementary school.

Manufacturing and business services of agriculture

The towns of Wakefield and Emerson have the largest market and shopping centers of the county. Other centers are in Allen, Dixon, Concord, Maskell, Newcastle, Martinsburg, and Waterbury. Thus, the centers are well distributed throughout the county. Most of the industries in the county are related to purchasing, processing, and selling agricultural products.

General facilities

Churches of various faiths are throughout the county. Radio and television stations are in Sioux City, Iowa; Omaha and Wayne, Nebraska; and Yankton, South Dakota. Weekly newspapers are published in Emerson, Ponca, and Wakefield.

Electricity is supplied to all rural areas of the county by the Rural Electric Administration and Consumers Public Power District. Natural gas is available to all towns in the county except Maskell and Waterbury.

Outdoor water recreation is provided by the Missouri River and by Logan Creek.

Trends in agriculture and soil use

Farming has been the most important enterprise in Dixon County since the county was settled. Raising and fattening cattle and hogs and off-farm employment in agricultural related industries provide part of the income for Dixon County residents.

According to the Nebraska Agricultural Statistics, the total number of hogs decreased slightly from 98,407 in 1964 to 86,582 in 1969. Cattle increased from 65,064 in 1964 to 69,208 in 1970. The increase in cattle numbers was primarily in the cow-calf operations. The number of milk cows decreased from 3,562 in 1969 to 1,888 in 1970.

Corn is the most important crop grown in the county. In 1964 there were 3,265,250 bushels harvested from 78,482 acres, and 5,114,427 bushels were harvested from 73,298 acres in 1969.

Soybeans have increased as an important cash-grain crop. In 1964, 304,645 bushels were harvested from 13,779 acres. By 1969 production increased to 448,572 bushels on 16,388 acres.

Production of oats has decreased somewhat. In 1964, there were 23,631 bushels harvested as compared to 1969 when 22,411 bushels were harvested. Oats are planted as a nurse crop when legumes are seeded.

Alfalfa hay has decreased slightly because of its changing need in the cropping sequence. In 1964, there were 23,611 acres planted and 50,278 tons harvested. In 1969, 58,733 tons were harvested from 22,050 acres. A large acreage of alfalfa is grown for hay and is used as cattle feed.

According to the Census of Agriculture, the number of farms in the county decreased from 1,049 in 1964 to 954 in 1969. The trend is towards larger sized operating units. The average size of a farm was approximately 270 acres in 1964. It has gradually increased and was 301 acres in 1969. The cost per acre of farmland varies with the kind of soil and with the economic factors. The average value was 148 dollars per acre in 1964. It increased to 222 dollars by 1969. Approximately 95 percent of the land area is in farms.

Cash-grain is the most important type of farm operation in Dixon County. Some livestock are kept, however, on nearly all farms. In 1969, 470 farms of the county were operated by full owners, 262 by part owners, and 222 were operated by tenants.

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Glossary

Alkali (sodic) soil. A soil having 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 plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (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 moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Buried soil. A developed soil, once exposed but now overlain by more recently formed soil.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system which creates the best conditions possible for growing a crop with a limited amount of soil disturbance and maximum retention of crop residue on the soil surface.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, alumnium, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Immature soil. A soil lacking clearly defined horizons because the soil-forming forces have acted on the parent material only a relatively short time since it was deposited or exposed.

Intake rate. The average rate of water that enters the soil under irrigation. Most soils have a faster initial rate which decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending upon the net irrigation application. The rate of water intake in inches per hour is expressed thus:

Very low	Less than 0.2
Low	0.2 to 0.4
Moderately low	0.4 to 0.75
Moderate	0.75 to 1.25
Moderately high	1.25 to 1.75
High	1.75 to 2.5
Very high	More than 2.5

Intermittent stream or drainageway. A stream or drainageway that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources.

Landscape. All the natural features, such as fields, hills, forests, water, etc., that distinguish one part of the earth's surface from another part, usually that portion of land or territory which the eye can comprehend in a single view, including all of its natural characteristics.

Leaching. The removal of soluble material from soil or other material by percolating water.

Legume. A member of the legume or pulse family (*Leguminosae*). One of the most important and widely distributed plant families. Includes many valuable forage species, such as peas, beans, peanuts, clover, alfalfa, sweet clover, lespedeza vetch, and kudzu. Practically all legumes are nitrogen-fixing plants, and many of the herbaceous species are used as cover and green-manure crops. Even some of the legumes that have no forage value (crotalaria and some lupines) are used for soil improvement. Other legumes are locust, honeylocust, redbud, mimosa, wisteria, and many tropical plants.

Lime. Chemically, lime is calcium oxide (CaO), but its meaning has been extended to include all limestone-derived materials applied to neutralize acid soils. Agricultural lime can be obtained as ground limestone, hydrated lime, or burned lime, with or without magnesium minerals. Basic slag, oystershells, and marl also contain calcium.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follow: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Mulch. A natural or artificially applied layer of plant residue or other material on the surface of the soil. Mulches are generally used to help conserve moisture, control temperature, prevent surface compaction or crusting, reduce runoff and erosion, improve soil structure, or control weeds. Common mulching materials are wood chips, plant residue, sawdust, and compost.

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Organic matter (soil). The organic fraction of the soil. Includes plant and animal residues at various stages of decomposition, cells and tissues of soil organisms and substances synthesized by the soil population. Commonly determined as those organic materials which accompany the soil when put through a 2-mm sieve. In this report, organic matter was rated as follows:

Very low	Less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

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

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The degree of deviation of a surface from the horizontal, usually expressed in percent or degrees. In this report, the following slope classes are recognized:

Nearly level	0 to 2 percent
Gently sloping	2 to 6 percent
Strongly sloping	6 to 11 percent
Moderately steep	11 to 15 percent
Steep	15 to 30 percent
Very steep	30 to 60 percent

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and 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 C horizon, in which the processes of soil formation are active. The solum in mature soil consists of 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 characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Underlying material. Weathered soil material immediately beneath the solum. In this report, the C horizon of a soil.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

GUIDE TO MAP UNITS

For a full description of map unit, read both the description of the map unit and that of the soil series to which the map unit belongs. Information about the use and management of each soil is given in the description of the capability unit and range site (or other interpretive group) to which it is assigned.

Map symbol	Map unit	Page	Capability unit Dryland	Capability unit Irrigated	Range site	Windbreak suitability group
Ab	Albaton silty clay, 0 to 2 percent slopes----	9	IIIw-1	IIIw-1	Clayey Overflow	2
AcC	Alcester silt loam, 2 to 6 percent slopes----	11	IIe-1	IIIe-6	Silty Lowland	4
AcD	Alcester silt loam, 6 to 11 percent slopes---	11	IIIe-1	IVe-6	Silty	4
AgG	Alcester silt loam, gullied, 11 to 60 percent slopes------------------------------------	11	VIIe-7	------	Silty	10
Ao	Aowa silt loam, 0 to 2 percent slopes--------	12	IIw-3	IIw-6	Silty Overflow	1
Ap	Aowa soils, channeled, 0 to 2 percent slopes-	12	VIw-7	------	Silty Overflow	10
Ba	Baltic silty clay, 0 to 2 percent slopes-----	13	IIIw-1	IIIw-1	Clayey Overflow	2
BcC	Bazile silty clay loam, 2 to 6 percent slopes	14	IIIe-1	IIIe-3	Silty	4
BeB	Blendon sandy loam, 0 to 3 percent slopes----	15	IIe-3	IIe-8	Sandy	3
Ca	Calco silt loam, overwash, 0 to 2 percent slopes------------------------------------	15	IIw-3	IIw-4	Silty Overflow	2
Cb	Calco silty clay loam, 0 to 2 percent slopes-	16	IIw-4	IIw-3	Subirrigated	2
Cc	Calco silty clay loam, wet, 0 to 2 percent slopes------------------------------------	16	Vw-7	------	Wet Land	6
Ce	Colo silty clay loam, 0 to 2 percent slopes--	17	IIw-4	IIw-3	Subirrigated	2
CfC2	Crofton silt loam, 2 to 6 percent slopes, eroded------------------------------------	18	IIIe-9	IIIe-6	Limy Upland	5
CfD2	Crofton silt loam, 6 to 11 percent slopes, eroded------------------------------------	18	IVe-9	IVe-6	Limy Upland	5
CfE2	Crofton silt loam, 11 to 15 percent slopes, eroded------------------------------------	18	IVe-9	------	Limy Upland	5
CfF	Crofton silt loam, 15 to 30 percent slopes---	18	VIe-9	------	Limy Upland	10
CfF2	Crofton silt loam, 15 to 20 percent slopes, eroded------------------------------------	18	VIe-9	------	Limy Upland	10
CfG	Crofton silt loam, 30 to 60 percent slopes---	19	VIIe-9	------	Thin Loess	10
Gb	Grable very fine sandy loam, 0 to 2 percent slopes------------------------------------	19	IIs-5	I-6	Silty Lowland	1
He	Haynie silt loam, 0 to 2 percent slopes------	20	I-1	I-6	Silty Lowland	1
Ke	Kennebec silt loam, 0 to 2 percent slopes----	21	I-1	I-6	Silty Lowland	1
La	Lamo silt loam, 0 to 2 percent slopes--------	22	IIw-4	IIw-4	Subirrigated	2
Mh	Maskell loam, 0 to 2 percent slopes----------	23	I-1	I-4	Silty Lowland	4
MhC	Maskell loam, 2 to 6 percent slopes----------	24	IIe-1	IIIe-4	Silty Lowland	4
Mk	Modale very fine sandy loam, 0 to 2 percent slopes------------------------------------	24	I-1	I-6	Silty Lowland	1
Mo	Moody silty clay loam, 0 to 2 percent slopes-	26	I-1	I-3	Silty	4
MoC	Moody silty clay loam, 2 to 6 percent slopes-	26	IIe-1	IIIe-3	Silty	4
MoC2	Moody silty clay loam, 2 to 6 percent slopes, eroded------------------------------------	26	IIe-8	IIIe-3	Silty	4
MoD	Moody silty clay loam, 6 to 11 percent slopes	26	IIIe-1	IVe-3	Silty	4
MoD2	Moody silty clay loam, 6 to 11 percent slopes, eroded----------------------------	27	IIIe-8	IVe-3	Silty	4
MsC	Moody-Leisy complex, 2 to 6 percent slopes---	27	IIe-3	IIe-5	Silty	4
MsD	Moody-Leisy complex, 6 to 11 percent slopes--	27	IIIe-3	IIIe-5	Silty	4
NoE	Nora silt loam, 11 to 15 percent slopes------	28	IVe-1	------	Silty	4
NoE2	Nora silt loam, 11 to 15 percent slopes, eroded------------------------------------	28	IVe-8	------	Silty	4
NoF	Nora silt loam, 15 to 30 percent slopes------	28	VIe-1	------	Silty	10
NrC	Nora silty clay loam, 2 to 6 percent slopes--	29	IIe-1	IIIe-3	Silty	4
NrC2	Nora silty clay loam, 2 to 6 percent slopes, eroded------------------------------------	29	IIe-8	IIIe-3	Silty	4
NrD	Nora silty clay loam, 6 to 11 percent slopes-	29	IIIe-1	IVe-3	Silty	4
NrD2	Nora silty clay loam, 6 to 11 percent slopes, eroded------------------------------------	29	IIIe-8	IVe-3	Silty	4
NsE	Nora-Alcester silt loams, 11 to 15 percent slopes------------------------------------	30	IVe-1	------	Silty	4

Map symbol	Map unit	Page	Capability unit Dryland	Capability unit Irrigated	Range site	Windbreak suitability group
NsF	Nora-Alcester silt loams, 15 to 30 percent slopes------------------------------------	30	VIe-1	------	Silty	10
On	Onawa silty clay, 0 to 2 percent slopes------	31	IIw-1	IIw-1	Clayey Overflow	2
OrC	Ortello sandy loam, 2 to 6 percent slopes----	31	IIIe-3	IIIe-8	Sandy	3
Pe	Percival silty clay, 0 to 2 percent slopes---	32	IIw-1	IIw-1	Clayey Overflow	2
Sa	Sarpy loamy fine sand, 0 to 2 percent slopes-	33	IVs-7	IIIs-11	Sandy Lowland	3
Sc	Sarpy silty clay, overwash, 0 to 2 percent slopes------------------------------------	34	IVs-2	IVs-1	Clayey Overflow	2
SdB	Sarpy-Duneland complex, 0 to 4 percent slopes	34	VIs-7	------	---------------	7
	Sarpy soil-------------------------------	--	------	------	Sandy Lowland	--
	Duneland part----------------------------	--	------	------	Sands	--
SrB	Sarpy-Riverwash complex, 0 to 3 percent slopes------------------------------------	34	Vw-7	------	---------------	10
	Sarpy soil-------------------------------	--	------	------	Sandy Lowland	--
	Riverwash part---------------------------	--	------	------	---------------	--
TaE	Thurman sand, 3 to 20 percent slopes---------	35	VIIe-5	------	Sands	10
ThC	Thurman loamy sand, 2 to 6 percent slopes----	35	IVe-5	IVe-11	Sandy	7
ThC2	Thurman loamy sand, 2 to 6 percent slopes, eroded------------------------------------	36	VIe-5	IVe-11	Sands	7
ThD	Thurman loamy sand, 6 to 11 percent slopes---	36	VIe-5	IVe-11	Sands	7
ThD2	Thurman loamy sand, 6 to 11 percent slopes, eroded	36	VIe-5	IVe-11	Sands	7
TnC	Thurman-Leisy complex, 3 to 6 percent slopes-	36	IVe-5	IVe-11	---------------	3
	Thurman soil-----------------------------	--	------	------	Sandy	--
	Leisy soil-------------------------------	--	------	------	Silty	--
TnD	Thurman-Leisy complex, 6 to 11 percent slopes------------------------------------	36	IVe-5	IVe-11	---------------	7
	Thurman soil-----------------------------	--	------	------	Sands	--
	Leisy soil-------------------------------	--	------	------	Silty	--
Zo	Zook silty clay loam, 0 to 2 percent slopes--	37	IIw-4	IIw-1	Clayey Overflow	2
Zw	Zook silty clay, 0 to 2 percent slopes-------	37	IIIw-1	IIIw-1	Clayey Overflow	2

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