designate units within the classes and subclasses in all classes but class I are these:

0. A problem or limitation caused by very gravelly material in the substratum.
1. An erosion hazard, actual or potential.
2. A problem or limitation of wetness because of a high water table, seepage, or flooding.
3. A problem or limitation of slow permeability of the subsoil.
4. A problem or limitation caused by coarse soil texture or excessive gravel.
5. A problem or limitation caused by fine soil texture.
6. A problem or limitation caused by salt or alkali.
7. A problem or limitation caused by stones or rock outcrops.
8. A problem or limitation caused by shallow depth of soil over bedrock.
9. A problem or limitation caused by low fertility.

Management by Capability Units

The productivity and responses of a soil depend on many factors, especially on the nature of the soil, the climate in which it is located, and the management it receives. Soil characteristics and climate cannot be changed readily, but management can be controlled. Changes in the management of some soils can drastically change the quality and yield the crops produce. Depending on the kind, recurring practices in management establish a trend toward improvement, maintenance, or depletion of the soil.

A good system of soil management is likely to consist of a combination of several practices. Among these practices are the use of a good cropping system, application of fertilizer, and the control of runoff. The effectiveness of any one practice is dependent upon other practices. For example, a system for disposal of storm water may be ineffective unless the outlet can be connected with an adequate community drainage system.

Because of the wide variety of soils, it is desirable to group most of them into units for general discussion of their use and management requirements. Such a grouping has been made in this section. This section contains a description of each capability unit and suggestions for use and management of the soils. Additional information about each kind of soil is given in the section "Descriptions of the Soils." For the names of the soils in any given unit, refer to the "Guide to Mapping Units" at the back of this survey.

Capability unit I-1

In this unit are very deep or moderately deep, nearly level, well-drained soils on alluvial fans and flood plains. They range from fine sandy loam to silty clay. The soils formed in fairly uniform deposits of alluvial material. They are stratified, but variations in texture caused by stratification do not hinder use. The soils on the flood plain of the Sacramento River formed in alluvium from various sources. Those on the west side of the Sacramento Valley, in contrast, formed in material washed from sedimentary and metasedimentary rocks.

All of the soils in this unit are moderate to high in fertility, are easy to work, and have moderate to high available water holding capacity. Permeability is moderately slow to moderately rapid.

The soils in this capability unit are the most productive in the county. They are suited to the row and field crops commonly grown, and to grapes, orchard fruits, berries, and pasture. Many of the areas are used as orchards.

These soils generally are fairly low in organic matter. They are also fairly low in nitrogen and are moderate to high in other plant nutrients. Crops respond readily if fertilizer is applied. For favorable yields, most crops require fertilizer that contain nitrogen, and the quality of legumes improves if phosphorus and sulfur are applied.

The content of organic matter can be maintained by growing green-manure crops, rotating crops, and conserving crop residues. Orchards benefit most if the green-manure crop is planted in fall. Yields of irrigated pasture are best if grazing is rotated from field to field and if fertilizer is applied.

All methods of irrigation are suitable for these soils. The soils hold water well, and some are naturally subirrigated. Some of the soils, particularly the Columbia, Orland, and Wyo, have moisture in the substratum at a depth of 10 to 12 feet. On these soils deep-rooted tree crops require less irrigation than on other soils.

Leveling or grading causes little damage on these soils. Soils that have a texture of clay loam, however, are particularly susceptible to the formation of a tillage pan. Formation of a tillage pan can be reduced if overcultivation is avoided and if machinery and livestock are kept out of fields when the soils are wet. Eliminating tillage, chopping the cover crop, and irrigating with sprinklers all help in reducing formation of a tillage pan in orchards. If a pan forms, it can be corrected in orchards by chiseling and in open fields by subsoiling or chiseling.

Capability unit IIe-1

In this unit are very deep, gently sloping, well drained and moderately well drained soils on fans and low stream terraces. These soils consist of material that has been deposited fairly recently. Their texture ranges from fine sandy loam to silty clay loam. The soils that are on the flood plain of the Sacramento River formed in mixed sediments. In contrast the soils on the west side of the Sacramento Valley formed in deposits derived mostly from sedimentary rock.

All of the soils in this unit have gentle slopes, moderate to moderately rapid permeability, slow to medium runoff, and a slight to moderate erosion hazard, but they are otherwise similar to the soils of capability unit I-1.

These highly productive soils are used mostly for dryland grain rotated with pasture. If irrigated, these soils are suited to all crops commonly grown under irrigation.

The use of crop residues, green-manure crops, crop rotations, and fertilizer helps maintain organic matter and yields. Sheet erosion in grainfields can be controlled by cultivating across the slope, stubble mulching, and using similar practices that are fairly easy to apply. Leveling and grading can be done without lasting damage to the soil.

On irrigated areas, the hazard of erosion is slight to moderate. Erosion can be controlled by applying the irrigation water carefully, generally by contour furrows on the gentler slopes and by sprinklers on the steeper ones. By these methods, the water can be applied evenly and at a rate that permits the soils to absorb it. A system for removing excess water safely also is needed.

All of the soils in this unit are easy to work, but a tillage pan tends to form in the soils that have a silty surface soil. Careful tillage slows formation of such a pan, but if a pan forms, it can be broken by chiseling or subsoiling.

Capability unit IIe-3

This unit consists of well-drained, gently sloping soils on smooth, low terraces. The surface layer of these soils is clay loam or silty clay loam, and the subsoil is dense clay loam or clay. These soils are underlain by sediments derived from siltstone, sandstone, and shale, or by a mixture of rock from various sources.

Aeration in most places is favorable for growth of crops. Permeability of the subsoil is moderately slow to slow, and the effective rooting depth is about 3 to 4 feet. The water-holding capacity is moderate. Productivity is moderate, and the soils are fairly easy to work. Runoff is slow to medium. The erosion hazard is slight to moderate, and some areas of Tehama soils are gullied.

The soils in this unit are well suited to irrigated, shallow-rooted field crops and pasture plants. They are also suited to dryland hay, grain, and pasture. Most irrigated crops on these soils respond if fertilizer that contains nitrogen and phosphorus is added. The content of organic matter is naturally low, and under dryland farming it is difficult to increase the supply. If these soils are irrigated, conserving of crop residues, growing of green-manure crops, and rotating of crops all help to maintain the content of organic matter.

Erosion caused by irrigation can be controlled on the sloping areas by using sprinklers, but on the gentler slopes contour irrigation can be used. If surface irrigation methods are used, a system for safely disposing of excess irrigation water is needed. Erosion caused by irrigation can be minimized if the water is applied at a slow rate. In this way, nearly all the water enters the soil and runoff is slight. Sheet erosion in fields of grain and hay can be controlled if tillage is done across the slope, and if stubble mulching and similar easily applied practices are followed.

Capability unit IIe-4

The soils in this unit are deep, well drained, and gently sloping to sloping. They are on material derived chiefly from the Tehama and Red Bluff formations. These soils are typically in narrow valleys along streams or are on low, dissected terraces. They are on the west side of the Sacramento Valley. Irrigation water is available for only part of the area.

These soils have a surface layer of gravelly loam. The subsoil is gravelly clay loam, and in places the lower part of the substratum is very gravelly. Depth of the soils is more than 5 feet. Permeability, water-holding capacity, and fertility are moderate. The erosion hazard is slight to moderate. These soils are easy to work, but in places gravel interferes with seeding.

If irrigated, these soils are suited to many orchard, vineyard, row, field, and specialty crops. Dryfarmed areas are suited only to grain, hay, and pasture. The soils are well suited to deep-rooted crops if irrigated. They also are suited to shallow-rooted crops, but these require more careful irrigation practices. Irrigation water must be applied in smaller amounts on shallow-rooted crops, and more frequently.

These soils are difficult to irrigate because of the slopes and the erosion hazard. Erosion can be controlled if irrigation is done on the contour or if sprinklers are used. These practices also control loss of water and leaching of plant nutrients. The supply of organic matter can be maintained if green-manure crops are grown, crop residues are turned under, and suitable crop rotations are followed. Most crops on these soils respond if fertilizer that contains nitrogen and phosphorus is applied. In dryfarmed areas erosion can be controlled if seeding is done across the slope and if stubble mulching is practiced.

Capability unit IIw-2

In this unit are nearly level fine sandy loams or silt loams. These soils are on recent alluvium derived from various kinds of rocks. They are along the Sacramento River and are moderately well drained but are subject to occasional overflow unless they are protected by levees. In places the water table is high for a few days when the level of the river is high.

Permeability of these soils is moderate to moderately rapid. The available water holding capacity is moderate to high, and fertility is high. The soils are easy to work. Streambank erosion is a serious hazard in small areas.

If irrigated, these soils are suited to alfalfa, corn, milo, beans, sugarbeets, prunes, walnuts, and almonds. Dryfarmed areas are suited to barley, milo, safflower, and walnuts. Because of subirrigation, some crops can be grown successfully without irrigation or with only supplemental irrigation late in summer.

Tillage pans are common in these soils, but formation of a tillage pan can be reduced if cultivating is done after the surface soil dries. If a tillage pan forms, it can be broken by chiseling in summer or in fall when the soil is dry. Crops in most areas of these soils respond if fertilizer that contains nitrogen is applied. Growing green-manure crops, turning under crop residues, and using suitable crop rotations also help to maintain productivity. In areas where streambank erosion is a problem, piling, riprap, and similar materials can be used for control of erosion.

Capability unit IIs-0

In this unit are well-drained, nearly level loams that have a gravelly substratum. These soils are on sediments derived mostly from metasedimentary and metavolcanic rocks. The water-holding capacity is moderate. Permeability of the substratum is rapid. The soils are easy to work. Fertility is moderate, and crops on these soils respond quickly if fertilizer is added.

These soils are well suited to irrigated orchard, row, and field crops. All methods of irrigation are suitable, but irrigating must be done frequently, and small quantities of water applied. Growing green-manure crops, turning under crop residues, and choosing suitable crop rotations help to maintain productivity. Most crops on these soils respond if fertilizer that contains nitrogen and phosphorus is added. For best results the fertilizer should be applied in small amounts several times during the growing season.

Capability unit IIs–3

This unit consists of nearly level, well-drained soils on alluvial fans and low terraces. The areas are on outwash derived from sedimentary rock or from rock of various sources. The surface layer ranges from loam to silty clay loam. The subsoil is moderately dense clay loam or dense clay. A few of the soils have a hardpan or gravel at a considerable depth. A tillage pan tends to form in the soils that have a silty surface layer.

Permeability of the subsoil is slow or very slow in all of these soils. Runoff is slow. The available water holding capacity and fertility are moderate to high.

The soils in this unit are well suited to irrigated pasture and to most irrigated row crops, field crops, and shallow-rooted tree crops. They are also suited to dryland grain and hay. Most crops on these soils respond if fertilizer that contains nitrogen and phosphorus is applied. If the soils are used intensively, however, some crops also require potassium for high yields. Returning crop residues to the soils, growing green-manure crops, and using crop rotations all help to maintain yields. Working these soils when they are too wet causes a tillage pan to form, but the pan can be broken by chiseling. If leveling and grading are done, the cuts should be fairly shallow to keep from exposing the less fertile, dense clayey subsoil.

All methods of irrigation are suitable for these soils. If the water is applied at a moderate rate and in long runs, the water will have ample time to enter the soil. Excess irrigation water generally must be disposed of through a drainage system to keep from scalding or drowning the crops at the lower end of the field. In irrigated pasture puddling of the soils by livestock can be prevented if grazing is delayed for a few days following a rain or an irrigation.

Capability unit IIs–4

The soils in this unit are well drained, nearly level, and gravelly. They are in narrow valleys along streams or are on old alluvial fans and low terraces. The surface soil ranges from gravelly sandy loam to gravelly sandy clay loam. Most of the soils have a subsoil of gravelly clay loam, and in places the lower part of the subsoil is very gravelly.

Permeability of these soils is moderately slow to slow. The water-holding capacity and fertility are moderate. Runoff is very slow, but irrigation water enters the soils rapidly.

If these soils are irrigated, they are suited to a wide range of orchard, row, and field crops. Deep-rooted crops grow well, and shallow-rooted crops also grow well if careful irrigation practices are used. On shallow-rooted crops the irrigation water must be applied in smaller amounts, and more often, than on deep-rooted crops. Short irrigation runs are best because the soils take water rapidly. In areas where these gravelly soils are intermingled with less permeable soils, irrigation may be difficult.

Organic matter is naturally low in these soils, but it can be increased if green-manure crops, crop residues, and crop rotations are used. Most crops on these soils respond if fertilizer that contains nitrogen and phosphorus is applied, but a few may need potassium, especially under intensive management.

Capability unit IIs–6

In this unit are deep, nearly level, silty soils that are slightly affected by excess salts and alkali. These soils are on alluvium derived mostly from metasedimentary rocks or from a mixture of various kinds of rocks.

The available water holding capacity of these soils is high. Fertility is moderate. The erosion hazard is slight, and runoff is slow. If worked when too wet, these soils compact readily.

These soils are better suited to crops that tolerate slight amounts of salts and alkali than to other crops. Adding fertilizer and removing excess salts and alkali through deep leaching, improved drainage, and use of gypsum and similar soil amendments all help to improve productivity.

Capability unit IIIe–3

In this unit are moderately deep, gently sloping to undulating, well-drained soils that have a very slowly permeable subsoil. These soils are on smooth terraces on old alluvium derived from sedimentary rock. The dense clay subsoil limits the effective rooting depth, which is about 2 or 3 feet.

Permeability of these soils is slow to very slow. The available water holding capacity and fertility are moderate to low. Runoff is slow to medium, and the erosion hazard generally is moderate. The soils are easy to work, but they compact easily if they are cultivated or trampled when wet.

If these soils are irrigated, they are well suited to pasture plants, olives, and other shallow-rooted crops. They are also suited to dryland grain, hay, and pasture. These soils are susceptible to erosion if irrigated or if used for dryland crops. Erosion caused by irrigation can be controlled by irrigating on the contour or by using sprinklers. Best results are obtained if small quantities of water are applied frequently. Cultivating and seeding across the slope, growing cover crops, and returning crop residues to the soil all help to control erosion on areas in dryland crops.

Capability unit IIIe–5

In this unit are moderately deep to very deep, gently sloping to rolling, mostly clayey soils that are well drained. These soils are on dissected terraces or are on foot slopes in the upland. They overlie shale, softly consolidated siltstone, or fine-textured alluvium. The surface soil shrinks and cracks when dry.

Permeability of these soils is slow to moderate. The available moisture holding capacity is moderate to high. Fertility is moderate. The soils are fairly easy to work unless they are dry. Runoff from higher lying soils has cut gullies in many areas of these soils, but the erosion hazard otherwise is moderate.

These soils are well suited to dryland grain, to hay and range, and to pasture. If water is available, the gentler slopes are suitable for irrigated crops and for pasture. Irrigation is hazardous on steeper slopes, except by sprinklers. When the soils are dry, they take water rapidly, but after they become moist, permeability is slow and runoff increases. Wide cracks occur when the soils are dry, and preparing a seedbed is difficult.

In grainfields erosion can be controlled by seeding on the contour and by mixing stubble from the grain into the surface soil. Special practices are needed in some fields for the control of gully erosion. Growing soil-improving crops in a rotation, turning under green-manure crops, and adding fertilizer all help to maintain yields. Most crops on these soils respond if nitrogen fertilizer is applied.

Capability unit IIIw-0

This unit consists of nearly level to gently sloping, well-drained or moderately well drained, loamy soils that mostly are moderately deep to loose gravel. These soils are along the Sacramento River and its tributaries on alluvium from metasedimentary rock or from various kinds of rocks. They have an intermittent high water table or are subject to overflow in winter.

The water-holding capacity of these soils is low. Permeability of the surface soil is moderate to moderately rapid, and that of the subsoil is moderately rapid to rapid. The soils are easy to work. Fertility is moderate, and crops on these soils respond readily if fertilizer is applied. Runoff is very slow to slow, and the erosion hazard is slight.

These soils are better suited to irrigated orchard, row, and field crops than to other uses. They are too droughty for satisfactory yields without irrigation. Sprinklers are best to use, though the loams and silt loams can be irrigated satisfactorily by surface methods. Applying small amounts of water at frequent intervals saves water and plant nutrients. Cuts made when leveling and grading are done should be shallow to avoid exposing the underlying sand and gravel.

The use of crop rotations, green-manure crops, and crop residues helps to maintain productivity. Nonleguminous crops on these soils benefit if nitrogen fertilizer is added.

Capability unit IIIw-3

Soils in this unit are mostly nearly level and are somewhat poorly drained or poorly drained. Most of them are silty, but a few are gravelly and loamy. In areas where the water table fluctuates, the soils are slightly saline-alkali. These soils are in basins and on low alluvial fans and flood plains. Permeability is moderate to very slow.

These soils are well suited to row crops, grain, rice, and irrigated pasture. They are not suited to deep-rooted crops. Drainage is needed. The saline-alkali soils can be reclaimed by lowering the water table, applying gypsum, and deep leaching. Nitrogen and phosphorus are commonly needed.

Capability unit IIIw-5

Soils in this unit generally are moderately deep, are somewhat poorly drained or poorly drained, and are clayey at or near the surface. They are mainly nearly level and are in basins or on flood plains, but the Burris soil is on 1 to 8 percent slopes and has seep areas. The soils that have a fluctuating water table are slightly saline-alkali. Permeability in all of the soils is slow or very slow.

These soils are better suited to rice, row crops, grain, and irrigated pasture than to other uses. Most crops on these soils respond if nitrogen and phosphorus are applied, but in some areas legumes require phosphorus and sulfur. Adequate drainage is needed. Irrigation water also must be applied carefully to keep the areas from becoming waterlogged or to prevent a perched water table from forming at a shallow depth. The use of green-manure crops, crop rotations, and crop residues helps maintain the supply of organic matter.

Capability unit IIIw-6

The soils in this unit are nearly level, are somewhat poorly drained or poorly drained, and are moderately affected by excess salts and alkali. The surface layer generally is silty clay loam or clay, but in one of the Riz soils it is silt loam. The soils are on basins or are on rims of basins. Runoff and permeability are very slow.

Soils in this unit are better suited to irrigated pasture and rice than to other crops. Field and row crops that tolerate moderate amounts of salts and alkali can be grown successfully if soil amendments and fertilizer are used. A system for providing adequate surface and subsurface drainage is needed. Open ditches or tile drains help to improve subsurface drainage.

Large amounts of manure and gypsum are needed for reclaiming these soils. Use of green-manure crops, crop rotations, and crop residues helps to maintain the content of organic matter.

Capability unit IIIs-3

Soils in this unit are nearly level to very gently undulating and are well drained or moderately well drained. Some of the soils are moderately deep over clay, claypan, or hardpan. The surface layer in these soils is loam, clay loam, or silt loam, and in many of the soils it is gravelly. The subsoil or substratum is dense and clayey and is slowly permeable to very slowly permeable. Depth to the subsoil or substratum is about 2 or 3 feet. These soils are on fans or low terraces on old alluvium derived mostly from sedimentary rock. Because of the relief, disposal of surface water generally is a problem.

These soils are wet during the rainy season but are dry and hard during the summer. Wetness during the growing season generally is not enough to interfere with the growth of crops. The available moisture holding capacity is moderate to low, and fertility also is moderate to low.

These soils are better suited to shallow-rooted, irrigated pasture plants, ladino clover, and similar crops than to other uses. They are also suited to such dryland crops as safflower, grain, hay, and pasture. Rice is grown in places. These soils are likely to become waterlogged when they are irrigated. Applying small amounts of water at frequent intervals helps to avoid waterlogging. Leveling and grading must be done with care to avoid exposing the clayey subsoil. The soils generally can be graded so that excess surface water drains off, but in places a community type of drain involving several farms is needed for adequate removal of such water.

The use of crop rotations, green-manure crops, crop residues, and fertilizer helps maintain productivity. Most crops on these soils respond if fertilizer that contains nitrogen and phosphorus is applied. Productivity can be maintained in irrigated pastures if grazing is rotated and if fertilizer is applied.

Capability unit IIIs-4

In this unit are deep, nearly level, gravelly or cobbly loams and sandy loams that have moderately rapid to very rapid permeability. These soils are on recent alluvial fans and flood plains. Most of the soils are underlain by gravel at a moderate depth. The moisture-holding capacity is low, and use of the soils therefore is severely limited. Fertility is low to moderate.

If adequate irrigation water is available at low cost, these soils are suited to all irrigated crops grown in the county except rice.

Because of low water-holding capacity, irrigation water must be applied often and in small amounts. Sprinklers are best to use, but if surface methods are used, irrigation runs must be short. Most crops on these soils respond if nitrogen fertilizer is applied, and best results are obtained if the fertilizer is applied several times and in small amounts. Using crop rotations, growing green-manure crops, and turning under crop residues all help to maintain organic matter and soil structure.

Capability unit IIIs-5

In this unit are nearly level clays that are deep or very deep. These soils are on low terraces or are along minor drainageways. They overlie fine-textured alluvium derived from sedimentary or volcanic rocks. Permeability is slow, and runoff is slow in some areas. Penetration of roots and moisture is difficult. The soils are very plastic and sticky when wet and are very hard when dry. As these soils dry, they shrink and wide cracks form, and they are then difficult to work. The available water holding capacity is moderate, and fertility is low to moderate.

These soils are better suited to irrigated row crops, rice, and pasture plants than to other uses. They are, however, also used for dryfarmed grain, hay, and pasture. All methods of irrigation are suitable, but sprinklers generally apply the water at a rate that permits the soil to absorb it more evenly. The irrigation water penetrates rapidly when the soils are dry and have cracks in them, but it moves into the soils slowly to very slowly when they are wet. Long irrigation runs allow the water ample time to soak into the soil. In places a system for disposing of excess water at the end of checks improves yields.

Using crop rotations, growing green-manure crops, and turning under crop residues all help to maintain productivity and to maintain tilth. Most crops on these soils respond if fertilizer that contains nitrogen is added, but fertilizer that contains other elements may be needed to maintain yields under more intensive use.

Capability unit IVe-3

In this unit are nearly level to moderately steep gravelly loams that are well drained. These soils are on terraces. They have a dense claypan at a depth of 1 to 2 feet that restricts the effective rooting depth. Permeability of the subsoil is slow or very slow. The available water holding capacity and fertility are low to moderate. Runoff is slow to medium, and if these soils are cultivated, the erosion hazard is slight to severe. Some of the more gently sloping soils are hummocky, but the soils are all fairly easy to work. A tillage pan does not form readily unless the soils are worked when wet.

These soils are better suited to a long rotation of dryfarmed pasture crops and an occasional grain crop than to other uses. Most areas are difficult to reach with irrigation water, but if water is available, these soils are fairly well suited to irrigated pasture. Because of the erosion hazard and relief, sprinklers are the best method to use in applying water. Erosion can be controlled if tillage is done across the slope.

Yields of grain and forage on these soils are low, even if grown in a long rotation; they can be increased if fertilizer that contains nitrogen and phosphorus is applied. Hummocky areas need to be graded and smoothed before they can be farmed satisfactorily.

Capability unit IVe-4

In this unit are moderately deep or deep, well-drained, moderately steep soils. These soils are in mountainous areas on formations of sedimentary rock. The surface soil is loam or gravelly loam, and the subsoil is gravelly loam or clay loam. Rainfall is high in areas of these soils, and the growing season is short. The vegetation is mainly coniferous forests and associated shrubs.

The available water supplying capacity of these soils is moderate to high, and permeability is moderately rapid to rapid. The erosion hazard is low unless the cover is removed and the areas are cultivated, and some areas are eroded. Fertility is moderate.

These soils are well suited to trees, and rate of tree growth is high. Yields of timber are among the highest in the county. In many areas, however, yields can be improved by pruning and thinning the trees and controlling fires, insects, and diseases.

If irrigation water is available, the less sloping areas of these soils could be cleared and planted to irrigated orchards or pasture. Intensive practices are needed, however, for control of brush and trees, which reproduce rapidly unless seed sources are eliminated. Also stones need to be removed from a few areas. Orchards generally need a permanent cover for control of erosion. For satisfactory yields of forage, fertilizer that contains nitrogen and phosphorus is needed. The pastures also require protection from deer.

Capability unit IVe-5

Soils in this unit are well drained, gently sloping to moderately steep, and clayey. These soils are in the central part of the county. The texture in most areas is clay, and the soils are underlain by sandstone and shale or softly consolidated siltstone, generally at a depth of 2 to 4 feet. The vegetation is mainly annual grasses, oak trees, and shrubs. Most areas are now cultivated or have been cultivated, and many areas are gullied.

Permeability of the subsoil is moderate to slow. Fertility is moderate. Runoff is slow to medium if the soils are under grass, but it is medium to rapid if the soils are cultivated. These soils are difficult to work, and gullies are likely to form in them if the cover is disturbed. The soils that have clay texture drain slowly in spring and are slow to warm up. They shrink when dry, and wide cracks form in them and make preparing a seedbed difficult.

These soils are better suited to dryland grain and hay rotated with range or pasture than to other uses. Some of the areas need to be cleared of trees and shrubs before they can be cultivated. If irrigation water is available, the soils are suitable for irrigated pasture. When the soils are dry, they take in water rapidly, but after they are moist, water penetration is moderate to slow. The steep, irregular slopes make sprinkling the best method of irrigating. Yields of forage generally are high if these soils are used for pasture and range.

Using a long rotation and farming across the slope generally controls erosion, but areas that are gullied require special practices. Yields of crops grown in a long rotation can be maintained if fertilizer is applied. Grain crops on these soils generally require nitrogen, and irrigated pastures generally also require phosphorus.

Capability unit IVe-9

Soils in this unit are deep, nearly level to moderately steep, and well drained. They are on alluvium derived from serpentine rock. The texture is clay, and most areas are gravelly. These soils are very hard when dry, and cracks form in them. They are very sticky when moist.

Permeability is very slow when these soils are moist. Runoff is slow to rapid, depending on the slope. The available water holding capacity is moderate. Fertility is low, and the soils are difficult to work.

These soils are better suited to range or pasture than to other uses. Adding fertilizer generally does not produce satisfactory results.

Capability unit IVw-1

Soils in this unit are deep or moderately deep, nearly level to gently undulating, and clayey. They are channeled and are flooded occasionally. All areas are subject to scouring when flooded, and if the soils are left bare during winter, the erosion hazard is high. Permeability is slow, and the available water supplying capacity is high. Fertility is moderate.

These soils are better suited to crops that can be planted in spring after the danger of overflow is past than they are suited to other uses. In areas protected by levees, the soils are suited to fall-seeded grain and to pasture. Crops on these soils generally respond if nitrogen fertilizer is applied.

Capability unit IVw-6

This unit consists of deep, nearly level, poorly drained, clayey soils that are strongly saline-alkali. These soils are in basins. In some of the soils, the subsoil is dense. Permeability and runoff are very slow, and salts and alkali occur throughout these soils. Fertility is moderate. The vegetation consists of sparse stands of grasses and forbs that tolerate excess salts and alkali.

Reclaiming these soils is difficult, and the areas are better suited to pasture, recreation, and wildlife than to farming. Adequate drainage is needed before applications of gypsum and leaching can be effective in removing excess salts and alkali. Irrigation water must be applied carefully to avoid raising the water table. In places surface drainage is needed for removal of excess surface water.

Fertilizer that contains nitrogen and phosphorus is needed for satisfactory yields. Growing green-manure crops, using crop rotations, and turning under crop residues all help to maintain good soil structure and to improve permeability of these soils.

Capability unit IVs-3

This unit consists of one Corning soil. It is a nearly level gravelly loam that has a claypan. This soil is on terraces that generally have hummocky relief. The subsoil generally is gravelly clay. Depth to the claypan ranges from 8 to 22 inches.

The available water holding capacity and fertility of this soil are low. Effective depth for root development is shallow, being restricted by very slow permeability in the claypan. Runoff is very slow, and the erosion hazard is slight.

This soil is better suited to irrigated pasture or to dryland grain rotated with pasture than to other uses. In places hummocks need to be smoothed to keep water from accumulating between the mounds and standing in the areas all winter. Border or sprinkler irrigation is suitable, the choice depending on the smoothness of the field. If leveling is done, cuts must be shallow to avoid exposing the underlying claypan. For best yields in irrigated areas, the water should be applied frequently and in small amounts. Irrigated forage plants generally also require fertilizer that contains nitrogen and phosphorus.

Capability unit IVs-4

In this unit are nearly level soils that are gravelly or very gravelly or are shallow over gravel. These soils are along streams where they are subject to overflow. They are on recent alluvium washed from rocks of the Red Bluff and Tehama formations and from metasedimentary rock.

The available water holding capacity and fertility of these soils are low. Permeability is rapid, and runoff is slow. Erosion is a hazard only along streambanks.

If adequate water is available at low cost, these soils are best suited to irrigated row and field crops, orchards, and pasture. The water-holding capacity of these soils is so low that yields are seldom satisfactory if the soils are dryfarmed. Because of the coarse texture of the soils, irrigation runs should be short and sprinklers should be used for irrigating. Also the irrigation water must be applied frequently. Crops on these soils respond if nitrogen is applied, and in some places phosphorus is also needed.

If leveling and grading are done, care is needed to avoid deep cuts that would uncover raw sand and gravel. Areas subject to overflow require a protective cover of close-growing crops in winter.

Capability unit IVs-8

This unit consists of one Redding soil. It is well drained, shallow, and nearly level to very gently sloping. This soil is on terraces that generally have hummocky relief. The surface layer is gravelly loam. The subsoil generally is gravelly clay and is underlain by a hardpan. Depth to the hardpan ranges from about 20 to 30 inches.

The water-holding capacity and fertility of this soil are low. Effective rooting depth, which is about 12 to 24 inches, is restricted by the very slowly permeable, gravelly claypan or hardpan. Runoff is slow to very slow, and the erosion hazard is slight.

This soil is better suited to irrigated pasture or to dryland pasture than to other uses. Yields are low, and irrigating is feasible only if irrigation water is inexpensive. Most areas are hummocky; they need to be smoothed, which would improve surface drainage in low areas between the hummocks. Borders or sprinkler methods are suitable for irrigation, the choice depending on the smoothness of the field. If leveling is done, cuts must be shallow to avoid exposing the underlying claypan or hardpan. For best yields in irrigated areas, the water must be applied frequently and in small amounts. Irrigated forage also requires fertilizer that contains nitrogen and phosphorus.

Capability unit Vw–2

Only one mapping unit, Mixed alluvial land, is in this unit. It consists of very poorly drained, deep soil material. The areas are in mountain meadows on alluvium derived mainly from sedimentary and volcanic rocks. The soil material is gravelly or stony in some areas, and permeability generally is moderately slow in the lower part. Runoff is slow, and the areas are saturated with water during most of the year.

This mapping unit is better suited to grazing than to other uses, though hay can be harvested from the drier areas. The amount and the quality of the forage can be improved in some areas by providing better water control and adding fertilizer that contains nitrogen and phosphorus. Improved water control also reduces the size of marshy areas.

In drier areas the meadows consist chiefly of tufted hairgrass and of small amounts of Kentucky bluegrass, meadow bluegrass, red top, native clover, sedges, yarrow, five fingers, and dock. The vegetation in the wetter areas is mainly wiregrass, sedges, and grasses and weeds that tolerate wetness.

Capability unit VIe–1

In this unit are moderately deep to deep, moderately steep to steep, loamy soils that are well drained. These soils are in the mountains on sedimentary rock. The vegetation is mostly conifers but includes some hardwoods and shrubs.

Permeability of these soils is moderate to rapid, and the available water supplying capacity is good to high. Runoff is medium to rapid, and the erosion hazard is high.

These soils are too steep for cultivated crops, and the growing season is too short. They are better suited to trees than to other uses. Tree growth is medium to high. Yields of timber can be improved by pruning and thinning the trees and by controlling fire, insects, and diseases.

Capability unit VIe–3

This unit consists of gently sloping to moderately steep soils that are well drained but have a slowly permeable subsoil. These soils are in the upland on sedimentary rock or on gravelly sediments of the Tehama formation. The surface soil is loam or gravelly loam, and the subsoil is gravelly clay. The Parrish soils are underlain by very slowly permeable bedrock. Oaks and annual grasses make up the vegetation.

The available water supplying capacity of these soils is low. Effective rooting depth is shallow to moderately deep, and fertility is low to moderate. Runoff is rapid, and the erosion hazard is high. Gullies form readily if the soils are cultivated or overgrazed, and many areas are gullied.

These soils are better suited to grazing than to other uses. Yields of forage are low to fair, but they can be improved in places if the trees and brush are cleared from the areas. In places on some of the gentler slopes, the areas can be seeded and fertilizer applied. In areas best suited to grazing, the desirable plants are soft chess, wild oats, needlegrass, pine bluegrass, melicgrass, hill lotus, and annual clover. Less desirable plants are filaree, annual fescue, red brome, ripgut brome, three-awn, and lupine. In places such undesirable plants as medusahead and fiddleneck grow. In overgrazed areas the less desirable and the undesirable plants are dominant.

Capability unit VIe–4

This unit consists of moderately deep to deep, moderately steep to steep, gravelly soils that are well drained to excessively drained. These soils are in the upland under a forest of coniferous trees, hardwoods, and shrubs. They are underlain by greenstone or by sedimentary rock. The surface soil is gravelly or cobbly loam, and the subsoil is similar in texture or is slightly more clayey.

Permeability of these soils is moderate to rapid. The available water supplying capacity is moderate to high. Slopes are moderately steep or steep, and runoff is medium to rapid. The erosion hazard is slight unless the vegetation is destroyed, and some areas are eroded.

These soils are better suited to trees than to other uses, and trees grow at moderate to rapid rates on most of the soils. The soils are too steep for cultivated crops. Also they occur at high elevations where the growing season is short. Yields of timber can be improved by pruning and thinning the trees and by controlling fire, insects, and diseases.

Capability unit VIe–41

In this unit are steep, well-drained gravelly loams that are shallow over sericite schist or partly metamorphosed sandstone and shale. These soils are in the upland under shrubs, oaks, Digger pines, and grasses. The surface soil and subsoil are similar in texture.

Permeability of these soils is moderately rapid. The available water supplying capacity and fertility are low. Runoff is rapid, and the erosion hazard is high.

These soils are better suited to grazing than to other uses. In areas best suited to grazing, the desirable plants are soft chess, wild oats, clover, needlegrass, and a few other perennial grasses. Yields of forage can be improved if trees and brush are cleared from the areas. Brush generally invades in areas overgrazed or burned.

Capability unit VIe–5

This unit consists of steep to very steep, well-drained, clayey soils. These soils are in the upland on sandstone, shale, or siltstone. The surface layer is clay loam or clay, and the subsoil is silty clay or clay. Many of the soils are strongly calcareous, especially in the subsoil.

Permeability of these soils is moderate to slow. The available moisture supplying capacity is moderately low, and the soils absorb water rapidly when dry. Effective soil depth generally is 18 to 36 inches. Runoff is rapid, and some areas are gullied. The erosion hazard is severe in overgrazed areas.

These soils are better suited to grazing than to other uses. Yields of forage are fair to good if good management is used. Brush and trees can be cleared from the gentler slopes, and some of these soils are suitable for seeding. Also plants on them respond if fertilizer is applied. It seldom is feasible, however, to improve areas that have slopes of more than 50 percent.

Capability unit VIe-8

In this unit are shallow to deep, moderately steep to steep gravelly loams that are well drained. The surface soil and subsoil are similar in texture. These soils are in the upland. Many areas have a fairly dense stand of brush and oaks on them, but a few Digger pines grow at the lower elevations.

Permeability of these soils is moderately rapid. The available water supplying capacity and fertility are low. Runoff is rapid, and the erosion hazard is high.

These soils are better suited to pasture and range than to other uses. Yields of forage can be improved in most places if trees and brush are cleared from the areas. Selected areas of the Los Gatos soils are suitable for seeding to improved legumes and grasses.

Desirable plants in areas best suited to grazing are soft chess, wild oats, clover, needlegrass, melicgrass, and a few other perennial grasses. Brush is likely to invade areas overgrazed or burned.

Capability unit VIw-1

The soils in this unit are mostly shallow or moderately deep. They are subject to flooding and severe erosion. The areas are along the Sacramento River and its tributaries. All of the soils are subject to scouring because of flooding, and erosion is likely to be severe if the soils are left bare of vegetation during winter. Most of the soils are stratified. The texture of the surface soil varies greatly within a short distance. Many areas are traversed by a network of flood channels. Some of the soils are shallow, and others are moderately deep. The soils along the Sacramento River are more uniform and less gravelly than those along Stony Creek.

Because of the variability in texture of these soils, permeability ranges from rapid to very slow. The available water supplying capacity also varies, according to the texture.

These soils are better suited to pasture and range than to other uses. Yields of forage generally are fair to good, and the higher yields are from soils along the Sacramento River. Yields generally are lower on Gravelly alluvial land and on the Orland soils because their water-supplying capacity is lower.

On the soils best suited to pasture and range, the plant cover is made up of blue wildrye, needlegrass, oniongrass, wild oats, soft chess, clover, and similar desirable plants. Less desirable plants are red brome, squirreltail, filaree, wild buckwheat, star-thistle, and tarweed. Soils that produce lower yields have a larger proportion of the less desirable plants. Yields can be increased in many areas by removing blackberries, wild grapes, and shrubs. If protected by levels, some areas of these soils could be used more intensively.

Capability unit VIs-5

In this unit are gently sloping to sloping bouldery or cobbly clays that are somewhat poorly drained. These soils are in the upland on basalt. The surface soil and subsoil are similar in texture, but the subsoil is more bouldery and cobbly.

Permeability is slow, but the soils absorb water rapidly when dry. The available moisture supplying capacity is moderate. Effective soil depth is moderately deep. Runoff is medium to rapid, and the erosion hazard is high.

These soils are better suited to grazing than to other uses. Yields of forage generally are low. Selected areas are suitable for seeding, and plants on some areas respond if fertilizer is applied. In places overgrazed areas have been invaded by medusahead wildrye and other undesirable grasses.

Capability unit VIs-7

This unit consists of gently sloping to steep loams that are stony, rocky, or cobbly and are well drained. These soils are in the upland under forest. They are shallow to deep over greenstone, a hard rock. The surface soil and subsoil are similar in texture.

Permeability of these soils is rapid. The available water supplying capacity is low to moderate. Runoff and erosion are slight unless the cover of vegetation is destroyed.

These soils are too steep and too cobbly, rocky, or stony for satisfactory yields of cultivated crops. They are better suited to trees than to other uses, and trees on them grow at a moderate rate. The quantity and quality of the timber can be improved by pruning and thinning the trees and by controlling fires, insects, and diseases.

Capability unit VIs-8

Soils in this unit are shallow to moderately deep and are well drained. They are in the foothills on sandstone and shale. The surface soil is rocky or very rocky loam, sandy loam, or clay loam, and the subsoil is similar in texture or is slightly more clayey. The vegetation consists chiefly of annual grasses and forbs and a few perennial grasses, but in a few areas there are open stands of blue oaks and shrubs.

The available water supplying capacity of these soils is low. Water moves slowly through the subsoil and very slowly through the bedrock. Effective rooting depth generally is about 12 to 30 inches. Runoff is slow to rapid, and the erosion hazard is slight to moderate.

These soils are better suited to pasture and range than to other uses. Yields of forage are low to moderate. Desirable forage plants are soft chess, wild oats, clover, needlegrass, melicgrass, and a few other perennial grasses. Brush crowds out the desirable grasses if these soils are overgrazed or burned. Clearing trees and brush and applying fertilizer that contains nitrogen improves the forage in most areas. In addition phosphorus and sulfur are needed for increased yields of clover.

Capability unit VIIe-1

This unit consists of one Hugo soil. It is a moderately deep, very steep loam that is well drained to excessively drained. This soil is in the mountains on sandstone and shale. The vegetation is coniferous trees and shrubs.

Permeability of this soil is rapid. The available water supplying capacity is moderately low. Runoff is very rapid. The erosion hazard is very severe after a fire or if logging is carelessly done.

This soil is better suited to trees than to other uses. The trees grow at a moderate rate. Erosion is a very serious hazard unless logging is carefully done. Wildfire also is a hazard.

Capability unit VIIe-3

This unit consists of steep to very steep soils that are well drained. These soils are in the upland on sedimentary rock or on gravelly sediments of the Tehama formation. The surface layer generally is gravelly loam, and the subsoil generally is gravelly clay. The vegetation is oaks, shrubs, and grasses.

Most of these soils have a subsoil that is very slowly permeable, and some of the soils are underlain by bedrock that is very slowly permeable. Runoff is rapid, and the available water holding capacity is low to high. The effective rooting depth is shallow to moderately deep. Fertility is low to moderate. If these soils are overgrazed, gullies are likely to form, and some areas are moderately gullied.

The soils in this unit are better suited to grazing than to other uses. Yields of forage are low to medium. On range in good condition, soft chess, wild oats, needlegrass, pine bluegrass, melicgrass, hill lotus, and annual clover are dominant. In areas overgrazed the dominant plants are filaree, annual fescue, red brome, ripgut brome, three-awn, lupine, and other less desirable plants and medusahead wildrye, fiddleneck, prickly phlox, ceanothus, manzanita, and other undesirable plants.

Capability unit VIIe-4

In this unit are shallow, very steep soils that are well drained to excessively drained. These soils have a surface soil and subsoil of gravelly loam. Water enters the soils rapidly, and the available water supplying capacity is low. Runoff is rapid to very rapid. The erosion hazard is very high, and some areas are eroded.

These soils are better suited to trees than to other uses; trees grow on them at slow to moderate rates. The areas are also used for wildlife, watershed, and recreation. Logging must be carefully done on these soils to prevent further erosion. Fires, insects, and diseases also must be controlled.

Capability unit VIIe-5

This unit consists of shallow or moderately deep, steep to very steep, clayey soils that are well drained to somewhat excessively drained. Most of these soils are in the foothills on sandstone and shale, but the Stonyford soil is in the mountains on basalt. The surface soil is clay loam or clay, and the subsoil is light clay. In places the subsoil is calcareous. Most areas are under annual grasses and oaks or are under dense stands of brush.

Permeability is slow on these soils, and runoff is rapid to very rapid. The available moisture supplying capacity is low to moderate. Many areas are eroded, and some are gullied.

These soils are suited to limited grazing. They are also suited to wildlife, recreation, and watershed purposes.

Capability unit VIIe-8

Soils in this unit are shallow to moderately deep, steep to very steep, and well drained to excessively drained. These soils are in the upland under brush and are on sedimentary and volcanic rocks. The surface soil is gravelly loam, and the subsoil is similar in texture or is slightly more clayey. The available water supplying capacity is moderate to low. Intake of water is moderate. Runoff is very high, and the erosion hazard is high.

These soils are better suited to watershed, wildlife, and recreation than to other uses. Some of the soils provide limited grazing and browse for cattle and wildlife. Protection from fire is needed for control of erosion.

Capability unit VIIs-7

Soils in this unit are very shallow or shallow, mostly steep to very steep, and well drained. They are rocky, very rocky, extremely rocky, or cobbly. These soils are on basalt bedrock under vegetation consisting mainly of annual grasses and forbs. The surface soil and subsoil generally are loam or silt loam.

The available water supplying capacity of these soils is low. Fertility is moderate. Runoff is rapid, and the erosion hazard is moderate.

These soils are too rocky and shallow for cultivated crops. They are best suited to grazing. Yields of forage are low to moderate. The forage consists mainly of wild oats, soft chess, clover, and other desirable plants. Less desirable plants are filaree, red brome, ripgut brome, and annual fescue.

Capability unit VIIs-8

In this unit are very shallow to shallow, moderately steep to very steep, rocky or gravelly soils that are well drained. These soils are in the upland, mostly on shale, sandstone, or conglomerate bedrock. Texture of the surface layer ranges from very rocky or rocky sandy loam to loam or clay loam.

The available water supplying capacity of these soils is low. Water soaks into the soils fairly quickly, and runoff is rapid to very rapid. The erosion hazard is very high. Many areas are eroded, and some are gullied.

These soils are better suited to grazing than to other uses. Yields of forage are low to very low. In areas best suited to grazing, the vegetation is mainly wild oats, soft chess, clover, filaree, a few perennial grasses, and other desirable plants. Less desirable plants, such as red brome, annual fescue, ripgut, and annual barley also grow in a few areas; and a few undesirable plants, such as wild mustard, wild buckwheat, tarweed, and gold-fields, are on the areas. In places brush grows in dense patches, and oak trees generally are scattered throughout the areas.

Capability unit VIIs-9

In this unit are moderately steep to steep soils that are well drained. These soils are in the upland on serpentine bedrock. The vegetation is mostly shrubs.

Permeability of these soils is slow. The available water supplying capacity is low, and fertility is very low. Runoff is rapid, and the erosion hazard is high. The soils tend to slip when they are wet.

These soils are better suited to grazing and browse than to other uses. Because of the very low fertility, annual grasses are sparse among the shrubs on these soils. Roads across areas of the soils may need excessive maintenance because of landslides.

Capability unit VIIIw-4

This unit consists of gravel bars and of sandy land deposited along rivers and smaller streams. Constructing levees in places on these land types would help to protect adjacent areas from scouring during floods.

These land types are not suitable for farming. The areas are suitable for recreation and provide food and shelter for wildlife.

Capability unit VIIIs-7

This unit consists of shallow to very shallow, gently sloping to very steep, well-drained to excessively drained, rocky soils and miscellaneous land types. These soils are underlain by various kinds of bedrock. Runoff is rapid to very rapid, and the erosion hazard is very high.

These soils and land types are suitable only for wildlife, watershed, and recreation. The areas require protection from fire, which helps to prevent accelerated erosion.

Capability unit VIIIs-8

Soils in this unit are shallow, moderately steep to very steep, and well drained. They consist mostly of gravelly loams or clay loams. These soils are in the upland on shale or on volcanic rock. The vegetation is brush in open to dense stands.

Runoff on these soils is medium to rapid. The erosion hazard is moderate to high, and many areas are eroded. During heavy storms much water and sediment from these soils washes into streams. Fertility ranges from medium to low.

These soils are better suited to wildlife, watershed, and recreation than to other uses. Protection from fire is needed to keep the brush cover on these highly erodible soils from being destroyed.

Capability unit VIIIs-9

In this unit are sloping to very steep well-drained soils and rocky areas underlain by serpentine bedrock. All of these soils are in the upland. Runoff is rapid to very rapid, and the erosion hazard is severe to very severe. These soils tend to slip when wet, and landslides are common. Roads built across them generally require excessive maintenance.

These soils are better suited as sites for wildlife, watershed, and recreation than they are for other purposes. Low fertility makes it impractical to convert the vegetation from brush to grass. Protection from wildlife is needed, for if the vegetation is destroyed, the soils erode easily.

Major Crops

The soils and climate in the foothill valleys in Glenn County and in the Sacramento Valley part of the county are favorable for growth of many kinds of crops. Irrigation water is available for many orchard, field, and forage crops. Vegetables, nursery stock, and seed crops are grown in some areas. Rainfall is adequate in most years for growing small grains without irrigation. In some areas the soils store enough moisture from winter and spring rains to produce grain sorghum, safflower, and sudangrass without irrigation. Yields of these crops increase, however, if the soils are irrigated.

The acreage of most field and seed crops has increased steadily in the past 10 years. In general the acreage in orchard crops has decreased, though that in olives, oranges, prunes, pears, and English walnuts has increased.

For information about current management practices, the farmer can consult local representatives of the Soil Conservation Service and the Extension Service. Statistics used in this subsection are from the report of the agricultural commissioner of Glenn County.[2]

Alfalfa.—About 17,000 acres in Glenn County is planted to alfalfa. This crop is grown on a wide variety of soils, but mostly on the deep, medium-textured or moderately fine textured, well-drained soils of the Columbia, Tehama, Wyo, Yolo, and Zamora series. Smaller acreages of the Arbuckle, Cortina, Kimball, Myers, and similar soils are also planted to alfalfa.

Alfalfa is grown mostly on irrigated soils, but on a small acreage in the foothill valleys it is dryfarmed. Less than 5 percent of the acreage in alfalfa is sprinkler irrigated. Most of the alfalfa is baled for hay, but some is made into pellets. Less than 10 percent is chopped in the field and used as green feed.

Alfalfa grown on the Arbuckle, Tehama, and similar soils generally requires 35 pounds of phosphorus and 50 pounds of sulfur per acre each year.

Irrigated pasture.—Irrigated pasture occupies about 74,000 acres, the largest acreage of any irrigated crop. The pastures are used mostly to provide roughage for dairy cattle, but late in spring and in summer a large acreage is used for grazing sheep and beef cattle.

Irrigated pasture is grown on more soils in Glenn County than any other crop. The chief limitation is the interval between irrigations. For example, pasture does poorly on the very gravelly Cortina soils in the district serviced by the Orland Water Users Association, because of existing water rotation schedules. Pasture does much better on similar soils under pump irrigation, even though yields seldom are so good as on nongravelly, finer textured soils.

Depending on the past cropping history, irrigated pasture on most soils in the county commonly requires 50 to 65 pounds of nitrogen and 25 to 35 pounds of phosphorus an acre each year.

Ladino clover seed.—Ladino clover seed is grown on about 12,000 acres in Glenn County. The clover is grown in rotation with grain sorghum, sudangrass, and cereal grains.

The soils of the Artois, Hillgate, and Kimball series, which are shallow over a claypan, are well suited for production of clover seed. Soils of the Marvin, Plaza, and Tehama series are also well suited. Deep, well-drained

[2] GLENN COUNTY, ANNUAL REPORT, AGRICULTURAL COMMISSIONER. 16 pp., illus. 1962.

soils, such as the Columbia and Zamora, are less suitable for production of seed. They have high fertility and high available moisture holding capacity, which encourages excessive growth of vegetation and lower yields of seed.

Most of the soils used for ladino clover seed commonly require 35 pounds of phosphorus and 50 pounds of sulfur an acre annually.

Rice.—Rice was grown on about 41,000 acres in Glenn County in 1962. It is the most valuable irrigated crop and is grown under USDA acreage allotments.

Because of their high moisture-holding capacity and slow permeability, fine-textured soils are better suited to rice than other kinds. In this county rice is grown chiefly on the Capay, Castro, Landlow, Marvin, Myers, Plaza, Riz, Stockton, Sunnyvale, and Willows soils.

Rice generally requires 90 to 125 pounds of nitrogen an acre annually. The nitrogen can be applied at the time of seeding, or in split applications, whichever method produces the best yield on the particular soil. On the Myers, Riz, and Willows soils that do not have a dense subsoil, 20 to 25 pounds of phosphorus an acre generally must be applied each year. The phosphorus hastens maturity of the crop and increases yields slightly. Much of the fertilizer used is applied by airplane, but some is applied on the soil before the areas are flooded.

Grain sorghum.—In Glenn County grain sorghum is grown on 8,000 to 14,000 acres annually. In some years one-fourth or more of the acreage in grain sorghum is double cropped following a crop of grain grown for cereal or for hay.

Many soils in the county are suitable for grain sorghum. The soils used range from gravelly or very gravelly soils, such as those of the Cortina and Arbuckle series, to fine-textured soils like those of the Landlow and Myers. Yields generally are highest, however, on the Columbia, Yolo, Wyo, and Zamora soils, which are deep, well drained, and medium textured or moderately fine textured.

In this county grain sorghum commonly requires 80 to 100 pounds of nitrogen an acre annually for satisfactory yields.

Sugarbeets.—The area in sugarbeets has ranged from 1,500 to 2,200 acres in recent years. This acreage probably will remain at 2,200 acres or increase. The acreage used for sugarbeets generally depends on the processing capacity of the company which contracts with the farmers for growing beets.

Sugarbeets are grown chiefly on deep, well drained to moderately well drained soils that are not gravelly. In this county sugarbeets are grown mainly on soils of the Columbia, Jacinto, Myers, Tehama, Wyo, and Zamora series.

On most soils in this county, sugarbeets generally require 80 to 125 pounds of nitrogen an acre each year for satisfactory yields. On some Tehama soils, 25 to 30 pounds of potassium per acre have increased yields.

Almonds.—This crop was grown on 5,171 acres in Glenn County in 1962. Of this, 3,287 acres was in bearing trees, and 1,884 acres was in trees not of bearing age. The acreage in almonds has increased somewhat in the last few years, but most of the increased acreage has been planted by three growers. Little increase in the almond acreage is likely because other orchard crops are being planted on the better soils.

In the past almonds have been planted without much regard to suitability of the soils for the crop. Yields in many of the orchards are therefore marginal. Some of the best orchards in the county are on the Columbia, Jacinto, Wyo, and Zamora soils. Almonds grow quite well on the Arbuckle gravelly loams, but windthrow is a problem in some wet years.

Almonds grown in this county commonly require about 100 pounds of nitrogen and about 15 pounds of zinc an acre annually. The zinc should be applied as a foliar spray on most of the soils for optimum yields.

Olives.—In 1962, 1,247 acres was in olives in Glenn County. Of this acreage, 1,032 acres was in bearing trees, and 215 acres was in trees that were not of bearing age. Most of the acreage is in the northeastern part of the county between Orland and Hamilton City.

Olives grow best on well-drained soils, and some of the most productive olive orchards are on the Jacinto and Wyo soils. Many olive orchards, however, are on soils of the Arbuckle, Cortina, and Tehama series. Olive trees planted on the more gravelly soils of the Cortina series remain relatively small, and some of those planted on the Tehama clay loams have root rot. In some parts of the county, the temperature is unfavorable for olives, although the soils are otherwise well suited.

Nitrogen generally is needed for satisfactory yields of olives on soils in this county. It should be applied to older established trees at the rate of 1½ to 2 pounds a tree each year.

Oranges.—In Glenn County oranges were grown on 1,317 acres in 1962. Of this acreage, 606 acres was in bearing trees, and 711 acres was in trees not of bearing age. The orchards are in the northeastern part of the county, which is the northernmost commercial orange-producing area in the State. They extend from Orland east and southeast to Hamilton City and Ordbend. The newer orchards were planted about 5 years ago and are mainly in the districts of Ordbend and Plaza.

Many soils in this county are suitable for orange trees, but the temperature in some of the areas is too low for the trees to survive. The Arbuckle, Jacinto, and Wyo soils are well suited to oranges, and the less gravelly, deeper Cortina soils are also well suited. Orange trees have also been planted on some areas of the Hillgate and Kimball soils, which have a claypan. On these soils impeded drainage causes problems in wet winters, particularly in the older orchards.

From 1½ to 2 pounds of nitrogen commonly is needed annually for each mature orange tree on soils in this county. Zinc sulfate, applied as a foliar spray, generally is required at the rate of 7 pounds an acres each year.

Prunes.—Prunes are grown on 3,273 acres in Glenn County. Of this acreage, 1,750 acres is in bearing trees, and 1,523 acres is in trees not of bearing age. New plantings have increased in the last 3 years, and other plantings probably will be made. Most of the new prune orchards are on deep soils on alluvium along the Sacramento River.

Prune trees are hardy and grow on a wide variety of soils. Yields are highest, however, on the deep, well drained to moderately well drained soils. Some of the most productive prune orchards are on the Arbuckle, Columbia, Wyo, and Zamora soils. Prunes do not grow well on the very gravelly Cortina soils, nor on the claypan soils of the Hillgate and Kimball series. If prune trees are planted on claypan soils, they are planted more closely than on other soils to compensate for the poorer growth expected.

Nitrogen generally is required for satisfactory yields of prunes on all of the soils. The nitrogen should be applied annually at the rate of 1 to 1½ pounds a mature tree. On some of the soils, the trees benefit if each tree receives 9 to 10 pounds of potassium every fourth year.

Walnuts.—English walnuts are grown on 1,896 acres. Of this acreage 1,080 acres are in bearing trees, and 816 acres are in trees not of bearing age. The most recent plantings are on soils on alluvium along the Sacramento River.

Walnut trees are better suited to fertile, deep, well drained to moderately well drained soils than to other soils. The Columbia soils are used most extensively for walnuts, but the Jacinto, Wyo, and Zamora soils are also well suited to these trees. Some walnut trees are on shallow soils or on soils that have a restrictive claypan layer, but in these areas root rot is a hazard, the trees are small, and yields are low.

Nitrogen fertilizer generally is needed for walnuts on soils in this county. It should be applied annually at the rate of 3½ to 5 pounds a tree in mature orchards. In plantings that are 8 to 10 years old, 2 pounds of nitrogen is needed for each tree annually.

Barley.—From 50,000 to 60,000 acres annually are used for barley in this county. The acreage is larger than that of any other dryfarmed crop. Most of the barley is grown in the lower foothills and in the Sacramento Valley on soils not serviced by irrigation districts, and less than 10 percent of the acreage is irrigated. When the Tehama-Colusa Canal is completed and irrigation water is available, a larger acreage can be used for irrigated barley grown in rotation with other crops.

Most of the dryfarmed barley is grown in a 3 to 5 year rotation with pasture or is summer fallowed every other year. Nearly all of the barley is used for feed, though some is sold for malting purposes.

Dryfarmed barley grows best on soils that have high available water holding capacity. In the foothills the fine-textured soils of the Altamount, Nacimiento, Sehorn, and Shedd series are well suited to barley. The gravelly Corning, Newville, and Redding soils, on dissected terraces, are not so well suited to barley, because of lower available water holding capacity and low fertility. In the Sacramento Valley, west of the river, the Hillgate, Myers, and Tehama soils are the ones used chiefly for barley. In these areas barley is also grown on the Arbuckle, Artois, Cortina, Plaza, Yolo, Zamora, and similar soils. East of the Sacramento River, the Marvin and Zamora soils are the chief soils in barley, but some areas of Landlow and Stockton soils are used for barley in rotation with rice.

Fertilizer generally is not used on soils in dryfarmed barley, because rainfall in spring is uncertain.

Safflower.—Safflower, a relatively new crop in Glenn County, is grown on 16,000 to 23,000 acres annually. The crop is planted mostly in spring and is not irrigated. The acreage used for the crop generally is less when fall and winter rains are below normal than when rainfall is adequate. Safflower is sold for oil to manufacturers of paints, varnishes, and related products and to processors for use in food products.

In this county the Marvin, Myers, Tehama, Wyo, Zamora, and similar soils are well suited to safflower. These soils have high available moisture holding capacity.

Fertilizer generally is not used on soils that are used for dryfarmed safflower.

Soil Fertility Studies [8]

The results of fertility studies of selected soils in Glenn County, in relation to specified elements, are shown in table 2. The level of these plant nutrients was determined by studies made in the greenhouse on indicator plants grown in potted soils. The sampled soils listed had been cultivated or were under range, brush, or timber.

Samples of each soil were taken to spade depth from several areas in the field. About 100 pounds of each soil was collected. The material from each soil was mixed thoroughly in separate lots, and each lot was passed through a half-inch mesh screen. Representative samples of each sieved soil were then placed in 6-inch clay pots that were coated with black asphalt paint on the inside and aluminum paint on the outside. Each pot was filled with 1,600 grams of air-dry soil that had been mixed with a chemical fertilizer.

Different combinations of fertilizer were used in which one or more of the nutrients—nitrogen, phosphorus, potassium, and sulfur—were omitted to evaluate the availability of each nutrient in relation to adequate amounts of the others. The combinations used were (1) a complete fertilizer containing all four elements; (2) fertilizer containing phosphorus, potassium, and sulfur; (3) fertilizer containing nitrogen, potassium, and sulfur; (4) fertilizer containing nitrogen, phosphorus, and sulfur; and (5) fertilizer containing nitrogen and potassium. In addition a check, consisting of soil that was not fertilized, was used. The nutrients were chemically pure. The nitrogen was used as ammonium nitrate, the phosphorus as monobasic calcium phosphate, the potassium as potassium sulfate, and the sulfur as sodium sulfate.

The indicator plants grown were Romaine lettuce, barley, and tomatoes. One species was seeded to a pot. After the plants germinated, they were thinned to three or five plants a pot. The plants were irrigated with distilled water as needed. After 6 weeks of growth, they were harvested, dried in an oven at 70° C., and then weighed. The dry weight yields from treatment with the different kinds of fertilizer were compared and the ability of the soil to supply each nutrient determined.

Ordinarily, only nitrogen, phosphorus, potassium, and sulfur are tested. If treatment with a complete fertilizer caused leaf symptoms or produced unsatisfactory yields, further tests were made with lime, gypsum, micronutrients, or other materials.

Fertilizer responses obtained in the greenhouse generally are more pronounced than those obtained on plots in the field. It is necessary therefore to calibrate greenhouse results with field responses to get a more accurate estimate of the nutrients needed for improved yields.

Results of the greenhouse tests for the different kinds of soils are summarized in the paragraphs that follow.

[8] By JAMES VLAMIS, associate plant physiologist, University of California Agricultural Experiment Station, Berkeley, Calif.

TABLE 2.—*Fertility level of specified elements in selected soils in Glenn County, Calif.*

Soil types	Nitrogen	Phosphorus	Potassium	Sulfur
Cultivated Soils				
Arbuckle gravelly loam	Low	Medium	High	High.
Artois gravelly loam	Low	Very low	High	Medium.
Capay clay	Medium	Medium	High	High.
Clear Lake clay	Low	Very low	High	Low.
Columbia silt loam	High	High	High	High.
Cortina very gravelly sandy loam	Low	Very low	High	High.
Hillgate clay loam	Low	Medium	High	High.
Jacinto fine sandy loam	Low	Medium	High	Medium.
Kimball loam	Low	Very low	High	Medium.
Landlow clay	Medium	Very low	High	Low.
Marvin silty clay loam	Low	Very low	High	Medium.
Myers clay	Low	Very low	High	Medium.
Orland loam	Low	Very low	High	Medium.
Plaza silt loam	Low	Low	High	High.
Redding gravelly loam	Low	Very low	High	High.
Stockton clay	Low	Very low	High	Medium.
Tehama silt loam	Medium	Low	High	High.
Wyo silt loam	Low	Very low	High	Medium.
Yolo clay loam	Low	Low	High	Medium.
Zamora silty clay loam	Low	High	High	Medium.
Range Soils				
Altamont clay	Medium	Low	High	Medium.
Ayar clay	Medium	Very low	High	Low.
Corning gravelly loam	Low	Very low	High	Medium.
Hulls gravelly loam	Low	Medium	High	Medium.
Nacimiento clay	Medium	Low	High	High.
Newville gravelly loam	Low	Medium	High	Medium.
Polebar loam	Low	Very low	High	High.
Shedd silty clay loam	Low	Medium	High	High.
Brushland Soils				
Los Gatos gravelly loam	Medium	Medium	High	Low.
Maymen gravelly loam	Medium	High	High	Medium.
Parrish gravelly loam	Low	Very low	High	Medium.
Stonyford gravelly clay loam	Low	Very low	High	Medium.
Tyson gravelly loam	Medium	Medium	High	Low.
Timber Soils				
Masterson gravelly loam	Medium	Medium	High	High.
Neuns cobbly loam	Low	Low	High	Medium.
Sheetiron gravelly loam	Very low	High	High	High.

Cultivated soils.—The largest sampling of soils was made in cultivated soils. These soils have greater economic importance than other soils in the county, and fertilizer generally is applied for improved yields. The results shown in table 4 indicate that the level of nitrogen generally is low in most of the cultivated soils. Three of the soils tested were rated medium in nitrogen, and only one soil, the Columbia, was rated high.

The amount of phosphorus in the cultivated soils was more variable. Nearly half of the soils were rated very low in phosphorus. The rest were divided about equally among the low, medium, and high ratings. The Columbia soil and the Zamora silty clay loam were rated high in phosphorus. Eight of the cultivated soils were rated high in sulfur, ten were rated medium, and two were rated low. There were no indications of a potassium deficiency in the cultivated soils.

Pasture and range soils.—The level of nitrogen in the range soils generally was low, and the content of phosphorus also was mostly low or was very low. The Ayar, Corning, and Polebar soils were most deficient in phosphorus; they were rated very low in this element. Of the rest, two soils were rated low in phosphorus, and three were rated medium.

Three of the range soils, the Nacimiento, Polebar, and Shedd, were adequately supplied with sulfur, but the sulfur content in the Ayar was low. The other four soils were rated medium in sulfur. The potassium content in all of the range soils appeared to be sufficient.

Brushland soils.—Soils under brush are not intensively used for farming but are used mostly to provide browse for wildlife or livestock or are used as watershed areas.

Of the five soils sampled from areas under various kinds of brush, the Parrish and Stonyford were low in nitrogen, very low in phosphorus, and medium in sulfur. The Maymen soil was high in phosphorus and medium in nitrogen and sulfur. All soils under brush were high in potassium.

Timber soils.—Of the three soils sampled from areas under timber, the Masterson had the best supply of nutrients. It was rated medium in nitrogen and phosphorus and high in sulfur. The Sheetiron soil was very low in nitrogen and high in phosphorus and sulfur. The Los Gatos and Tyson soils were medium in nitrogen and phosphorus and low in sulfur. The Neuns soil required lime for a more favorable pH. In addition it was low in nitrogen and phosphorus and medium in sulfur. Potassium was high in all soils under timber.

The results obtained on the soils in timber must be used with caution, because trees probably have different nutritional requirements than the indicator plants used in these tests. Calibration curves may need to be developed if the data obtained are to be used for fertilizing trees or in determining the need for lime. Timber appears to have a higher tolerance for soil acidity than most agricultural crops.

In brief, most of the soils tested were deficient in nitrogen and phosphorus, and many were deficient in sulfur. The Newville and Stonyford soils tested were deficient in molybdenum, and the Neuns soil was deficient in lime. None of the soils tested showed a need for supplemental potassium.

Saline-Alkali Soils

In Glenn County the soils in 52,941 acres contain excess salts and alkali in amounts large enough to affect plant growth. These soils are mostly in basins south and east of Willows and southeast of Butte City (fig. 10). The acreage of soils affected by salts and alkali is shown in table 3.

Saline-alkali soils contain soluble salts and exchangeable sodium (alkali) in amounts that interfere with the growth of most crop plants. In saline-alkali soils the percentage of exchangeable sodium is greater than 15, and the electrical conductivity of the saturation extract is greater than 4 millimhos per centimeter at 25° C. The pH reading of the saturated soil generally is less than 8.5 (*15*).[4]

Three classes of saline-alkali soils were mapped: *Slightly saline-alkali*, *moderately saline-alkali*, and *strongly saline-alkali*. From 5 to 20 percent of the total area of a slightly saline-alkali soil is affected by salts and alkali. Only those crops that tolerate salt and alkali can be grown on such a soil, and these with moderate to good success. From 20 to 70 percent of the area of a moderately saline-alkali soil is affected by salts and alkali. Irrigated pasture, sugarbeets, and rice can be grown on such a soil with limited success, but the affected areas must be reclaimed before most other crops can be grown. More than 70 percent of the area of a strongly saline-alkali soil is affected by salts and alkali. No crops can be grown successfully on these soils without reclamation.

Opportunity for reclaiming saline-alkali soils in Glenn County is now limited because large acreages of rice are grown in and around the affected areas. Ponding of water is necessary for growing rice, but it causes a high water table to develop. The resulting poor drainage prevents leaching of soluble salts and facilitates the buildup of excess salts and alkali in fields not used for rice.

[4] Numbers in parentheses refer to Literature Cited, p. 196.

TABLE 3.—*Acreage of soils affected by salts and alkali*

Soil type	Slightly affected	Moderately affected	Strongly affected
	Acres	*Acres*	*Acres*
Castro clay	1, 418	459	
Marvin silty clay	1, 599	48	
Marvin silty clay loam	7, 896	730	
Plaza silt loam	164		
Plaza silty clay loam	1, 583		
Plaza silt loam, dense subsoil	654		
Plaza silty clay loam, dense subsoil	2, 643	380	
Riz gravelly loam		95	
Riz silt loam	847	373	
Riz silty clay loam		1, 632	3, 079
Sunnyvale silty clay	584		
Willows clay	7, 433	5, 175	1, 747
Willows clay, dense subsoil	7, 548	3, 772	912
Wyo silt loam	151		
Yolo clay loam	251		
Zamora silty clay loam	1, 284	484	
Totals	34, 055	13, 148	5, 738

Estimated Yields

Estimated yields of the principal crops grown in the county for those soils suitable for crops are given in table 4. The estimates were made by extending yield data from a few soils, and they are for crops that are irrigated or are dryfarmed.

The management for any one soil varies from farm to farm. It also varies for most crops from year to year, depending upon climate, diseases, insects, and the economic aspects of the crop. Because of these differences in management, yields vary considerably. If current management practices suggested by the Soil Conservation Service and the Extension Service are followed, the range in yields shown in the table can be expected most years. As new management methods are developed and applied, even greater yields can be expected.

Not all mapping units in the county are listed in table 4. Only the mapping units that are expected to be used intensively for agriculture in the near future are listed. Also some crops listed are not suitable for certain soils because the slope, location, lack of water for irrigation, or other factors make it uneconomical to grow them on those soils. This does not mean that the crop cannot be grown, and in places the crop could be grown under improved management.

Many kinds of crops other than the principal crops listed in table 4 have been grown in the county. Some of these, and vegetable crops in particular, have been raised successfully but lack of processing facilities, distance to market, and other factors make it uneconomical to grow them at present. These crops and others like them may become important in the future. Estimated yields for such

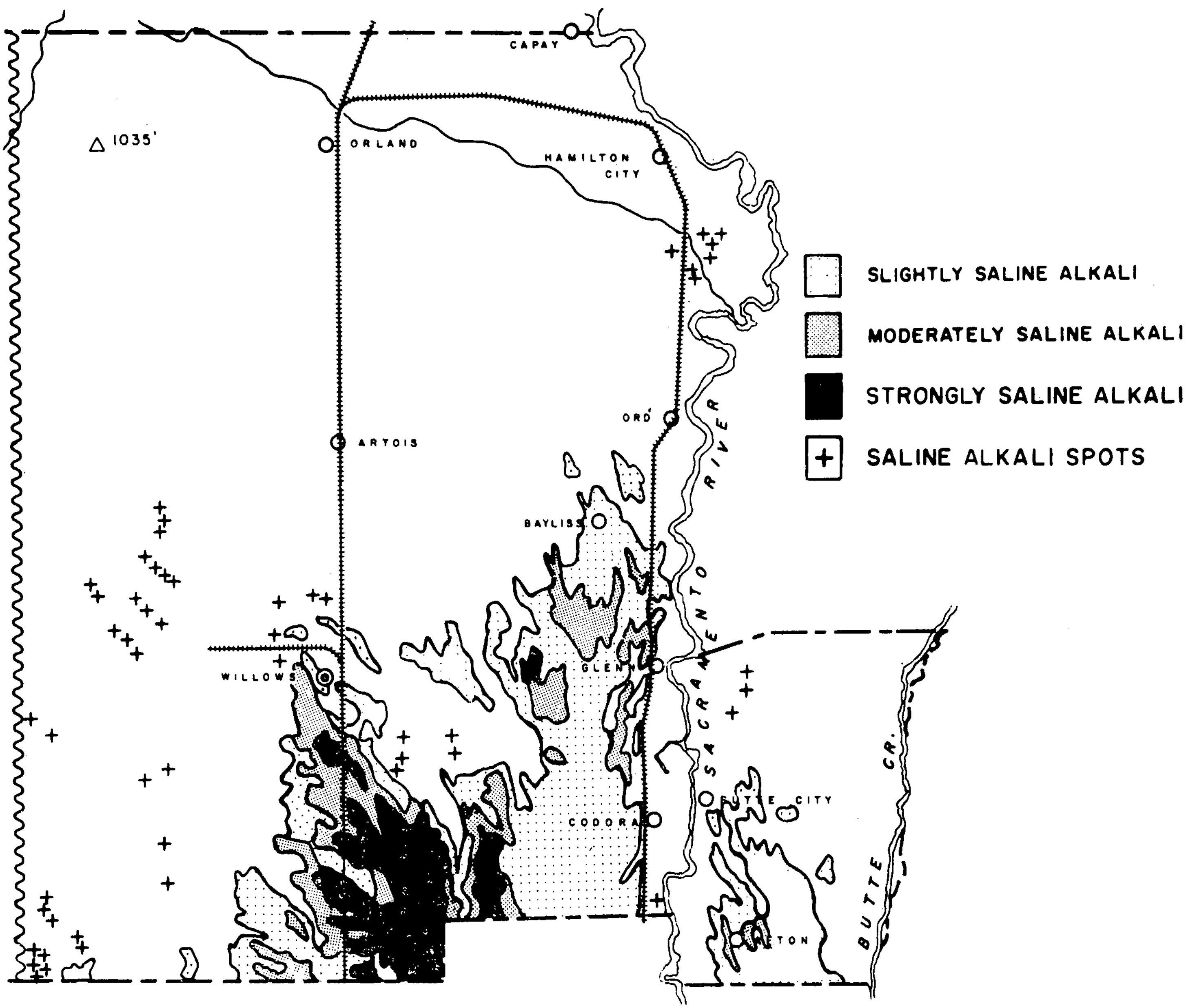

Figure 10.—**Distribution of soils affected by salts and alkali in Glenn County.**

crops can be made by relating the characteristics of an unlisted crop with a crop listed in the table.

Storie Index Rating

In table 5 the soils of the county are listed in alphabetic order by series and are rated according to the Storie index (*11*). This index expresses numerically the relative degree of suitability, or value of a soil, for general intensive agriculture. The rating is based on soil characteristics only. It does not take into account other factors, such as availability of water for irrigation, climate, and distance from markets, which might determine the desirability of growing specific crops in a given locality. For these reasons, the index, in itself, cannot be considered an index for land valuation.

Four factors that represent the inherent characteristics and qualities of the soils are considered in the index rating. Each factor is rated or evaluated separately in terms of percentage of the ideal, or 100 percent. The factors are:

Factor A, Profile characteristics.—Factor A expresses relative suitability of the profile for the growth of plant roots. Soils that have deep permeable profiles are rated 100 percent. Those that have a dense clay layer or a hardpan or are shallow over bedrock are rated less than 100 percent. The rating depends upon the extent to which root penetration is limited.

TABLE 4.—*Estimated average acre yields of the*

[No estimates are given for soils on which a particular crop

Map symbol	Soil name	Irrigated crops			
		Alfalfa (hay)	Irrigated pasture	Ladino clover (seed)	Rice
		Tons	*Animal-unit month* [1]	*Hundredweight*	*Hundredweight*
AaA	Altamont clay, 0 to 3 percent slopes				
AaC	Altamont clay, 3 to 15 percent slopes				
AaD	Altamont clay, 15 to 30 percent slopes				
AbC	Altamont gravelly clay, 3 to 15 percent slopes				
AdC	Altamont soils, 3 to 15 percent slopes				
AdD	Altamont soils, 15 to 30 percent slopes				
AhC	Altamont-Contra Costa clays, 8 to 15 percent slopes				
AhD	Altamont-Contra Costa clays, 15 to 30 percent slopes				
AmC	Altamont-Nacimiento association, 3 to 15 percent slopes				
AnC	Altamont-Shedd association, 3 to 15 percent slopes				
AoA	Arbuckle gravelly loam, 0 to 2 percent slopes	6–9	12–15	250–400	
AoB	Arbuckle gravelly loam, 2 to 8 percent slopes				
AoxA	Arbuckle cobbly loam, 0 to 3 percent slopes		9–12		
Ap	Arbuckle gravelly loam, water table, 0 to 2 percent slopes	6–9	12–15	250–400	
Ar	Arbuckle gravelly loam, clayey substratum, 0 to 2 percent slopes	6–9	12–15	250–400	
As	Arbuckle gravelly sandy loam, 0 to 2 percent slopes	6–9	9–12	250–400	
At	Artois loam	4–7	12–15	300–450	40–55
Au	Artois clay loam	4–7	12–15	300–450	40–55
Av	Artois gravelly loam	4–7	12–15	300–450	40–55
Aw	Artois gravelly clay loam	4–7	12–15	300–450	40–55
AxC	Ayar clay, 3 to 15 percent slopes				
AyD	Ayar-Nacimiento clays, 10 to 30 percent slopes				
BcB	Burris clay, 1 to 8 percent slopes				
CaA	Capay clay, 0 to 2 percent slopes	4–7	9–12	300–450	50–65
CaB	Capay clay, 2 to 8 percent slopes				
Cb	Castro clay	4–7	9–12	300–450	40–55
Cba	Castro clay, slightly saline-alkali	4–7	9–12	250–400	30–45
Cbb	Castro clay, moderately saline-alkali	3–5			20–35
Cc	Clear Lake clay	4–7	9–12	300–450	50–65
CeA	Columbia fine sandy loam, 0 to 2 percent slopes	8–11	12–15		
CeB	Columbia fine sandy loam, 2 to 8 percent slopes	8–11			
Cf	Columbia fine sandy loam, moderately deep over sand and gravel, 0 to 2 percent slopes	6–9	9–12		
CgA	Columbia loamy fine sand, coarse variant, 0 to 2 percent slopes	6–9	9–12		
CgB	Columbia loamy fine sand, coarse variant, 2 to 8 percent slopes	6–9			
ChA	Columbia silt loam, 0 to 2 percent slopes	8–11	12–15		
ChB	Columbia silt loam, 2 to 8 percent slopes	8–11			
Ck	Columbia silt loam, moderately deep over clay loam, 0 to 1 percent slopes	6–9	12–15		
Cl	Columbia silt loam, moderately deep over claypan, 0 to 1 percent slopes	6–9	12–15		
Cm	Columbia silt loam, moderately deep over gravel, 0 to 2 percent slopes	6–9	9–12		
Cn	Columbia silt loam, shallow over clay, 0 to 1 percent slopes	6–9	12–15		
CpB	Columbia silt loam, water table, 1 to 8 percent slopes				
CsB	Contra Costa clay, shallow, 3 to 8 percent slopes				
CwA	Corning gravelly loam, 0 to 2 percent slopes		9–12	250–400	
CwB	Corning gravelly loam, 2 to 8 percent slopes				
CwxB	Corning-Gullied land complex, 2 to 10 percent slopes				
CxC	Corning-Newville gravelly loams, 3 to 15 percent slopes				
CyC	Corning-Newville-Gullied land complex, 3 to 15 percent slopes				
CzB	Corning-Redding gravelly loams, 1 to 5 percent slopes				
Czh	Cortina gravelly fine sandy loam	6–9	9–12	250–400	
Czk	Cortina gravelly fine sandy loam, shallow		6–9		
Czr	Cortina very gravelly sandy loam	4–7	6–9	250–400	
Czs	Cortina very gravelly sandy loam, shallow		6–9		
Czt	Cortina very gravelly sandy loam, moderately deep	4–7	6–9	250–400	
HgA	Hillgate loam, 0 to 2 percent slopes	4–7	12–15	350–500	40–55
HgB	Hillgate loam, 2 to 8 percent slopes				
HgxB	Hillgate-Gullied land complex, 2 to 10 percent slopes				
HhB	Hillgate loam, moderately deep, 0 to 10 percent slopes				
HhxB	Hillgate-Gullied land complex, moderately deep, 2 to 10 percent slopes				
Hl	Hillgate clay loam, 0 to 3 percent slopes	4–7	12–15		
HmA	Hillgate gravelly loam, 0 to 2 percent slopes	4–7	12–15	300–450	40–55

See footnote at end of table.

principal irrigated crops and dryland crops

is not grown or for soils to which a crop is not suited]

Irrigated crops—Continued							Dryland crops	
Sorghum (grain)	Sugarbeets	Almonds	Olives	Oranges	Prunes (dried)	Walnuts	Barley (grain)	Safflower
Hundredweight	*Tons*	*Tons*	*Tons*	*Boxes*	*Tons*	*Tons*	*Hundredweight*	*Hundredweight*
							16–22	
							16–22	
							16–22	
							12–18	
							16–22	
							12–18	
							16–22	
							12–18	
							16–22	
							16–22	
45–60		0. 5–0. 8	4. 0–5. 0	400–550	2. 0–3. 0		12–18	
							12–18	
							8–12	
							12–18	
35–50							12–18	
35–50		0. 5–0. 8	4. 0–5. 0	400–550	2. 0–3. 0		8–12	
35–50							16–22	
35–50							16–22	
35–50							12–18	
35–50							12–18	
							16–22	
							16–22	
35–50	16–22						16–22	12–18
							16–22	
35–50	16–22						16–22	16–22
25–40							12–18	9–15
							8–12	
35–50	16–22						16–22	16–22
55–70	20–26	0. 9–1. 2			3. 0–4. 0	0. 9–1. 1	20–25	12–18
							20–25	12–18
45–60	16–22	0. 5–0. 8			2. 0–3. 0	0. 6–0. 8	16–22	
45–60	16–22	0. 7–1. 0			2. 0–3. 0	0. 8–1. 0	16–22	
							16–22	
55–70	20–26	0. 9–1. 2			3. 0–4. 0	0. 9–1. 1	20–25	16–22
							20–25	12–18
45–60	16–22	0. 5–0. 8			3. 0–4. 0	0. 6–0. 8	20–25	12–18
45–60	16–22				2. 0–3. 0		20–25	12–18
45–60	16–22	0. 5–0. 8			2. 0–3. 0	0. 6–0. 8	16–22	9–15
35–50							20–25	12–18
							16–22	
							12–18	
25–40							12–18	
							12–18	
							8–12	
							12–18	
							8–12	
							8–12	
35–50		0. 5–0. 8	2. 5–3. 5	300–450			8–12	
25–40		0. 5–0. 8	2. 0–3. 5	300–450			8–12	
25–40		0. 5–0. 8	2. 0–3. 5	300–450			8–12	
35–50				300–450			16–22	12–18
							16–22	12–18
							12–18	12–18
							12–18	
							12–18	9–15
							16–22	12–18
35–50							12–18	9–15

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TABLE 4.—*Estimated average acre yields of the principal*

Map symbol	Soil name	Irrigated crops: Alfalfa (hay)	Irrigated crops: Irrigated pasture	Irrigated crops: Ladino clover (seed)	Irrigated crops: Rice
		Tons	*Animal-unit month* [1]	*Hundredweight*	*Hundredweight*
HmB	Hillgate gravelly loam, 2 to 8 percent slopes				
HmxB	Hillgate-Gullied land complex, gravelly, 2 to 10 percent slopes				
Hn	Hillgate gravelly loam, water table, 0 to 2 percent slopes	4–7	12–15	300–450	40–55
JaA	Jacinto fine sandy loam, 0 to 2 percent slopes	6–9	12–15	300–450	
JaB	Jacinto fine sandy loam, 2 to 8 percent slopes				
Kb	Kimball loam, 0 to 2 percent slopes	4–7	12–15	350–500	40–55
KbB	Kimball loam, 2 to 10 percent slopes				
KmA	Kimball gravelly loam, 0 to 2 percent slopes	4–7	9–12	300–450	30–45
KmB	Kimball gravelly loam, 2 to 10 percent slopes				
KnB	Kimball-Gullied land complex, 2 to 10 percent slopes				
La	Landlow clay	4–7	9–12		50–65
Lc	Landlow clay loam	4–7	9–12		50–65
LoD	Lodo-Millsap-Gullied land complex, 10 to 30 percent slopes				
LsD	Lodo-Tehama clay loams, 10 to 30 percent slopes				
LtD	Lodo-Tehama-Gullied land complex, 10 to 30 percent slopes				
Ma	Marvin silty clay, 0 to 1 percent slopes	4–7	9–12	350–500	50–65
Maa	Marvin silty clay, slightly saline-alkali, 0 to 1 percent slopes	4–7	9–12		40–55
Mab	Marvin silty clay, moderately saline-alkali, 0 to 1 percent slopes		6–9		20–35
MaoB	Marvin silty clay, overflow, 0 to 5 percent slopes				
MbA	Marvin silty clay loam, 0 to 2 percent slopes	6–9	9–12	350–500	50–65
MbB	Marvin silty clay loam, 2 to 10 percent slopes				
Mba	Marvin silty clay loam, slightly saline-alkali, 0 to 1 percent slopes	4–7	9–12		40–55
Mbb	Marvin silty clay loam, moderately saline-alkali, 0 to 1 percent slopes		6–9		20–35
Me	Maywood loam, shallow over gravel	4–7	6–9		
MnD	Millsholm clay loam, 10 to 30 percent slopes				
Mz	Moda loam		9–12	300–450	40–55
MzrA	Myers clay, 0 to 3 percent slopes	6–9	9–12	350–500	50–65
MzrB	Myers clay, 3 to 10 percent slopes				
MzyA	Myers clay loam, 0 to 3 percent slopes	6–9	9–12	350–500	50–65
MzyB	Myers clay loam, 3 to 8 percent slopes				
MzxB	Myers-Gullied land complex, 3 to 10 percent slopes				
NaC	Nacimiento clay, 3 to 15 percent slopes				
NaD	Nacimiento clay, 15 to 30 percent slopes				
NcD	Nacimiento soils, 10 to 30 percent slopes				
NdD	Nacimiento-Gullied land complex, 15 to 30 percent slopes				
NfD	Nacimiento-Altamont association, 10 to 30 percent slopes				
NgD	Nacimiento-Altamont-Gullied land complex, 15 to 30 percent slopes				
NhC	Nacimiento-Contra Costa association, 3 to 15 percent slopes				
NhD	Nacimiento-Contra Costa association, 15 to 30 percent slopes				
NkD	Nacimiento-Contra Costa-Gullied land complex, 15 to 30 percent slopes				
NvC	Newville gravelly loam, 3 to 15 percent slopes				
NvD	Newville gravelly loam, 15 to 30 percent slopes				
NwD	Newville-Gullied land complex, 8 to 30 percent slopes				
Oa	Orland loam	8–11	12–15	350–500	
Od	Orland loam, very deep	8–11	12–15	350–500	
Odp	Orland loam, deep over claypan	6–9	12–15	350–500	
Omp	Orland loam, moderately deep over claypan	6–9	12–15	350–500	
Omr	Orland loam, moderately deep over gravel	6–9	9–12	300–450	
Oms	Orland loam, moderately deep over gravelly loam	6–9	12–15	350–500	
Osg	Orland loam, shallow over gravel	5–7	9–12	250–400	
Osm	Orland loam, shallow over gravelly loam	6–9	12–15	300–450	
Ox	Orland-Cortina complex	6–9	9–12	250–400	
PeA	Perkins gravelly loam, 0 to 3 percent slopes	6–9	12–15		
PeC	Perkins gravelly loam, 3 to 15 percent slopes				
Pf	Plaza silt loam	6–9	12–15	350–500	50–65
Pfa	Plaza silt loam, slightly saline-alkali	4–7	9–12	300–450	40–55
Pg	Plaza silty clay loam	6–9	12–15	350–500	50–65
Pga	Plaza silty clay loam, slightly saline-alkali	4–7	9–12	250–400	40–55
Ph	Plaza silt loam, dense subsoil	6–9	12–15	300–450	50–65
Pha	Plaza silt loam, dense subsoil, slightly saline-alkali	4–7	9–12	250–400	40–55
Pk	Plaza silty clay loam, dense subsoil	6–9	12–15	300–450	50–65
Pka	Plaza silty clay loam, dense subsoil, slightly saline-alkali	4–7	9–12	250–400	40–55
Pkb	Plaza silty clay loam, dense subsoil, moderately saline-alkali		6–9		30–45
PmA	Pleasanton gravelly loam, 0 to 2 percent slopes	4–7	12–15	300–450	

See footnote at end of table.

irrigated crops and dryland crops—Continued

Irrigated crops—Continued							Dryland crops	
Sorghum (grain)	Sugarbeets	Almonds	Olives	Oranges	Prunes (dried)	Walnuts	Barley (grain)	Safflower
Hundredweight	*Tons*	*Tons*	*Tons*	*Boxes*	*Tons*	*Tons*	*Hundredweight*	*Hundredweight*
							12–18	
							8–12	
35–50							12–18	
45–60	20–26	0. 9–1. 2	4. 0–5. 0	400–550	3. 0–4. 0	0. 8–1. 0	16–22	
							12–18	
35–50				300–450			12–18	
							12–18	
35–50							12–18	
							12–18	
							12–18	
35–50							16–22	12–18
35–50							12–22	12–18
							8–12	
							8–12	
							8–12	
45–60	16–22						16–22	12–18
35–50	12–18						12–18	9–15
25–40							8–12	
							12–18	9–15
45–60	16–22				2. 0–3. 0		16–22	12–18
							16–22	12–18
35–50	12–18						12–18	9–15
25–40							8–12	
25–40							8–12	
							12–18	
25–40							12–18	
45–60	16–22						20–25	12–18
							16–22	12–18
45–60	16–22						20–25	12–18
							16–22	12–18
							16–22	12–18
							16–22	
							16–22	
							12–18	
							12–18	
							16–22	
							16–22	
							16–22	
							16–22	
							12–18	
							12–18	
							8–12	
							8–12	
45–60	18–22	0. 7–1. 0	4. 0–5. 0	400–550	2. 0–3. 0	0. 8–1. 0	18–22	
45–60	18–22	0. 7–1. 0	4. 0–5. 0	400–550	2. 0–3. 0	0. 8–1. 0	18–22	
35–50	18–22	0. 5–0. 8	3. 0–4. 0	300–450	2. 0–3. 0		18–22	
35–50	18–22	0. 5–0. 8	3. 0–4. 0	300–450	2. 0–3. 0		18–22	
35–50	12–18	0. 5–0. 8	3. 0–4. 0	300–450	1. 5–2. 5	0. 7–0. 9	12–18	
45–60	18–22	0. 7–1. 0	3. 5–4. 5	400–550	2. 0–3. 0		18–22	
35–50		0. 5–0. 8	2. 0–3. 5		1. 5–2. 5		8–12	
45–60	12–18	0. 7–1. 0	3. 5–4. 5	400–550	2. 0–3. 0		12–18	
35–50		0. 5–0. 8	2. 0–3. 5	300–450	1. 5–2. 5		12–18	
35–50		0. 5–0. 8	3. 0–4. 0				12–18	
							12–18	
45–60	18–22		3. 0–40.		2. 0–3. 0		18–22	12–18
35–50	18–22						12–18	9–15
45–60	18–22		3. 0–4. 0		2. 0–3. 0		12–18	12–18
35–50	16–22						12–18	9–15
45–60	16–22						16–22	12–18
35–50	12–18						12–18	9–15
45–60	16–22						16–22	12–18
35–50	12–18						12–18	9–15
							8–12	
35–50		0. 5–0. 8	3. 0–4. 0		2. 0–3. 0		12–18	

TABLE 4.—*Estimated average acre yields of the principal*

Map symbol	Soil name	Irrigated crops: Alfalfa (hay)	Irrigated crops: Irrigated pasture	Irrigated crops: Ladino clover (seed)	Irrigated crops: Rice
		Tons	*Animal-unit month* [1]	*Hundredweight*	*Hundredweight*
PmB	Pleasanton gravelly loam, 2 to 10 percent slopes				
Pn	Pleasanton gravelly sandy clay loam, 0 to 2 percent slopes	4–7	12–15	300–450	
Po	Pleasanton very gravelly sandy loam, 0 to 2 percent slopes	4–7	9–12	250–400	
PtA	Porterville clay, 0 to 2 percent slopes		9–12		
PtB	Porterville clay, 2 to 10 percent slopes				
Rg	Redding gravelly loam, 0 to 3 percent slopes		9–12		
Rlb	Riz gravelly loam, moderately saline-alkali		6–9		
Rma	Riz silt loam, slightly saline-alkali		9–12		30–45
Rmb	Riz silt loam, moderately saline-alkali		6–9		20–35
Rnb	Riz silty clay loam, moderately saline-alkali		6–9		20–35
Sa	Sacramento clay	4–7	12–15	300–450	50–65
SbC	Sehorn soils, 3 to 15 percent slopes				
SbD	Sehorn soils, 15 to 30 percent slopes				
ScD	Sehorn-Gullied land complex, 10 to 30 percent slopes				
SdC	Sehorn-Millsholm association, 8 to 15 percent slopes				
SdD	Sehorn-Millsholm association, 15 to 30 percent slopes				
SeD	Sehorn-Millsholm-Gullied land complex, 15 to 30 percent slopes				
SfC	Shedd silty clay loam, 3 to 15 percent slopes				
SfD	Shedd silty clay loam, 15 to 30 percent slopes				
SgD	Shedd-Altamont association, 10 to 30 percent slopes				
ShC	Shedd-Altamont-Gullied land complex, 8 to 15 percent slopes				
Sm	Stockton clay	4–7	9–12		50–65
Sn	Stockton clay, moderately deep	4–7	9–12		50–65
So	Stockton clay, very deep	4–7	9–12		50–65
Sr	Stockton clay, moderately deep, overflow		9–12		30–45
Sw	Sunnyvale clay	4–7	12–15		50–65
Sxa	Sunnyvale silty clay, slightly saline-alkali	4–7	9–12		40–55
Sy	Sunnyvale silty clay loam	4–7	12–15	350–500	50–65
Ta	Tehama loam, moderately deep over gravel, 0 to 2 percent slopes	4–7	9–12	250–400	
Tb	Tehama loam, deep to gravel, 0 to 3 percent slopes	6–9	9–12	300–450	
TcA	Tehama clay loam, 0 to 2 percent slopes	6–9	12–15	350–500	50–65
TcB	Tehama clay loam, 2 to 10 percent slopes				
Tf	Tehama fine sandy loam, 0 to 3 percent slopes	6–9	9–12	350–500	40–55
Tg	Tehama gravelly loam, 0 to 3 percent slopes	6–9	9–12	300–450	
Th	Tehama gravelly loam, moderately deep over hardpan, 0 to 2 percent slopes	4–7	9–12	300–450	
Tk	Tehama gravelly fine sandy loam, moderately deep over gravel, 0 to 2 percent slopes	6–9	9–12	300–450	
Tm	Tehama silt loam, 0 to 3 percent slopes	6–9	12–15	350–500	50–65
Tn	Tehama silt loam, water table, 0 to 2 percent slopes	6–9	12–15	350–500	
ToB	Tehama-Gullied land complex, 2 to 10 percent slopes				
Wca	Willows clay, slightly saline-alkali	4–7	9–12		40–55
Wcb	Willows clay, moderately saline-alkali				30–45
Wcc	Willows clay, strongly saline-alkali				10–25
Wd	Willows clay, dense subsoil	4–7	9–12	300–450	50–65
Wda	Willows clay, dense subsoil, slightly saline-alkali	4–7	9–12		40–55
Wdb	Willows clay, dense subsoil, moderately saline-alkali		6–9		30–45
Wdc	Willows clay, dense subsoil, strongly saline-alkali				10–25
Wg	Wyo loam, deep over gravel	8–11	12–15	350–500	
Wh	Wyo gravelly loam, moderately deep over gravel	6–9	9–12	300–450	
Wm	Wyo gravelly clay loam	6–9	9–12	300–450	
Wn	Wyo silt loam	8–11	12–15	350–500	
Wo	Wyo silt loam, moderately deep over clay	6–9	12–15	350–500	
Wp	Wyo silt loam, deep over claypan	6–9	12–15	350–500	
Wsa	Wyo silt loam, slightly saline-alkali	6–9	9–12	300–450	
Wsw	Wyo silt loam, water table	6–9	12–15	350–500	
Yc	Yolo clay loam	8–11	12–15		
Yd	Yolo clay loam, moderately deep over clay	6–9	12–15		55–70
Yf	Yolo clay loam, deep over claypan	6–9	12–15		55–70
Yg	Yolo clay loam, moderately deep over hardpan		9–12	300–450	
Yh	Yolo clay loam, shallow over clay	6–9	9–12	350–500	55–70
Yma	Yolo clay loam, slightly saline-alkali		9–12		40–55

See footnote at end of table.

irrigated crops and dryland crops—Continued

Irrigated crops—Continued							Dryland crops	
Sorghum (grain)	Sugarbeets	Almonds	Olives	Oranges	Prunes (dried)	Walnuts	Barley (grain)	Safflower
Hundredweight	*Tons*	*Tons*	*Tons*	*Boxes*	*Tons*	*Tons*	*Hundredweight*	*Hundredweight*
---	---	---	---	---	---	---	12–18	---
35–50	---	0. 5–0. 8	3. 0–4. 0	---	2. 0–3. 0	---	12–18	---
35–50	---	0. 5–0. 8	2. 5–3. 5	---	2. 0–3. 0	---	8–12	---
---	---	---	---	---	---	---	12–18	---
---	---	---	---	---	---	---	8–12	---
---	---	---	---	---	---	---	8–12	---
---	---	---	---	---	---	---	12–18	---
---	---	---	---	---	---	---	8–12	---
---	---	---	---	---	---	---	8–12	---
45–60	16–22	---	---	---	---	---	16–22	12–18
---	---	---	---	---	---	---	12–18	---
---	---	---	---	---	---	---	12–18	---
---	---	---	---	---	---	---	12–18	---
---	---	---	---	---	---	---	12–18	---
---	---	---	---	---	---	---	12–18	---
---	---	---	---	---	---	---	12–18	---
---	---	---	---	---	---	---	16–22	---
---	---	---	---	---	---	---	16–22	---
---	---	---	---	---	---	---	16–22	---
---	---	---	---	---	---	---	16–22	---
35–50	16–22	---	---	---	---	---	16–22	12–18
35–50	16–22	---	---	---	---	---	16–22	12–18
35–50	16–22	---	---	---	---	---	16–22	12–18
35–50	---	---	---	---	---	---	12–18	---
35–50	16–22	---	---	---	---	---	16–22	12–18
25–40	12–18	---	---	---	---	---	12–18	9–15
35–50	16–22	---	---	---	---	---	16–22	12–18
35–50	16–22	0. 5–0. 8	2. 5–3. 5	300–450	1. 5–2. 5	---	12–18	---
45–60	16–22	0. 5–0. 8	3. 0–4. 0	400–550	2. 0–3. 0	---	16–22	---
55–70	12–22	0. 5–0. 8	3. 0–4. 0	400–550	2. 0–3. 0	---	16–22	12–18
							16–22	12–18
45–60	16–22	0. 7–1. 0	3. 0–4. 0	400–550	2. 0–3. 0	0. 6–0. 8	16–22	---
45–60	---	0. 5–0. 8	2. 0–3. 5	300–450	1. 5–2. 5	0. 6–0. 8	12–18	---
35–50	---	---	---	---	---	---	12–18	---
35–50	---	---	2. 0–3. 5	---	---	---	12–18	---
55–70	16–22	0. 7–1. 0	3. 0–4. 0	400–550	2. 0–3. 0	0. 7–0. 9	16–22	12–18
45–60	16–22	---	---	---	---	---	16–22	12–18
							12–18	---
35–50	12–18	---	---	---	---	---	12–18	9–15
25–40	---	---	---	---	---	---	8–12	---
45–60	12–18	---	---	---	---	---	16–22	12–18
35–50	12–18	---	---	---	---	---	12–18	9–15
25–40	---	---	---	---	---	---	8–12	---
45–60	16–22	0. 7–1. 0	3. 5–4. 5	400–550	2. 5–3. 5	0. 8–1. 0	16–22	12–18
35–50	---	0. 5–0. 8	3. 0–4. 0	400–550	2. 0–3. 0	0. 6–0. 8	12–18	---
35–50	---	0. 7–1. 0	3. 5–4. 5	400–550	2. 5–3. 5	0. 8–1. 0	12–18	---
55–70	20–25	0. 9–1. 2	4. 0–5. 0	500–650	3. 0–4. 0	0. 9–1. 2	20–25	16–22
55–70	20–25	0. 7–1. 0	3. 0–4. 0	400–550	3. 0–4. 0	0. 6–0. 8	20–25	16–22
45–60	20–25	0. 7–1. 0	3. 0–4. 0	400–550	2. 5–3. 5	0. 6–0. 8	20–25	16–22
45–60	16–22	---	---	---	---	---	12–18	12–18
35–50	16–22	---	---	---	2. 5–3. 5	---	16–22	16–22
55–70	20–25	0. 9–1. 2	4. 0–5. 0	---	3. 0–4. 0	0. 9–1. 2	20–25	16–22
45–60	20–25	0. 7–1. 0	3. 5–4. 5	---	2. 5–3. 5	---	20–25	16–22
45–60	20–25	0. 7–1. 0	3. 5–4. 5	---	2. 5–3. 5	---	20–25	16–22
35–50	---	---	---	---	---	---	12–18	12–18
45–60	16–22	---	---	---	---	---	16–22	12–18
35–50	12–18	---	---	---	---	---	12–18	12–18

TABLE 4.—*Estimated average acre yields of the principal*

Map symbol	Soil name	Irrigated crops			
		Alfalfa (hay)	Irrigated pasture	Ladino clover (seed)	Rice
		Tons	*Animal-unit month* [1]	*Hundredweight*	*Hundredweight*
Yo	Yolo silt loam, silty clay loam substratum	6–9	9–12	350–500	50–65
Za	Zamora silty clay, 0 to 2 percent slopes	6–9	12–15		50–65
ZbA	Zamora silty clay loam, 0 to 2 percent slopes	8–11	12–15		50–65
ZbB	Zamora silty clay loam, 2 to 8 percent slopes				
Zc	Zamora silty clay loam, deep over hardpan, 0 to 2 percent slopes	6–9	12–15		50–65
Zd	Zamora silty clay loam, deep over silty clay, 0 to 2 percent slopes	6–9	12–15		50–65
Zma	Zamora silty clay loam, slightly saline-alkali, 0 to 2 percent slopes	4–7	9–12		40–55
Zmb	Zamora silty clay loam, moderately saline-alkali, 0 to 2 percent slopes		6–9		30–45

[1] An animal-unit month is the amount of forage or feed required to maintain one animal-unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

TABLE 5.—*Storie index rating for the soils*

[Limitations used in computing the X factor for some of the soils are indicated by figures in parentheses after the factor as follows: (1) Nutrient content; (2) Nutrient content; erosion; (3) Erosion; (4) Drainage; nutrient content; (5) Drainage; (6) Drainage; alkali; (7) Overflow; (8) Overflow; channeled; (9) Drainage, overflow; (10) Nutrient content, hummocks; (11) Acidity; (12) Acidity, erosion]

Soil symbol	Soil	Storie index					
		Rating factors				Index rating	Soil grade
		A (Profile)	B (Texture)	C (Slope)	X (Other conditions)		
AaC	Altamont clay, 3 to 15 percent slopes	80	60	90	95(1)	41	3
AaA	Altamont clay, 0 to 3 percent slopes	80	60	100	95(1)	46	3
AaD	Altamont clay, 15 to 30 percent slopes	80	60	70	95(1)	32	4
AaE	Altamont clay, 30 to 50 percent slopes	80	60	40	95(1)	18	5
AbC	Altamont gravelly clay, 3 to 15 percent slopes	80	50	90	95(1)	34	4
AcD	Altamont rocky clay loam, 15 to 30 percent slopes	45	75	80	100	27	4
AcE	Altamont rocky clay loam, 30 to 50 percent slopes	45	75	40	95(1)	13	5
AdE	Altamont soils, 30 to 65 percent slopes	60	75	30	95(1)	13	5
AdC	Altamont soils, 3 to 15 percent slopes	60	75	85	100	38	4
AdD	Altamont soils, 15 to 30 percent slopes	60	75	75	100	34	4
AhC	Altamont-Contra Costa clays, 8 to 15 percent slopes	60	70	85	100	36	4
AhD	Altamont-Contra Costa clays, 15 to 30 percent slopes	60	70	75	100	32	4
AhE	Altamont-Contra Costa clays, 30 to 50 percent slopes	60	70	40	95(1)	16	5
AfD	Altamont-Gullied land complex, 10 to 30 percent slopes	80	60	80	76(2)	29	4
AfE	Altamont-Gullied land complex, 30 to 50 percent slopes	80	60	40	76(2)	15	5
AfsD	Altamont-Gullied land complex, shallow, 10 to 30 percent slopes	60	75	80	80(3)	29	4
AfsE	Altamont-Gullied land complex, shallow, 30 to 65 percent slopes	60	75	30	80(3)	11	5
AgE	Altamont-Rocky gullied land complex, 15 to 45 percent slopes	40	75	60	80(3)	14	5
AkE3	Altamont and Millsholm soils, 30 to 65 percent slopes, severely eroded	20	70	30	50(3)	2	6
AmC	Altamont-Nacimiento association, 3 to 15 percent slopes	90	60	85	100	46	3
AnC	Altamont-Shedd association, 3 to 15 percent slopes	80	70	90	95(1)	48	3
AoA	Arbuckle gravelly loam, 0 to 2 percent slopes	95	75	100	95(1)	68	2
AoB	Arbuckle gravelly loam, 2 to 8 percent slopes	95	75	95	95(1)	64	2
Ap	Arbuckle gravelly loam, water table, 0 to 2 percent slopes	95	75	100	57(4)	41	3
Ar	Arbuckle gravelly loam, clayey substratum, 0 to 2 percent slopes	80	75	100	67(4)	40	3

irrigated crops and dryland crops—Continued

Irrigated crops—Continued							Dryland crops	
Sorghum (grain)	Sugarbeets	Almonds	Olives	Oranges	Prunes (dried)	Walnuts	Barley (grain)	Safflower
Hundredweight	*Tons*	*Tons*	*Tons*	*Boxes*	*Tons*	*Tons*	*Hundredweight*	*Hundredweight*
45–60	18–22	0.7–1.0	3.5–4.5	----	----	----	16–22	16–22
55–70	20–26	0.9–1.2	----	----	3.0–4.0	0.8–1.0	20–25	16–22
55–70	20–26	0.9–1.2	4.0–5.0	----	3.0–4.0	0.8–1.0	20–25	16–22
----	----	----	----	----	----	----	20–25	12–18
45–60	16–22	----	----	----	2.5–3.5	----	20–25	12–18
45–60	20–26	0.7–1.0	----	----	3.0–4.0	0.8–1.0	20–25	16–22
35–50	16–22	----	----	----	2.0–3.0	----	16–22	12–18
----	----	----	----	----	----	----	8–12	----

TABLE 5.—*Storie index rating for the soils*—Continued

Soil symbol	Soil	Storie index: Rating factors: A (Profile)	B (Texture)	C (Slope)	X (Other conditions)	Index rating	Soil grade
As	Arbuckle gravelly sandy loam, 0 to 2 percent slopes	95	70	100	95(1)	63	2
AoxA	Arbuckle cobbly loam, 0 to 3 percent slopes	95	60	100	95(1)	54	3
Av	Artois gravelly loam	60	80	100	81(4)	39	4
At	Artois loam	60	90	100	81(4)	44	3
Au	Artois clay loam	60	80	100	81(4)	39	3
Aw	Artois gravelly clay loam	60	75	100	81(4)	36	4
AxC	Ayar clay, 3 to 15 percent slopes	75	70	90	95(1)	45	3
AyD	Ayar-Nacimiento clays, 10 to 30 percent slopes	80	70	80	95(1)	43	3
BuD	Burris bouldery clay, 10 to 30 percent slopes	80	30	75	85(5)	15	5
ByC	Burris cobbly clay, 3 to 15 percent slopes	80	40	85	85(5)	23	3
BcB	Burris clay, 1 to 8 percent slopes	85	60	95	90(5)	44	3
CaA	Capay clay, 0 to 2 percent slopes	85	60	100	86(4)	44	3
CaB	Capay clay, 2 to 8 percent slopes	85	60	95	86(4)	41	3
Cb	Castro clay	60	70	100	60(5)	25	4
CbA	Castro clay, slightly saline-alkali	60	70	100	45(6)	19	5
Cbb	Castro clay, moderately saline-alkali	60	70	100	30(6)	13	5
Cc	Clear Lake clay	90	60	100	80(5)	43	3
CdsF	Colluvial land, sedimentary rocks	([1])	([1])	([1])	([1])	[2]<5	6
CduF	Colluvial land, serpentine rocks	([1])	([1])	([1])	([1])	[2]<5	6
CdvF	Colluvial land, volcanic rocks	([1])	([1])	([1])	([1])	[2]<5	6
ChA	Columbia silt loam, 0 to 2 percent slopes	95	100	100	90(7)	85	1
ChB	Columbia silt loam, 2 to 8 percent slopes	95	100	90	90(7)	77	2
Ck	Columbia silt loam, moderately deep over clay loam, 0 to 1 percent slopes	95	100	100	100	95	1
Cl	Columbia silt loam, moderately deep over claypan, 0 to 1 percent slopes	85	100	100	90(7)	76	2
Cm	Columbia silt loam, moderately deep over gravel, 0 to 2 percent slopes	80	100	100	90(7)	72	2
Cn	Columbia silt loam, shallow over clay, 0 to 1 percent slopes	85	100	100	80(7)	68	2
Co	Columbia silt loam, shallow over clay, channeled, 0 to 3 percent slopes	70	95	95	30(8)	19	5
CpB	Columbia silt loam, water table, 1 to 8 percent slopes	95	100	90	54(9)	46	1
CeA	Columbia fine sandy loam, 0 to 2 percent slopes	95	100	100	90(7)	85	1
CeB	Columbia fine sandy loam, 2 to 8 percent slopes	95	100	95	90(7)	81	3

See footnotes at end of table.

TABLE 5.—*Storie index rating for the soils*—Continued

Soil symbol	Soil	Storie index					
		Rating factors				Index rating	Soil grade
		A (Profile)	B (Texture)	C (Slope)	X (Other conditions)		
Cf	Columbia fine sandy loam, moderately deep over sand and gravel, 0 to 2 percent slopes	80	100	100	90(7)	72	2
CgA	Columbia loamy fine sand, coarse variant, 0 to 2 percent slopes	90	90	100	90(7)	73	2
CgB	Columbia loamy fine sand, coarse variant, 2 to 8 percent slopes	95	90	90	90(7)	69	2
CrB	Columbia soils, channeled, 0 to 10 percent slopes	([1])	([1])	([1])	([1])	[2]25–85	1–4
CtE	Contra Costa clay loam, 30 to 65 percent slopes	60	85	30	95(1)	15	5
CuE2	Contra Costa clay loam, shallow, 30 to 65 percent slopes, eroded	40	85	30	80(3)	8	6
CsB	Contra Costa clay, shallow, 3 to 8 percent slopes	40	70	90	95(1)	24	4
CvE	Contra Costa-Millsholm clay loams, 30 to 65 percent slopes	55	85	30	95(1)	13	4
CwB	Corning gravelly loam, 2 to 8 percent slopes	45	80	90	81(2)	26	4
CwA	Corning gravelly loam, 0 to 2 percent slopes	45	80	100	77(10)	28	4
CwxB	Corning-Gullied land complex, 2 to 10 percent slopes	45	80	90	68(2)	22	4
CxC	Corning-Newville gravelly loams, 3 to 15 percent slopes	45	80	85	81(2)	25	4
CyC	Corning-Newville-Gullied land complex, 3 to 15 percent slopes	45	80	85	68(2)	21	4
CzB	Corning-Redding gravelly loams, 1 to 5 percent slopes	35	80	95	77(10)	20	4
Czt	Cortina very gravelly sandy loam, moderately deep	80	45	100	90(4)	32	4
Czr	Cortina very gravelly sandy loam	90	45	100	90(4)	37	4
Czs	Cortina very gravelly sandy loam, shallow	65	45	100	86(4)	25	5
Czh	Cortina gravelly fine sandy loam	90	70	100	90(4)	57	3
Czk	Cortina gravelly fine sandy loam, shallow	65	70	100	86(4)	39	4
Czg	Cortina gravelly loam, water table	90	70	100	57(4)	36	4
DuE	Dubakella stony loam, 30 to 50 percent slopes	50	60	50	63(2)	9	6
EcB	East Park gravelly clay, 2 to 10 percent slopes	80	50	90	70(1)	25	5
EaD	East Park clay, black variant, 10 to 30 percent slopes	80	60	75	45(4)	16	5
Er	Eroded land, alluvial material	([1])	([1])	([1])	([1])	[2]<5	6
EsE	Eroded land, shale material	([1])	([1])	([1])	([1])	[2]<5	6
GoF	Goulding rocky loam, 50 to 65 percent slopes	40	50	25	72(2)	4	6
GoE	Goulding rocky loam, 30 to 50 percent slopes	45	50	40	81(2)	7	6
Gp	Gravel pits	---	---	---	---	---	6
Gr	Gravelly alluvial land	([1])	([1])	([1])	([1])	[2]<10	6
HcE	Henneke stony clay loam, 30 to 65 percent slopes	35	60	35	60(2)	4	6
HcD	Henneke stony clay loam, 10 to 30 percent slopes	40	60	80	63(2)	12	5
HgA	Hillgate loam, 0 to 2 percent slopes	60	100	100	90(1)	54	3
HgB	Hillgate loam, 2 to 8 percent slopes	60	100	95	90(1)	51	3
HhB	Hillgate loam, moderately deep, 0 to 10 percent slopes	50	100	90	90(1)	41	3
Hl	Hillgate clay loam, 0 to 3 percent slopes	60	85	100	90(1)	46	3
HmA	Hillgate gravelly loam, 0 to 2 percent slopes	60	80	100	90(1)	43	3
Hn	Hillgate gravelly loam, water table, 0 to 2 percent slopes	60	80	100	54(4)	26	4
HmB	Hillgate gravelly loam, 2 to 8 percent slopes	60	80	90	90(1)	39	4
HgxB	Hillgate-Gullied land complex, 2 to 10 percent slopes	60	100	90	72(2)	39	3
HmxB	Hillgate-Gullied land complex, gravelly, 2 to 10 percent slopes	60	80	90	72(2)	31	4
HhxB	Hillgate-Gullied land complex, moderately deep, 2 to 10 percent slopes	50	100	90	72(2)	32	4
HoE	Hohmann rocky loam, 30 to 65 percent slopes	70	50	30	86(2)	9	6
HpD	Hohmann rocky loam, deep, 10 to 30 percent slopes	75	50	70	90(1)	24	4
HtE	Hugo loam, moderately deep, 30 to 50 percent slopes	70	90	40	95(1)	24	4
HtD	Hugo loam, moderately deep, 10 to 30 percent slopes	60	90	80	95(1)	41	3
HtF	Hugo loam, moderately deep, 50 to 65 percent slopes	70	90	25	90(2)	14	5
HrE	Hugo loam, 20 to 50 percent slopes	80	90	60	95(1)	41	3
HuE	Hulls gravelly loam, 30 to 50 percent slopes	60	70	40	90(12)	15	5
HuD	Hulls gravelly loam, 10 to 30 percent slopes	70	70	80	95(11)	37	4
HuF	Hulls gravelly loam, 50 to 65 percent slopes	50	70	25	90(12)	8	6
JaA	Jacinto fine sandy loam, 0 to 2 percent slopes	90	100	100	95(1)	85	1
JaB	Jacinto fine sandy loam, 2 to 8 percent slopes	90	100	90	95(1)	77	2
JgE	Josephine gravelly loam, 30 to 50 percent slopes	80	70	70	95(1)	21	4
JgD2	Josephine gravelly loam, 10 to 30 percent slopes, eroded	60	70	80	76(2)	25	4
JgE2	Josephine gravelly loam, 30 to 50 percent slopes, eroded	60	70	40	76(2)	13	5

See footnotes at end of table.

TABLE 5.—*Storie index rating for the soils*—Continued

Soil symbol	Soil	Storie index: Rating factors: A (Profile)	B (Texture)	C (Slope)	X (Other conditions)	Index rating	Soil grade
JmE	Josephine-Maymen gravelly loams, 30 to 50 percent slopes	60	70	40	90(2)	15	5
JsE	Josephine-Sheetiron gravelly loams, 30 to 50 percent slopes	70	70	40	95(1)	19	5
Kb	Kimball loam, 0 to 2 percent slopes	50	100	100	90(1)	45	3
KbB	Kimball loam, 2 to 10 percent slopes	50	100	90	90(1)	41	3
KmA	Kimball gravelly loam, 0 to 2 percent slopes	50	80	95	90(1)	34	4
KmB	Kimball gravelly loam, 2 to 10 percent slopes	50	80	85	90(1)	31	4
KnB	Kimball-Gullied land complex, 2 to 10 percent slopes	50	100	85	72(3)	31	4
La	Landlow clay	60	60	100	81(4)	29	4
Lc	Landlow clay loam	70	85	100	81(4)	48	3
LmD	Lodo-Gullied land complex, 10 to 30 percent slopes	20	70	75	76(3)	8	6
LmE	Lodo-Gullied land complex, 30 to 50 percent slopes	20	70	30	76(3)	3	6
LoD	Lodo-Millsap-Gullied land complex, 10 to 30 percent slopes	(1)	(1)	(1)	(1)	[2] 18	5
LoE	Lodo-Millsap-Gullied land complex, 30 to 65 percent slopes	(1)	(1)	(1)	(1)	[2] 9	6
LsD	Lodo-Tehama clay loams, 10 to 30 percent slopes	(1)	(1)	(1)	(1)	[2] 23	4
LsE	Lodo-Tehama clay loams, 30 to 50 percent slopes	(1)	(1)	(1)	(1)	[2] 16	5
LtD	Lodo-Tehama-Gullied land complex, 10 to 30 percent slopes	(1)	(1)	(1)	(1)	[2] 20	4
LtE	Lodo-Tehama-Gullied land complex, 30 to 50 percent slopes	(1)	(1)	(1)	(1)	[2] 13	5
LvE	Los Gatos gravelly loam, schist bedrock, 30 to 50 percent slopes	40	70	40	86(2)	10	5
LvD	Los Gatos gravelly loam, schist bedrock, 10 to 30 percent slopes	40	70	80	86(2)	19	5
LvF	Los Gatos gravelly loam, schist bedrock, 50 to 65 percent slopes	40	70	25	86(2)	6 0	6
LuE	Los Gatos gravelly loam, 30 to 50 percent slopes	40	70	40	86(2)	16	5
LuF	Los Gatos gravelly loam, 50 to 65 percent slopes	40	70	25	81(2)		6
LxE	Los Gatos-Josephine gravelly loams, 30 to 50 percent slopes	60	70	40	86(2)	14	5
LyE	Los Gatos-Parrish gravelly loams, 30 to 50 percent slopes	45	70	40	81(2)	10	5
MbA	Marvin silty clay loam, 0 to 2 percent slopes	85	90	100	86(4)	65	2
MbB	Marvin silty clay loam, 2 to 10 percent slopes	85	90	90	86(4)	58	3
Mba	Marvin silty clay loam, slightly saline-alkali, 0 to 1 percent slopes	85	90	100	56(6)	43	3
Mbb	Marvin silty clay loam, moderately saline-alkali, 0 to 1 percent slopes	85	90	100	38(6)	29	4
Ma	Marvin silty clay, 0 to 1 percent slopes	85	65	100	86(4)	47	3
Maa	Marvin silty clay, slightly saline-alkali, 0 to 1 percent slopes	85	65	100	56(6)	31	4
Mab	Marvin silty clay, moderately saline-alkali, 0 to 1 percent slopes	85	65	100	38(6)	21	4
MaoB	Marvin silty clay, overflow, 0 to 5 percent slopes	85	65	85	53(9)	25	4
McD	Masterson gravelly loam, 10 to 30 percent slopes	75	70	80	95(1)	40	3
McE	Masterson gravelly loam, 30 to 50 percent slopes	75	70	40	95(1)	20	4
MdD	Masterson gravelly loam, moderately deep, 10 to 30 percent slopes	60	70	80	76(2)	26	4
MdE	Masterson gravelly loam, moderately deep, 30 to 50 percent slopes	60	70	40	76(2)	13	5
MdmE	Maymen gravelly loam, schist bedrock, 30 to 65 percent slopes	20	70	30	72(2)	3	6
MdkE	Maymen gravelly loam, shallow over schist, 30 to 65 percent slopes	35	70	30	81(2)	6	6
MdgD	Maymen gravelly loam, 10 to 30 percent slopes	25	70	80	72(2)	10	5
MdgE	Maymen gravelly loam, 30 to 65 percent slopes	20	70	30	72(2)	3	6
MdoE	Maymen-Los Gatos gravelly loams, 30 to 65 percent slopes	35	70	30	81(2)	6	6
MdoD	Maymen-Los Gatos gravelly loams, 10 to 30 percent slopes	35	70	80	81(2)	16	5

See footnotes at end of table.

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TABLE 5.—*Storie index rating for the soils*—Continued

Soil symbol	Soil	Storie index: Rating factors: A (Profile)	B (Texture)	C (Slope)	X (Other conditions)	Index rating	Soil grade
MdpE	Maymen-Parrish gravelly loams, 30 to 65 percent slopes	35	70	30	72(2)	5	6
MdpD	Maymen-Parrish gravelly loams, 10 to 30 percent slopes	35	70	80	77(2)	15	5
Me	Maywood loam, shallow over gravel	80	100	100	54(9)	43	3
MfE	Millsap loam, 30 to 50 percent slopes	45	80	40	95(1)	14	5
MfF	Millsap loam, 50 to 65 percent slopes	45	80	25	90(2)	8	6
MnD	Millsholm clay loam, 10 to 30 percent slopes	40	85	80	95(1)	26	4
MnE	Millsholm clay loam, 30 to 50 percent slopes	45	85	30	95(1)	11	5
MnE2	Millsholm clay loam, 30 to 65 percent slopes, eroded	30	70	30	76(2)	5	6
MlD	Millsholm rocky loam, 10 to 30 percent slopes	40	70	80	95(1)	21	4
MlE	Millsholm rocky loam, 30 to 50 percent slopes	40	70	35	95(1)	9	6
MoD	Millsholm rocky clay loam, 10 to 30 percent slopes	40	75	80	95(1)	23	4
MoE	Millsholm rocky clay loam, 30 to 65 percent slopes	40	75	30	90(2)	8	6
MtD	Millsholm very rocky loam, 15 to 45 percent slopes	35	60	40	95(1)	8	6
MuE	Millsholm very rocky sandy loam, 30 to 65 percent slopes	45	50	30	90(2)	6	6
MrD	Millsholm rocky sandy loam, 10 to 30 percent slopes	45	60	80	95(1)	21	4
MrE	Millsholm rocky sandy loam, 30 to 50 percent slopes	45	55	30	90(2)	7	6
MrE2	Millsholm rocky sandy loam, 30 to 50 percent slopes, eroded	35	50	30	76(2)	4	6
MkF	Millsholm gravelly loam, schist bedrock, 50 to 65 percent slopes	40	70	25	90(2)	6	6
MkE	Millsholm gravelly loam, schist bedrock, 30 to 50 per- percent slopes	40	70	35	90(2)	9	6
MgF	Millsholm cherty loam, 50 to 65 percent slopes	40	60	25	90(2)	5	6
MhE	Millsholm gravelly loam, 30 to 50 percent slopes	40	70	35	90(2)	9	6
MhF	Millsholm gravelly loam, 50 to 65 percent slopes	40	70	25	90(2)	6	6
MvE	Millsholm soils, 30 to 50 percent slopes	45	70	40	95(1)	12	5
MwE2	Millsholm-Contra Costa clay loams, 30 to 50 percent slopes, eroded	40	80	30	81(2)	8	6
MxE	Millsholm-Contra Costa complex, 30 to 50 percent slopes	55	70	40	95(1)	15	5
MyE2	Millsholm-Lodo complex, 30 to 50 percent slopes, eroded	25	65	30	76(2)	4	6
MmD	Millsholm rocky loam-Gullied land complex, 15 to 30 percent slopes	40	70	75	76(2)	16	5
MmE	Millsholm rocky loam-Gullied land complex, 30 to 65 percent slopes	35	75	30	76(2)	6	6
MngD	Millsholm clay loam-Gullied land complex, 10 to 30 percent slopes	40	85	80	76(2)	21	4
MpE	Millsholm rocky clay loam-Gullied land complex, 15 to 50 percent slopes	35	75	30	76(2)	6	6
MsE	Millsholm-Gullied land complex, 30 to 50 percent slopes	45	50	30	81(2)	5	6
Mdw	Mixed alluvial land	(1)	(1)	(1)	(1)	[2] <10	6
Mz	Moda loam	35	100	95	90(1)	30	4
MznE	Montara clay, 20 to 50 percent slopes	40	60	60	76(2)	11	5
MzrA	Myers clay, 0 to 3 percent slopes	85	60	100	95(1)	48	3
MzrB	Myers clay, 3 to 10 percent slopes	85	60	90	95(1)	43	3
MzyA	Myers clay loam, 0 to 3 percent slopes	85	85	100	95(1)	69	2
MzyB	Myers clay loam, 3 to 8 percent slopes	85	85	95	95(1)	65	2
MzxB	Myers-Gullied land complex, 3 to 10 percent slopes	85	60	90	76(2)	35	4
NaD	Nacimiento clay, 15 to 30 percent slopes	90	70	75	100	47	3
NaC	Nacimiento clay, 3 to 15 percent slopes	90	70	85	100	54	3
NaE	Nacimiento clay, 30 to 50 percent slopes	90	70	40	100	25	4
NcD	Nacimiento soils, 10 to 30 percent slopes	60	80	75	100	36	4
NcE	Nacimiento soils, 30 to 50 percent slopes	60	80	40	100	19	5
NdD	Nacimiento-Gullied land complex, 15 to 30 percent slopes	90	70	75	85(3)	40	3
NdE	Nacimiento-Gullied land complex, 30 to 50 percent slopes	60	80	40	80(3)	15	5
NgD	Nacimiento-Altamont-Gullied land complex, 15 to 30 percent slopes	90	65	80	85(3)	40	3

See footnotes at end of table.

TABLE 5.—*Storie index rating for the soils*—Continued

Soil symbol	Soil	Storie index: Rating factors: A (Profile)	B (Texture)	C (Slope)	X (Other conditions)	Index rating	Soil grade
NkD	Nacimiento-Contra Costa-Gullied land complex, 15 to 30 percent slopes	70	80	75	85(3)	36	4
NkE	Nacimiento-Contra Costa-Gullied land complex, 30 to 50 percent slopes	70	80	40	80(2)	18	5
NfD	Nacimiento-Altamont association, 10 to 30 percent slopes	90	65	80	100	47	3
NhC	Nacimiento-Contra Costa association, 3 to 15 percent slopes	70	80	85	100	48	3
NhD	Nacimiento-Contra Costa association, 15 to 30 percent slopes	70	80	75	100	42	3
NhE	Nacimiento-Contra Costa association, 30 to 50 percent slopes	70	80	40	95(3)	21	4
NmE	Neuns cobbly loam, 30 to 50 percent slopes	60	60	40	86(2)	12	5
NmD	Neuns cobbly loam, 10 to 30 percent slopes	60	60	80	90(1)	26	4
NmF	Neuns cobbly loam, 50 to 65 percent slopes	60	60	25	81(2)	7	6
NnD	Neuns cobbly loam, deep, 10 to 30 percent slopes	75	60	80	90(1)	32	4
NnE	Neuns cobbly loam, deep, 30 to 50 percent slopes	75	60	40	86(2)	15	5
NoD	Neuns cobbly loam, shallow, 10 to 30 percent slopes	45	60	80	86(2)	18	5
NoE	Neuns cobbly loam, shallow, 30 to 50 percent slopes	45	60	40	81(2)	9	6
NvD	Newville gravelly loam, 15 to 30 percent slopes	50	80	70	90(1)	25	4
NvC	Newville gravelly loam, 3 to 15 percent slopes	50	80	85	90(1)	31	4
NvE	Newville gravelly loam, 30 to 50 percent slopes	50	80	40	90(1)	14	5
NvF2	Newville gravelly loam, 50 to 65 percent slopes, eroded	50	80	20	81(2)	6	6
NwD	Newville-Gullied land complex, 8 to 30 percent slopes	50	80	80	72(2)	23	23
NwE	Newville-Gullied land complex, 30 to 50 percent slopes	50	80	40	72(2)	12	12
NxE	Newville-Lodo-Gullied land complex, 30 to 50 percent slopes	30	80	40	72(2)	7	6
Oa	Orland loam	90	100	100	95(1)	85	1
Od	Orland loam, very deep	100	100	100	95(1)	95	1
Odp	Orland loam, deep over claypan	80	100	100	95(1)	76	2
Omp	Orland loam, moderately deep over claypan	70	100	100	90(1)	63	2
Omr	Orland loam, moderately deep over gravel	80	100	100	95(1)	76	2
Oms	Orland loam, moderately deep over gravelly loam	95	100	100	95(1)	90	1
Osg	Orland loam, shallow over gravel	65	100	100	90(7)	58	3
Osm	Orland loam, shallow over gravelly loam	90	100	100	95(1)	86	1
Owo	Orland loam, shallow over gravel, overflow	70	90	95	49(8)	29	4
Ox	Orland-Cortina complex	[1]	[1]	[1]	[1]	[2] 67	2
PaE	Parrish gravelly loam, 30 to 50 percent slopes	60	75	30	86(2)	12	5
PbE	Parrish gravelly loam, shallow, 30 to 50 percent slopes	45	75	40	86(2)	12	5
PbF	Parrish gravelly loam, shallow, 50 to 65 percent slopes	45	75	25	86(2)	7	6
PcD	Parrish-Gullied land complex, 10 to 30 percent slopes	45	75	80	77(2)	21	4
PcE	Parrish-Gullied land complex, 30 to 50 percent slopes	45	75	40	77(2)	10	5
PdD	Parrish-Yorkville-Gullied land complex, 10 to 30 percent slopes	60	80	80	77(2)	29	4
PdE	Parrish-Yorkville-Gullied land complex, 30 to 50 percent slopes	60	80	40	77(2)	15	5
PeA	Perkins gravelly loam, 0 to 3 percent slopes	85	75	100	90(1)	57	3
PeC	Perkins gravelly loam, 3 to 15 percent slopes	85	75	95	90(1)	54	3
Pf	Plaza silt loam	85	95	100	86(4)	69	2
Pfa	Plaza silt loam, slightly saline-alkali	85	95	100	56(6)	46	3
Pg	Plaza silty clay loam	85	90	100	86(4)	65	2
Pga	Plaza silty clay loam, slightly saline-alkali	85	90	100	56(6)	43	3
Ph	Plaza silt loam, dense subsoil	70	95	100	81(4)	54	3
Pha	Plaza silt loam, dense subsoil, slightly saline-alkali	70	95	100	56(6)	37	4
Pk	Plaza silty clay loam, dense subsoil	70	90	100	81(4)	51	3
Pka	Plaza silty clay loam, dense subsoil, slightly saline-alkali	70	90	100	56(6)	35	4
Pkb	Plaza silty clay loam, dense subsoil, moderately saline-alkali	70	90	100	38(6)	24	4
PmA	Pleasanton gravelly loam, 0 to 2 percent slopes	80	75	100	95(1)	57	3
PmB	Pleasanton gravelly loam, 2 to 10 percent slopes	80	75	90	95(1)	41	3
Pn	Pleasanton gravelly sandy clay loam, 0 to 2 percent slopes	80	65	100	95(1)	49	3

See footnotes at end of table.

TABLE 5.—*Storie index rating for the soils*—Continued

Soil symbol	Soil	Storie index: Rating factors: A (Profile)	B (Texture)	C (Slope)	X (Other conditions)	Index rating	Soil grade
Po	Pleasanton very gravelly sandy loam, 0 to 2 percent slopes	80	55	100	95(1)	42	3
PpE	Polebar loam, 30 to 50 percent slopes	70	80	40	90(1)	20	4
PrE	Polebar-Gullied land complex, 30 to 50 percent slopes	70	80	40	72(2)	16	5
PsE	Polebar-Millsholm-Gullied land complex, 30 to 50 percent slopes	55	75	40	72(2)	12	5
PtA	Porterville clay, 0 to 2 percent slopes	80	55	100	90(1)	40	3
PtB	Porterville clay, 2 to 10 percent slopes	80	55	95	90(1)	36	4
Rg	Redding gravelly loam, 0 to 3 percent slopes	30	80	95	76(10)	17	5
Rh	Riverwash	----	----	----	----	[2] <5	6
Rnc	Riz silty clay loam, strongly saline-alkali	70	90	100	14(6)	9	6
Rnb	Riz silty clay loam, moderately saline-alkali	70	90	100	35(6)	22	4
Rmb	Riz silt loam, moderately saline-alkali	70	100	100	35(6)	24	4
Rma	Riz silt loam, slightly saline-alkali	70	100	100	56(6)	39	4
Rlb	Riz gravelly loam, moderately saline-alkali	70	80	100	38(6)	21	4
RosF	Rock land, sedimentary rocks	[1]	[1]	[1]	[1]	[2] <5	6
RouF	Rock land, serpentine	[1]	[1]	[1]	[1]	[2] <5	6
RovF	Rock land, volcanic rocks	[1]	[1]	[1]	[1]	[2] <5	6
RpF	Rock outcrop	[1]	[1]	[1]	[1]	[2] <5	6
Sa	Sacramento clay	90	60	100	80(5)	43	3
SbE	Sehorn soils, 30 to 65 percent slopes	65	75	35	95(1)	16	5
SbC	Sehorn soils, 3 to 15 percent slopes	65	75	85	95(1)	38	4
SbD	Sehorn soils, 15 to 30 percent slopes	65	75	75	95(1)	34	4
ScD	Sehorn-Gullied land complex, 10 to 30 percent slopes	60	75	80	76(2)	28	4
ScE	Sehorn-Gullied land complex, 30 to 50 percent slopes	60	75	35	76(2)	12	5
SdE	Sehorn-Millsholm association, 30 to 65 percent slopes	50	80	35	95(1)	13	5
SdC	Sehorn-Millsholm association, 8 to 15 percent slopes	50	80	85	95(1)	32	4
SdD	Sehorn-Millsholm association, 15 to 30 percent slopes	50	80	75	95(1)	29	4
SeE	Sehorn-Millsholm-Gullied land complex, 30 to 65 percent slopes	50	80	35	76(2)	11	5
SeD	Sehorn-Millsholm-Gullied land complex, 15 to 30 percent slopes	50	80	75	76(2)	23	4
SfC	Shedd silty clay loam, 3 to 15 percent slopes	70	90	85	95(1)	52	3
SfD	Shedd silty clay loam, 15 to 30 percent slopes	70	90	75	95(1)	45	3
SfE	Shedd silty clay loam, 30 to 50 percent slopes	70	90	40	95(1)	24	4
SgD	Shedd-Altamont association, 10 to 30 percent slopes	75	80	80	95(1)	46	3
ShC	Shedd-Altamont-Gullied land complex, 8 to 15 percent slopes	75	80	85	81(2)	41	3
SkE	Sheetiron gravelly loam, 30 to 50 percent slopes	60	70	40	90(1)	15	5
SkD	Sheetiron gravelly loam, 10 to 30 percent slopes	60	70	80	90(1)	30	4
SkF	Sheetiron gravelly loam, 50 to 65 percent slopes	60	70	25	86(2)	9	6
SlD	Sheetiron gravelly loam, shallow, 10 to 30 percent slopes	45	70	80	90(1)	23	4
SlD2	Sheetiron gravelly loam, shallow, 10 to 30 percent slopes, eroded	40	70	80	77(2)	17	5
SlE	Sheetiron gravelly loam, shallow, 30 to 50 percent slopes	45	70	40	90(1)	11	5
SlE2	Sheetiron gravelly loam, shallow, 30 to 50 percent slopes, eroded	40	70	40	77(2)	9	6
SlF	Sheetiron gravelly loam, shallow, 50 to 65 percent slopes	45	70	25	86(2)	7	6
SlF2	Sheetiron gravelly loam, shallow, 50 to 65 percent slopes, eroded	40	70	25	72(2)	5	6
Sm	Stockton clay	70	60	100	80(5)	34	4
Sn	Stockton clay, moderately deep	60	60	100	80(5)	29	4
So	Stockton clay, very deep	80	60	100	85(5)	41	3
Sp	Stockton clay, deep, overflow	80	60	75	40(8)	14	5
Sr	Stockton clay, moderately deep, overflow	60	60	100	60(9)	22	4
Ss	Stockton clay, moderately deep, frequent overflow	60	60	75	40(8)	11	5
SuE	Stonyford gravelly clay loam, 20 to 50 percent slopes	45	70	40	86(2)	11	5
SuE2	Stonyford gravelly clay loam, 20 to 50 percent slopes, eroded	30	70	40	72(2)	6	6
SuF	Stonyford gravelly clay loam, 50 to 65 percent slopes	35	70	25	81(2)	5	6
SuF2	Stonyford gravelly clay loam, 50 to 65 percent slopes, eroded	30	70	25	72(2)	4	6

See footnotes at end of table.

TABLE 5.—*Storie index rating for the soils*—Continued

Soil symbol	Soil	Storie index: Rating factors: A (Profile)	B (Texture)	C (Slope)	X (Other conditions)	Index rating	Soil grade
StE	Stonyford clay, 30 to 65 percent slopes	50	80	25	86(2)	9	6
SvE	Stonyford-Henneke complex, 30 to 65 percent slopes	30	70	30	68(2)	4	6
Sw	Sunnyvale clay	85	70	100	60(5)	36	4
Sxa	Sunnyvale silty clay, slightly saline-alkali	85	70	100	45(6)	27	4
Sy	Sunnyvale silty clay loam	85	90	100	67(4)	51	3
Tm	Tehama silt loam, 0 to 3 percent slopes	80	95	100	95(1)	72	2
Tb	Tehama loam, deep to gravel, 0 to 3 percent slopes	80	90	100	86(4)	54	3
Ta	Tehama loam, moderately deep over gravel, 0 to 2 percent slopes	70	90	100	86(4)	54	3
TcA	Tehama clay loam, 0 to 2 percent slopes	80	85	100	95(1)	65	2
TcB	Tehama clay loam, 2 to 10 percent slopes	80	85	90	95(1)	58	3
Tf	Tehama fine sandy loam, 0 to 3 percent slopes	80	100	95	95(1)	72	2
Tg	Tehama gravelly loam, 0 to 3 percent slopes	80	75	100	95(1)	57	3
Th	Tehama gravelly loam, moderately deep over hardpan, 0 to 2 percent slopes	70	75	100	95(1)	50	3
Tk	Tehama gravelly fine sandy loam, moderately deep over gravel, 0 to 2 percent slopes	75	75	100	95(1)	53	3
Tn	Tehama silt loam, water table, 0 to 2 percent slopes	80	95	100	67(4)	51	3
ToB	Tehama-Gullied land complex, 2 to 10 percent slopes	80	85	90	76(2)	47	3
TpF	Terrace escarpments	(1)	(1)	(1)	(1)	[2] <5	6
TsC	Toomes extremely rocky silt loam, 5 to 30 percent slopes	40	50	80	95(1)	15	5
TrD	Toomes very rocky silt loam, 10 to 30 percent slopes	40	60	80	95(1)	18	5
TtE	Tyson gravelly loam, 30 to 50 percent slopes	50	70	40	76(2)	12	5
TvE2	Tyson gravelly loam, shallow, 30 to 50 percent slopes, eroded	35	70	40	72(2)	7	6
TvF2	Tyson gravelly loam, shallow, 50 to 65 percent slopes, eroded	35	70	25	72(2)	4	6
TuD	Tyson gravelly loam, deep, 10 to 30 percent slopes	75	70	80	72(4)	30	4
TuE	Tyson gravelly loam, deep, 30 to 50 percent slopes	75	70	40	72(4)	15	5
Wcb	Willows clay, moderately saline-alkali	85	60	100	35(6)	18	4
Wca	Willows clay, slightly saline-alkali	85	60	100	56(6)	29	4
Wcc	Willows clay, strongly saline-alkali	85	60	100	14(6)	7	6
Wda	Willows clay, dense subsoil, slightly saline-alkali	75	65	100	53(6)	25	4
Wdb	Willows clay, dense subsoil, moderately saline-alkali	75	65	100	35(6)	17	5
Wdc	Willows clay, dense subsoil, strongly saline-alkali	75	65	100	14(6)	7	6
Wd	Willows clay, dense subsoil	75	65	100	71(4)	35	4
Wn	Wyo silt loam	95	95	100	100	90	1
Wg	Wyo loam, deep over gravel	90	90	100	95(1)	77	2
Wh	Wyo gravelly loam, moderately deep over gravel	85	75	100	95(1)	61	2
Wm	Wyo gravelly clay loam	95	70	100	95(1)	63	2
Wo	Wyo silt loam, moderately deep over clay	80	95	100	80(5)	61	2
Wp	Wyo silt loam, deep over claypan	85	95	100	95(1)	77	2
Wsa	Wyo silt loam, slightly saline-alkali	95	95	100	75(6)	68	2
Wsw	Wyo silt loam, water table	95	95	100	70(5)	63	2
Yc	Yolo clay loam	100	85	100	100	85	1
Yd	Yolo clay loam, moderately deep over clay	90	85	100	90(5)	69	2
Yf	Yolo clay loam, deep over claypan	85	85	100	95(5)	69	2
Yg	Yolo clay loam, moderately deep over hardpan	50	85	100	90(5)	38	4
Yh	Yolo clay loam, shallow over clay	85	85	100	90(5)	65	2
Yma	Yolo clay loam, slightly saline-alkali	85	85	100	60(6)	43	3
Yo	Yolo silt loam, silty clay loam substratum	85	100	100	90(5)	76	2
YvE	Yorkville clay loam, 30 to 65 percent slopes	70	80	40	68(2)	15	5
ZbA	Zamora silty clay loam, 0 to 2 percent slopes	95	90	100	100	85	1
Za	Zamora silty clay, 0 to 2 percent slopes	95	65	100	100	62	2
ZbB	Zamora silty clay loam, 2 to 8 percent slopes	95	90	90	100	77	2
Zc	Zamora silty clay loam, deep over hardpan, 0 to 2 percent slopes	85	90	100	80(5)	61	2
Zd	Zamora silty clay loam, deep over silty clay, 0 to 2 percent slopes	90	90	100	85(5)	69	2
Zma	Zamora silty clay loam, slightly saline-alkali, 0 to 2 percent slopes	95	90	100	68(6)	58	3
Zmb	Zamora silty clay loam, moderately saline-alkali, 0 to 2 percent slopes	95	90	100	45(6)	38	4

[1] Variable. [2] Estimated.

Factor B, Texture of the surface soil.—Factor B is rated according to the texture of the surface soil, which affects the ease of tillage and the capacity of the soil to hold water. The moderately coarse and medium textures—fine sandy loam, loam, and silt loam—are the most desirable and are rated as 100 percent. The coarser and finer textures, such as sand and clay, are rated less than 100 percent.

Factor C, Slope.—Factor C is particularly important if the soil is irrigated. The amount of water that runs off a soil and its susceptibility to erosion are influenced by the slope of the soil. Smooth, nearly level or very gently sloping soils are rated 100 percent. The rating decreases as the slope increases.

Factor X, Other conditions.—Factor X is used to evaluate any limitations to use of the soil, such as poor drainage or a high water table, erosion, salts or alkali, low fertility, acidity, or unfavorable microrelief. If more than one limitation exists, the values of each are multiplied together to get the X factor. The index rating of a soil is obtained by multiplying the four factors A, B, C, and X; thus, any one factor may dominate or control the final rating. For example, a soil may have an excellent profile justifying a rating of 100 percent for factor A, excellent texture of the surface soil justifying 100 percent for factor B, a smooth, nearly level surface justifying 100 percent for factor C, but a high accumulation of salts or alkali that would give a rating of 20 percent for factor X. Multiplying these four ratings gives an index rating of 20 for this soil. The high accumulation of salts or alkali dominates, makes the soil unproductive for crops, and justifies the low index rating of 20.

Soils are placed in grades according to their suitability for agricultural use as shown by their Storie index ratings. The six grades and their range in index ratings are—

	Index rating
Grade 1	80 to 100
Grade 2	60 to 80
Grade 3	40 to 60
Grade 4	20 to 40
Grade 5	10 to 20
Grade 6	Less than 10

Soils of grade 1 have few or no limitations that restrict their use for crops. Soils of grade 2 are suitable for most crops, but they have minor limitations that narrow the choice of crops and have few special management needs. Grade 3 soils are suited to a few crops or to special crops and require careful management. Grade 4 soils are severely limited for crops. If used for crops, they require special management. Grade 5 soils generally are not suited to cultivated crops but can be used for pasture and range. Grade 6 consists of soils and land types that generally are not suited to farming.

Pasture and Range [5]

A third of the acreage in Glenn County, or 275,000 acres, is used chiefly for pasture and range. Generally from 110,000 to 185,000 sheep are grazed in the county, and from 15,000 to 25,000 beef cattle. Hogs and dairy cattle are also grazed to some extent.

The vegetation on the land used for pasture and range has been much modified by grazing, which has continued for more than 100 years. The kinds of plants in an area vary, and a plant considered valuable for grazing in one area may be undesirable in another place. Also the desirability of a plant may change during the season. Ripgut, for example, can be grazed when young but not when the plants are mature. On the other hand, rose clover is best grazed when mature and when dry. The grasses, forbs, shrubs, and trees in various grazed areas in the county are shown in the list that follows. The relative value for forage of the shrubs listed is shown in manual 33, 162 pp., "California Range Brushlands and Browse Plants," written by A. W. Sampson and B. S. Jesperson, University of California Agricultural Experiment Station, published in 1963.

ANNUAL GRASSES

Common name	*Scientific name*
Annual fescue	*Festuca* spp.
Cheatgrass	*Bromus tectorum*
Common wild oats	*Avena fatua*
Foxtail barley	*Hordeum leporinum* and *H. hystrix*
Italian ryegrass	*Lolium multiflorum*
Medusahead	*Elymus caput-medusae* spp. *asper*
Nitgrass	*Gastridium ventricosum*
Red brome	*Bromus rubens*
Ripgut	*Bromus rigidus*
Silver hairgrass	*Aira caryophyllea*
Slender wild oats	*Avena barbata*
Soft chess (Blando brome)	*Bromus mollis*
Spanish brome	*Bromus madritensis*

PERENNIAL GRASSES

Common name	*Scientific name*
California melic	*Melica californica*
Hardinggrass	*Phalaris tuberosa* var. *stenoptera*
Intermediate wheatgrass	*Agropyron intermedium*
Pine bluegrass	*Poa scabrella*
Purple stipa	*Stipa pulchra*
Tall fescue	*Festuca arundinacea*

FORBS

Common name	*Scientific name*
Blow-wives	*Achyrachaena mollis*
Bracken	*Pteridium aquilinum* var. *lanuginosum*
Broadleaf filaree	*Erodium botrys* and *E. obtusiplicatum*
Brodiaea	*Brodiaea* spp.
Burclover	*Medicago hispida*
Clover, annual	*Trifolium* spp.
Fiddleneck	*Amsinckia* spp.
Foothill plantain	*Plantago hookeriana* var. *californica*
Hedge parsley	*Torilis nodosa*
Lotus	*Lotus* spp.
Lupine, annual	*Lupinus* spp.
Micropus	*Micropus californicus*
Navarretia	*Navarretia* spp.
Popcornflower	*Plagiobothrys* spp.
Rattlesnakeweed	*Daucus pusillus*
Redstem filaree	*Erodium cicutarium*
Rose clover	*Trifolium hirtum*
Smooth cats-ear	*Hypochoeris glabra*
Soapplant	*Chlorogalum pomeridianum*
Subterranean clover	*Trifolium subterraneum*
Wild buckwheat	*Eriogonum* spp.
Yellow star-thistle	*Centaurea solstitialis*

[5] Written in cooperation with FREMONT L. BELL, range and livestock advisor, Glenn County Extension Service, and W. ROBERT POWELL, associate specialist in agronomy, University of California.

Shrubs

Common name	Scientific name
Bitter cherry	*Prunus emarginata*
Blue elderberry	*Sambucus cerulea*
Brewer oak	*Quercus garryana* var. *breweri*
California buckeye	*Aesculus californica*
California coffeeberry	*Rhamnus californica*
California scrub oak	*Quercus dumosa*
California wild grape	*Vitis californica*
California yerba santa	*Eriodictyon californicum*
Chamise	*Adenostoma fasciculatum*
Coast silktassel	*Garrya elliptica*
Common manzanita	*Arctostaphylos manzanita*
Curl-leaf mountain mahogany	*Cercocarpus ledifolius*
Deerbrush ceanothus	*Ceanothus integerrimus*
Dwarf mistletoe	*Arceuthobium campylopodum*
Eastwood manzanita	*Arctostaphylos glandulosa*
Gooseberry and currant	*Ribes* spp.
Greenleaf manzanita	*Arctostaphylos patula*
Hoary manzanita	*Arctostaphylos canescens*
Jepson ceanothus	*Ceanothus jepsonii*
Leather oak	*Quercus durata*
Mountain alder	*Alnus tenuifolia*
Mountain-mahogany	*Cercocarpus betuloides*
Mountain whitehorn	*Ceanothus cordulatus*
Pacific poison-oak	*Toxicodendron diversilobum*
Pine-mat manzanita	*Arctostaphylos nevadensis*
Redbud	*Cercis occidentalis*
Scrub canyon live oak	*Quercus chrysolepis* var. *nana*
Scrub interior live oak	*Quercus wislizeni* var. *frutescens*
Snowbrush	*Ceanothus velutinus*
Toyon	*Heteromeles arbutifolia*
Wedgeleaf ceanothus	*Ceanothus cuneatus*
Western choke-cherry	*Prunus virginiana* var. *demissa*
Whiteleaf manzanita	*Arctostaphylos viscida*
Willow	*Salix* spp.

Trees

Common name	Scientific name
Blue oak	*Quercus douglasii*
California black oak	*Quercus kelloggii*
California black walnut	*Juglans hindsii*
California red fir	*Abies magnifica*
Canyon live oak	*Quercus chrysolepis*
Digger pine	*Pinus sabiniana*
Douglas-fir	*Pseudotsuga menziesii*
Fremont cottonwood	*Populus fremontii*
Incense-cedar	*Libocedrus decurrens*
Interior live oak	*Quercus wislizenii*
Jeffrey pine	*Pinus jeffreyi*
Knobcone pine	*Pinus attenuata*
Madrone	*Arbutus menziesii*
Oregon white oak	*Quercus garryana*
Ponderosa pine	*Pinus ponderosa*
Sugar pine	*Pinus lambertiana*
Valley oak	*Quercus lobata*
White fir	*Abies concolor*

Two main grazing areas, or zones, are recognized in the county, the foothills and the mountains. The foothills area is in soil associations 6 through 11, and the mountains area in soil associations 3 through 5. These two main areas are discussed separately in the pages that follow.

Foothill Zone

Pasture and range in the foothills provide 5 or 6 months of green feed for livestock in the period of November 15 to May 15. The length of time the areas can be grazed depends on the amount and distribution of rainfall and on the temperature. Many ranchers depend on natural vegetation to supply year-round forage for the livestock and provide supplemental feed in summer and early fall when forage is low in protein. Other ranchers depend on pasture and range to provide for grazing in winter and spring. In summer they move the animals to the mountains or graze them on irrigated pasture in the valley in summer and in fall.

More than half the soils used for grazing have slopes of 30 percent or less and are at elevations below 1,000 feet. Most of these soils are suitable for cultivation, and many are dryfarmed to barley in rotation with pasture every third to fifth year.

The density and composition of the plants that make up the vegetation at a particular site vary from year to year because of slope and other characteristics of the soils, variations in weather and grazing use, and frequency of fire. A knowledge of the soils is therefore necessary in making decisions in grazing management. On many soils herbage can be increased by removing woody vegetation and thus reducing the competition for water and plant nutrients. Also, ponds (fig. 11) that provide water for livestock can be improved by careful placement of small earth dams, and grazing pressure can be regulated by crossfencing.

Vegetation in the foothills consists chiefly of Valley Grassland and of Oak Grassland plants, though minor areas have a cover of Chaparral. The Valley Grassland dominates the eastern half of the foothills, and Oak Grassland, the western half of the area. The Valley Grassland is an open, treeless plant community dominated by annual grasses and forbs. Many of the plants were introduced and are of Mediterranean origin. The Oak Grassland plant community is characterized by open and semidense stands of blue oak and grass that in a few areas have brush scattered under and between the trees. The Chaparral plant community consists chiefly of common manzanita, wedgeleaf ceanothus, California scrub oak, mountain-mahogany, chamise, and Digger pine.

Soils in the foothills vary greatly in texture, depth, and in content of gravel. The most productive are the Altamont, Ayar, Burris, Contra Costa, Nacimiento, Sehorn, and Shedd soils on hard sandstone, shale, soft siltstone, and basalt, and the associated Hillgate, Meyers, and Tehama soils on alluvium. These soils are moderately fine textured or fine textured and are moderately deep or deep. They are mostly in the southwestern part of the foothills, but they also occupy areas in the center of the foothills and northward to the county line.

On these productive foothill soils, the vegetation is mostly soft chess, common wild oats, burclover and other desirable grasses and forbs. Among the many other annual grasses and forbs are slender wild oats, medusahead, silver hairgrass, foxtail barley, Spanish brome, ripgut, clover, lupine, popcornflower, yellow star-thistle, blow-wives, and redstem filaree. California melic and purple stipa are among the few perennial grasses on these productive soils. In places the more shallow Contra Costa soils in the south-central part of the area have a semidense or dense cover of chaparral plants and blue oak.

Soils of intermediate grazing value occupy a long, narrow area extending from the north to the south in the middle and western parts of the foothills. Dominant here are the Millsholm soils and the shallow Contra Costa soils, but minor areas of Millsap soils on hard sandstone and shale are included. All of these soils are medium textured or moderately fine textured and are shallow. The vegetation is mostly of the Oak Grassland plant com-

Figure 11.—**Stock pond on Newville gravelly loam, 10 to 30 percent slopes, one of many ponds in the foothills for the storage of winter and spring runoff for use by livestock.**

munity, but it is of the Chaparral plant community in small areas. The dominant annual plants are soft chess, slender wild oats, fescue, broadleaf filaree, micropus, and redstem filaree. Other common plants are lotus, nitgrass, fiddleneck, rattlesnakeweed, hedge parsley, and pine bluegrass, as well as most plants that grow on the most productive foothill soils.

Dominant on high terraces in the northeastern part of the foothills are the Corning and Newville soils. These soils are gravelly, are shallow over a claypan, and are associated with the Arbuckle and Pleasanton soils. They have a cover of Valley Grassland plants in the eastern part of the area, and of Oak Grassland plants in the western part. Dominant annual plants are broadleaf filaree, annual fescue, foothill plantain, and smooth cats-ear, but other common plants are annual lupine, navarretia, brodiaea, Fitch spikeweed, and red brome.

The least productive soils in the foothills are the Lodo and Toomes soils. Lodo soils are on shale in a narrow area that extends from the north to the south in the western part of the foothills, and Toomes soils are on basalt that caps the Orland Buttes. These soils are medium textured and are very shallow. The vegetation on them is characteristically a thin cover of weedy annual grasses and forbs and a few perennial forbs, such as annual fescue, foothill plaintain, broadleaf filaree, soap-plant, and wild buckwheat. In a few places the cover on the Lodo soils is blue oak, Digger pine, and chaparral plants.

Use of commercial fertilizer on pasture is not common in this county, but greenhouse studies (table 6) and field trials indicate that grazing can be improved on practically all of the soils if suitable fertilizers are applied. All the soils respond to nitrogen; many to sulfur, phosphorus, or both; and some to molybdenum.

Results of fertility studies on Sehorn, Millsholm, and Newville soils were reported by Powell (*8*) in 1964. On the Sehorn soils unfertilized control plots had a plant cover that was 30 to 45 percent desirable grasses and desirable forbs and 40 to 60 percent weedy grasses and weedy forbs, and the yield from these plots was 1,600 to 2,000 pounds of oven-dry herbage per acre annually. On these plots that gave maximum response to fertilizer, however, 72 to 85 percent of the vegetation was desirable grasses and desirable forbs, only 12 to 20 percent was weedy grasses and weedy forbs, and the yield was 5,300 to 6,000 pounds of air-dry herbage annually.

The trials on the Sehorn soils indicate that nitrogen applied alone has no residual effect on yields of herbage 2 years after it is applied. If nitrogen is applied with sulfur, the residual effect of the nitrogen still does not extend beyond 2 years. Sulfur, in elemental form, is effective for 7 years after it is applied if burclover is a part of the forage. On plots where there was no burclover, application of sulfur did not increase yield, which remained as it was on the unfertilized control plots.

It is thought that the response of the Sehorn soils to fertilization is representative of the response that would be made if fertilizer were applied to soils of the Altamont, Ayar, Burris, Contra Costa, Nacimiento, Shedd, Hillgate, Meyers, and Tehama series.

TABLE 6.—*Response of pasture and range plants to specified elements on some soils used for grazing*

Soil series	Response to [1] —		
	Nitrogen	Phosphorus	Sulfur
Contra Costa	Strong	Weak	Weak.
Lodo	Strong	Mild	Mild.
Millsap	Strong	Weak	Weak.
Millsholm	Strong	None	None to strong.[2]
Newville	Strong	Weak	None.
Nacimiento	Strong	Mild	None.
Sehorn	Strong	Weak	None to strong.[2]

[1] *Strong* means statistically significant (0.05 level); *mild* means barely significant; *weak* means a response too small to be statistically significant; and *none* means no response.

[2] Indicates differences among the samples tested.

Millsholm soils in unfertilized control plots had 50 to 65 percent desirable grasses and desirable forbs and 25 to 40 percent weedy grasses and weedy forbs, and they yielded 1,200 to 1,600 pounds of oven-dry herbage per acre annually. In contrast, on those plots giving maximum response to fertilizer, the plant cover was 75 to 100 percent desirable grasses and desirable forbs, and only 10 to 20 percent weedy grasses and weedy forbs, and the yield was 4,500 to 5,000 pounds of air-dry herbage annually. It is thought that the Millsap soils would show a response to fertilization similar to that shown by the Millsholm soils.

Newville soils in unfertilized control plots had 40 to 65 percent desirable grasses and desirable forbs and 35 to 70 percent weedy grasses and weedy forbs, and they yielded 400 to 1,100 pounds of oven-dry herbage per acre annually. In contrast, those plots giving maximum response to fertilizer had 25 to 95 percent desirable grasses and desirable forbs and 17 to 45 percent weedy grasses and weedy forbs and produced as much as 2,500 to 5,500 pounds of herbage annually. It is probable that Corning, Arbuckle, and Pleasanton soils would respond to fertilization in about the same way as the Newville soils.

Details concerning amounts and kinds of amendments applied in making the foregoing tests may be learned by referring to Powell's study (*8*). The tests indicate, however, that fertilization not only improves yields but also palatability and protein content of the herbage. Other benefits are reduction of erosion hazard and lengthening of the grazing season. Nitrogen encourages growth of grasses during cold weather, the time when pasture is most needed.

The trials show that lack of response to phosphorus and sulfur frequently occurs because there is not an adequate legume in the plant cover. Where a suitable legume is lacking, seeding of subterranean clover, rose clover, or some similar legume is a means of getting improved yields through fertilization. Rose clover has been successfully introduced on Newville soils, and subterranean clover on most of the deep, fine-textured soils.

MOUNTAIN ZONE

In the mountains the chief soils used for grazing livestock are those of the Millsholm, Parrish, and Polebar series in soil association 5, though minor soils, those of the Hulls, Montara, Tyson, and Yorkville series, are in this association and provide some grazing. All of these soils are gravelly and are shallow to moderately deep over schist and partly metamorphosed sandstone and shale. The vegetation is chiefly oaks and grasses but includes various kinds of chaparral. The grasses and forbs are similar to those in the foothills. The areas provide grazing mainly in spring and early in summer, but areas at higher elevations can be grazed late in summer.

The Henneke and Stonyford soils in association 4 support an open to very dense cover of chaparral plants. Henneke soils, on serpentine, are shallow and gravelly, and Stonyford soils, on metamorphosed rock, are shallow to moderately deep and are gravelly. The chief plants on Henneke soils are leather oak, whiteleaf manzanita, and Jepson ceanothus, and those on the Stonyford soils are chamise and wedgeleaf ceanothus. The areas are used chiefly for watershed purposes and as habitats for deer. A small acreage of Stonyford soils has been cleared of brush to produce brush sprouts for deer and to improve fire control.

Soils of association 3, the Maymen-Los Gatos association, support a dense to very dense cover of chaparral. These soils are on schist and partly metamorphosed sandstone and shale and are gravelly. Maymen soils generally are shallow, but Los Gatos soils are moderately deep in some places. On the moderately deep Los Gatos soils on the more gentle ridges and slopes that face north, the U.S. Forest Service has converted more than 3,000 acres of dense brush to perennial grasses. The areas were seeded to such plants as hardinggrass, intermediate wheatgrass, tall fescue, and soft chess or annual ryegrass. These areas now support about six times the livestock that the average unimproved mountain grasslands can. In addition in areas converted to grass, the flow of springs and streams is increased and the hazards of fire and erosion are reduced.

Controlled burning of small areas covered with tall brush improves the browse by increasing production of brush sprouts. It also provides improved cover for deer and gives hunters better access through the areas.

The most desirable and abundant browse plants on the soils in this association are wedgeleaf ceanothus and chamise. Other desirable plants for this purpose are mountain-mahogany, hollyleaf redberry, and California scrub oak. Less desirable as browse plants but common to the area are poison-oak, California yerba santa, scrub interior live oak, California buckeye, California coffeeberry, redbud, and toyon.

Woodland

The chief wooded areas in Glenn County are coniferous forests on soils in the mountains in the western part of the county. The areas are at elevations of 2,000 to about 7,500 feet and cover about 103,000 acres, or more than 12 percent of the total county area. The forests provide timber chiefly for saw logs, but also for many other wood products. They also provide food for wildlife, and in addition serve as recreational areas for tourists and those living in the county.

In general, the forests are on broad, rounded ridges separated by steep, deep, V-shaped canyons. The forested slopes run in a northwesterly to northerly direction. More than three-fourths of the area is occupied by long side slopes with gradients of 30 to 50 percent. In the adjacent canyons slopes range from 50 to 70 percent, but on the crests of the ridges, slopes are rolling and are less than 30 percent. Areas in the canyons and on the ridges are about equal in acreage.

On the hot, dry slopes that face southwest, timber grows in a few narrow areas at elevations of 3,200 to 4,000 feet in canyons that have a dense cover of brush. On such slopes, however, most of the timber stands begin at elevations of about 4,000 feet and extend into higher areas. On the cooler, more moist slopes that face north and northeast, timber stands begin at an elevation of about 2,000 feet in small, narrow areas in the canyons. Most of the timber is at elevations between 4,500 and 6,500 feet, but some is on Black Butte at elevations ranging up to nearly 7,500 feet.

In the timbered areas the winters typically are wet. Summers are fairly dry, but occasional thunderstorms occur in July and August. The average annual rainfall ranges from 40 inches at the lower elevations to as much as 65 inches at the higher elevations. A few stands of timber are on the north sides of narrow, steep canyons where the rainfall is only 35 inches annually. In winter snow stays on areas at elevations above 5,000 feet. The temperature generally is moderate in summer in the forested areas, but on slopes that face south, it sometimes is more than 100° F. Winds generally are moderate, though in winter south to southwest winds sometimes blow at a speed of as much as 90 miles an hour and bring torrential downpours.

The stands of trees are open to dense. In about half of the stands, mature trees are dominant, but young trees also are present. The remaining stands consist of young trees, with about 3 percent of the areas unstocked. The stands generally consist of conifers and associated hardwoods and have an understory of shrubs, forbs, and grasses. The conifers are chiefly ponderosa pine, sugar pine, Douglas-fir, white fir, California red fir, and incense-cedar, but Jeffrey pine grows in some stands. The conifers generally grow in mixed stands, but there are a few stands that consist solely of ponderosa pine, or of white and California red firs, or of Douglas-fir. Associated hardwood trees are chiefly black oak, canyon live oak, interior live oak, and madrone, but Oregon white oak grows in some stands. The shrubs in the understory generally are low growing and are denser at the lower elevations than at the higher. Some of the dominant shrubs are hoary manzanita, snowbrush, deerbrush, and bitter cherry.

FOREST TYPES

The coniferous commercial forests in this county are grouped into types, according to the predominant tree or kinds of trees. The chief forest types in order of elevation from low to high are pine, pine and Douglas-fir, mixed conifers, and true firs. These are described in the paragraphs that follow.

The pine forest type occupies 8 percent of the timbered area in the county. It consists mainly of ponderosa pine, but sugar pine grows in places, and a few Jeffrey pines grow in some areas. Other plants commonly associated with the pine forest type are black oak, hoary manzanita, and incense-cedar. The pine forest type is mostly on the shallow Sheetiron soils on hot, dry slopes that face south. The trees grow in scattered, open stands and are a mixture of young and old trees. Elevations at which they grow range from 3,200 to 6,000 feet. Some pure stands of ponderosa pine are on the Dubakella, Hohmann, Hugo, and Josephine soils at the lower elevations. Jeffrey pine grows in two small areas of Dubakella soils, on serpentine rock, 2 miles southwest of St. John Mountain.

The pine and Douglas-fir forest type occupies about 53 percent of the area in trees. This forest type is on broad areas of the deeper Sheetiron soils, on slopes of 30 to 50 percent, and on small areas of the Josephine and Neuns soils. Most of the stands consist of mixtures of old and young trees. The stands are semidense; that is, the crowns of the trees form a canopy that covers 50 to 80 percent of each area. On slopes that face north, Douglas-fir is predominant, but pine generally predominates on slopes that face south. Sugar pine generally grows in all the stands. The amount of black oak and manzanita in the stands varies according to the elevation and the direction of the slope. Near the crests of the rounded ridges, trees of the pine and Douglas-fir type are intermixed with trees of the mixed-conifer type.

The mixed-conifer forest type covers about 29 percent of the forested area. It consists of stands of ponderosa pine, sugar pine, Douglas-fir, and white fir. In these stands no one kind of tree occupies more than 30 percent of the stand. Trees of the mixed-conifer type are on slopes of 30 to 50 percent that face north and northeast and are at elevations of 4,500 to 6,000 feet. The trees in the stands are mostly old or young, and the stands are semidense. The trees grow chiefly on the deeper Sheetiron soils and on a few areas of Neuns soils. The understory is sparse, but in places the openings between the trees in the less dense stands are occupied by a dense growth of conifer seedlings.

The true fir forest type occupies about 10 percent of the forested area in this county. This type consists of mixtures of white fir and California red fir. These trees grow in the extreme northwest corner of the county. More than half of the true fir forest type consists of old and young trees in dense and semidense stands, and the rest consists of dense stands of young trees. True firs grow on the deeper Masterson, Neuns, and Sheetiron soils, on slopes that face north and on rounded, gently sloping ridgetops. Elevations range from 4,500 to nearly 7,500 feet, but most of the stands are at an elevation of more than 6,000 feet. Pure stands of white fir and mixtures of white fir and California red fir grow at elevations between 6,000 and 6,500 feet. Pure stands of red fir are at elevations of more than 6,500 feet. At these elevations the soils are deeper, rainfall is higher, and slopes are gentler than at lower elevations. The true fir forest type generally has little or no understory. The forest floor is covered with a thick duff of twigs, branches, and needles, and in the small openings the growth of seedlings is moderate.

SUITABILITY OF THE SOILS FOR TIMBER

The soils in the county were mapped and the vegetation on them was studied by a State cooperative soil and vegetation survey, and the site class of the principal commercial conifers was determined. Table 7 lists the soils of the county used for timber, gives the site class for each, and shows the predominant commercial conifers in order of their abundance.

TABLE 7.—*Soils in Glenn County used for timber, their site class, and predominant commercial conifers*

Soil	Site class	Predominant commercial conifers
Dubakella stony loam, 30 to 50 percent slopes.	IV	Incense-cedar, Jeffrey pine, ponderosa pine.
Hohmann rocky loam, 30 to 65 percent slopes.	IV, III	Douglas-fir, sugar pine, ponderosa pine.
Hohmann rocky loam, deep, 10 to 30 percent slopes.	II	Sugar pine, ponderosa pine.
Hugo loam, 20 to 50 percent slopes.	I	Douglas-fir, sugar pine, ponderosa pine.
Hugo loam, moderately deep, 10 to 30 percent slopes.	III, II	Douglas-fir, ponderosa pine.
Hugo loam, moderately deep, 30 to 50 percent slopes.	III, II	Douglas-fir, incense-cedar, sugar pine, white fir, ponderosa pine.
Hugo loam, moderately deep, 50 to 65 percent slopes.	III, II	Douglas-fir, sugar pine, white fir, ponderosa pine.
Josephine gravelly loam, 30 to 50 percent slopes.	III, II	Douglas-fir, incense-cedar, sugar pine, ponderosa pine.
Masterson gravelly loam, 10 to 30 percent slopes.	II, III	Douglas-fir, red fir, sugar pine, white fir, ponderosa pine.
Masterson gravelly loam, 30 to 50 percent slopes.	III, II	Douglas-fir, red fir, sugar pine, white fir, ponderosa pine.
Masterson gravelly loam, moderately deep, 10 to 30 percent slopes.	III	Red fir, white fir, ponderosa pine.
Masterson gravelly loam, moderately deep, 30 to 50 percent slopes.	III	Red fir, white fir, ponderosa pine.
Neuns cobbly loam, 10 to 30 percent slopes.	II, III	Douglas-fir, red fir, sugar pine, white fir, ponderosa pine.
Neuns cobbly loam, 30 to 50 percent slopes.	III	Douglas-fir, incense-cedar, red fir, sugar pine, white fir, ponderosa pine.
Neuns cobbly loam, 50 to 65 percent slopes.	III	Douglas-fir, incense-cedar, sugar pine, white fir, ponderosa pine.
Neuns cobbly loam, deep, 10 to 30 percent slopes.	II, I	Douglas-fir, incense-cedar, sugar pine, white fir, ponderosa pine.
Neuns cobbly loam, deep, 30 to 50 percent slopes.	II, I	Douglas-fir, sugar pine, white fir, ponderosa pine.
Neuns cobbly loam, shallow, 10 to 30 percent slopes.	IV, III	Incense-cedar, red fir, sugar pine, white fir, ponderosa pine.
Neuns cobbly loam, shallow, 30 to 50 percent slopes.	IV, III	Red fir, sugar pine, white fir, ponderosa pine.
Sheetiron gravelly loam, 10 to 30 percent slopes.	II, III	Douglas-fir, incense-cedar, red fir, sugar pine, white fir, ponderosa pine.
Sheetiron gravelly loam, 30 to 50 percent slopes.	II, III	Douglas-fir, incense-cedar, red fir, sugar pine, white fir, ponderosa pine.
Sheetiron gravelly loam, 50 to 65 percent slopes.	III	Douglas-fir, incense-cedar, red fir, sugar pine, white fir, ponderosa pine.
Sheetiron gravelly loam, shallow, 10 to 30 percent slopes.	IV, III	Douglas-fir, red fir, sugar pine, white fir, ponderosa pine.
Sheetiron gravelly loam, shallow, 10 to 30 percent slopes, eroded.	IV, III	Douglas-fir, red fir, sugar pine, white fir, ponderosa pine.
Sheetiron gravelly loam, shallow, 30 to 50 percent slopes.	IV, III	Douglas-fir, incense-cedar, red pine, white fir, ponderosa pine.
Sheetiron gravelly loam, shallow, 30 to 50 percent slopes, eroded.	IV	Douglas-fir, incense-cedar, red fir, sugar pine, white fir, ponderosa pine.
Sheetiron gravelly loam, shallow, 50 to 65 percent slopes.	IV, III	Douglas-fir, incense-cedar, red fir, sugar pine, white fir, ponderosa pine.
Sheetiron gravelly loam, shallow, 50 to 65 percent slopes, eroded.	IV	Douglas-fir, incense-cedar, sugar pine, white fir, ponderosa pine.

The site classes in table 7 indicate the suitability of the soils for timber. They are based on site index, which is based on the height of the dominant or codominant trees in the stand at specified years of age. More than 300 trees, on deep soils and on shallow soils, were measured to obtain data needed to establish indexes. The measurements show the effect of soil depth on height and growth rate. Growth on shallow soils slowed appreciably at about 200 years and did not continue beyond 290 years. On the deeper soils growth in height continued rapidly, even past the age of 300 years.

The site classes are based on Dunning's tree curves (*5*) (see table 8). For example, Dubakella stony loam, 30 to 50 percent slopes, is shown in site class IV in table 7. Reference to table 8 shows that areas with a site class of IV have a site index of 100, or that at an age of 300 years, the trees are 100 feet tall.

TABLE 8.—*Site class, height of dominant trees, class interval, and rating*

Site class	Site index at 300 years	Class interval	Rating
	Feet	*Feet*	
V	75	62. 5– 82. 5	Very low.
IV	100	82. 5–112. 5	Low.
III	125	112. 5–137. 5	Medium.
II	150	137. 5–162. 5	Moderately high.
I	175	162. 5–187. 5	High.

[1] Height of dominant trees at age of 300 years.

About 42 percent of the commercial forests in the county are on sites of medium quality, and about 47 percent are on sites of moderately high quality. Of the rest, about 6 percent are on sites of high quality, and about 5 percent are on sites of low quality. Sites of very low quality were not considered as a source of commercial trees. Rate of tree growth at such sites is slow, and the stands are sparse.

The net volume of timber stands in board feet per acre depends on the age, class, density, and site quality of the particular stand. Net volume ranges from 45,000 to 55,000 board feet an acre, in dense and semidense stands of old and young mixed conifers, to only about 2,000 to 3,000 board feet, in open stands of young trees. Next highest in volume are open stands of old and young ponderosa pine and open stands of mixed young and old Douglas-fir. The volume of incense-cedar is small except in open stands of mixed young and old trees. Incense-cedar generally grows on sites of low quality at low elevations. After logging, incense-cedar comes in rapidly and competes with the more desirable conifers.

True firs generally have the highest volume per acre and are the most productive commercial trees. Ponderosa pines are second. The true fir forest type occupies only 10,000 acres of the area in forest, but the trees are abundant in the mixed conifer type, which occupies 30,000 acres. Ponderosa pine is predominant in the pure pine forest type and also is common in the pine and Douglas-fir and mixed-conifer types.

Most of the soils that make up the acreage in commercial forests in Glenn County are moderately coarse textured. Sheetiron soils make up 85 percent of the acreage, and of the rest, 7 percent is Neuns soils, 4 percent is Hugo soils, 2 percent is Masterson soils, 1 percent is Josephine soils, and another 1 percent consists of Hohmann and Dubakella soils.

Sheetiron soils, on metamorphic rock, are at elevations of 3,000 feet on north slopes and range up to elevations of 6,000 feet near Black Butte. Neuns soils, on metabasic igneous rock, are at elevations of 3,500 to 7,000 feet near St. John Mountain and Black Butte. Hugo soils, on sandstone (graywacke) of the Franciscan formation, occupy two separate areas at moderate elevations. Masterson soils, on schistose metasedimentary rock, are near the Sheetiron but are on more gentle slopes at elevations of 5,500 to 6,800 feet. Josephine soils are mostly on ridgetops in small areas at lower elevations adjacent to areas under chaparral. They are reddish brown, and their subsoil is more clayey than that in any of the other forest soils. Josephine soils also erode more readily than other forest soils if disturbed, and gullies form quickly in them.

The quality of a site for trees is closely correlated with soil depth, and depth to bedrock is closely correlated with slope and the direction the slope faces. Most soils between 2 and 3 feet deep are at moderate elevations on steep slopes that face north and northeast, and these soils make up more than half of the forested area. Soils between 1 and 2 feet deep are mostly on steep slopes that face south and southwest or are in very steep canyons. They cover about a third of the forested area. Soils between 3 and 4 feet deep are on gentle slopes that face north and in some canyons. These soils make up about one-seventh of the area. Soils that are more than 4 feet deep occupy only about 500 acres and are of the Josephine, Hohmann, and Hugo series. Soils that are less than 1 foot deep are mostly on ridge spurs at lower elevations. They are in the Sheetiron series and occupy 350 acres.

Trees on some of the soils are affected by windfall. Windfall generally occurs on soils that are shallow to parent rock, have a claypan or other restrictive layer, or have a high water table. In such soils the roots of trees characteristically spread out near the surface. Trees in exposed areas on ridgetops and in the lower parts of steep, narrow canyons, which act as a wind funnel during storms when the velocity of the wind is high, are particularly susceptible to windthrow. They are especially susceptible in such areas when the soil is wet. Trees growing in shallow Sheetiron soils and in the Josephine soil are particularly susceptible to windthrow. On these soils thinning and release cutting that would leave only a few trees on each are not feasible.

Engineering Uses of the Soils

Some of the properties of soils important to engineering are described in this section. The information can be used by engineers along with other information in the survey to—

1. Make studies of soil and land use that will aid in selecting and developing sites for industrial, commercial, residential, and recreational uses.
2. Make estimates of the soil properties of soils for use in planning agricultural drainage systems, farm ponds, irrigation systems, dikes, waterways, and other structures for conserving soil and water.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, cables, and sewage disposal fields and in planning detailed survey of the soils at the selected locations.
4. Locate probable sources of sand, gravel, and other material for use in construction.
5. Correlate performance of engineering structures with the soil mapping units and thus develop information for overall planning that will be useful in designing and maintaining the structures.

6. Determine the suitability of the soils for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps, reports, and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Used with the soil map to identify the soils, the engineering interpretations in this section can be useful for many purposes. It should be emphasized, however, that the interpretations do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or where the excavations are deeper than the depths of layers here reported. Nevertheless, even in such situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that can be expected.

Some of the information useful for engineering can be obtained from the soil map. For more information about the soils, however, it is necessary to refer to other parts of the survey, particularly to the sections "Descriptions of the Soils" and "Formation and Classification of Soils." By using the information in the soil survey, the soils engineer can concentrate on the most suitable soils for engineering purposes. Then a minimum number of soil samples will be needed for laboratory testing and an adequate investigation can be made at minimum cost.

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some words, for example, soil, clay, silt, and sand, may have special meanings in soil science. These and other special terms that are used are defined in the Glossary at the back of the survey.

Engineering classification systems

Agricultural scientists of the United States Department of Agriculture classify soils according to texture. In some ways this system of naming textural classes is comparable to the two systems used by engineers for classifying soils, that is, the system of the American Association of State Highway Officials (AASHO) and the Unified system. Following is a description of the classification systems used by engineers.

Most highway engineers classify soils in accordance with the classification developed by the American Association of State Highway Officials (AASHO) (*1*). In this system soil materials are classified in seven principal groups. The groups range from A–1 (gravelly soils of high bearing capacity, the best soils for subgrade) to A–7 (clay soils having low strength when wet, the poorest soils for subgrade). The estimated AASHO classification for all the soils of the county is given in table 9.

Some engineers prefer to use the Unified soil classification system (*18*). In this system soil materials are identified as coarse grained, eight classes; fine grained, six classes; and highly organic. In the Unified system, the symbols SM and SC represent sand with fines of silt and clay; ML and CL, silt and clay of low liquid limit; and GP and GM, gravel and mixtures of gravel and sand. Some soil materials have characteristics that are borderline between the major classes and are given a borderline classification, such as CL–CH. The estimated classification for all the soils in the county, according to the Unified system, is given in table 9.

Engineering descriptions of the soils

Table 9 lists the soil series and land types and the map symbols for each mapping unit and gives estimates of some properties significant to engineering. It also gives the textural classification of the U.S. Department of Agriculture, estimates of the Unified classifications, and estimates of the classification used by the American Association of State Highway Officials. In addition estimates of the grain-size distribution, permeability, available water capacity, reaction, and shrink-swell potential are given. The estimates are based partly on examination made in the field and partly on information obtained in other parts of the survey. Since the estimates are only for typical soils, considerable variation from these values should be anticipated. More information on the range of properties of the soils can be obtained from the sections "Descriptions of the Soils" and "Descriptions of Soil Profiles."

Permeability of the soil, in inches per hour, gives an estimate of the rate at which water moves downward through the undisturbed soil.

Available water capacity, given in inches per inch of soil depth, refers to the approximate amount of capillary water in the soil when the soil is wet to field capacity. When the soil is air dry, this same amount of water will wet the soil to a depth of 1 inch without deeper percolation. The estimates are based on values suggested by Shockley (*9*).

Reaction gives the intensity of the acidity or alkalinity of the soil, expressed in pH value. A notation of pH 7.0 is neutral. A lower value indicates acidity and a higher value indicates alkalinity. Some soils are variously affected by excess amounts of salt and alkali. The term slightly, moderately, or strongly saline-alkali in a soil name shows that from 5 to 20 percent, 20 to 50 percent, or more than 50 percent of the area is affected by slight to strong concentrations of salt and alkali. The soil series in Glenn County thus affected are the Castro, Marvin, Plaza, Riz, Sunnyvale, Willows, Wyo, Yolo, and Zamora.

The shrink-well potential is an indication of the volume change to be expected of the soil material with the change in moisture content. It is estimated on the basis of the amount and type of clay in the soil layers. In general soils classified as A–7 and CH have high shrink-swell potential. Clean sands and gravels and those having a small amount of nonplastic to slightly plastic fines have low shrink-swell potential, as does most other nonplastic to slightly plastic soil material.

Engineering interpretations

Table 10 rates the soils according to their suitability as a source of topsoil, sand, gravel, and road fill. It also gives soil features that affect the suitability of the soils as sites for highways and for agricultural engineering. Limitations to use as filter fields for septic tanks are also shown, and then the hydrologic soil group is given.

TABLE 9.—*Estimated properties*

[Dashes indicate information was not available or

Soil series, land type, and map symbol	Depth from surface	Classification	
		USDA texture	Unified
	Inches		
Altamont:			
Clay (AaA, AaC, AaD, AaE, AcD, AcE, AdC, AdD, AdE, AfD, AfsD, AfE, AfsE, AgE, AhC, AhD, AhE, AkE3, AmC, AnC). (For properties of Contra Costa soils in mapping units AhC, AhD, and AhE, refer to Contra Costa clay loam in this table; for properties of Millsholm soils in AkE3, for Nacimiento in AmC, and for Shedd in AnC, refer to those series, respectively, in this table.)	0–30 30	Clay Siltstone or mudstone and shale	CH ----
Gravelly clay (AbC).	0–43 43	Gravelly clay Siltstone	CH ----
Arbuckle (AoA, AoB, AoxA, Ap, Ar, As).	0–21 21–60 60	Gravelly loam Gravelly clay loam Very gravelly loam	SM or SC SM or SC GM or GC
Artois:			
Loam (At, Au).	0–18 18–60	Loam Clay	CL CH
Gravelly loam (Av, Aw).	0–17 17–60	Gravelly loam Clay	CL CH
Ayar (AxC, AyD). (For properties of Nacimiento soil in mapping unit AyD, refer to Nacimiento series in this table.)	0–32 32	Clay Caliche and interstratified clay	CH ----
Burris:			
Clay (BcB).	0–60	Clay	CH
Bouldery or cobbly clay (BuD, ByC).	0–46	Bouldery or cobbly clay	CH
Capay (CaA, CaB).	0–60	Clay underlain by clay loam at a depth below 45 inches.	CH
Castro (Cb, Cba, Cbb).	0–32 32–42 42–60	Clay Caliche, strongly cemented Loam	CH ---- ML or CL
Clear Lake (Cc).	0–29 29–52	Clay Gravelly clay	CH CH
Colluvial land (CdsF, CduF, CdvF).[1]			
Columbia:			
Fine sandy loam (CeA, CeB, CrB).	0–60	Fine sandy loam	SM
Silt loam (ChA, ChB, CpB).	0–60	Silt loam that is stratified with sand at a depth below 12 inches.	ML or CL
Loamy fine sand, coarse variant (CgA, CgB).	0–60	Loamy fine sand	SM
Fine sandy loam, moderately deep over sand and gravel (Cf).	0–30 30	Fine sandy loam Gravel and sand	SM GP or GW
Silt loam, moderately deep over gravel (Cm).	0–30 30	Silt loam Gravel and sand	ML or CL GP or GW
Silt loam, moderately deep over clay loam (Ck, Cl, Cn, Co).	0–30 30–60	Silt loam Clay loam and clay	ML or CL CL or CH

See footnote at end of table.

of the soils of Glenn County, Calif.

was not obtained; <=less than; >=more than]

Classification—Con.	Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4	No. 10	No. 200				
				Inches per hour	*Inches per inch of soil*	*pH*	
A-7	95–100	95–100	90–95	0.05–0.20	0.14–0.17	6.1–7.8	High.
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A-7	80–90	75–85	60–75	0.05–0.20	0.12–0.14	6.1–7.8	High.
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A-4	65–85	60–80	35–45	0.8–2.50	0.10–0.13	5.6–6.0	Low.
A-4	65–85	60–80	40–50	0.20–0.80	0.12–0.15	5.6–6.0	Moderate.
A-2	25–60	20–50	15–25	5.0–10.0	0.04–0.07	5.6–7.3	Low.
A-6	----	95–100	70–80	0.8–2.50	0.13–0.15	6.0–6.5	Moderate.
A-7	----	95–100	90–95	0.05–0.20	0.14–0.17	6.5–7.3	High.
A-6	80–90	75–85	55–65	0.8–2.50	0.12–0.14	6.0–6.5	Moderate.
A-7	90–95	80–90	70–80	0.05–0.20	0.14–0.17	6.5–7.3	High.
A-7	95–100	95–100	75–85	0.05–0.20	0.16–0.18	7.4–7.8	High.
----	----	----	----	<0.05	----	7.9–8.4	
A-7	95–100	95–100	85–95	0.05–0.20	0.15–0.17	6.1–7.8	High.
A-7	55–80	55–75	50–70	0.05–0.20	0.10–0.14	6.1–7.8	High.
A-7	95–100	95–100	85–95	0.05–0.20	0.15–0.19	6.1–8.4	High.
A-7	100	100	85–95	0.05–0.20	0.16–0.18	7.4–8.4	High.
----	----	----	----	----	----	----	
A-4	100	100	55–65	0.20–0.80	0.16–0.18	7.4–7.8	Moderate.
A-7	90–95	90–95	85–90	0.05–0.20	0.16–0.18	6.1–7.3	High.
A-7	85–95	80–90	60–70	<0.05	0.16–0.18	7.4–7.8	High.
A-4	100	95–100	35–50	2.5–5.0	0.11–0.14	6.6–7.3	Low.
A-4	100	95–100	70–90	0.80–2.5	0.15–0.17	6.6–7.3	Low to moderate.
A-2	100	95–100	15–25	2.5–5.0	0.08–0.11	6.6–7.5	Low.
A-4	100	95–100	35–50	2.5–5.0	0.11–0.14	6.6–7.3	Low.
A-1	30–60	20–50	0–10	>10.0	0.04–0.06	6.6–7.3	Low.
A-4	100	95–100	70–90	0.8–2.5	0.15–0.17	6.6–7.3	Low to moderate.
A-1	30–60	20–50	0–10	>10.0	0.04–0.06	6.6–7.3	Low.
A-4	100	95–100	70–90	0.8–2.5	0.15–0.17	6.6–7.3	Low to moderate.
A-6 or A-7	100	95–100	85–95	0.20–0.80	0.15–0.19	6.6–7.3	Moderate to high.

TABLE 9.—*Estimated properties of the*

Soil series, land type, and map symbol	Depth from surface	Classification: USDA texture	Classification: Unified
	Inches		
Contra Costa: Clay, shallow (CsB).	0–18	Light clay	CH
	18	Sandstone and shale bedrock	
Clay loam (CtE, CuE2, CvE). (For properties of Millsholm soil in mapping unit CvE, refer to Millsholm gravelly loam, schist bedrock, in this table.)	0–21	Clay loam in the uppermost 5 inches but clay below.	CH
	21–34	Shaly clay	CH
	34	Sandstone and shale bedrock	
Corning (CwA, CwB, CwxB, CxC, CyC, CzB). (For properties of Newville soils in mapping units CxC and CyC and for Redding soil in mapping unit CzB, refer to Newville and Redding series, respectively, in this table.)	0–14	Gravelly loam	SM
	14–40	Clay	CH
	40–60	Very gravelly sandy clay loam	GM or GC
Cortina (Czg, Czh, Czk, Czr, Czs, Czt).	0–32	Very gravelly sandy loam	GP or GM
	32–60	Gravel and sand	GP
Dubakella (DuE).	0–18	Gravelly loam and gravelly clay loam.	GC or SC
	18	Serpentine rock	
East Park, black variant (EaD).	0–45	Clay	CH
	45	Serpentine rock	
East Park (EcB).	0–20	Gravelly clay	CH
	20–60	Very gravelly sandy clay	GC or SC
Eroded land (Er, EsE).[1]			
Goulding (GoE, GoF).	0–16	Very gravelly loam	GM or SM
	16	Greenstone bedrock	
Gravel pits (Gp).[1]			
Gravelly alluvial land (Gr).[1]			
Henneke (HcD, HcE).	0–22	Gravelly and very gravelly clay loam.	GC or SC
	22	Serpentine bedrock	
Hillgate (HgA, HgB, HgxB, HhB, HhxB, Hl, HmA, HmB, HmxB, Hn).	0–15	Loam	ML or CL
	15–54	Clay	CH
Hohmann (HoE, HpD).	0–29	Gravelly clay loam	GC or SC
	29	Basic volcanic bedrock	
Hugo (HrE, HtD, HtE, HtF).	0–13	Loam	ML or CL
	13–29	Gravelly heavy loam	ML or CL
	29	Sandstone and shale bedrock	
Hulls (HuD, HuE, HuF).	0–35	Gravelly loam	SM
	35	Mica schist bedrock	
Jacinto (JaA, JaB).	0–60	Fine sandy loam and heavy fine sandy loam.	SM
Josephine (JgD2, JgE, JgE2, JmE, JsE). (For properties of Maymen soil in mapping unit JmE and for Sheetiron soil in mapping unit JsE, refer to Maymen and Sheetiron series, respectively, in this table.)	0–11	Gravelly heavy loam	GC or SC
	11–46	Gravelly clay	GC or SC
	46	Schist bedrock	

See footnote at end of table.

soils of Glenn County, Calif.—Continued

Classification—Con.	Percentage passing sieve—			Perme-ability	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4	No. 10	No. 200				
				Inches per hour	*Inches per inch of soil*	*pH*	
A-7	95–100	95–100	90–95	0. 05–0. 20	0. 14–0. 17	6. 1–7. 3	High.
A-7	95–100	95–100	90–95	0. 05–0. 20	0. 14–0. 16	6. 1–7. 3	High.
A-7	80–90	75–85	60–75	0. 05–0. 20	0. 13–0. 15	6. 1–7. 3	High.
A-4 or A-6	75–85	70–80	40–50	0. 8–2. 5	0. 12–0. 15	5. 6–6. 0	Low.
A-7	85–95	80–90	65–75	<0. 05	0. 14–0. 17	5. 6–6. 5	High.
A-1	25–35	20–30	5–15	0. 20–0. 80	0. 07–0. 10	5. 6–6. 0	Low.
A-1	40–55	35–50	5–15	>10. 0	0. 4–0. 6	5. 6–6. 5	Low.
A-1	10–15	5–10	0–5	>10. 0	0. 4–0. 06	6. 6–7. 3	Low.
A-4	65–80	60–75	40–50	0. 80–2. 5	0. 12–0. 15	6. 6–7. 3	Low to moderate.
A-7	90–100	95–100	85–95	0. 05–0. 20	0. 14–0. 17	7. 4–8. 4	High.
A-7	80–85	75–80	65–75	0. 05–0. 20	0. 10–0. 12	6. 6–7. 3	High.
A-2 or A-4	40–60	30–50	25–40	0. 05–0. 20	0. 08–0. 10	7. 4–7. 8	Low to moderate.
A-2	45–55	40–50	20–25	0. 8–2. 50	0. 04–0. 07	6. 6–7. 3	Low.
A-2 or A-4	40–70	35–65	25–45	0. 05–0. 20	0. 04–0. 10	6. 6–7. 3	Low to moderate.
A-4 or A-6	95–100	95–100	70–80	0. 8–2. 50	0. 14–0. 17	5. 5–6. 0	Moderate.
A-7	95–100	95–100	80–90	>0. 05	0. 14–0. 17	5. 5–7. 3	High.
A-4	65–70	60–70	35–45	0. 20–0. 80	0. 10–0. 14	6. 0–6. 5	Moderate.
A-4	90–95	85–95	60–70	0. 8–2. 50	0. 14–0. 17	5. 6–6. 5	Low to moderate.
A-4	75–90	70–85	50–60	0. 8–2. 50	0. 10–0. 14	5. 6–6. 5	Moderate.
A-4	60–85	55–80	35–50	0. 8–2. 5	0. 10–0. 14	5. 5–6. 0	Low to moderate.
A-4	95–100	95–100	40–50	2. 5–5. 0	0. 13–0. 16	6. 1–7. 8	Low.
A-4	65–75	60–70	35–45	0. 8–2. 5	0. 11–0. 14	5. 6–6. 5	Moderate.
A-4	55–65	50–60	35–45	0. 8–2. 5	0. 11–0. 14	5. 1–6. 0	Moderate.

TABLE 9.—*Estimated properties of the*

Soil series, land type, and map symbol	Depth from surface	Classification	
		USDA texture	Unified
	Inches		
Kimball:			
Loam (Kb, KbB, KnB).	0–16	Loam	ML or CL
	16–27	Clay	CH
	27–60	Clay loam	CL
Gravelly loam (KmA, KmB).	0–16	Gravelly loam	SM or SC
	16–27	Gravelly clay	CH or CL
	27–60	Gravelly clay loam	SM or SC
Landlow (La, Lc).	0–35	Clay	CH
	35	Hardpan	
Lodo (LmD, LmE, LoD, LoE, LsD, LsE, LtD, LtE). (For properties of Millsap soils in mapping units LoD and LoE and for Tehama soils in mapping units LsD through LtE, refer to Millsap and Tehama series, respectively, in this table.)	0–7	Shaly clay loam	CL
	7	Shale bedrock	
Los Gatos (LuE, LuF, LvD, LvE, LvF, LxE, LyE). (For properties of Josephine soil in mapping unit LxE and for Parrish soil in mapping unit LyE, refer to Josephine and Parrish series, respectively, in this table.)	0–22	Gravelly loam and light clay loam.	GC or SC
	22	Bedrock	
Marvin (Ma, Maa, Mab, MaoB, MbA, MbB, Mba, Mbb).	0–60	Silty clay loam and silty clay	CH or CL
Masterson (McD, McE, MdD, MdE).	0–35	Gravelly loam	GC or SC
	35	Schist bedrock	
Maymen (MdgD, MdgE, MdkE, MdmE, MdoD, MdoE, MdpD, MdpE). (For properties of Los Gatos soils in mapping units MdoD and MdoE and for Parrish soils in MdpD and MdpE, refer to Los Gatos and Parrish series, respectively, in this table.)	0–9	Gravelly loam	GC
	9	Schist or sandstone bedrock	
Maywood (Me).	0–26	Loam	ML or CL
	26	Stratified sand and gravel	GP
Millsap (MfE, MfF).	0–6	Heavy loam	CL
	6–17	Shaly clay	CL or CH
	17	Shale bedrock	
Millsholm:			
Gravelly loam, schist bedrock (MgF, MhE, MhF, MkE, MkF, MlD, MlE, MmD, MmE, MtD, MvE).	0–17	Cherty or gravelly loam	GC or SC
	17	Schist, sandstone, and shale bedrock.	
Clay loam (MnD, MnE, MnE2, MngD, MoD, MoE, MpE, MwE2). (For properties of Contra Costa soil in mapping unit MwE2, refer to Contra Costa clay loam in this table.)	0–16	Clay loam	CL
	16	Sandstone and shale bedrock	
Very rocky sandy loam (MrD, MrE, MrE2, MsE, MuE, MxE, MyE2). (For properties of Contra Costa soil in MxE, refer to Contra Costa clay loam in this table; for properties of Lodo soil in mapping unit MyE2, refer to Lodo series in this table.)	0–23	Very gravelly sandy loam	GM
	23	Conglomerate bedrock	
Mixed alluvial land (Mdw) [1].			
Moda (Mz).	0–14	Loam	ML or CL
	14–21	Clay	CH
	21–30	Hardpan	
	30–54	Sandy clay loam	CL

See footnote at end of table.

soils of Glenn County, Calif.—Continued

Classification—Con.	Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4	No. 10	No. 200				
				Inches per hour	*Inches per inch of soil*	*pH*	
A-4	95–100	95–100	50–60	0.8–2.5	0.14–0.17	6.1–7.3	Low to moderate.
A-7	95–100	95–100	70–80	<0.05	0.14–0.17	6.1–6.5	High.
A-6	85–95	80–90	50–60	0.2–0.8	0.16–0.19	6.6–7.3	Moderate.
A-4	75–85	70–80	40–50	0.8–2.5	0.12–0.15	6.1–7.3	Low.
A-7	85–95	80–90	60–70	<0.05	0.11–0.14	6.1–6.5	High.
A-4	65–85	60–80	40–50	0.2–0.8	0.12–0.15	6.6–7.3	Low to moderate.
A-7	95–100	95–100	90–95	0.05–0.20	0.14–0.17	6.1–7.3	High.
				<0.05			
A-4	65–85	60–80	50–65	0.8–2.5	0.12–0.14	6.1–7.3	Low to moderate.
A-2 or A-4	60–80	55–75	25–45	0.8–2.5	0.12–0.15	5.1–5.5	Low.
A-7 or A-6	95–100	95–100	90–95	0.2–0.8	0.14–0.19	6.1–8.1	Moderate to high.
A-2 or A-4	55–70	50–65	30–40	0.8–2.5	0.10–0.14	4.5–5.5	Low.
A-2	40–65	35–60	15–30	0.8–2.5	0.10–0.14	5.6–6.0	Low.
A-4	90–95	85–95	55–65	0.8–2.5	0.14–0.17	6.1–6.5	Low.
A-1	10–20	5–10	0–5	>10.0	0.04–0.06	6.6–7.3	Low.
A-4	85–95	80–90	65–75	0.8–2.5	0.15–0.18	6.1–6.5	Moderate.
A-6 or A-7	65–80	60–75	50–65	0.05–0.20	0.11–0.14	5.6–6.0	Moderate to high.
A-2 or A-4	60–80	55–75	25–45	0.8–2.5	0.10–0.14	6.1–7.3	Low.
A-4	95–100	90–95	80–90	0.8–2.5	0.15–0.19	5.6–6.5	Moderate.
A-2	45–55	40–50	15–25	2.5–5.0	0.04–0.06	5.6–6.5	Low.
A-4	90–95	85–95	55–65	0.8–2.5	0.14–0.17	5.6–6.0	Moderate.
A-7	90–95	85–95	80–90	0.05–0.20	0.14–0.17	5.6–6.0	High.
				<0.05		6.6–7.3	
A-4	90–95	85–95	70–80	0.2–0.8	0.17–0.19	6.6–7.3	Moderate.

TABLE 9.—*Estimated properties of the*

Soil series, land type, and map symbol	Depth from surface	Classification	
		USDA texture	Unified
	Inches		
Montara (MznE).	0–23	Clay underlain by gravelly clay at a depth below 10 inches.	CH
	23	Serpentine bedrock	
Myers (MzrA, MzrB, MzyA, MzyB, MzxB).	0–60	Clay	CH
Nacimiento (NaC, NaD, NaE, NcD, NcE, NdD, NdE, NfD, NgD, NhC, NhD, NhE, NkD, NkE). (For properties of Altamont soils in mapping units NfD and NgD, refer to Altamont clays in this table; for properties of Contra Costa soils in mapping units NhC through NkE, refer to Contra Costa clay, shallow, in this table.)	0–41	Clay	CH
	41	Siltstone bedrock	
Neuns (NmD, NmE, NmF, NnD, NnE, NoD, NoE).	0–27	Cobbly loam	GC or GM
	27	Volcanic bedrock	
Newville (NvC, NvD, NvE, NvF2, NwD, NwE, NxE). (For properties of Lodo soil in mapping unit NxE, refer to Lodo series in this table.)	0–15	Gravelly loam	SC
	15–26	Gravelly clay	GC
	26–48	Very cobbly sandy clay loam	GC
Orland:			
Loam (Oa, Od, Ox). (For properties of Cortina soil in mapping unit Ox, refer to Cortina series in this table.)	0–39	Loam and stratified silt loam and loamy fine sand.	ML or CL
	39–60	Very gravelly sand	GP
Loam, moderately deep over claypan (Odp, Omp).	0–30	Loam	ML or CL
	30–60	Light clay and heavy clay loam	CH
Loam, moderately deep over gravel (Omr, Oms, Osg, Osm, Owo).	0–30	Loam	ML or CL
	30–60	Gravelly loam	SM
Parrish (PaE, PbE, PbF, PcD, PcE, PdD, PdE). (For properties of Yorkville soils in units PdD and PdE, refer to Yorkville series in this table.)	0–11	Gravelly loam and clay loam	SC
	11–25	Gravelly clay	SC
	25	Schist bedrock	
Perkins (PeA, PeC).	0–22	Gravelly loam and light clay loam.	CL
	22–46	Gravelly to very gravelly clay loam.	GC or SC
	46–64	Very gravelly sandy clay loam	GC
Plaza (Pf, Pfa, Pg, Pga, Ph, Pha, Pk, Pka, Pkb).	0–10	Silt loam	ML or CL
	10–60	Clay loam	CL
Pleasanton (PmA, PmB, Pn, Po).	0–54	Gravelly loam underlain by gravelly sandy clay loam.	GC or SC
Polebar (PpE, PrE, PsE). (For properties of Millsholm soil in mapping unit PsE, refer to Millsholm gravelly loam, schist bedrock, in this table.)	0–8	Loam	CL or ML
	8–35	Gravelly heavy clay loam	SC or CL
	35	Serpentinized sandstone bedrock.	
Porterville (PtA, PtB).	0–16	Clay	CH
	16–40	Gravelly clay underlain by gravelly sandy clay loam below a depth of 27 inches.	GC
Redding (Rg).	0–14	Gravelly loam	SM
	14–23	Clay	CH
	23–54	Indurated hardpan that is partly cemented below a depth of 36 inches.	
Riverwash (Rh).[1]			

See footnote at end of table.

soils of Glenn County, Calif.—Continued

Classification—Con.	Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4	No. 10	No. 200				
				Inches per hour	*Inches per inch of soil*	*pH*	
A–7	85–95	80–90	70–80	0. 05–0. 20	0. 13–0. 15	6. 6–7. 8	High.
A–7	95–100	95–100	90–95	0. 05–0. 20	0. 14–0. 17	6. 1–7. 8	High.
A–7	95–100	95–100	90–95	0. 05–0. 20	0. 14–0. 17	7. 4–7. 8	High.
A–2	45–65	40–60	25–35	2. 5–5. 0	0. 07–0. 11	4. 5–5. 0	Low.
A–4	70–80	65–75	35–45	0. 8–2. 5	0. 10–0. 14	5. 6–6. 5	Low.
A–2	55–65	50–60	25–35	0. 05–0. 20	0. 10–0. 14	5. 6–6. 0	Moderate.
A–2	25–45	20–40	15–20	0. 8–2. 5	0. 07–0. 11	6. 1–6. 5	Low.
A–4	95–100	90–95	70–80	0. 8–2. 5	0. 14–0. 17	6. 6–7. 8	Low to moderate.
A–1	15–30	10–20	0–5	>10. 0	0. 03–0. 06	7. 4–7. 8	Low.
A–4	95–100	90–95	70–80	0. 8–2. 50	0. 14–0. 17	6. 6–7. 8	Low to moderate.
A–7	95–100	95–100	80–90	<0. 05	0. 15–0. 19	7. 4–7. 8	High.
A–4	95–100	90–95	70–80	0. 8–2. 5	0. 14–0. 17	6. 6–7. 8	Low to moderate.
A–4	65–85	60–80	35–45	0. 2–0. 3	0. 10–0. 14	7. 4–7. 8	Low.
A–4	80–90	75–85	40–50	0. 8–2. 5	0. 11–0. 14	5. 6–6. 5	Low.
A–4	55–65	50–60	35–45	0. 05–0. 20	0. 11–0. 14	5. 1–5. 5	Moderate.
A–4	80–90	75–85	50–60	0. 8–2. 5	0. 11–0. 14	5. 6–6. 5	Low.
A–2 or A–4	50–75	45–70	30–50	0. 2–0. 8	0. 09–0. 11	5. 1–6. 0	Low to moderate.
A–2	25–45	20–40	15–20	0. 8–2. 5	0. 07–0. 09	5. 1–5. 5	Low.
A–4	95–100	95–100	70–80	0. 8–2. 5	0. 14–0. 17	5. 6–6. 0	Low.
A–4 or A–6	95–100	95–100	75–85	0. 2–0. 8	0. 15–0. 19	6. 6–8. 4	Moderate.
A–2	45–65	40–60	20–30	0. 20–0. 80	0. 07–0. 11	5. 6–6. 5	Low.
A–4	85–95	80–90	50–60	0. 8–2. 5	0. 12–0. 14	6. 1–6. 5	Low to moderate.
A–4	65–80	60–75	45–55	0. 05–0. 20	0. 12–0. 15	6. 1–7. 8	Moderate.
A–7	85–95	80–90	70–80	0. 20–0. 80	0. 14–0. 17	6. 1–6. 5	High.
A–2	35–60	30–50	20–35	0. 05–0. 20	0. 08–0. 10	6. 6–7. 3	Low to moderate.
A–4	75–85	70–80	40–50	0. 8–2. 5	0. 12–0. 14	5. 6–6. 0	Low to moderate.
A–7	95–100	90–95	75–85	<0. 05	0. 12–0. 14	5. 6–6. 0	High.
				<0. 05			

TABLE 9.—*Estimated properties of the*

Soil series, land type, and map symbol	Depth from surface	Classification	
		USDA texture	Unified
	Inches		
Riz (Rlb, Rma, Rmb, Rnb, Rnc).	0–60	Silty clay loam 8 inches thick underlain by silty clay to silty clay loam; heavy clay loam at a depth below 46 inches.	CH
Rock land (RosF, RouF, RovF).[1]			
Rock outcrop (RpF).			
Sacramento (Sa).	0–60	Clay	CH
Sehorn (SbC, SbD, SbE, ScD, ScE, SdC, SdD, SdE, SeD, SeE). (For properties of Millsholm soils in mapping units SdC through SeE, refer to Millsholm series in this table.)	0–27	Clay; in places the uppermost 4 to 6 inches is clay loam.	CH
	27	Shale and sandstone bedrock	
Shedd (SfC, SfD, SfE, SgD, ShC). (For properties of Altamont soils in mapping units SgD and ShC, refer to Altamont series in this table.)	0–29	Heavy silty clay loam to light silty clay.	CL or CH
	29	Softly consolidated sandstone or siltstone.	
Sheetiron (SkD, SkE, SkF, SlD, SlD2, SlE, SlE2, SlF, SlF2).	0–28	Gravelly loam	GC
	28	Schist bedrock	
Stockton (Sm, Sn, So, Sp, Sr, Ss).	0–54	Clay	CH
	54	Weakly cemented hardpan	
Stonyford (StE, SuE, SuE2, SuF, SuF2, SvE). (For properties of Henneke soil in mapping unit SvE, refer to Henneke series in this table.)	0–14	Gravelly clay loam	SM or SC
	14	Basalt bedrock	
Sunnyvale clay (Sw, Sxa, Sy).	0–24	Clay	CH
	24–60	Clay loam	CL
Tehama:			
Loam (Ta, Tb, Tk).	0–30	Loam	ML or CL
	30–60	Sand and gravel	GP
Silt loam (TcA, TcB, Tf, Tm, Tn, ToB).	0–60	Silt loam 9 inches thick underlain by silty clay loam.	CL or CH
Gravelly loam (Tg).	0–30	Gravelly loam	SM or SC
	30–60	Gravelly clay loam	GC or SC
Gravelly loam, moderately deep over hardpan (Th).	0–30	Gravelly loam	SM or SC
	30	Indurated hardpan	
Terrace escarpments (TpF).[1]			
Toomes (TrD, TsC).	0–16	Gravelly to very gravelly silt loam.	GM
	16	Basalt bedrock	
Tyson (TtE, TuD, TuE, TvE2, TvF2).	0–23	Gravelly loam to gravelly heavy loam.	GC
	23	Schist bedrock	
Willows (Wca, Wcb, Wcc, Wd, Wda, Wdb, Wdc).	0–35	Clay	CH
	35–56	Clay loam	CL
Wyo:			
Loam (Wg, Wh).	0–42	Loam to gravelly loam	ML or CL
	42–60	Sand and gravel	GP
Silt loam (Wm, Wn, Wsa, Wsw).	0–60	Silt loam	ML or CL
Silt loam, deep over claypan (Wo, Wp).	0–24	Silt loam	CL
	24–60	Clay	CH

See footnote at end of table.

soils of Glenn County, Calif.—Continued

Classification—Con.	Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4	No. 10	No. 200				
				Inches per hour	*Inches per inch of soil*	*pH*	
A-7	95–100	90–100	85–95	0. 05–0. 20	0. 10–0. 14	8. 5–9. 7	High.
A-7	95–100	95–100	90–95	0. 05–0. 20	0. 14–0. 17	6. 1–8. 4	High.
A-7	95–100	95–100	85–95	0. 05–0. 20	0. 14–0. 18	6. 1–6. 5	High.
A-6 or A-7	95–100	95–100	85–95	0. 05–0. 20	0. 15–0. 19	7. 9–8. 4	High.
A-2	55–75	50–70	25–35	2. 5–5. 0	0. 10–0. 14	5. 1–6. 0	Low.
A-7	95–100	95–100	90–95	0. 05–0. 20	0. 14–0. 17	5. 6–7. 8	High.
				<0. 05			
A-4	60–85	55–80	35–50	0. 8–2. 5	0. 12–0. 15	6. 1–6. 5	Low to moderate.
A-7	95–100	95–100	90–100	0. 05–0. 20	0. 14–0. 18	7. 4–8. 4	High.
A-6	95–100	95–100	80–90	0. 2–0. 8	0. 15–0. 19	7. 4–8. 4	High.
A-4	95–100	95–100	70–80	0. 8–2. 5	0. 14–0. 17	5. 6–6. 5	Moderate.
A-1	10–20	5–10	0–5	>10. 0	0. 03–0. 06	7. 4–8. 4	Low.
A-6 or A-7	95–100	95–100	90–95	0. 05–0. 20	0. 17–0. 19	6. 1–8. 4	Moderate to high.
A-4	75–85	70–80	40–50	0. 8–2. 5	0. 10–0. 13	5. 6–6. 5	Low to moderate.
A-4	65–75	60–70	35–45	0. 2–0. 8	0. 12–0. 15	7. 4–8. 4	Moderate.
A-4	75–85	70–80	40–50	0. 8–2. 5	0. 10–0. 13	5. 6–6. 5	Low to moderate.
				<0. 05			
A-2	45–55	40–50	25–35	0. 8–2. 5	0. 06–0. 09	5. 1–6. 0	Low.
A-2	55–65	50–60	25–35	2. 5–5. 0	0. 07–0. 11	5. 6–6. 5	Low.
A-7	95–100	95–100	85–95	<0. 05	0. 14–0. 17	6. 1–8. 4	High.
A-6	95–100	95–100	65–75	0. 05–0. 20	0. 17–0. 19	8. 5–9. 0	Moderate.
A-4	80–90	70–80	50–60	2. 5–5. 0	0. 14–0. 17	6. 6–7. 3	Low.
A-1	10–20	5–10	0–5	>10. 0	0. 04–0. 06	7. 9–8. 4	Low.
A-4 or A-6	95–100	95–100	80–90	0. 8–2. 5	0. 14–0. 17	6. 6–8. 4	Low.
A-4 or A-6	95–100	95–100	80–90	0. 8–2. 5	0. 14–0. 17	6. 6–7. 3	Low.
A-7	90–95	90–95	85–90	0. 05–0. 20	0. 16–0. 18	6. 1–7. 3	High.

TABLE 9.—*Estimated properties of the*

Soil series, land type, and map symbol	Depth from surface	Classification: USDA texture	Classification: Unified
	Inches		
Yolo:			
Clay loam (Yc, Yg).	0–34	Clay loam 9 inches thick underlain by silty clay loam.	CL
	34–60	Loam	ML or CL
Clay loam, moderately deep over clay (Yd, Yf, Yh, Yma, Yo).	0–32	Clay loam 9 inches thick underlain by silty clay loam.	CL
	32–60	Clay	CH
Yorkville (YvE).	0–14	Clay loam	CL
	14–38	Gravelly clay	SC or CL
	38	Serpentinized sandstone bedrock.	
Zamora (Za, ZbA, ZbB, Zc, Zd, Zma, Zmb).	0–60	Silty clay loam	CL

[1] Too variable to be rated.

TABLE 10.—*Engineering interpretations of*

[Dashes indicate information was

Soil series and map symbols	Suitability as a source of—: Topsoil	Sand	Gravel	Road fill	Soil features affecting engineering practices: Road location
Altamont (AaA, AaC, AaD, AaE, AbC, AcD, AcE, AdC, AdD, AdE, AfD, AfsD, AfE, AfsE, AgE, AhC, AhD, AhE, AkE3, AmC, AnC). (For properties of Contra Costa soils in mapping units AhC, AhD, and AhE, refer to Contra Costa series in this table; for properties of Millsholm soils in AkE3, for Nacimiento in AmC, and for Shedd in AnC, refer to those series, respectively, in this table.)	Poor	Not suitable	Not suitable	Poor	Very gently sloping to steep; plastic clays; rocky in places; landslips occur in places on steep slopes.
Arbuckle (AoA, AoB, AoxA, Ap, Ar, As)	Fair	Not suitable	Not suitable	Good	Nearly level to sloping; gravelly soils; high water table in places.
Artois (At, Au, Av, Aw)	Good	Not suitable	Not suitable	Fair	Nearly level loams; gravelly in places; very plastic clay is at a depth below 18 inches.
Ayar (AxC, AyD). (For properties of Nacimiento soil in mapping unit AyD, refer to Nacimiento series in this table.)	Poor	Not suitable	Not suitable	Poor	Gently undulating to rolling, plastic clays on ridgetops.

soils of Glenn County, Calif.—Continued

Classification—Con.	Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4	No. 10	No. 200				
				Inches per hour	*Inches per inch of soil*	*pH*	
A-6	95–100	95–100	80–90	0. 8–2. 5	0. 16–0. 19	6. 6–7. 3	Moderate.
A-4	95–100	90–95	70–80	0. 8–2. 5	0. 14–0. 17	7. 4–7. 8	Low.
A-6	95–100	95–100	80–90	0. 8–2. 5	0. 16–0. 10	6. 6–7. 2	Moderate.
A-7	95–100	95–100	85–95	0. 05–0. 20	0. 14–0. 17	7. 4–7. 8	High.
A-6	90–95	85–95	60–70	0. 2–0. 8	0. 16–0. 19	6. 6–7. 3	Moderate.
A-4 or A-6	55–70	50–65	45–60	0. 05–0. 20	0. 08–0. 12	7. 4–7. 8	Moderate to high.
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A-6	95–100	95–100	95–100	0. 2–0. 8	0. 17–0. 19	6. 6–8. 4	High.

soils in Glenn County, Calif.

not available or was not obtained]

Soil features affecting engineering practices—Continued				Limitations to use as filter fields for septic tanks	Hydrologic soil group
Farm ponds		Agricultural drainage	Irrigation		
Embankments	Reservoir area				
High resistance to piping and settlement cracking; high compressibility.	Low seepage; fractured shale and sandstone at a depth of 2½ feet.	No adverse features	Not irrigated	Severe	D.
Low resistance to piping and settlement cracking; gravelly; slight to medium compressibility.	High seepage; gravelly throughout, and the amount of gravel increases with increasing depth; rapid permeability at a depth below 5 feet.	Generally well drained; when used for rice, an intermittent water table develops in places.	Generally is nearly level; 4 to 8 inches of available water held; permeability is moderate.	Severe	B.
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; clay subsoil to a depth of more than 60 inches.	Clay subsoil; a perched water table in places; moderately well drained; slow permeability.	Nearly level; subsoil is slowly permeable; a perched water table in places; 6 to 10 inches of available water held.	Severe	D.
High resistance to piping and settlement cracking high compressibility.	Low seepage rate; caliche and interstratified clay are at a depth below 2½ feet.	No adverse features	Not irrigated	Severe	D.

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TABLE 10.—*Engineering interpretations of*

Soil series and map symbols	Suitability as a source of—				Soil features affecting engineering practices
	Topsoil	Sand	Gravel	Road fill	Road location
Burris (BcB, BuD, ByC)	Poor	Not suitable	Not suitable	Poor	Gently sloping to moderately steep, cobbly and bouldery soils; very plastic.
Capay (CaA, CaB)	Poor	Not suitable	Not suitable	Poor	Nearly level to very gently sloping clays on alluvial fans; very plastic; flooded in places after a heavy rain.
Castro (Cb, Cba, Cbb)	Poor	Not suitable	Not suitable	Poor	Nearly level, plastic clays in basins; high water table.
Clear Lake (Cc)	Poor	Not suitable	Not suitable	Poor	Nearly level, very plastic clay in basins.
Colluvial land (CdsF, CduF, CdvF).[1]					
Columbia (CeA, CeB, Cf, CgA, CgB, ChA, ChB, Ck, Cl, Cm, Cn, Co, CpB, CrB).	Good	Good in mapping units Cf and Cm below a depth of 30 inches; not suitable in other units.	Good in mapping units Cf and Cm below a depth of 30 inches; not suitable in other units.	Fair	Nearly level to very gently sloping soils on flood plains; in a few places flooding occurs or the water table is high.
Contra Costa (CsB, CtE, CuE2, CvE). (For properties of Millsholm soil in mapping unit CvE, refer to Millsholm series in this table.)	Poor	Not suitable	Not suitable	Poor	Hilly to very steep, plastic clays.
Corning (CwA, CwB, CwxB, CxC, CyC, CzB). (For properties of Newville soils in mapping units CxC and CyC and for Redding soil in mapping unit CzB, refer to Newville and Redding series, respectively, in this table.)	Poor	Not suitable	Not suitable	Fair to poor	Nearly level gravelly loams on high terraces dissected by streams; hummocky microrelief; subsoil is very plastic clay.
Cortina (Czg, Czh, Czk, Czr, Czs, Czt)	Poor	Not suitable	Not suitable	Good	Nearly level, gravelly or very gravelly soils in old stream channels or on flood plains; subject to flooding.
Dubakella (DuE)	Poor	Not suitable	Not suitable	Good	Moderately steep to steep, gravelly loam 1½ feet thick; underlain by serpentine bedrock; landslips occur in places.
East Park, black variant (EaD)	Poor	Not suitable	Not suitable	Poor	Strongly sloping plastic clay in a small seep area.

See footnote at end of table.

soils in Glenn County, Calif.—Continued

Soil features affecting engineering practices—Continued				Limitations to use as filter fields for septic tanks	Hydrologic soil group
Farm ponds		Agricultural drainage	Irrigation		
Embankments	Reservoir area				
High resistance to piping and settlement cracking; high compressibility; cobbly and bouldery material.	Low seepage rate; cobbly and bouldery clay are more than 5 feet deep.	Somewhat poorly drained; seep areas occur in places.	Slow permeability; 5 to 9 inches of available water held.	Severe	D.
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; clay is more than 5 feet deep.	Somewhat poorly drained; when used for rice water table is at a depth of 2 to 4 feet.	Slow permeability; 8 to 10 inches of available water held.	Severe	D.
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; hardpan at a depth of about 2½ feet.	Poorly drained; high water table; hardpan at a depth of 2½ feet.	Slow permeability; high water table.	Severe	D.
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; consists of more than 5 feet of clay.	Poorly drained; in basins.	Permeability is slow to very slow; 8 to 10 inches of available water held.	Severe	D.
Low to moderate resistance to piping and settlement cracking; slight to medium compressibility.	High seepage rate; in places sand or gravel occurs at variable depths.	Moderately well drained; intermittent high water table in places.	Permeability in the subsoil ranges from moderate to very rapid in places; intermittent high water table in places; 4 to 10 inches of available water held.	Slight to severe.	B.
High resistance to piping and settlement cracking; high compressibility.	Hard shale and sandstone at a depth of less than 3 feet; moderate seepage rate.	No adverse features	Not irrigated	Severe	C and D.
Clay subsoil has high resistance to piping and settlement cracking; high compressibility.	Low seepage rate; claypan at a depth of about 14 inches; very gravelly sandy clay loam at a depth of about 3½ feet.	No adverse features	Not irrigated	Severe	D.
Low resistance to piping; moderate resistance to settlement cracking; slight compressibility.	Generally high seepage rate; subsoil is sand and gravel at a depth below 2½ feet.	Excessively drained; no adverse features.	Permeability is rapid to very rapid; 2 to 5 inches of available water held.	Moderate to severe.	A.
Moderate resistance to piping and settlement cracking; slight compressibility.	Fractured serpentine rock at a depth of 18 inches; high seepage rate.	No adverse features	Not irrigated	Severe	C.
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; clay 4 feet thick underlain by serpentine bedrock; seep area.	Poorly drained	Not irrigated	Severe	D.

TABLE 10.—*Engineering interpretations of*

Soil series and map symbols	Suitability as a source of—				Soil features affecting engineering practices
	Topsoil	Sand	Gravel	Road fill	Road location
East Park (EcB)	Poor	Not suitable	Not suitable	Poor	Very gently sloping to sloping, gravelly or cobbly, plastic clay on alluvial fans.
Eroded land (Er, EsE).[1]					
Goulding (GoE, GoF)	Poor	Not suitable	Not suitable	Good	Steep to very steep, rocky soils in mountainous areas; many pebbles and cobblestones.
Gravel pits (Gp)	Not suitable.	Good	Good	Good	
Gravelly alluvial land (Gr).[1]					
Henneke (HcD, HcE)	Poor	Not suitable	Not suitable	Good	Stony and gravelly plastic clays on rolling to hilly ridgetops and steep to very steep canyon slopes.
Hillgate (HgA, HgB, HgxB, HhB, HhxB, Hl, HmA, HmB, HmxB, Hn).	Good	Not suitable	Not suitable	Fair	Nearly level to gently sloping soils on low terraces and alluvial fans; gravelly in places.
Hohmann (HoE, HpD)	Poor	Not suitable	Not suitable	Good	Moderately steep to very steep, rocky soils that are gravelly and plastic.
Hugo (HrE, HtD, HtE, HtF)	Good	Not suitable	Not suitable	Fair	Moderately steep to very steep, gravelly soils.
Hulls (HuD, HuE, HuF)	Fair	Not suitable	Not suitable	Good	Sloping to very steep, gravelly soils in mountainous areas.
Jacinto (JaA, JaB)	Good	Not suitable	Not suitable	Good	Gently undulating fine sandy loams on ridges near old streambeds.
Josephine (JgD2, JgE, JgE2, JmE, JsE) (For properties of Maymen soil in mapping unit JmE, and for Sheetiron soil in mapping unit JsE, refer to Maymen and Sheetiron series, respectively, in this table.)	Fair	Not suitable	Not suitable	Good	Moderately steep to steep, gravelly soils in mountainous areas.

See footnote at end of table.

soils in Glenn County, Calif.—Continued

Soil features affecting engineering practices—Continued						
Farm ponds		Agricultural drainage	Irrigation	Limitations to use as filter fields for septic tanks	Hydrologic soil group
Embankments	Reservoir area				
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; clay 2 feet thick, underlain by very gravelly sandy clay.	Well drained; no adverse features.	Not irrigated	Severe	D.
Low resistance to piping; moderate resistance to settlement cracking; slight compressibility.	High seepage rate; fractured metavolcanic rock at a depth of 16 inches that becomes massive with increasing depth.	Excessively drained; no adverse features.	Not irrigated	Severe	D.
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Moderate resistance to piping and settlement cracking; slight compressibility.	Gravelly to very gravelly clay loams with a high seepage rate; underlain by fractured serpentine at a depth of 2 feet; moderate seepage rate in the serpentine.	No adverse features	Not irrigated	Severe	D.
High resistance to piping and settlement cracking at a depth below 15 inches.	Low seepage rate; in many places the clay at a depth below 15 inches is gravelly.	Well drained, but in places has an intermittent high water table.	Permeability is moderate in the surface soil but very slow in the subsoil; 4 to 7 inches of available water held.	Severe	D.
Moderate resistance to piping and settlement cracking; slight compressibility.	High seepage rate; fractured basic rock at a depth of 2½ feet.	No adverse features	Not irrigated	Severe	C.
Low to moderate resistance to piping; low resistance to settlement cracking; slight to medium compressibility.	High seepage rate; gravelly fractured sandstone and shale at a depth of 2½ feet.	No adverse features	Not irrigated	Severe	B and C.
Low resistance to piping and settlement cracking; slight to medium compressibility.	High seepage rate; gravelly fractured mica schist at a depth of 3 feet.	No adverse features	Not irrigated	Severe	C.
Low resistance to piping and settlement cracking; slight to medium compressibility.	Moderate seepage rate; sandy loam more than 5 feet deep.	No adverse features	Moderately rapid permeability; 8 to 10 inches of available water held.	Slight	B.
Moderate resistance to piping and settlement cracking; slight compressibility.	Moderate seepage rate; fractured schist at a depth of 4 feet.	No adverse features	Not irrigated	Severe	C.

TABLE 10.—*Engineering interpretations of*

Soil series and map symbols	Suitability as a source of—				Soil features affecting engineering practices
	Topsoil	Sand	Gravel	Road fill	Road location
Kimball (Kb, KbB, KmA, KmB, KnB)	Good	Not suitable	Not suitable	Fair	Nearly level to very gently sloping, loamy soils on alluvial fans and low terraces; very plastic clay at a depth below 16 inches.
Landlow (La, Lc)	Poor	Not suitable	Not suitable	Poor	Nearly level, clayey soils in basins; very plastic clay subsoil over hardpan at a depth of 3 feet.
Lodo (LmD, LmE, LoD, LoE, LsD, LsE, LtD, LtE). (For properties of Millsap soils in mapping units LoD and LoE, and for Tehama soils in mapping units LsD through LtE, refer to Millsap and Tehama series, respectively, in this table.)	Fair	Not suitable	Not suitable	Fair	Rolling to steep, very shallow shaly loams or clay loams.
Los Gatos (LuE, LuF, LvD, LvE, LvF, LxE, LyE). (For properties of Josephine soil in mapping unit LxE, and for Parrish soil in mapping unit LyE, refer to Josephine and Parrish series, respectively, in this table.)	Fair	Not suitable	Not suitable	Good	Rolling to very steep, gravelly soils in mountainous areas; plastic clay at a depth of 1 foot.
Marvin (Ma, Maa, Mab, MaoB, MbA, MbB, Mba, Mbb).	Fair	Not suitable	Not suitable	Poor	Nearly level to very gently sloping, plastic clays along the lower edges of old flood plains.
Masterson (McD, McE, MdD, MdE)	Fair	Not suitable	Not suitable	Good	Gravelly soils on rolling to hilly ridgetops and steep mountainous slopes.
Maymen (MdgD, MdgE, MdkE, MdmE, MdoD, MdoE, MdpD, MdpE). (For properties of Los Gatos soils in mapping units MdoD and MdoE, and for Parrish soils in mapping units MdpD and MdpE, refer to Los Gatos and Parrish series, respectively, in this table.)	Fair	Not suitable	Not suitable	Good	Rolling to very steep gravelly loams.
Maywood (Me)	Good	Good at a depth below 26 inches.	Good at a depth below 26 inches.	Fair	Nearly level soil on stream benches next to creeks; sand and gravel at a depth of 1 to 3 feet.

soils in Glenn County, Calif.—Continued

Soil features affecting engineering practices—Continued					Limitations to use as filter fields for septic tanks	Hydrologic soil group
Farm ponds		Agricultural drainage	Irrigation			
Embankments	Reservoir area					
Low to moderate resistance to piping and settlement cracking; medium to high compressibility.	Low seepage rate; claypan at a depth of about 1½ feet.	Well drained; claypan at a depth of about 1½ feet.	Permeability is rapid in the upper part but very slow below; 3 to 5 inches of available water held.		Severe	C.
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; hardpan at a depth of about 3 feet.	Somewhat poorly drained; hardpan at a depth of about 3 feet.	Permeability is slow; hardpan at a depth of about 3 feet.		Severe	D.
Less than 1 foot to shale	Moderate to high seepage rate; massive shale at a depth of less than 1 foot.	No adverse features	Not irrigated		Severe	D.
Moderate resistance to piping and settlement cracking; slight compressibility.	High seepage rate; gravelly, fractured schistose rock at a depth of 2 feet.	No adverse features	Not irrigated		Severe	C.
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; silty clay loam and silty clay more than 5 feet deep.	Somewhat poorly drained soils along basins; in places has a high water table or is subject to flooding.	Slow permeability; areas used for rice; 9 to 10 inches of available water held; variable saline-alkali content.		Severe	D.
Moderate resistance to piping and settlement cracking; slight compressibility.	Moderate seepage rate; shattered schist at a depth of 5 feet.	No adverse features	Not irrigated		Severe	C.
Moderate resistance to piping and settlement cracking; slight compressibility.	High seepage rate; fractured schist at a depth of less than 1 foot.	No adverse features	Not irrigated		Severe	D.
Low to moderate resistance to piping and settlement cracking; slight to medium compressibility.	High seepage rate; sand and gravel at a depth of 1 to 3 feet.	Well drained to somewhat excessively drained; gravel at a depth below 1 to 3 feet; in places has a seasonal high water table.	Permeability is moderate in the upper part but very rapid at a depth below 2 feet; 3 to 6 inches of available water held.		Slight	B.

TABLE 10.—*Engineering interpretations of*

Soil series and map symbols	Suitability as a source of—				Soil features affecting engineering practices
	Topsoil	Sand	Gravel	Road fill	Road location
Millsap (MfE, MfF)	Good	Not suitable	Not suitable	Fair	Hilly to very steep, shaly, cherty, or gravelly soils; plastic clay at a depth of about 6 inches.
Millsholm (MgF, MhE, MhF, MkE, MkF, MlD, MlE, MmD, MmE, MnD, MnE, MnE2, MngD, MoD, MoE, MpE, MrD, MrE, MrE2, MsE, MtD, MuE, MvE, MwE2, MxE, MyE2). (For properties of Contra Costa soils in mapping units MwE2 and MxE, and for Lodo soil in mapping unit MyE2, refer to Contra Costa and Lodo series, respectively, in this table.)	Fair to poor	Not suitable	Not suitable	Good to fair	Rolling to very steep, cherty, gravelly, or rocky soils in the foothills and mountainous uplands.
Mixed alluvial land (Mdw).[1]					
Moda (Mz)	Good	Not suitable	Not suitable	Fair	Nearly level to very gently undulating loam on fans and low terraces; very plastic clay at a depth of 14 inches; hardpan at a depth of 21 inches.
Montara (MznE)	Poor	Not suitable	Not suitable	Poor	Moderately steep to steep; plastic, clayey soil; in places rocks crop out.
Myers (MzrA, MzrB, MzyA, MzyB, MzxB).	Poor	Not suitable	Not suitable	Poor	Nearly level to moderately sloping, very plastic clays on old alluvial fans and flood plains.
Nacimiento (NaC, NaD, NaE, NcD, NcE, NdD, NdE, NfD, NgD, NhC, NhD, NhE, NkD, NkE). (For properties of Altamont soils in mapping units NfD and NgD and for Contra Costa soils in mapping units NhC through NkE, refer to Altamont and Contra Costa series, respectively, in this table.)	Poor	Not suitable	Not suitable	Poor	Gently undulating to steep, very plastic clays in the foothills.
Neuns (NmD, NmE, NmF, NnD, NnE, NoD, NoE).	Poor	Not suitable	Not suitable	Good	Hilly to very steep cobbly loams in mountainous areas.
Newville (NvC, NvD, NvE, NvF2, NwD, NwE, NxE). (For properties of Lodo soil in mapping unit NxE, refer to Lodo series in this table.)	Fair to poor.	Not suitable	Not suitable	Good	Undulating to very steep gravelly loams on dissected terraces; gravelly, plastic clay at a depth of 15 inches.

See footnote at end of table.

soils in Glenn County, Calif.—Continued

Soil features affecting engineering practices—Continued				Limitations to use as filter fields for septic tanks	Hydrologic soil group
Farm ponds		Agricultural drainage	Irrigation		
Embankments	Reservoir area				
Low to moderate resistance to piping and settlement cracking; variable compressibility.	High seepage rate; shattered shale at a depth of 1½ feet that is massive with increasing depth.	No adverse features	Not irrigated	Severe	D.
Moderate resistance to piping and settlement cracking; slight compressibility.	Fractured shale and sandstone at a depth of 16 inches.	No adverse features	Not irrigated	Severe	C.
Low to moderate resistance to piping; low resistance to settlement cracking; slight to medium compressibility.	Low seepage rate; hardpan at a depth of about 2 feet.	Well drained; a perched water table develops in places when the soil is irrigated.	Moderate to slow permeability; hardpan at a depth of about 2 feet; 3 to 4 inches of available water held.	Severe	D.
High resistance to piping and settlement cracking; high compressibility.	Fractured, hard serpentine rock at a depth of about 2 feet.	No adverse features	Not irrigated	Severe	D.
High resistance to piping and settlement cracking; high compressibility.	Clay, more than 5 feet deep; low seepage rate.	Well drained; slow permeability.	Slow permeability; 9 to 11 inches of available water held.	Severe	D.
High resistance to piping and settlement cracking; high compressibility.	Fractured, hard, fine-grained sandstone and shale at a depth of 8½ feet.	No adverse features	Not irrigated	Severe	C.
Low to moderate resistance to piping; moderate resistance to settlement cracking; slight compressibility.	High seepage rate; fractured greenstone at a depth of 27 inches; cobbly.	No adverse features	Not irrigated	Severe	C.
Moderate resistance to piping and settlement cracking; slight compressibility.	Low seepage rate; gravelly, plastic clay at a depth of 15 inches; weakly consolidated sediments below a depth of 2 feet.	No adverse features	Not irrigated	Severe	C.

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TABLE 10.—*Engineering interpretations of*

Soil series and map symbols	Suitability as a source of—				Soil features affecting engineering practices
	Topsoil	Sand	Gravel	Road fill	Road location
Orland (Oa, Od, Odp, Omp, Omr, Oms, Osg, Osm, Owo, Ox). (For properties of Cortina soil in mapping unit Ox, refer to Cortina series in this table.)	Good	Good in mapping units Oa and Od below a depth of 39 inches; not suitable in others.	Good in mapping units Oa and Od below a depth of 39 inches; not suitable in others.	Fair	Nearly level loams on low benches or flats near stream channels; in places gravel and sand are at a depth below 3 feet; a few areas are subject to overflow.
Parrish (PaE, PbE, PbF, PcD, PcE, PdD, PdE). (For properties of Yorkville soil in mapping units PdD and PdE, refer to Yorkville series in this table.)	Fair	Not suitable	Not suitable	Good	Rolling to very steep gravelly loams; plastic clay at a depth of 11 inches.
Perkins (PeA, PeC)	Fair	Not suitable	Not suitable	Fair to good.	Nearly level to very gently sloping gravelly loams on high terraces; plastic, gravelly clay below a depth of 2 feet.
Plaza (Pf, Pfa, Pg, Pga, Ph, Pha, Pk, Pka, Pkb).	Good	Not suitable	Not suitable	Fair	Nearly level silt loams or silty clay loams on old alluvial fans; plastic clay loam below a depth of 10 inches.
Pleasanton (PmA, PmB, Pn, Po)	Fair	Not suitable	Not suitable	Good	Nearly level to gently sloping, gravelly soils on alluvial fans and stream terraces; plastic, gravelly sandy clay loam below a depth of 1 foot.
Polebar (PpE, PrE, PsE) (For properties of Millsholm soil in mapping unit PsE, refer to Millsholm series in this table.)	Fair to poor.	Not suitable	Not suitable	Fair in the surface layer; good in the subsoil.	Moderately steep to steep, loamy soils in mountainous areas; plastic, gravelly clay below a depth of 8 inches.
Porterville (PtA, PtB)	Poor	Not suitable	Not suitable	Poor in the surface layer; good in the subsoil.	Very gently sloping to sloping clays on alluvial fans; very plastic, slightly gravelly clay to a depth of 27 inches; gravelly sandy clay loam below.
Redding (Rg)	Poor	Not suitable	Not suitable	Good in the surface layer; poor in the subsoil.	Nearly level to gently sloping gravelly loam on high terraces; very plastic gravelly clay below a depth of 14 inches; hardpan at a depth of 2 feet.

soils in Glenn County, Calif.—Continued

Soil features affecting engineering practices—Continued				Limitations to use as filter fields for septic tanks	Hydrologic soil group
Farm ponds		Agricultural drainage	Irrigation		
Embankments	Reservoir area				
Low to moderate resistance to piping and settlement cracking; slight to medium compressibility; variable below a depth of 30 inches.	Low to high seepage rate; in places clay, loam, or gravelly sand are below a depth of 30 inches.	Well drained; subject to flooding if not protected by dams or levees.	Permeability is moderate in the surface layer, but it is variable at a depth below 30 inches.	Slight to moderate.	B and C.
Moderate resistance to piping and settlement cracking; slight compressibility.	High seepage rate; gravelly; hard, fractured, fine-grained sandstone at a depth of 2 feet.	No adverse features	Not irrigated	Severe	C.
Moderate resistance to piping and settlement cracking; slight to medium compressibility.	Low seepage rate; gravelly.	No adverse features	Not irrigated	Severe	C.
Moderate to high resistance to piping and settlement cracking; medium compressibility.	Low seepage rate; clay loam more than 5 feet deep; in places a hardpan is at a depth between 20 and 40 inches.	Somewhat poorly drained; intermittent high water table where used for rice.	Permeability is moderate in the upper part, but it is moderately slow below; 9 to 11 inches of available water held.	Severe	D.
Moderate resistance to piping and settlement cracking; slight compressibility.	Moderate to low seepage rate; gravelly.	Well drained; gravelly; dense subsoil.	Moderately slow permeability; 4 to 7 inches of available water held.	Severe	C.
Moderate to high resistance to piping and settlement cracking; slight to medium compressibility; gravelly.	Moderate to high seepage rate; gravelly plastic clay below a depth of 8 inches; hard, fractured, partly metamorphosed sandstone at a depth of 3 feet.	No adverse features	Not irrigated	Severe	D.
Moderate to high resistance to piping and settlement cracking; slight to high compressibility; gravelly subsoil.	Low seepage rate; very gravelly clay loam below a depth of about 2 feet.	Well drained; slow permeability.	Slow permeability; 6 to 9 inches of available water held.	Severe	D.
Low resistance to piping and settlement cracking in the surface layer, and high resistance to piping and settlement cracking in the subsoil; variable compressibility.	Low seepage rate; gravelly; hardpan at a depth of 2 feet.	No adverse features	Not irrigated	Severe	D.

TABLE 10.—*Engineering interpretations of*

Soil series and map symbols	Suitability as a source of—				Soil features affecting engineering practices
	Topsoil	Sand	Gravel	Road fill	Road location
Riverwash (Rh)	Not suitable.	Good	Good	Good	In stream channels
Riz (Rlb, Rma, Rmb, Rnb, Rnc)	Poor	Not suitable	Not suitable	Poor	Nearly level, very plastic silty clays; at the edge of old alluvial fans bordering basins.
Rock land (RosF, RouF, RovF)	Not suitable.	Not suitable	Not suitable	Not suitable.	Very steep
Rock outcrop (RpF)	Not suitable.	Not suitable	Not suitable	Not suitable.	Very steep
Sacramento (Sa)	Poor	Not suitable	Not suitable	Poor	Nearly level, very plastic clay in small basins.
Sehorn (SbC, SbD, SbE, ScD, ScE, SdC, SdD, SdE, SeD, SeE). (For properties of Millsholm soils in mapping units SdC through SeE, refer to Millsholm series in this table.)	Poor	Not suitable	Not suitable	Poor	Rolling to very steep, very plastic clays.
Shedd (SfC, SfD, SfE, SgD, ShC) (For properties of Altamont soils in mapping units SgD and ShC, refer to Altamont series in this table.)	Poor	Not suitable	Not suitable	Poor	Undulating to steep, plastic silty clay loams in the foothills.
Sheetiron (SkD, SkE, SkF, SlD, SlD2, SlE, SlE2, SlF, SlF2).	Fair	Not suitable	Not suitable	Good	Hilly to very steep gravelly loams.
Stockton (Sm, Sn, So, Sp, Sr, Ss)	Poor	Not suitable	Not suitable	Poor	Nearly level, very plastic clays; weakly cemented hardpan at a depth of 4½ feet; subject to overflow in places.
Stonyford (StE, SuE, SuE2, SuF, SuF2, SvE.) (For properties of Henneke soil in mapping unit SvE, refer to Henneke series in this table.)	Fair	Not suitable	Not suitable	Good	Moderately steep to very steep, gravelly soils in mountainous areas.
Sunnyvale (Sw, Sxa, Sy)	Poor	Not suitable	Not suitable	Poor	Nearly level, plastic clay loam and clay in basins; seasonal high water table.
Tehama (Ta, Tb, TcA, TcB, Tf, Tg, Th, Tk, Tm, Tn, ToB).	Good to fair.	Good below a depth of 30 inches in mapping units Ta, Tb, Tk; others not suitable.	Good below a depth of 30 inches in mapping units Ta, Tb, Tk; others not suitable.	Fair to good.	Nearly level to sloping, old fans and terraces; plastic silty clay loam below a depth of 12 inches.
Terrace escarpments (TpF)	Not suitable.	Not suitable	Not suitable	Not suitable.	

soils in Glenn County, Calif.—Continued

Soil features affecting engineering practices—Continued					Limitations to use as filter fields for septic tanks	Hydrologic soil group
Farm ponds		Agricultural drainage	Irrigation			
Embankments	Reservoir area					
----------	----------	----------	----------	----------	A.	
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; clay and clay loam more than 5 feet deep.	Poorly drained; slow permeability; fluctuating high water table.	Slow permeability; 9 to 11 inches of available water held; variable saline-alkali.	Severe	D.	
----------	----------	----------	----------	----------	D.	
----------	----------	----------	----------	----------	D.	
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; clay more than 5 feet deep.	Somewhat poorly drained; slow permeability.	Permeability is slow; 8 to 10 inches of available water held.	Severe	D.	
High resistance to piping and settlement cracking; high compressibility.	Moderate to high seepage rate; hard, fractured shale and very fine grained sandstone at a depth of 27 inches.	No adverse features	Not irrigated	Severe	D.	
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; softly consolidated, very fine grained sandstone and siltstone at a depth of 2½ feet.	No adverse features	Not irrigated	Severe	C.	
Moderate resistance to piping and settlement cracking; slight compressibility.	Moderate to high seepage rate; strongly folded and fractured schist at a depth of 2½ feet.	No adverse features	Not irrigated	Severe	C.	
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; in basins; weakly cemented hardpan at a depth of 4½ feet.	Somewhat poorly drained; subject to overflow; slow permeability; hardpan at a depth of 4½ feet.	Slow permeability; 5 to 10 inches of available water held.	Severe	D.	
Low to moderate resistance to settlement cracking; slight to medium compressibility.	High seepage rate; fractured, partly weathered basalt at a depth of 14 inches.	No adverse features	Not irrigated	Severe	D.	
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; clay and clay loam more than 5 feet deep; in basins.	Poorly drained; permeability is slow; seasonal high water table.	Permeability is slow; 9 to 11 inches of available water held.	Severe	D.	
Low to moderate resistance to piping and settlement cracking; variable compressibility.	Generally low to moderate seepage rate; in places gravel is at a depth below 30 inches.	Well drained but slow permeability; subsoil is silty clay loam to clay loam.	Slow to moderate permeability; 4 to 11 inches of available water held.	Severe	C.	
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TABLE 10.—*Engineering interpretations of*

Soil series and map symbols	Suitability as a source of—				Soil features affecting engineering practices
	Topsoil	Sand	Gravel	Road fill	Road location
Toomes (TrD, TsC)	Poor	Not suitable	Not suitable	Good	Gently sloping to moderately steep, very rocky and extremely rocky soils on lava flows.
Tyson (TtE, TuD, TuE, TvE2, TvF2)	Fair	Not suitable	Not suitable	Good	Moderately steep to very steep, gravelly soils in mountainous areas.
Willows (Wca, Wcb, Wcc, Wd, Wda, Wdb, Wdc).	Poor	Not suitable	Not suitable	Poor	Nearly level, plastic clays in basins; high water table.
Wyo (Wg, Wh, Wm, Wn, Wo, Wp, Wsa, Wsw).	Good to fair.	Good in mapping units Wg and Wh; others not suitable.	Good in mapping units Wg and Wh; others not suitable.	Fair	Nearly level soils on recent alluvial fans and low benches; in places water table is seasonally high.
Yolo (Yc, Yd, Yf, Yg, Yh, Yma, Yo)	Good	Not suitable	Not suitable	Fair	Nearly level clay loams and silt loams on flood plains and recent alluvial fans.
Yorkville (YvE)	Poor	Not suitable	Not suitable	Poor	Irregular, steep to very steep clay loam in mountainous areas; plastic clay below a depth of 6 inches; subject to landslips.
Zamora (Za, Zba, ZbB, Zc, Zd, Zma, Zmb)	Fair	Not suitable	Not suitable	Fair	Nearly level to gently sloping, plastic silty clay or silty clay loams on young alluvial fans and stream ridges.

[1] Too variable to be rated.

The soils are rated as a source of topsoil for use on slopes, shoulders of roads, and along ditches. The ratings are according to suitability of the soils for growth of vegetation. The ratings used are *good*, *fair*, *poor*, or *not suitable*.

In rating the soils as a source of sand and gravel, the material is considered as a good source or as not suitable for such use. Suitability for a specific engineering use must be determined on the site being considered.

Estimates of suitability of the soils for use as a source of road fill are based on the AASHO classification (see table 9) and on judgment of the appropriate soil properties. Ratings used are *good*, *fair*, *poor*, or *not suitable*.

Some of the features that would adversely affect the location of roads are a high water table, flooding, seepage, and hazard of landslips. It is also important to know the kind of topography, location of outcrops of rock, and plasticity of the soil material. These and other features affecting the location of roads are given in table 10.

In locating a site for a farm pond, the suitability of the site as a reservoir area and the presence of suitable material for the core and embankment are the chief considerations. Soils that are resistant to piping and settlement cracking, that are readily compressible, and that have a low seepage rate and are very slowly permeable are desirable as sites. These soil features and

soils in Glenn County, Calif.—Continued

Soil features affecting engineering practices—Continued				Limitations to use as filter fields for septic tanks	Hydrologic soil group
Farm ponds		Agricultural drainage	Irrigation		
Embankments	Reservoir area				
Low resistance to piping; moderate resistance to settlement cracking; slight compressibility.	Low seepage rate; rocky; columnar basalt at a depth of 16 inches.	No adverse features	Not irrigated	Severe	D.
Moderate resistance to piping and settlement cracking; slight compressibility.	High seepage rate; gravelly; strongly folded and fractured schist at a depth of 2 feet.	No adverse features	Not irrigated	Severe	C.
High resistance to piping and settlement cracking; high compressibility.	Low seepage rate; consists of clay and clay loam more than 5 feet deep.	Poorly drained; high water table.	Very slow permeability; variable saline-alkali; 8 to 10 inches of available water held.	Severe	D.
Low to moderate resistance to piping; low resistance to settlement cracking; slight to medium compressibility.	Low to high seepage rate; in places sand and gravel is at a depth of 3½ feet; in other places clay is at a depth below 2 feet.	Well drained; high water table develops in places in those areas underlain by clay.	Permeability is moderately rapid in the surface layer but variable in the subsoil; 3 to 11 inches of available water held.	Slight	B and C.
Moderate to high resistance to piping; variable resistance to settlement cracking; variable compressibility.	Low seepage rate; in places subsoil is a claypan.	Well drained; perched water table may develop in places; subsoil slowly permeable in places.	Permeability generally is moderate, but in places it is slow in the subsoil; 5 to 11 inches of available water held.	Slight to severe.	B and C.
Moderate to high resistance to piping and settlement cracking; variable compressibility.	High seepage rate; fractured serpentinized sandstone at a depth of 3 feet; subject to landslips.	No adverse features	Not irrigated	Severe	D.
Moderate to high resistance to piping and settlement cracking; moderate to high compressibility.	Low seepage rate; consists of more than 5 feet of silty clay or silty clay loam.	Well drained to moderately well drained; moderately slow permeability	Moderately slow permeability; 10 to 12 inches of available water held.	Severe	C.

others, such as features of the substratum and underlying material, are given in table 10 if they would adversely affect location of a farm pond.

The drainage of the soils, as shown in table 10, is expressed in terms of relative permeability of the soil material. It is based on soil permeability classes as used by the Soil Conservation Service (*14*). Some of the factors considered in determining the kind of drainage or need for drainage are the rate of water movement into and through the soil, depth to a restricting layer or to bedrock, and presence of a water table.

Suitability of a soil for irrigation is based chiefly on its available water holding capacity, permeability, natural drainage, stoniness, and topography. For those soils that are irrigated, the available water is given in range of inches for the effective depth of the soil. The permeability of the soil is indicated, and barriers to movement of air and water into the soil are noted. If the soil is saline-alkali affected, this is also noted.

Ratings used to describe limitations to use of a soil as a filter field are *slight, moderate, or severe.* These are based on soil depth, slope, permeability, percolation rate, water table, soil drainage, and overflow or flooding hazards. A septic tank filter field is a part of the septic tank soil absorption system for disposal of sewage on the site. It is a subsurface tile system laid in such a way that effluent from the septic tank is distributed with reasonable uniformity into the natural soil.

Engineers and soil scientists of the Soil Conservation Service have classified the soil series in the county into four hydrologic groups—A, B, C, and D. The grouping is based on estimates of the intake of water during the latter part of a storm of long duration. The estimate is made of the intake of water in a soil without protective vegetation after the soil profile is wet and has swelled. The hydrologic soil groups shown in table 10 are tentative and may change as more data are obtained and evaluated. The four groups are described as follows:

A. Soils that have a high infiltration rate even when thoroughly wet. These soils are chiefly deep, well drained to excessively drained, and sandy or gravelly. They have a high rate of water transmission. Potential runoff is low.

B. Soils that have a moderate infiltration rate when thoroughly wet. These soils are chiefly moderately deep to deep, moderately well drained to well drained, and moderately fine textured to moderately coarse textured. They have a moderate rate of water transmission.

C. Soils that have a slow infiltration rate when thoroughly wet. Most of these soils contain a layer that impedes the downward movement of water. The soils in this group are moderately fine textured to fine textured. Rate of water transmission is slow.

D. Soils that have a very slow infiltration rate when thoroughly wet. The soils in this group are chiefly clays that have a high swelling potential. Most of them have a permanent high water table and a claypan or clay layer at or near the surface. Many of the soils are shallow over nearly impervious material. The soils in this group have a very slow rate of water transmission. Potential runoff is high.

Formation and Classification of Soils

In this section the factors that affect the formation of the soils are discussed. Then the classification of the soils by higher categories is given.

Factors of Soil Formation

Soil is a natural body on the surface of the earth in which plants grow; it is composed of organic and mineral material (*16*). Soils differ in their appearance, composition, productivity, and management requirements in different localities or even within short distances in the same locality. The factors that cause soils to differ are (1) the physical and chemical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the biological forces; (4) the relief, or lay of the land, and (5) the length of time the forces of formation have acted on the soil material. The relative importance of each factor differs from place to place, but generally the interaction of all the factors determines the kind of soil that forms in any given place. The influence of each soil-forming factor on the soils in Glenn County is described in the pages that follow.

Parent material

Parent material is the weathered rock or unconsolidated material from which soils form. The hardness, grain size, and porosity of the parent material and its content of weatherable minerals greatly influence the formation of soils. There are three main sources of parent material in Glenn County: (1) alluvium, (2) weakly consolidated old alluvial sediments, and (3) hard bedrock.

The largest areas of soils are those formed on alluvium washed from the Coast Ranges and the Cascade Mountains. These materials range in character from clay deposited in poorly drained basins through broad expanses of loamy deposits on alluvial fans and terraces to poorly sorted gravel, sand, and finer material on flood plains.

The alluvial materials can also be divided into several kinds, depending on the source of the rock. The dominant alluvium is that derived mainly from mountainous areas and laid down by Stony Creek. Stony Creek drains areas made up mainly of metasedimentary rocks, such as schist and phyllite, with which some sedimentary and metavolcanic rocks are mixed. The alluvium along minor streams draining the foothills is from sedimentary rocks, and the gravelly alluvium laid down along intermittent streams also is from sedimentary rocks. The mixed alluvium laid down by the Sacramento River is from a variety of rocks. Along Butte Creek, which originates in the mountains on the east side of the Sacramento Valley, the alluvium is from basic igneous rock.

The weakly consolidated old alluvial material consists chiefly of deposits on high terraces or of calcareous silt and clay. These sediments are from rocks of the Coast Ranges to the west.

Hard bedrock underlies the foothills and the mountainous areas. In the foothills the bedrock consists of calcareous and noncalcareous conglomerate, sandstone, and shale of the Knoxville formation and of other formations of the Cretaceous period. In the mountains the rocks are mainly phyllite, schist, and other pre-Franciscan rocks and sandstone, shale, chert, metavolcanic rocks, pillow basalt, serpentine, and other rocks of the Franciscan formation.

The various kinds of parent materials are briefly described in the paragraphs that follow.

Recent mixed alluvium.—This material consists of stratified, relatively unweathered, medium-textured and moderately coarse textured sediments on recent flood plains of the Sacramento River. In it the Columbia soils are forming. These soils are moderately well drained. The water table is frequently high during periods of peak runoff. Flooding is common, and many areas receive fresh deposits of new material annually.

Recent metasedimentary alluvium.—This material is highly stratified and is extremely variable in texture. It originated in mountainous areas in the county and is on the bottom lands and recent flood plains of Stony Creek and its tributaries. The material generally is shallow to moderately deep over channel sand and gravel. The Cortina soils and Riverwash formed on gravelly recent metasedimentary alluvium, and the Orland soils on the nongravelly, medium-textured sediments.

Recent and young sedimentary alluvium.—This material consists of moderately fine textured alluvium from sedimentary rock sources. It was laid down by local streams draining the foothills. The areas are on the bottoms of narrow foothill valleys and on stream ridges that extend into the Sacramento Valley. The well-drained Yolo and Zamora soils are forming in this material. Yolo soils are on the most recently deposited sediments, and the weakly developed Zamora soils are on the slightly older sediments.

Young mixed alluvium.—This material was deposited earlier than the recent alluvium; it is finer textured, is less stratified, and is on older flood plains of the Sacramento River. The alluvium is slightly to moderately weathered. From it have formed the well-drained Zamora soils and the moderately well drained to somewhat poorly drained soils of the Marvin series.

Young and moderately old metasedimentary alluvium.—This material consists of medium-texured and moderately fine textured sediments on fans. Intermingled with the sediments is gravelly alluvium in narrow stringers. All of the sediments were laid down by Stony Creek. The areas are mainly in the northeastern part of the county, and the sediments are somewhat older and less stratified than those laid down on recent flood plains of Stony Creek. Wyo soils are on the younger fans, and the Arbuckle, Plaza, and Tehama soils are on the moderately old fans or low terraces. These soils are all well drained and seldom are flooded.

Moderately old sedimentary alluvium.—This material is moderately fine textured or fine textured and is intermittently calcareous. It was deposited by intermittent streams draining the central foothills of the county. The areas are in foothill valleys and on coalescing alluvial fans along the eastern edge of the foothills. The well-drained Hillgate and Tehama soils formed on the moderately fine textured alluvium, and the well-drained Myers and the somewhat poorly drained Capay soils formed on the fine-textured alluvium.

Moderately old gravelly sedimentary alluvium.—This poorly sorted mixture of gravel, sand, and finer textured material was laid down on alluvial fans by local intermittent streams draining the gravelly high terraces. The areas are mostly northwest of Artois along the eastern edge of the foothills. The principal soils formed from these materials are gravelly Arbuckle, Artois, Hillgate, and Pleasanton soils.

Old metasedimentary alluvium.—This somewhat poorly sorted material is on a fan of Stony Creek. It was deposited earlier than the moderately old alluvium; subsequently the fan was slightly uplifted, and later it was partly dissected by Stony Creek. Remnants of this fan are on low terraces in the northeastern part of the county. In these areas are gravelly Arbuckle soils, claypan soils of the Hillgate and Kimball series, and hardpan soils of the Moda series.

Metasedimentary alluvium in basins.—These fine-textured sediments are of the same origin as the young and moderately old metasedimentary alluvium, but they probably are slightly older. They have been modified by the high water table and the accumulation of calcium carbonate. The principal soils formed from these materials are the calcareous Castro and Sunnyvale soils and the Willows soils that have a dense substratum and are affected by salts and alkali. All are poorly drained.

Sedimentary alluvium in basins.—This fine-textured alluvium originated in the foothills west of Willows. It probably is equivalent in age to the moderately old sedimentary alluvium, but it has been modified by a fluctuating high water table and the accumulation of salts and alkali. The poor drainage has been intensified as the result of flooding the areas for the growing of rice. Soils that formed in this alluvium are the poorly drained Riz and Willows that are affected by salts and alkali and the somewhat poorly drained Capay.

Basic igneous alluvium in basins.—This fine-textured material, from basic igneous rock, was deposited by Butte Creek and other streams draining the foothills and mountains along the east side of the Sacramento Valley. These sediments are older than those laid down by the Sacramento River, but they probably are younger than the old metasedimentary alluvium. Soils formed on basic igneous alluvium are the somewhat poorly drained Landlow and Stockton.

High terrace mixed gravel and cobblestones.—This material is poorly sorted and contains some finer textured material. It is on partly dissected high terraces in the north-central part of the county or is along the western edge of the foothills. This material generally occurs as a capping on hard sedimentary rocks of the Knoxville formation and of other rocks of the Cretaceous period or overlies softly consolidated silt and clay of the Tehama formation. In many places the capping has been partly removed through erosion and the underlying rock exposed. These terrace remnants have a nearly level surface. The material on top of the terrace probably is the Red Bluff formation, and that on the dissected side slopes probably is the Tehama formation. Corning and Redding soils are on the terrace cap, and Newville soils are on the dissected side slopes.

Weakly consolidated sediments.—This material consists of softly consolidated beds of calcareous silty clay and clay of the Tehama formation derived from older rock of the Coast Ranges. Nomlaki tuff crops out near the base of these sediments. Soils of the Altamont, Nacimiento, and Shedd series formed in material from these weakly indurated sediments. They are moderately fine textured or fine textured and are calcareous.

Basalt.—This basic volcanic material is of Pliocene time. It occurs as a lava capping on rocks of the Cretaceous period. The areas are mostly near the Orland Buttes in the north-central part of the county. The very rocky and extremely rocky Toomes soils are on the lava capping, and the bouldery, fine-textured Burris soil is on the colluvial side slopes.

Sandstone, shale, and conglomerate.—These sedimentary rocks, derived from the Knoxville formation and from other rocks of the Cretaceous period, are the dominant rocks in the foothills. From the Knoxville shale was derived the parent material of the very shallow Lodo soils and the shallow to moderately deep Millsap soils. The Contra Costa, Millsholm, and Sehorn soils formed in material weathered from noncalcareous conglomerate, sandstone, and shale, and the Altamont and Nacimiento soils in material weathered from calcareous beds of the Cretaceous period.

Partly metamorphosed sandstone and shale.—These sedimentary rocks are part of the Franciscan formation. They are near metavolcanic rocks, and in many places are interbedded with strata of radiolarian chert. These rocks are mostly in the Open Ridge and Lee Logan Basin areas in the mountains in the western part of the county. The principal soils formed in material from these rocks are the Maymen, Parrish, Polebar, Yorkville, and Tyson soils and the gravelly Millsholm soils.

Metamorphosed basic igneous rocks.—These metavolcanic rocks are part of the Franciscan formation and probably consist of metamorphosed andesite and basalt. They are in the mountainous areas near St. John Mountain, Black Butte, Fiddlers Green, and Euchre Glade. The rocky Goulding and Hohmann soils and the cobbly Neuns soils formed in material from these rocks.

Serpentine and pillow basalt.—These ultrabasic and basic rocks are along the place where rocks in the mountains, of the Franciscan and older formations, make contact with rocks in the foothills that are of the Knoxville formation. The stony Henneke soils formed in material from serpentine, an ultrabasic metamorphic rock. Pillow basalt, a partly altered volcanic rock, is the source rock in the material from which the gravelly Stonyford soils formed.

Schist.—These rocks consist mainly of sericite schist or of sericite-chlorite schist that contains seams of quartzite. They are metamorphosed sedimentary rocks that probably are older than those of the Franciscan formation. These rocks are most extensive in the mountains. They are the source rock of the parent material of the Hulls, Josephine, Los Gatos, Masterson, Maymen, Parrish, Sheetiron, and Tyson soils.

Climate

Climate affects the formation of soils chiefly through its influence on the rate of weathering of rocks and on the decomposition of minerals and organic matter. It also affects biological activity in the soils and the leaching and movement of weathered materials.

In Glenn County the summers are warm to hot, and little rain falls. Except for some clouds over the mountains, the sky is clear. Winters are cool and moist. Most of the precipitation falls between September and May. The average annual rainfall in the valley and foothill areas, which make up the eastern and central parts of the county, respectively, ranges from about 15 to 25 inches. Precipitation in the mountains, which are in the western part of the county, increases rapidly from about 25 inches at the lower elevations to more than 60 inches on the higher peaks and ridges. Much of the precipitation at the higher elevations occurs as snow, which remains on north-facing slopes until late in June or early in July. Fog and frost occur occasionally in the valley area during winter and spring.

The differences in precipitation from east to west across the county account for the various kinds of vegetation and their distribution. In the valley and foothills, annual grasses, or trees and annual grasses, are dominant. In these areas precipitation is sufficient to wet the soils to their available moisture holding capacity. Seasonal distribution is uneven, however, and much of the precipitation is lost through runoff and evapotranspiration. As a result not enough moisture is available to leach the soils beyond the depth that roots of plants can penetrate. Plant growth is rapid in spring, but it ceases with the coming of hot weather late in May and the depletion of the limited supply of moisture. The amount of organic matter produced by plants in these areas is moderate, but it decomposes rapidly in the hot summers. Consequently, the content of organic matter in the soils is low.

In the mountains brush is the dominant vegetation at the lower elevations, and coniferous trees are dominant at the higher elevations and on the more humid north-facing slopes. The amount of organic matter produced is large, and it decomposes slowly in the cool, moist climate. As a result the content of organic matter in the soils is moderate to very high. The soils in the mountains are predominantly shallow or are moderately deep. Ample moisture is available for leaching after the soils are wet to field capacity. The base saturation therefore is lower than in other parts of the county, and the soils are more acid.

Biological forces

In Glenn County vegetation is dominant among the biological forces that affect formation of soils. Plants, animals, insects, bacteria, and other organisms add organic matter to the soils. Their activity, however, in the cycle of transferring and returning nutrients from the subsoil to the surface depends upon the vegetation that grows on the soil.

The vegetation, with decreasing precipitation and elevation from west to east, progressively consists of coniferous forest, of brush, of oaks and grasses, and of grasses. The pattern and distribution of the vegetation have been affected somewhat by changes caused by fires, by grazing practices, by cultivating, by seeding, and by application of fertilizer. Annual grasses and forbs are dominant in areas of grasses and of oaks and grasses. Many of these were introduced and replace perennial grasses and other native forage plants.

The coniferous forest is dominantly mixed stands of ponderosa pine, Douglas-fir, white fir, sugar pine, and incense-cedar, but it includes some oaks, madrone, and other hardwoods. In some areas the understory consists of low shrubs. Red fir is common at elevations of more than 6,000 feet, and in many places it grows in combination with white fir. Fresh and partly decomposed needles, leaves, and twigs form a litter from one-half inch to several inches thick on the surface of the soils. Such material is acid and contributes to the acidity of the soils. The content of organic matter in soils formed under forest is high, and the carbon-nitrogen ratio exceeds 20. The abundance of organic matter accounts for the granular structure, friable consistence, and the dark color of the surface soil. In addition, roots of the trees and shrubs follow cracks and fracture planes in the parent rock and help break up the rock. Their growth and decomposition also make the soil more porous.

Brush grows chiefly on the lower slopes of the mountains. Here chamise and buckbrush are dominant on ridgetops and south-facing slopes, and mixed stands of scrub oaks, manzanita, ceanothus, mountain-mahogany, and foothill ash are dominant on north-facing slopes.

Oaks grow in scattered stands in some of the areas. Leather oak, stickyberry manzanita, hollyleaf ceanothus, and California holly and a few Digger pines on the Henneke soils are typical of the vegetation growing along the eastern edge of the mountains in soils on serpentine. The leaves and twigs of the brush form a thin litter on the surface of the soils. This material is less acid than that on timber soils. Soils under brush are therefore less acid than soils under timber and have a higher base saturation. The content of organic matter in the surface layer typically is between 1½ and 2½ percent, and the carbon-nitrogen ratio is 12 to 18.

Annual grasses and blue oaks grow chiefly in the higher foothills. Digger pines occupy a few areas, and brush some patches. Grasses are the dominant vegetation on the lower slopes of the foothills. In soils that are under grasses and oaks or are under grasses, the content of organic matter in the surface layer is low. The growing season is short, moisture is scarce, and plant residues decompose rapidly in the hot summers. The content of organic matter in such soils typically is less than 1½ percent, and the carbon-nitrogen ratio is 12 or less. Base saturation is high, and the dominant cations are calcium and magnesium.

In the Sacramento Valley grasses and small herbaceous plants were dominant in the original plant cover. Annual grasses that matured late in spring or early in summer were the chief kinds of plants, though perennial grasses were common in places. Trees grew only along the channels of streams and on recent flood plains where moisture was available most of the summer. In the low-lying, poorly drained basins, grasses and sedges that tolerated wetness were dominant. The lush growth of these plants provided ample organic matter and are responsible for the dark color of the Castro, Capay, Sacramento, Stockton, and Willows soils.

Gophers, moles, squirrels, and other burrowing rodents have affected the soils through slow but continuing mixing of the soils. Their activities are considered more destructive than constructive. In building mounds to provide dry storage and nesting sites for their young, pocket gophers alter the depth and thickness of soil horizons within a short distance. The low hummocks, or mound microrelief, of shallow claypan or hardpan soils is probably the result of burrowing by pocket gophers (*2*).

Relief

Relief, through its effect on drainage, runoff, and erosion, has had a marked affect on formation of the soils in Glenn County. Variations in topography, and associated differences in moisture and temperature, account for many differences among the soils.

In the mountains the soils generally are steep to very steep and typically are shallow to moderately deep. Drainage is good to excessive. Erosion generally is slight, but it is moderate to severe if the cover of vegetation is destroyed.

The central foothills consist of rolling to steep hills and narrow valleys. Soils on the sides of the hills typically are shallow or moderately deep and are well drained to somewhat excessively drained. Erosion generally is slight, though accelerated erosion is likely to occur in areas cultivated or overgrazed. Soils in the valleys within the foothills are deep to very deep. They generally are well drained, but the fine-textured soils on narrow stringers that parallel some of the more sluggish drainageways are poorly drained.

In the north-central part of the county and along the western edge of the foothills, old gravelly terrace deposits cap the foothills. These high terraces have been partly dissected by incised drainageways leaving small, nearly level remnants of the terraces surrounded by rolling to steep side slopes. The soils on the undissected terraces are well developed and have a claypan or hardpan subsoil. Runoff is slow, and erosion is slight. Low hummocks are common in places, and water remains on the surface between the mounds for short periods following a heavy rain. Soils on the dissected slopes are well drained to excessively drained and typically are less developed than soils on the terrace cap. Runoff is moderate to excessive. Accelerated sheet and gully erosion are common if the soils are cultivated or overgrazed.

The valley in the eastern part of the county is part of the Great Valley of California. It is broad and nearly level. This valley is made up of a series of coalescing alluvial fans on outwash from the mountains and foothills to the west, of deposits on the flood plain of the Sacramento River, and of low-lying basins.

On the older alluvial fans extending eastward from the foothills, the relief is nearly level or very gently undulating. The soils on these fans are well drained. Runoff generally is slow, but in low areas between the fans it is very slow. The soils on the fans have a medium-textured surface layer and a moderately fine textured or fine textured subsoil. Soils in areas between the fans, however, generally are fine textured throughout.

On the recent and young alluvium along local streams that drain the foothills are small, nearly level fans or narrow, very gently undulating stream ridges that extend into the Sacramento Valley. The soils in these areas are medium textured or moderately fine textured and are well drained. Runoff is slow, but there is no evidence of waterlogging or of a high water table.

Recent and young alluvial fans of Stony Creek cover the northeastern part of the area; they are nearly level or very gently undulating. On the south side of some of the older abandoned channels of the creek are gently undulating, long, narrow ridges of sandier material deposited by wind. The soils on all of these materials generally are well drained. Some areas adjacent to the present channel of Stony Creek, however, are subject to flooding and deposition. In these areas the water table is intermittently high during periods of peak runoff.

The recent flood plain of the Sacramento River occupies narrow areas on both sides of the River. These areas are mostly very gently undulating, but in a few places they are dissected by abandoned channels or oxbow lakes. The soils in the areas are medium textured and stratified and are moderately well drained. During winter and spring they are subject to overflow and have an intermittent high water table.

An older flood plain of the Sacramento River fans out on both sides of the river south of Jacinto. This area consists of a series of very gently undulating stream ridges, and of depressions in low areas between the ridges. Typically, the soils on the low ridges are moderately fine textured and well drained, and those in the depressions are moderately fine textured or fine textured and are somewhat poorly drained or poorly drained.

The basin areas are south and east of Willows and east of the Sacramento River between Campbell Slough and Butte Creek. They consist of depressions in low areas that are very slowly drained by winding channels of minor streams. The soils are fine textured and are very poorly drained. In many places the high water table and saline-alkali ground water cause the soils to be affected by excess salts and alkali.

Time

The age of soils is not necessarily related to the geologic age of the parent rock. In the majority of soils, the length of time the parent material has been influenced by the weathering processes is more closely related to the erosion cycle. Thus, areas in which erosion has proceeded at a slow rate have soils that have remained fairly stable for a long time; the horizon differentiation is greater and the profile more developed than in areas where erosion proceeded at a rapid rate.

In Glenn County the age of the soils ranges from a few to more than 500,000 years. The youngest soils are forming on recently deposited alluvium along stream bottoms or on recently exposed surfaces. The oldest soils are those on nearly level high terrace remnants of Pleistocene age near the Orland Buttes and along the western edge of the foothills between Stonyford and Newville.

The soils on recently deposited alluvium generally are deep, permeable, and rich in plant nutrients. They generally are stratified and have no discernible genetic horizons other than a slightly darker surface horizon in which the accumulation of organic matter is small. A distinct profile has not developed because the parent material has not been in place long enough or because there have been periodic fresh deposits of material.

The soils on remnants of nearly level high terraces have well-defined genetic horizons. They generally have claypan or hardpan layers at a depth of 2 feet or less. Such layers hinder movement of air and water through the profile and restrict development of roots. These old soils generally are strongly acid and are low in nitrogen, phosphorus, sulfur, and other nutrients.

The degree of soil development, or of horizon differentiation of soils, varies on the intermediate terraces or alluvial fans. In general, the higher the terrace, the older, more strongly developed, and less fertile is the soil.

In the foothills and mountains, the rocks are mostly of Franciscan or pre-Franciscan time of the Cretaceous period. Soils formed on these rocks have been modified continuously because of normal geologic erosion associated with periods of uplifting and subsequent dissection by streams.

The thickness of the soil developed on a particular slope is related to the rate that soil is removed through erosion and the rate that the parent rock is weathered so that new soil forms. The rate of erosion is influenced mainly by (1) the protective cover provided by vegetation; (2) the steepness, shape, and length of slope; (3) the rate that the soil absorbs water and the quantity it will hold; (4) resistance of the different kinds of soil and parent material to erosion; and (5) the intensity, amount, and frequency of precipitation and its distribution. Thus, the oldest soils are those on relatively level slopes in undissected areas, and the youngest are those on very steep side slopes and other areas subject to erosion.

As soils increase in age, the soil forming processes produce changes that are of significant importance to use. In well-drained areas the changes include (1) the gradual removal or translocation of soluble salts; (2) the leaching of exchangeable bases, such as calcium, magnesium, sodium, and potassium, from the upper part of the soil with an accompanying increase in acidity; (3) the accumulation of clay in the subsoil, through translocation and clay formation, resulting in the formation of a textural B horizon with characteristic structural units; (4) the accumulation of organic matter on the surface and throughout the soil profile; and (5) an increase in the phosphate fixing power of the soil and a decrease in available nutrients in the soils.

An example of the chronological sequence of soil development in the county is illustrated by the Cortina, Arbuckle, Perkins, Corning, and Redding soils. These well-drained soils are all on gravelly alluvium. The Cortina are grayish-brown, slightly acid to neutral soils on recent deposits on flood plains or young alluvial fans. Arbuckle soils, on older alluvial fans or low terraces, are brown, are slightly acid to medium acid, and have a weak textural B horizon. The Perkins soils, on terraces at intermediate elevations, are reddish brown, are medium acid to strongly acid, and have a moderately distinct textural B horizon. The Corning and Redding soils, on high terrace remnants, are the oldest members in this sequence. They are reddish brown, strongly acid, and low in nutrients; they have a dense claypan B horizon. Redding soils also have an indurated hardpan layer below the claypan horizon.

Classification of Soils

Soils are placed in narrow classes for the organization and application of knowledge about their behavior within farms, ranches, or counties. They are placed in broad classes for study and comparison of large areas, such as continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and revised later (*13*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study (*10*, *17*). Therefore, readers interested in developments of the system should refer to the latest literature available.

Under the newer system, all soils are placed in six categories. They are, beginning with the most inclusive, the order, the suborder, the great group, the subgroup, the family, and the series. In this system the criteria used as bases for classification are observable or measurable properties. The properties are so chosen, however, that soils of similar mode of origin are grouped together.

The 1938 system, with later revisions, also consists of six categories. In the highest of these, the soils of the whole country have been placed in three orders. Two categories, suborder and family, were never fully developed. As a consequence they have not been used much. More attention has been centered on the categories, great soil group, soil series, and soil type. A further subdivision of the soil type, called a soil phase, is defined, along with soil type and soil series, in the section "How This Survey Was Made" in the front of this survey.

The order, great soil group, series, and type are the categories that are used most. The classes in the highest category of the classification system are the azonal, intrazonal, and zonal orders. Each of these orders is represented by soils in Glenn County.

Zonal soils formed through processes dominated by climate and biological forces. They are well developed and have formed from parent material of mixed mineralogy that have been in place a long time and have not been subject to extreme conditions of relief.

Intrazonal soils are well developed and reflect the dominant influence of some local factor of relief or parent material rather than of climate and biological factors.

Azonal soils lack development or are weakly developed, mainly because they are forming in recently deposited sediments, are from highly resistant materials, or are on steep slopes where runoff and removal of soil materials are rapid.

In table 11 each soil series of Glenn County is placed in its family, subgroup, and order of the current classification and in its great soil group and order of the 1938 system. A representative profile of each series is described in the section "Descriptions of Soil Profiles." Supporting laboratory data is given in the section "Laboratory Analyses."

The great soil groups represented in the county are Alluvial soils, Lithosols, Calcium Carbonate Solonchak soils, Grumusols, Humic Gley soils, Rendzinas, Brunizems, Noncalcic Brown soils, Reddish-Brown Lateritic soils, and Sols Bruns Acides. They are discussed in the paragraphs that follow.

Alluvial soils

Alluvial soils consist of recently deposited water-laid material that has been little changed by soil-forming processes. The characteristics of these soils are largely determined by the nature of the parent material and the manner in which the alluvium has been sorted and deposited. Climate, drainage, and vegetation vary widely. Alluvial soils generally are stratified, contain a small amount of organic matter in the surface soil, and have little or no differentiation between horizons.

In this county soils of the Columbia, Cortina, Maywood, Orland, and Yolo series are in the Alluvial great soil group. Differences among these soils are chiefly in color, reaction, and clay mineralogy caused by differences in parent material and drainage. Clay mineralogy for the Yolo soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Columbia soils are the most extensive. They are pale brown, noncalcareous, coarse textured to medium textured, and moderately well drained. These soils are on mixed alluvium. Kaolinite and montmorillonite are the dominant clay minerals, but small amounts of mica, vermiculite, and quartz are also present. Columbia soils are on recent flood plains of the Sacramento River and are subject to periodic flooding and to streambank erosion. The water table is high for short periods in winter and spring when the level of the river is high.

Cortina soils consist of light brownish-gray or grayish-brown, noncalcareous, gravelly soils that are excessively drained. These soils are on old streambeds and recent flood plains of Stony Creek and its tributaries. They formed in coarse-textured, recent alluvium derived chiefly from schistose and sedimentary rocks. They range from slightly acid in the surface soil to neutral or mildly alkaline in the subsoil. The content of organic matter is low. Chlorite is the predominant clay mineral, but small amounts of sericite, vermiculite, and montmorillonite also are present. The high chlorite content accounts for the grayish color of these soils.

Orland soils are grayish brown, medium textured, and well drained. They are on outwash derived from schistose and sedimentary rocks. These soils generally are stratified. Depth to the gravelly substratum varies. Reaction ranges from slightly acid in the surface soil to neutral or mildly alkaline in the subsoil. In places the deeper soils contain a small amount of lime in the lower horizons. Chlorite is the predominant clay mineral, but small amounts of sericite, vermiculite, and montmorillonite are present in about equal amounts. Orland soils are on recent flood plains of Stony Creek near the Cortina soils. Areas not protected by levees are subject to flooding during periods of peak runoff. The water table is intermittently high for several days when the creek is high.

Maywood soils are pale brown, noncalcareous, medium textured, and moderately well drained. They are on recent alluvium washed from weakly consolidated sediments of the Tehama formation. These soils are somewhat stratified and generally are moderately deep over gravel. They occupy small areas along minor intermittent streams and commonly have a fluctuating high water table in winter and spring. Maywood soils are similar to the Columbia soils but formed from different parent material, and they therefore differ significantly in clay mineralogy. In the Maywood soils allophane is the chief clay mineral, but small amounts of montmorillonite and kaolinite are present as well as some vermiculite.

Yolo soils are brown, medium textured or moderately fine textured, and well drained. These soils are on recent alluvium derived from relatively unaltered sandstone and shale. The surface soil is slightly acid, and the subsoil is neutral to mildly alkaline. In a few areas these soils have a weakly developed, grayish-brown A horizon, but the horizons otherwise are indistinct. Yolo soils are slightly finer textured, less stratified, and better drained than the Columbia soils, but they otherwise are similar to those soils. Except for minor differences in the amounts of mica and montmorillonite they contain, both of these soil series have essentially the same clay minerals.

Lithosols

Lithosols are shallow or very shallow over hard rock. They generally are so steep and erodible that there has been little opportunity for soil development. They consist of fresh or partly weathered soil material or rock fragments, or both, and have an incomplete solum or no clearly expressed soil morphology.

The Goulding, Lodo, Maymen, Millsholm, and Toomes soils are representative of the Lithosol great soil group. Differences among soils in this group are mainly in tex-

TABLE 11.—*Soil series classified according to the current system of classification* [1] *and the 1938 system with its later revisions*

Series	Current classification			1938 classification	
	Family	Subgroup	Order	Great soil group	Order
Altamont	Fine, montmorillonitic, thermic.	Typic Chromoxererts	Vertisols	Grumusols	Intrazonal.
Arbuckle	Fine-loamy, mixed, thermic.	Typic Haploxeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Artois	Fine, mixed, thermic	Typic Haploxeralfs	Alfisols	Noncalcic Brown soils intergrading to Humic Gley soils.	Zonal.
Ayar	Fine, montmorillonitic, thermic.	Typic Chromoxererts	Vertisols	Grumusols	Intrazonal.
Burris	Fine, montmorillonitic, thermic.	Chromic Pelloxererts	Vertisols	Humic Gley soils	Intrazonal.
Capay	Fine, montmorillonitic, thermic.	Typic Chromoxererts	Vertisols	Grumusols	Intrazonal.
Castro	Fine, mixed, thermic	Typic Calcixerolls	Mollisols	Calcium Carbonate Solonchak soils.	Intrazonal.
Clear Lake	Fine, montmorillonitic, thermic.	Typic Pelloxererts	Vertisols	Humic Gley soils	Intrazonal.
Columbia	Coarse-loamy, mixed, thermic.	Aquic Xerofluvents	Entisols	Alluvial soils	Azonal.
Contra Costa	Fine, mixed, thermic	Mollic Haploxeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Corning	Fine, montmorillonitic, thermic.	Typic Palexeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Cortina	Loamy-skeletal, mixed, nonacid, frigid.	Typic Xerofluvents	Entisols	Alluvial soils	Azonal.
Dubakella	Clayey-skeletal, serpentinitic, mesic.	Typic Xerochrepts	Inceptisols	Reddish-Brown Lateritic soils.	Zonal.
East Park	Fine, montmorillonitic, thermic.	Typic Chromoxererts	Vertisols	Grumusols	Intrazonal.
Goulding	Loamy-skeletal, mixed, mesic.	Lithic Xerochrepts	Inceptisols	Lithosols	Azonal.
Henneke	Clayey-skeletal, serpentinitic, thermic.	Lithic Argixerolls	Mollisols	Noncalcic Brown soils intergrading to Brunizems.	Zonal.
Hillgate	Fine, montmorillonitic, thermic.	Typic Palexeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Hohmann	Fine-loamy, mixed, mesic	Typic Xerochrepts	Inceptisols	Sols Bruns Acides	Zonal.
Hugo	Fine-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides	Zonal.
Hulls	Fine-loamy, mixed, mesic	Typic Haploxerolls	Mollisols	Brunizems	Zonal.
Jacinto	Fine-loamy, mixed, thermic.	Mollic Haploxeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Josephine	Fine-loamy, mixed, mesic	Typic Haploxerults	Ultisols	Reddish-Brown Lateritic soils.	Zonal.
Kimball	Fine, montmorillonitic, thermic.	Mollic Palexeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Landlow	Fine, montmorillonitic, thermic.	Aquic Calcic Haploxerolls.	Mollisols	Grumusols	Intrazonal.
Lodo	Loamy, mixed, thermic	Lithic Haploxerolls	Mollisols	Lithosols	Azonal.
Los Gatos	Fine-loamy, mixed, mesic	Typic Argixerolls	Mollisols	Noncalcic Brown soils intergrading to Brunizems.	Zonal.
Marvin	Fine, montmorillonitic, thermic.	Aquic Haploxeralfs	Alfisols	Noncalcic Brown soils intergrading to Humic Gley soils.	Zonal.
Masterson	Coarse-loamy, mixed, mesic.	Dystric Xerochrepts	Inceptisols	Sols Bruns Acides	Zonal.
Maymen	Loamy, mixed, mesic	Dystric Lithic Xerochrepts.	Inceptisols	Lithosols	Azonal.
Maywood	Coarse-loamy, mixed, nonacid, thermic.	Typic Xerofluvents	Entisols	Alluvial soils	Azonal.
Millsap	Clayey, vermiculitic, thermic.	Lithic Palexeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Millsholm	Loamy, mixed, thermic	Lithic Xerochrepts	Inceptisols	Lithosols	Azonal.
Moda	Fine, vermiculitic, thermic.	Abruptic Durixeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Montara	Loamy, serpentinitic, thermic.	Lithic Haploxerolls	Mollisols	Grumusols	Intrazonal.
Myers	Thermic	Typic Chromoxererts	Vertisols	Grumusols	Intrazonal.
Nacimiento	Fine, montmorillonitic, thermic.	Entic Chromoxererts	Vertisols	Grumusols	Intrazonal.
Neuns	Loamy-skeletal, mixed, mesic.	Dystric Xerochrepts	Inceptisols	Sols Bruns Acides	Zonal.

See footnote at end of table.

TABLE 11.—*Soil series classified according to the current system of classification* [1] *and the 1938 system with its later revisions—Continued*

Series	Current classification			1938 classification	
	Family	Subgroup	Order	Great soil group	Order
Newville	Fine, mixed, thermic	Typic Palexeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Orland	Coarse-loamy, mixed, thermic.	Typic Xerorthents	Entisols	Alluvial soils	Azonal.
Parrish	Fine, vermiculitic, mesic	Ultic Haploxeralfs	Alfisols	Noncalcic Brown soils intergrading to Bruinzems.	Zonal.
Perkins	Fine, montmorillonitic, thermic.	Mollic Haploxeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Plaza	Fine-loamy, mixed, thermic.	Aquic Haploxeralfs	Alfisols	Noncalcic Brown soils intergrading to Humic Gley soils.	Zonal.
Pleasanton	Fine-loamy, mixed, thermic.	Mollic Haploxeralfs	Alfisols	Noncalcic Brown soils intergrading to Brunizems.	Zonal.
Polebar	Fine, vermiculitic, mesic	Aquic Calcic Argixerolls	Mollisols	Noncalcic Brown soils intergrading to Brunizems.	Zonal.
Porterville	Fine, montmorillonitic, thermic.	Typic Chromoxererts	Vertisols	Grumusols	Intrazonal.
Redding	Fine, kaolinitic, thermic	Abruptic Durixeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Riz	Fine, montmorillonitic, thermic.	Typic Natrixeralfs	Alfisols	Noncalcic Brown soils intergrading to Solonetz soils.	Zonal.
Sacramento	Fine, montmorillonitic, noncalcareous, thermic.	Vertic Haplaquolls	Mollisols	Humic Gley soils	Intrazonal.
Sehorn	Fine, montmorillonitic, thermic.	Entic Chromoxererts	Vertisols	Grumusols	Intrazonal.
Shedd	Fine, mixed, calcareous, thermic.	Typic Xerorthents	Entisols	Rendzinas	Intrazonal.
Sheetiron	Fine-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides	Zonal.
Stockton	Fine, montmorillonitic, thermic.	Typic Pelloxererts	Vertisols	Humic Gley soils	Intrazonal.
Stonyford	Loamy, mixed, thermic	Lithic Mollic Haploxeralfs.	Alfisols	Noncalcic Brown soils intergrading to Brunizems.	Zonal.
Sunnyvale	Fine-carbonatic, thermic	Typic Calciaquolls	Mollisols	Calcium Carbonate Solonchak soils.	Intrazonal.
Tehama	Fine-loamy, mixed, thermic.	Typic Haploxeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Toomes	Loamy-skeletal, mixed, thermic.	Lithic Haploxerolls	Inceptisols	Lithosols	Azonal.
Tyson	Fine-loamy, mixed, mesic.	Typic Argixerolls	Mollisols	Brunizems	Zonal.
Willows	Fine, montmorillonitic, thermic.	Chromic Pelloxererts	Vertisols	Humic Gley soils intergrading to Solonetz soils.	Intrazonal.
Wyo	Fine-loamy, mixed, thermic.	Mollic Haploxeralfs	Alfisols	Noncalcic Brown soils	Zonal.
Yolo	Fine-silty, mixed, nonacid, thermic.	Typic Xerorthents	Entisols	Alluvial soils	Azonal.
Yorkville	Fine, mixed, mesic	Mollic Haploxeralfs	Alfisols	Noncalcic Brown soils intergrading to Brunizems.	Zonal.
Zamora	Fine-loamy, mixed, thermic.	Typic Haploxeralfs	Alfisols	Noncalcic Brown soils	Zonal.

[1] Placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

ture, color, reaction, parent material, and clay mineralogy. The clay mineralogy for all of these soils is shown in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Goulding soils are rocky and are shallow over basic metavolcanic rock. They formed under brush or brush and grass on steep or very steep mountain slopes. These soils are brown, medium textured, and very slightly acid throughout. In places the upper part of the soil is slightly darker colored than the material below and contains a small amount of organic matter, but otherwise soil horizons are indistinct.

Lodo soils are shaly and are very shallow over hard shale. They formed under annual grasses, forbs, and scattered blue oaks on rolling to steep slopes. These soils typically are pale brown or grayish brown, medium textured or moderately fine textured, and slightly acid to neutral throughout. They have weak structure and are friable. These soils are very erodible and show little evidence of profile development.

Maymen soils are gravelly and are very shallow or shallow over schistose or slightly metamorphosed sandstone and shale. They formed under brush on rolling to very steep slopes. These soils are somewhat excessively drained to excessively drained and are medium textured. They typically are medium acid to strongly acid throughout and have essentially no increase in clay with increasing depth. On south-facing slopes and ridgetops, much of the darker surface soil has been eroded away.

Millsolm soils are shallow over conglomerate, sandstone, and shale. They formed chiefly under anual grasses or oaks and grasses on moderately steep to very steep slopes. These soils are well drained to somewhat excessively drained and are moderately coarse textured to moderately fine textured. They have essentially no increase in clay content with increasing depth. Except for a slight accumulation of organic matter in the uppermost few inches of the soil, there is no evidence of profile development. The soils are very slightly acid to medium acid, and they become slightly less acid with increasing depth.

Toomes soils are very rocky or extremely rocky and are shallow over basic volcanic rock. They formed under grasses and forbs in gently sloping to moderately steep areas. These soils are well drained and are medium textured. They are medium acid to strongly acid throughout. Outcrops of rock are common.

Calcium Carbonate Solonchak soils

Calcium Carbonate Solonchak soils characteristically have a dark-colored A horizon that abruptly overlies a distinct, light-colored Cca horizon or zone of lime accumulation. They formed under the influence of a high or intermittently high water table in nearly level or depressional areas (*7*). The Sunnyvale and Castro soils are representative of this great soil group in Glenn County. Clay mineralogy for both is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Sunnyvale soils have a very dark gray to black, calcareous, fine textured or moderately fine textured A horizon; a light-gray to nearly white, strongly calcareous Cca horizon; and a light brownish-gray, slightly calcareous, mottled Cg horizon.

Castro soils have a caliche layer or a hardpan that is strongly cemented with lime in the lower part of the Cca horizon just above the Cg horizon, but they otherwise are similar to the Sunnyvale soils.

Grumusols

Grumusols formed under grasses or grasses and oaks. They are clayey and have a dark-colored A horizon that grades gradually to a lighter colored C horizon or to parent material. Structure in the uppermost few inches of the A horizon is strong granular, but that below it is prismatic or is weak to strong blocky. Slickensides are common in the lower part of the A horizon and in the upper part of the C horizon. These soils are massive when wet; and when they dry they develop wide cracks that extend from the surface of the soil down into the C horizon. Apparently granular material from the upper part of the A horizon falls down the cracks when the soil is dry, and when the subsoil is moistened the resulting increase in volume causes the soils to move. As a result the lower part of the A horizon and the upper part of the C horizon are a mixture of material from both horizons.

The Altamont, Nacimiento, Sehorn, Ayar, Myers, Capay, Landlow, Montara, Porterville, and East Park soils are representative of Grumusols in this county. Clay mineralogy for all but the Capay, East Park, and Montara soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Altamont soils formed in material from calcareous sandstone, shale, and softly consolidated siltstone. They are moderately deep to deep, rolling to steep, fine textured or moderately fine textured soils that are well drained. These soils are in the foothills and are mostly under annual grasses, but in a few places they are under blue oaks. They have a brown or dark-brown, slightly acid to neutral A horizon that grades to a pale-brown, light olive-brown, or light reddish-brown, mildly alkaline to moderately alkaline and calcareous Cca horizon.

Nacimiento soils are from parent material similar to that of the Altamont soils but are calcareous throughout. Their A horizon is grayish brown and is mildly alkaline and slightly calcareous. The Cca horizon is light olive brown to light yellowish brown and is mildly alkaline and moderately calcareous to strongly calcareous.

Sehorn soils are similar to the Altamont soils in drainage, but they formed in material from noncalcareous sandstone and shale. They are moderately fine textured or fine textured and are moderately deep. Their A horizon is brown and is slightly acid, and their C horizon is slightly acid to neutral.

Ayar soils are well drained and calcareous. They formed under annual grasses and forbs in material from softly consolidated sedimentary rocks on gently undulating to rolling ridgetops. These soils are fine textured throughout and have an AC horizon that is reddish brown and mildly alkaline and strongly calcareous. Their Clca horizon is similar to the AC horizon in color but is very strongly calcareous. It is underlain by a layer of white, hard caliche.

Myers soils are very deep, fine textured, and well drained. These soils formed in alluvium from sedimentary rock. Their A horizon is dark brown and is slightly acid. The C horizon is brown to yellowish brown and is mildly alkaline and intermittently calcareous.

Capay soils are similar to the Myers soils and formed in similar parent material but are darker colored and are somewhat poorly drained. Their A horizon is dark grayish brown and is slightly acid to mildly alkaline. It grades to a light olive-brown or light yellowish-brown, faintly mottled Cca horizon that is moderately alkaline and strongly calcareous. Clay mineralogy is like that of the Myers soils (see table 14).

Landlow soils are fine textured or moderately fine textured and are somewhat poorly drained. These soils formed in basins in alluvium chiefly from basic igneous rock. Their A horizon is dark grayish brown to dark brown and is slightly acid. The Cca horizon is brown and is mildly alkaline to moderately alkaline and calcareous. Abruptly below the Cca horizon, at a moderate depth, is a hardpan that is strongly cemented with lime and silica.

Montara soils are steep, well drained, and somewhat rocky. They are shallow over serpentine rock. These soils are dark grayish brown to olive gray, are moderately fine textured or fine textured, and are neutral in reaction. They are in the upland, chiefly under grasses and forbs, but in some places they are under shrubs and Digger pines.

Porterville soils are gently sloping, deep, and well drained. These soils formed on fans under grasses and trees in alluvium from basic igneous and metamorphic rocks. The A horizon is moderately thick, dark brown to dark reddish brown, and neutral to slightly acid. The C horizon is brown to yellowish brown and is neutral and intermittently calcareous. Gravel is common in places, and especially on the upper parts of the fans.

East Park soils are similar to the Porterville soils and are associated with them in many places, but they formed in alluvium from serpentine rock. They generally are gravelly and have a neutral A horizon and a neutral to mildly alkaline C horizon. East Park soils are infertile and support only thin stands of grasses and a few scattered blue oaks and Digger pines.

Humic Gley soils

Humic Gley soils are poorly drained or very poorly drained hydromorphic soils that have a moderately thick, dark-colored horizon of organic and mineral material that is underlain by a somewhat lighter colored mineral gley horizon (*12*). The gley horizon typically is mottled, compact, and massive.

In this county Humic Gley soils are in basins or poorly drained areas where runoff is very slow and the water table is intermittently high. Deep drains, used to reclaim some of these soils, have improved the drainage. When the soils dry out, however, they develop some characteristics of Grumusols. Dense growths of grasses, sedges, reeds, and other plants that tolerate wetness produced large amounts of organic matter, which darkened the soils to a considerable depth in most places.

The Burris, Clear Lake, Sacramento, and Stockton are typical Humic Gley soils in this county, and the Willows are Humic Gley soils that are intergrading toward Solonetz soils. Clay mineralogy for all but the Sacramento soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Burris soils generally are bouldery or cobbly and are fine textured. These soils formed in basic alluvium on colluvial slopes. The A horizon is very dark gray, slightly acid, cobbly clay. The C horizon is similar in texture but is mottled olive gray and is mildly alkaline and strongly calcareous. The subsoil is always moist. Seeps and springs are common.

Clear Lake soils are fine textured. They formed in sedimentary alluvium along sluggish drainageways or in local, poorly drained basins. The A horizon is dark-gray or black clay that is slightly acid or neutral. It grades to a mottled and gleyed, grayish-brown C horizon that is alkaline and calcareous.

Sacramento soils are similar to the Clear Lake soils but formed in mixed alluvium laid down by the Sacramento River. They have an A horizon of slightly acid, dark-gray, faintly mottled clay. The C horizon is dark grayish-brown to grayish-brown and is faintly mottled and gleyed. It is alkaline and calcareous. Small pellets of iron and manganese are common in the lower part of the A and C horizons.

Stockton soils are dark colored and fine textured. These soils formed in predominantly basic alluvium. The A horizon is very dark gray or black, medium acid clay. The Cca horizon is very dark gray to very dark grayish-brown clay that is mildly alkaline and calcareous. A hardpan that is weakly cemented with lime underlies the Cca horizon at a variable depth.

HUMIC GLEY SOILS INTERGRADING TO SOLONETZ SOILS

Willows soils are the only Humic Gley soils intergrading to Solonetz soils in this county. They formed in sedimentary or metasedimentary alluvium under poor drainage and a fluctuating high water table. These soils are fine textured throughout. The A horizon is gray to dark grayish brown and is slightly acid to mildly alkaline. The C horizon is grayish brown to brown, is moderately alkaline to strongly alkaline and calcareous, and is gleyed. Excess salts and alkali occur in variable amounts throughout the profile.

Rendzinas

Rendzinas are well drained and overlie relatively soft, highly calcareous parent material. They have a calcareous A horizon that is light colored to dark colored and that is underlain by a yellowish, very calcareous Cca horizon.

Shedd soils are the only Rendzinas in this county. They have an A horizon of light-gray, calcareous silty clay loam, and a Cca horizon that is similar in texture but is pale yellow and very calcareous. The parent material is softly consolidated, light-gray to olive, calcareous siltstone or fine-grained sandstone.

Brunizems

Brunizems (formerly called Prairie soils) are very dark brown to grayish-brown or gray soils that grade to lighter colored parent material at a depth of 2 feet or more. They are leached of carbonates. These soils range from slightly acid to strongly acid throughout, and the pH generally changes little with increasing depth. They formed under grasses or shrubs, or under a mixture of shrubs and grasses that included some scattered oaks.

The Hulls and Tyson soils are representative of Brunizems in this county. Clay mineralogy for the Hulls soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Hulls soils formed under grasses and scattered Brewer oaks in material from chlorite-mica schist. The A horizon is grayish gravelly loam that is strongly acid to medium acid. It grades to a light brownish-gray C horizon that is similar in texture but is medium acid. These soils feel like talc and have a metallic sheen.

Tyson soils formed under various kinds of shrubs and Brewer oaks or under grasses and Brewer oaks in material from sericite schist that had bands of quartzite. The A horizon is dark grayish-brown gravelly loam that is very friable and is slightly acid. It grades to a weakly developed B2t horizon of pale-brown gravelly loam that is medium acid.

Noncalcic Brown soils

Noncalcic Brown soils form in a semiarid to subhumid climate having cool, moist winters and rather hot, dry summers. The vegetation is grass or is trees and grass and some shrubs. The A horizon is brown, massive, and somewhat acid and is low in organic matter. The B2t horizon is redder, finer textured, and richer in clay. It is leached of carbonates and is slightly acid to alkaline in reaction (*6*).

In Glenn County Noncalcic Brown soils are dominant in the foothills and along the western side of the Sacramento Valley. Three stages of profile development, based on the amount of clay in the B2t horizon relative to that in the A horizon, are recognized: (1) minimal (weak), (2) medial (moderate), and (3) maximal (strong). Some soils of maximal development also have a hardpan. Other than these typical Noncalcic Brown soils there are in this county soils that are intergrading toward Brunizems, toward Humic Gley soils, or toward Solonetz soils.

MINIMAL DEVELOPMENT

The Arbuckle, Contra Costa, Jacinto, Wyo, and Zamora soils in this county have minimal profile development. Clay mineralogy for the Contra Costa, Jacinto, and Zamora soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Arbuckle soils are deep, well drained, and medium textured. These soils are in the foothills and in the Sacramento Valley on gravelly and cobbly alluvium. The A horizon is brown gravelly loam that is medium acid to slightly acid. The B horizon is brown to reddish-brown gravelly heavy loam or light clay loam that is slightly acid to neutral. Kaolinite, montmorillonite, and vermiculite are the dominant clay minerals, and they are present in about equal amounts.

Contra Costa soils are moderately deep and are well drained. They are in the foothills on unaltered sandstone and shale under chaparral or grasses and oaks. The surface soil is brown clay loam, and the subsoil is brown to reddish-brown clay. Reaction ranges from slightly acid to neutral throughout the profile. Base saturation is more than 85 percent and increases with increasing depth.

Jacinto soils are very deep and are well drained. They formed in wind-laid, sandy material blown onto low ridges from abandoned streambeds of Stony Creek. Their A horizon is light brownish-gray or grayish-brown fine sandy loam that is slightly acid. The B2t horizon is somewhat browner heavy fine sandy loam that is neutral in reaction and overlies a C horizon of lighter colored fine sandy loam. Reaction of the B2t and C horizons ranges, with increasing depth, from slightly acid to mildly alkaline. Base saturation is more than 85 percent throughout the profile.

Wyo soils are on young alluvial fans of Stony Creek. They are moderately deep to very deep, well-drained soils formed in alluvium from schistose, sedimentary, and metavolcanic rocks. These soils have a grayish-brown, medium-textured A horizon that is slightly acid. The B2t horizon is similar in color but is slightly finer textured and is slightly acid to neutral. The parent material generally is lighter colored than the horizon above and is neutral to mildly alkaline and intermittently calcareous. Kaolinite and vermiculite are the dominant clay minerals, but small amounts of montmorillonite and mica are present.

Zamora soils formed in alluvium from sedimentary rock or from mixed alluvium on young alluvial fans and flood plains. They are very deep, moderately fine textured, well-drained soils. They have a grayish-brown, slightly acid surface soil. The B2t horizon is similar in color but is slightly finer textured and is neutral to mildly alkaline. The parent material is paler colored than the horizon above and is intermittently calcareous.

MEDIAL DEVELOPMENT

Two soil series, the Perkins and Tehama, are the Noncalcic Brown soils in this county that have medial development. Clay mineralogy for the Tehama soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Perkins soils, like the weakly developed Arbuckle soils, formed in gravelly and cobbly alluvium, but the alluvium is older and more weathered. Perkins soils have more reddish hues (7.5YR and 5YR) than the Arbuckle soils. Their surface soil is brown to strong brown, and their subsoil is reddish brown. The amount of clay in the B horizon is moderate, and differences in structure and consistence between A and B horizons are more evident than in the Arbuckle soils. The surface soil is medium acid, but the subsoil and substratum are slightly acid to medium acid. Base saturation is relatively high, and there has been some downward movement of bases in the profile.

Tehama soils are mostly on old alluvial fans of Stony Creek in the northeastern part of the county. These soils are well drained. They have a pale-brown, medium-textured surface soil that is slightly acid to medium acid. The subsoil is brown, moderately fine textured, and slightly acid to neutral. It grades to pale-colored, similarly textured parent material that is alkaline and intermittently calcareous. Base saturation is high and increases with increasing depth.

MAXIMAL DEVELOPMENT

The Corning, Hillgate, Kimball, Millsap, Moda, Newville, and Redding soils are Noncalcic Brown soils in this county that have maximal development; the Moda and Redding soils also have hardpan layers. Clay mineralogy for all but the Kimball and Moda soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Corning soils are typical Noncalcic Brown soils that have maximal development. They are on terraces on old gravelly and cobbly alluvium. Their A horizon is yellowish-red gravelly loam that is medium acid to strongly acid. It abruptly overlies a B2t horizon consisting of dense, reddish-brown to red slightly gravelly clay that is medium acid to neutral. These soils are low in fertility. Base saturation ranges from 55 to 70 percent in the surface soil to 80 percent or more in the subsoil and substratum.

Hillgate soils are similar to the moderately developed Tehama soils, but they generally are on alluvial fans and low terraces on slightly older material and have a more strongly developed profile. More clay also has accumulated in the B2t horizon, and this horizon generally is browner in color. Differences in structure and consistence between the A and B horizons also are more strongly expressed.

Kimball soils are intermediate in position and age between the Corning and Hillgate soils. They are on terraces and are well drained. Their A horizon is brown loam that is slightly acid to medium acid. It abruptly overlies a B2t horizon of reddish-brown, dense clay that is slightly acid to neutral. Clay accumulation in the B2t horizon is less than that in the Corning soils and more than that in the Hillgate soils. Kaolinite, montmorillonite, and vermiculite are the dominant clay minerals, and they occur in about the same amounts as in the Corning and Hillgate soils (see table 14).

Millsap soils are in the foothills and are shallow over shale. They are noncalcareous soils that have an A horizon of pale-brown loam that is slightly acid. The B2t horizon, abruptly below, is brown or dark brown, dense clay that is slightly acid to medium acid. Base saturation is more than 90 percent and increases slightly with increasing depth.

Moda soils have a hardpan below the B2t horizon, which is cemented with iron and silica, but they are otherwise similar to the Kimball soils.

Newville soils occupy dissected terrace slopes below areas of the Corning and Redding soils. They are gravelly and are similar to the Corning soils, but their surface soil is browner and their subsoil is less red. They also are less acid, and base saturation is somewhat higher. Newville soils, on slopes that face north under dense stands of blue oaks, have a darker colored surface soil than in other areas and some characteristics of Brunizems.

Redding soils, on terraces on old gravelly and cobbly deposits, are shallow, well-drained soils that have a hardpan. Except for the hardpan, which is below the reddish clay B2t horizon and is cemented with silica and iron, they are similar to the Corning soils. Both soils have distinct hummocky microrelief.

NONCALCIC BROWN SOILS INTERGRADING TO BRUNIZEMS

Noncalcic Brown soils that are intergrading to Brunizems have an A horizon that is darker colored and more friable than that in typical Noncalcic Brown soils and that is more than 1.75 percent organic matter in the uppermost 6 to 10 inches. They generally form where precipitation is high, and under brush or under oaks and grasses. The darker color of the surface horizon is the result of the greater accumulation of organic matter from the more luxuriant growth of vegetation.

The Henneke, Los Gatos, Parrish, Pleasanton, Polebar, Stonyford, and Yorkville soils are Noncalcic Brown soils that are intergrading to Brunizems in this county. Clay mineralogy for the Parrish, Polebar, and Stonyford soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Henneke soils typically are stony and are shallow over serpentine. Open to semidense stands of various kinds of shrubs grow on the areas. These soils are in the upland. They are rolling to very steep, are well drained, and have a weakly developed profile. The A1 horizon is thin, reddish-brown gravelly clay loam, and the B2t horizon is dark reddish-brown gravelly clay. Reaction is neutral throughout the profile. Base saturation is more than 75 percent in the surface soil and more than 90 percent in the subsoil. The calcium-magnesium ratio ranges from 1:2 to 1:5. Antigorite and montmorillonite are the dominant clay minerals, but small amounts of vermiculite also are present.

Los Gatos soils, which are mostly under brush, are shallow to moderately deep over schistose and partly metamorphosed sandstone and shale. They are well drained and have a weakly developed profile. The surface horizon is brown gravelly loam, and the B2t horizon is brown near reddish-brown gravelly clay loam. Reaction is medium acid to strongly acid throughout the profile. Base saturation ranges from 60 percent in the surface soil to more than 75 percent in the subsoil.

Parrish soils are associated with the Los Gatos and Maymen soils in areas under shrubs and with the Millsholm clay loams in areas under oaks and grasses. They are similar to the Los Gatos soils but have more clay in the B2t horizon and morphological differences between the A and B horizons are more distinct. Parrish soils are slightly acid to strongly acid, and they generally are more acid with increasing depth. Base saturation ranges from 60 percent in the surface soil to more than 85 percent in the lower part of the subsoil.

Pleasanton soils formed in gravelly alluvium under annual grasses and forbs or under oaks, grasses, and some shrubs. They are deep and are well drained and have medial profile development. Accumulation of clay in the subsoil is moderate. The surface soil is grayish brown, and it grades to brown or yellowish brown with increasing depth. Reaction is slightly acid to medium acid throughout the profile.

Polebar soils formed under grasses or oaks and grasses in material from partly metamorphosed sandstone and shale that in places are serpentinized. They are moderately deep, moderately steep to steep, and are well drained. They also have distinct color and textural A, B, and C horizons. The A horizon is brown loam that is slightly acid; the B2t horizon is reddish-brown heavy clay loam that is slightly acid to neutral. The Cca horizon is light gray and is mildly alkaline and calcareous.

Stonyford soils are shallow over pillow basalt or greenstone and are under dense stands of chamise or various kinds of shrubs. They are moderately steep to very steep, are well drained to excessively drained, and have a weakly developed profile. The surface soil is thin, brown gravelly heavy loam, and the subsoil is reddish-brown gravelly clay loam. Reaction is slightly acid to medium acid and changes little with increasing depth. Kaolinite, montmorillonite, and vermiculite occur in about equal amounts in the surface soil, but montmorillonite is dominant in the subsoil.

Yorkville soils are similar to the Polebar soils in depth and formed in similar positions under like vegetation and from similar parent material. They are moderately well drained to somewhat poorly drained. These soils are gray in color. The A horizon is clay loam that is slightly acid to neutral, and the subsoil is clayey and is alkaline and calcareous. Landslips are numerous, and rocks crop out in some places.

NONCALCIC BROWN SOILS INTERGRADING TO HUMIC GLEY SOILS

Noncalcic Brown soils that are intergrading to Humic Gley soils have poorer drainage than typical Noncalcic Brown soils. They are moderately well drained to somewhat poorly drained. In places mottles occur in the A3 horizon and in the B2t horizon. The water table is intermittently high during the wet winter months.

The Artois, Marvin, and Plaza soils are Noncalcic Brown soils that are intergrading to Humic Gley soils in this county. Clay mineralogy for all of these soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Artois soils are associated with the Arbuckle and Hillgate soils, which also are Noncalcic Brown soils but are slightly developed and strongly developed, respectively. Artois soils generally are in shallow depressions, have somewhat poorer drainage, and are strongly developed. Their surface soil is light brownish-gray loam that is slightly acid. The B2t horizon is yellowish brown or olive brown and is clayey and neutral to mildly alkaline. Rust mottles occur in the lower part of the surface soil and in the upper part of the subsoil.

Marvin soils are on the lower edges of an old flood plain of the Sacramento River. They occupy areas between the well-drained Zamora soils and the poorly drained Willows soils. They are moderately well drained to somewhat poorly drained and in places are mottled in the lower part of the A and B horizons. Some areas are affected by excess salts and alkali and have an intermittently high water table. The surface soil is grayish brown and moderately fine textured. The lower part of the subsoil is dark grayish-brown silty clay that grades to lighter colored silty clay loam parent material with increasing depth. These soils are slightly acid to neutral near the surface, but they are alkaline and calcareous in the lower part of the B and C horizons.

Plaza soils are on the lower edges of alluvial fans between the well-drained Tehama soils and the poorly drained Castro, Sunnyvale, and Willows soils, which are in basins. They are somewhat poorly drained and have an intermittently high water table. A few areas are affected by excess salts and alkali. These soils, like the Tehama soils, have a moderately developed profile, but they are grayer and more alkaline than those soils. In places the substratum is weakly cemented with lime and silica.

NONCALCIC BROWN SOILS INTERGRADING TO SOLONETZ SOILS

Riz soils are the only Noncalcic Brown soils in this county that are intergrading toward Solonetz soils. Differences between these soils and typical Noncalcic Brown soils, in addition to containing excess salts and alkali, are poorer drainage and gleying in the lower horizons. The brownish hues (10YR and 7.5YR) and moderate chromas of the Riz soils indicate that they formerly were well drained. Riz soils are similar to the Tehama or Hillgate soils but have become salinized as the result of a high water table and high concentrations of soluble salt. Clay mineralogy for these soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Reddish-Brown Lateritic soils

Reddish-Brown Lateritic soils form under tropical forests in the humid tropics or under forests of conifers and hardwoods in a humid, wet-dry climate. The soils have somewhat different characteristics under the two kinds of climate.

The Reddish-Brown Lateritic soils in this county formed under forests of various kinds of conifers and hardwoods at elevations between 1,500 and 5,500 feet. Rainfall ranges from 35 to 55 inches, and the average annual temperature is 50° to 55° F. These soils are well drained and acid. They have a thin 01 & 02 horizon over a reddish-brown or pale-brown A1 horizon. The B horizon is more clayey than the A1 horizon and is red, yellowish red, reddish brown, or yellowish brown.

The Dubakella and Josephine soils are the Reddish-Brown Lateritic soils in this county. Clay mineralogy for the Josephine soils is given in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Dubakella soils formed in material from serpentine rock. They are shallow to moderately deep, stony, and well drained. These soils are neutral throughout. They have an A1 horizon of reddish-brown stony loam or light clay loam. Their B horizon is slightly more clayey than the A1 horizon and is reddish brown or yellowish brown. Montmorillonite and antigorite are the main clay minerals, but small amounts of vermiculite are also present.

Josephine soils formed in material from schistose and partly metamorphosed sedimentary rocks. They are moderately deep to deep and are well drained. They have A1 and A3 horizons of pale-brown or light-brown, slightly acid to medium acid gravelly loam. The B2t horizon is reddish-yellow to red, medium acid to strongly acid gravelly clay loam or light clay.

Sols Bruns Acides

Sols Bruns Acides form in a humid, temperate, wet-dry climate under coniferous forests or under forests of conifers and hardwoods. They have a thin, grayish-brown to dark-brown A horizon. The B horizon is brown or lighter colored, and the parent material is yellowish brown. The content of clay is about uniform throughout the profile or increases slightly in the B horizon. Structure is granular in the A1 horizon and granular or weak, subangular blocky in the B and C horizons. Reaction ranges from medium acid to very strongly acid and increases with increasing depth. Base saturation is moderate to low (*4*).

The Sheetiron, Hohmann, Hugo, Masterson, and Neuns soils are the Sols Bruns Acides in this county. Clay mineralogy is given for all but the Hugo soils in table 14, in the subsection "Mineralogical Analyses of Clay Fractions."

Sheetiron soils are the most extensive. They are well-drained, moderately deep soils formed in material from schistose rock. They have a thin A1 horizon consisting of grayish-brown gravelly loam that is medium acid. The B2t horizon is weakly developed and consists of light yellowish-brown gravelly heavy loam that is strongly acid. Base saturation is 50 to 60 percent, and it decreases with increasing depth.

Hugo soils are similar to the Sheetiron soils, but they formed in material from sandstone and shale that in places are partly metamorphosed. They are slightly browner than the Sheetiron soils; they have hues of 10YR, and the Sheetiron have hues of 2.5Y.

Masterson soils formed under white and red firs from parent material similar to that of the Sheetiron soils, but they are at a higher elevation. Elevation generally is more than 5,500 feet. They have hues of 10YR and 7.5YR and are therefore richer in color than the Sheetiron soils. Masterson soils have an A1 horizon that is brown and strongly acid. Their B2 horizon is brown and very strongly acid, and the C1 horizon is light yellowish brown and very strongly acid. These soils are gravelly loam throughout, and the content of clay is essentially the same with increasing depth. Base saturation is less than 40 percent and decreases with increasing depth.

Neuns soils are somewhat similar to the Masterson soils in color and in many other characteristics, but they formed in material from greenstone or basic metavolcanic rock. They are cobbly, medium textured, and are medium acid to very strongly acid. The content of clay changes little with increasing depth. Base saturation ranges from 40 to 50 percent.

Hohmann soils formed in material from metavolcanic rock similar to that of the Neuns soils, but they have a distinct purplish or reddish-gray color. They are stony and moderately deep but are slightly finer textured and less acid than the Neuns soils. Base saturation is 55 to 65 percent.

Descriptions of Soil Profiles

Following are detailed descriptions of representative profiles of the different soil series in Glenn County. The place in the county where each profile was taken is given.

Technical terms used in describing the soils are defined in the Glossary in the back of the survey or in the Soil Survey Manual (*14*). Letters and numbers on the left designate the horizons in each soil profile. Combinations of letters and numbers in parentheses, such as (10YR 5/4), give a notation of color in terms of hue, value, and chroma. This notation, known as a Munsell notation, is more precise than the color name, which is also given. Unless otherwise indicated, the notation is for dry soil.

Some soils of the Altamont, Millsholm, Toomes, and Zamora series had other names in material published by the University of California Agricultural Experiment Station and the California Division of Forestry. The former name is indicated in parentheses or by footnote in the text where the profile is described.

ALTAMONT CLAY: On a 34 percent slope facing northwest; under annual grasses and forbs used as dryland range; elevation of 450 feet (about 10 miles west-northwest of Willows; SE¼ sec. 24, T. 20 N., R. 5 W.):

O1&O2—¼ inch to 0, fresh and partly decomposed leaves from grasses and forbs.

A11—0 to 2 inches, grayish-brown (10YR 5/2) clay, dark brown (10YR 4/3) to dark grayish brown (10YR 4/2) when moist; strong, medium to coarse, subangular blocky structure; very hard when dry, friable when moist, sticky and plastic when wet; very slightly acid (pH 6.6); clear, wavy boundary.

A12—2 to 11 inches, brown (10YR 5/3) clay, dark-brown (10YR 4/3) when moist; strong, very coarse, prismatic primary structure and moderate, coarse to very coarse, subangular blocky secondary structure; very hard when dry, firm when moist, sticky and plastic when wet; many fine roots; common, very fine and fine, tubular pores; slightly acid (pH 6.5); clear, wavy boundary.

A13—11 to 20 inches, brown (10YR 5/3) clay, dark brown (10YR 3/3) when moist; strong, very coarse, prismatic primary structure and moderate, very coarse, subangular blocky secondary structure; very hard when dry, firm when moist, sticky and plastic when wet; many fine roots; common very fine and fine pores; common slickensides along faces of deep cracks and on ped faces; very slightly acid (pH 6.8); clear, wavy boundary.

ACca—20 to 26 inches, brown (10YR 5/3) clay, dark brown (10YR 3/3) when moist; massive to subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; a few fine roots; common very fine pores; common slickensides; mildly alkaline (pH 7.4); calcareous; contains lime, mostly segregated in fine to coarse soft nodules; clear, irregular boundary.

Cca—26 to 34 inches, light olive-brown (2.5Y 5/3) shaly clay, olive brown (2.5Y 3/4) when moist; massive; a few slickensides; common, thin, patchy clay films; mildly alkaline (pH 7.6); strongly calcareous; lime is finely disseminated and segregated in small soft and hard nodules; abrupt, irregular boundary.

R—34 inches +, fractured shale and fine-grained sandstone that is partly weathered but hard; the material is less fractured and weathered with increasing depth; calcareous; lime is concentrated in whitish seams along fracture planes.

ALTAMONT CLAY (formerly known as Walker): On a 5 percent slope facing southeast; under range of annual grasses and forbs in an area previously cropped to dryfarmed barley; elevation of 320 feet (about 5 miles west-southwest of Orland; SE¼ sec. 26, T. 22 N., R. 4 W.):

Ap1—0 to 1 inch, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) when moist; a few cobblestones and pebbles on the surface; strong, medium to coarse, granular structure; very hard when dry, very firm when moist, very sticky and plastic when wet; very slightly acid (pH 6.8); abrupt, smooth boundary.

Ap2—1 to 6 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) when moist; strong, very coarse, prismatic primary structure and strong, coarse, subangular blocky secondary structure; very hard when dry, very firm when moist, very sticky and plastic when wet; many fine and medium roots; common very fine and fine pores; slightly acid (pH 6.3); clear, wavy boundary.

A1—6 to 18 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) when moist; strong, very coarse, prismatic primary structure and strong, coarse to very coarse, angular blocky secondary structure; very hard when dry, very firm when moist, very sticky and plastic when wet; many fine and medium roots; common very fine and fine pores; a few slickensides; very slightly acid (pH 6.6); clear, wavy boundary.

ACca—18 to 29 inches, brown (10YR 5/3) clay, dark brown (10YR 3/3) when moist; strong, very coarse, angular blocky structure; very hard when dry, very firm when moist, very sticky and plastic when wet; a few fine roots; common very fine and fine pores; many slickensides; mildly alkaline (pH 7.7); calcareous; contains finely disseminated lime; gradual, wavy boundary.

C1ca—29 to 43 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/3) when moist; massive; very hard when dry, very firm when moist, sticky and plastic when wet; a few very fine roots and very fine and fine pores; a few slickensides; mildly alkaline (pH 7.7); strongly calcareous; lime is finely disseminated and segregated in soft blotches and in a few, small, hard nodules; clear, wavy boundary.

C2—43 inches +, mottled, pale-yellow (2.5Y 7/3) and light yellowish-brown (2.5Y 6/4), softly consolidated siltstone (silty clay loam), light yellowish brown (2.5Y 6/3) and light olive brown (2.5Y 5/4) when moist; massive; mildly alkaline (pH 7.7); calcareous; lime in seams and soft nodules.

ARBUCKLE GRAVELLY LOAM: On a nearly level, low terrace; under dryfarmed barley; elevation of 165 feet (about 3 miles southwest of Hamilton City, about one-fourth mile east of the intersection of St. John Road and County Road VV in a field just north of St. John Road):

Ap—0 to 6 inches, brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/3) when moist; the gravel is mainly quartzite and chert; massive but breaks to subangular blocky structure; many fine roots; many fine and medium pores; hard when dry, friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.8); abrupt, smooth boundary.

A12—6 to 13 inches, brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/3) when moist; massive; many, fine and medium, irregular voids and tubular pores; many fine roots; hard when dry, friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.8); clear, smooth boundary.

B1t—13 to 21 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/4) when moist; massive; hard when dry, firm when moist, nonsticky and nonplastic when wet; many fine roots and pores; a few, thin, patchy clay films in pores; medium acid (pH 5.9); clear, smooth boundary.

B2t—21 to 32 inches, brown (7.5YR 5/4) gravelly loam near clay loam, dark brown (7.5YR 3/4) near dark reddish brown (5YR 3/4) when moist; massive; many fine and medium voids and pores; very hard when dry, firm when moist, slightly sticky and slightly plastic when wet; a few fine roots; common, thin to moderately thick, continuous clay films in voids and around pebbles; medium acid (pH 5.9); gradual, wavy boundary.

B3t—32 to 60 inches +, color, texture, and consistence similar to those of the B2t horizon; massive and very porous; a few fine roots; common, thin, continuous clay films in voids and around pebbles, but these are patchy with increasing depth; medium acid (pH 6.0) but very slightly acid (pH 6.8) with increasing depth.

ARTOIS GRAVELLY LOAM: In a nearly level field; under dryfarmed barley in a field formerly cropped to rice; elevation of 170 feet (about 1½ miles west of Artois; SW¼ sec. 5, T. 20 N., R. 3 W.):

Ap—0 to 9 inches, light brownish-gray (2.5Y 6/2) gravelly loam, dark grayish brown (2.5Y 4/2) when moist; the gravel is mainly quartzite and multicolored chert; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; common fine and medium pores; medium acid (pH 6.0); clear, smooth boundary.

A3—9 to 17 inches, light brownish-gray (2.5Y 6/2) gravelly light clay loam, dark grayish brown (2.5Y 3/2) when moist; common, fine mottles of strong brown and reddish brown; massive; hard when dry, firm when moist, sticky and plastic when wet; many very fine roots; common very fine and fine pores and voids; a few, thin, patchy clay films in pores and along old root channels; slightly acid (pH 6.2); clear, wavy boundary.

B1t—17 to 21 inches, light olive-brown (2.5Y 5/3) gravelly light clay, very dark grayish brown (2.5Y 3/2) when moist; a few fine mottles of strong brown and reddish brown; massive to weak, very coarse, subangular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; a few very fine roots; many very fine and fine pores; common, moderately thick, nearly continuous clay films in pores and on ped faces; a few fine manganese pellets; slightly acid (pH 6.5); clear, wavy boundary.

B2t—21 to 38 inches, yellowish-brown (10YR 5/4) clay dark brown (10YR 3/3) when moist; a few pebbles; moderate, very coarse, subangular blocky structure; extremely hard when dry, very firm when moist, very sticky and very plastic when wet; a few very fine roots; many, very fine tubular pores; many moderately thick, continuous clay films in pores and on ped faces; a few slickensides; a few fine manganese pellets; very slightly acid (pH 6.6); gradual, wavy boundary.

B3t—38 to 60 inches +, pale-brown (10YR 6/3) clay, dark brown (10YR 4/3) when moist; a few pebbles; massive; very hard when dry, very firm when moist, very sticky and plastic when wet; clay films are moderately thick and nearly continuous but are less common than in the B2t horizon; neutral (pH 6.9).

AYAR CLAY: On a 5 percent slope facing northeast; under range of annual grasses and forbs rotated with dryfarmed grain; elevation of 580 feet (about 7½ miles west-southwest of Willows; SE¼ sec. 17, T. 19 N., R. 4 W.):

Ap—0 to 10 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/3) when moist; strong, fine and medium, granular structure in the uppermost one-half inch, but strong, very coarse, subangular blocky below; very hard when dry, firm when moist, sticky and plastic when wet; many very fine and fine roots; many, very fine and fine, irregular pores and a few, very fine, tubular pores; mildly alkaline (pH 7.4); strongly calcareous; lime is finely disseminated and segregated in a few, hard, fine- and medium-sized concretions; clear, wavy boundary.

AC—10 to 17 inches, reddish-brown (5YR 4/3) clay, dark reddish brown, (5YR 3/3) when moist; moderate, coarse, subangular blocky structure; very hard when dry, firm when moist, sticky and very plastic when wet; many very fine and fine roots; common, very fine and fine, irregular and tubular pores; a few slickensides; mildly alkaline (pH 7.6); strongly calcareous; lime is finely disseminated and segregated in a few, hard, small- and medium-sized concretions; clear, wavy boundary.

C1ca—17 to 32 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; many very fine and fine roots; common, very fine to medium, irregular and tubular pores; a few slickensides; mildly alkaline (pH 7.6); very strongly calcareous; lime is finely disseminated and segregated as mycelial lime in old root channels and tubular pores and in a few, hard, fine- and medium-sized concretions.

Ccam—32 to 34 inches, white, massive, hardened caliche; extremely hard when dry, extremely firm when moist; mildly alkaline (pH 7.8); very strongly calcareous; abrupt, irregular boundary.

C&Ccam—34 to 54 inches +, stratified layers of pale-yellow (2.5Y 8/3) and reddish-brown (5YR 4/4) loam interbedded with thin layers of white caliche; very strongly calcareous; moderately alkaline (pH 7.9).

BURRIS BOULDERY CLAY: On a 7 percent colluvial slope facing east; under range consisting of annual grasses and forbs; elevation of 550 feet (east of Orland Buttes; near the center of sec. 5, T. 22 N., R. 4 W.):

O1&O2—¼ inch to 0, mat of fresh and partly decomposed leaves from grasses and forbs.

A11—0 to ½ inch, very dark gray (2.5Y 3/1) angular cobbly clay, very dark gray (2.5Y 3/1) to very dark grayish brown (2.5Y 3/2) when moist; strong, fine to coarse, granular structure; very hard when dry, very firm when moist, sticky and plastic when wet; many very fine roots; slightly acid (pH 6.2); abrupt, smooth boundary.

A12—½ inch to 7 inches, very dark gray (2.5Y 3/1) angular cobbly clay, very dark gray (2.5Y 3/1) to very dark grayish brown (2.5Y 3/2) when moist; strong; medium and coarse, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; common, very fine and fine, irregular pores and a few, very fine tubular pores; many very fine roots; slightly acid (pH 6.1); clear, wavy boundary.

A13—7 to 19 inches, very dark gray (5Y 3/1) angular cobbly clay, dark olive gray (5Y 3/2) when moist; strong, coarse, angular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; many very fine roots; common, very fine and fine, irregular pores and very fine tubular pores; many slickensides; slightly acid (pH 6.5) but neutral (pH 7.0) with increasing depth; clear, wavy boundary.

AC—19 to 31 inches, dark-gray (5Y 4/1) angular cobbly clay, dark olive (5Y 3/3) when moist; massive; very hard when dry, very firm when moist, very sticky and plastic when wet; a few very fine roots; a few, fine, irregular pores and common, very fine, tubular pores; many slickensides; neutral (pH 7.2); slightly calcareous; a few, small, soft concretions of lime; clear, wavy boundary.

Cgca—31 to 46 inches +, mottled, dark-gray (5Y 4/1), olive-gray (5Y 5/2), and white (5Y 8/1) angular cobbly clay, mottled dark olive gray (5Y 3/2), olive gray (5Y 4/2), and light gray (5Y 7/2) when moist; common, yellowish-brown and brown mottles; massive; very hard when dry, firm when moist, sticky and plastic when wet; a few very fine roots; mildly alkaline (pH 7.7); strongly calcareous; lime is segregated in large soft masses and in fine hard concretions.

CAPAY CLAY: In a nearly level field; under dry-farmed barley; elevation of 150 feet (about 4 miles north-northwest of Willows; NE¼ sec. 20, T. 20 N., R. 3 W.):

Ap—0 to 9 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; very coarse, prismatic primary structure and moderate, fine to coarse, subangular blocky secondary structure; very hard when dry, firm when moist, very sticky and very plastic when wet; many very fine and fine roots; many very fine to medium, irregular pores and common, very fine and fine, tubular pores; slightly acid (pH 6.3); clear, wavy boundary.

A11—9 to 21 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; strong, very coarse, prismatic primary structure that breaks to strong, medium and coarse, angular blocky; very hard when dry, firm when moist, very sticky and very plastic when wet; a few very fine roots; common, fine, irregular pores and very fine and fine, tubular pores; slickensides are few but are common with increasing depth; neutral (pH 7.0); clear, wavy boundary.

A12ca—21 to 34 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; strong, very coarse, prismatic primary structure that breaks to moderate, fine to coarse, angular blocky; very hard when dry, firm when moist, very sticky and very plastic when wet; many fine and very fine roots; common, very fine and fine, irregular pores and very fine and fine tubular pores; common slickensides; mildly alkaline (pH 7.7); slightly calcareous; lime is disseminated and segregated in a few, fine, soft masses; gradual, wavy boundary.

C1ca—34 to 45 inches, light olive-brown (2.5Y 5/3) clay, olive brown (2.5Y 4/3) when moist; massive; very hard when dry, firm when moist, sticky and plastic when wet; a few very fine and fine roots; common, very fine and fine, tubular pores and a few, fine, irregular pores; a few slickensides; moderately alkaline (pH 8.0); strongly calcareous; lime is finely disseminated and segregated in common, medium-sized, soft masses; gradual, wavy boundary.

C2ca—45 to 60 inches +, light yellowish-brown (2.5Y 6/3) clay loam, olive brown (2.5Y 4/3) when moist; a few, faint, brown mottles; massive; hard when dry, friable when moist, sticky and plastic when wet; many, very fine and fine, tubular pores; a few slickensides; moderately alkaline (pH 8.1); strongly calcareous; lime is finely disseminated and segregated in a few soft masses and in places along tubular pores.

CASTRO CLAY: In a nearly level basin; under dry-farmed barley grown in rotation with rice; elevation of 100 feet (1½ miles south of Bayliss; southeast corner sec. 46, Jacinto Rancho):

Ap1—0 to 4 inches, very dark gray (5Y 3/1 to 3/0) clay, black (5Y 2/1) when moist; strong, fine to coarse, subangular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; very fine and fine roots; many, very fine to medium, irregular pores; many worm channels; mildly alkaline (pH 7.6); slightly calcareous; lime is finely disseminated; abrupt, smooth boundary.

Ap2—4 to 10 inches, very dark gray (5Y 3/1 to 3/0) clay, black (5Y 2/1) when moist; strong, coarse, subangular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; many very fine and fine roots and medium roots; many, very fine to medium, irregular pores and few, very fine and fine, tubular pores; many worm channels; mildly alkaline (pH 7.7); slightly calcareous; lime is finely disseminated; clear, smooth boundary.

ACca—10 to 17 inches, dark-gray (5Y 4/1 to 4/0) clay, black (5Y 2/1) when moist; strong, coarse, angular blocky structure; vertical cracks in places; hard when dry, firm when moist, sticky and plastic when wet; many very fine to medium roots; common, very fine to medium, irregular pores and common, very fine and fine, tubular pores; a few krotovinas; a few slickensides; moderately alkaline (pH 8.1); strongly calcareous; lime mainly disseminated and segregated in common, fine, hard concretions; clear, wavy boundary.

C1ca—17 to 32 inches, light-gray (5Y 7/1) clay, dark gray (2.5Y 4/1) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; a few, fine and medium, irregular pores and many, very fine to fine, tubular pores; a few krotovinas; a few fine and medium roots; moderately alkaline (pH 8.2); very strongly calcareous; lime mainly disseminated and segregated in a few, fine, hard concretions; abrupt, wavy boundary.

Ccam—32 to 42 inches, mixed white (2.5Y 8/2) and pale-yellow (2.5Y 7/4) strongly cemented caliche, grayish brown (2.5Y 5/2) and olive (5Y 5/3) when moist; common, brown (10YR 5/3 to 5/4) mottles; the uppermost one-fourth inch is an indurated rocklike layer; caliche material is less strongly cemented with increasing depth; weak, thick, platy structure in the upper few inches; moderately alkaline (pH 8.4); very strongly calcareous; violently effervescent; gradual, wavy boundary.

C3g—42 to 60 inches +, light olive-gray (5Y 6/2) loam, olive (5Y 5/3) when moist; common, yellowish-brown (10YR 5/4) mottles; a few, olive-green, gleyed spots; massive; common, very fine to medium, irregular and tubular pores; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; moderately alkaline (pH 8.1); strongly calcareous; violently effervescent; lime is finely disseminated and segregated in large hard concretions that are irregular in shape; the water table is at a depth of 42 inches; the water level rose in the pit after the bottom of the caliche layer was broken through at a depth of 42 inches.

Clear Lake Clay: In a nearly level field; under fallowed dryfarmed barley; elevation of 235 feet (about 6½ miles northwest of Willows; SW¼ sec. 22, T. 20 N., R. 4 W.):

Ap—0 to 8 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; a few small pebbles; strong, very coarse, prismatic primary structure and moderate, fine to coarse, subangular blocky secondary structure; very hard when dry, firm when moist, very sticky and very plastic when wet; a few very fine roots; many, very fine to medium, irregular pores and many, very fine, tubular pores; common wormholes; slightly acid (pH 6.4); clear, smooth boundary.

A11—8 to 20 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; a few small pebbles; strong, very coarse, prismatic primary structure that breaks to moderate, fine to coarse, subangular blocky; very hard when dry, firm when moist, very sticky and very plastic when wet; many very fine roots; common, very fine and fine, tubular pores and a few, fine and medium, irregular pores; many slickensides; slightly acid (pH 6.7) but neutral (pH 7.0) with increasing depth; clear, wavy boundary.

A12ca—20 to 29 inches, similar to the A12 horizon except is mildly alkaline (pH 7.3) and slightly calcareous; lime is segregated in common, fine, soft masses and hard concretions; many slickensides; clear, irregular boundary.

ACca—29 to 40 inches, dark grayish-brown (2.5Y 4/2 to 4/1) clay, very dark grayish brown (2.5Y 3/2 to 3/1) when moist; a few pebbles; massive; hard when dry, firm when moist, very sticky and plastic when wet; no roots; common, very fine and fine, tubular pores and a few, fine, irregular pores; common slickensides; mildly alkaline (pH 7.5); strongly calcareous; lime is finely disseminated and segregated around pebbles and as fine and medium soft masses and fine concretions; clear, wavy boundary.

C1ca—40 to 52 inches +, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) when moist; a few pebbles; massive; hard when dry, friable when moist, sticky and plastic when wet; common, very fine and fine, tubular pores and common, fine and medium, irregular pores; mildly alkaline (pH 7.6); strongly calcareous; lime is finely disseminated and segregated around pebbles and as linings in pores; a few, brown mottles; water table is at a depth of 52 inches.

Columbia Silt Loam: On a recent, very gently undulating flood plain along the Sacramento River; under annual grasses, valley oaks, and sycamores used for pasture and range; elevation of 130 feet (about 4½ miles southeast of Hamilton City, 4,000 feet northeast of Phelan Island, and 1,000 feet northwest of the Sacramento River):

C1—0 to 12 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; massive to very weak, fine, granular structure; slightly hard when dry, friable when moist, very slightly sticky and nonplastic when wet; many very fine and fine roots; common, very fine to fine, irregular pores and fine to medium tubular pores; near neutral (pH 6.8); clear, smooth boundary.

C2—12 to 58 inches +, pale-brown (10YR 6/3), stratified silt loam and very fine sandy loam, with thin lenses or strata of loamy fine sand and sand, brown (10YR 4/3) when moist; common, distinct, strong-brown (7.5YR 5/6) mottles in silty strata above contrasting layers of loamy fine sand and sand; massive to single grain (sand); slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; many very fine to fine roots in the upper part of this horizon, but few in the lower part; common, fine to medium, irregular and tubular pores; neutral (pH 7.0).

Contra Costa Clay Loam: On a 55 percent slope facing north-northwest; under range mainly of annual grasses and blue oaks but that includes a few scattered shrubs; elevation of 1,600 feet (NE¼ sec. 1, T. 18 N., R. 6 W., west side of Needham Grade):

O1&O2—½ inch to 0, fresh and partly decomposed leaves and twigs.

A1—0 to 5 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 3/4) when moist; moderate, coarse, granular structure; hard when dry, friable when moist, slightly plastic and sticky when wet; many fine roots; many fine and medium pores; neutral (pH 6.9); abrupt, wavy boundary.

B1t—5 to 12 inches, brown (7.5YR 5/4) clay loam, dark reddish brown (5YR 3/4) when moist; moderate, very coarse, angular blocky structure; very hard when dry, firm when moist, plastic and very sticky when wet; a few fine and medium roots; common very fine and fine pores; a few, thin, continuous clay films on ped faces; very slightly acid (pH 6.7); clear, wavy boundary.

B2t—12 to 21 inches, brown (7.5YR 4/3) near reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/4) when moist; strong, very coarse, angular blocky structure; very hard when dry, very firm when moist, plastic and very sticky when wet; a few fine and medium roots; common very fine and fine pores; a few, thin, continuous clay films on ped faces and in pores; very slightly acid (pH 6.7); clear, wavy boundary.

B3t—21 to 34 inches, brown (7.5YR 5/4) shaly clay, dark reddish brown (5YR 3/4) when moist; moderate, coarse, subangular blocky structure; very hard when dry, firm when moist, plastic and very sticky when wet; a few medium roots; common very fine and fine pores; a few, thin, patchy clay films on ped faces; slightly acid (pH 6.5); abrupt, irregular boundary.

R—34 inches +, fractured and shattered, light yellowish-brown to light olive-brown shale and fine-textured sandstone; rock is less fractured with increasing depth; a few medium and large roots along fracture planes.

Corning Gravelly Loam: On a 3 percent slope on a terrace that has low hummocks; under annual grasses and forbs used as range for sheep; elevation of 300 feet (about 4 miles west of Orland; SW¼ sec. 22, 7. 22 N., R. 4 W.):

O1&O2—¼ inch to 0, fresh and partly decomposed leaves from grasses and forbs in a loose mat.

A1—0 to 8 inches, yellowish-red (5YR 5/5) gravelly loam, reddish brown (5YR 4/4) when moist; gravel is mainly quartzite and chert; massive; hard when dry, friable when moist, nonsticky and nonplastic when wet; many, very fine and fine, irregular pores and a few, fine, tubular pores; many fine roots; medium acid (pH 5.9); clear, wavy boundary.

A3—8 to 14 inches, yellowish-red (5YR 5/5) gravelly loam, reddish brown (5YR 4/5) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; common, fine and medium, irregular pores and a few, fine, tubular pores; many very fine and fine roots; thin patchy clay films in pores; medium acid (pH 5.8); abrupt, smooth boundary.

B21t—14 to 20 inches, reddish-brown (2.5YR 4/4) slightly gravelly clay, dark red (2.5YR 3/5) when moist; strong, coarse, prismatic structure in the uppermost 3 to 4 inches but coarse, angular blocky below; extremely hard when dry, extremely firm when moist, very sticky and very plastic when wet; a few fine roots; a few, fine, irregular pores and a few, very fine, tubular pores; very thick continuous clay films fill many voids; a few slickensides; medium acid (pH 5.9); clear, wavy boundary.

B22t—20 to 27 inches, reddish-brown (5YR 4/5) slightly gravelly clay, yellowish red (5YR 4/6) when moist; moderate, coarse, angular blocky structure; very hard when dry, very firm when moist, very sticky and plastic when wet; a few roots; a few, very fine, tubular pores and fine irregular pores; thick continuous clay films in voids, but not so many as in the B21t horizon; slickensides common; slightly acid (pH 6.2); gradual, wavy boundary.

B3t—27 to 40 inches, mottled, yellowish-red (5YR 5/6) and light yellowish-brown (10YR 6/4) slightly gravelly clay loam, yellowish red (5YR 4/6) and yellowish brown (10YR 5/4) when moist; massive; very hard when dry, firm when moist, slightly sticky and slightly plastic when wet; a few, fine, irregular pores and a few, very fine, tubular pores; moderately thick and thick nearly continuous clay films in pores and around pebbles; a few slickensides; slightly acid (pH 6.0); clear, wavy boundary.

C1—40 to 60 inches +, mottled, light yellowish-brown (10YR 6/4), yellowish-red (5YR 5/6), and red (2.5YR 4/6), stratified very gravelly sandy clay loam, gravelly sandy clay loam, and gravelly sandy loam, yellowish brown (10YR 5/4), yellowish red (5YR 4/6), and dark red (2.5YR 3/6) when moist; massive; hard when dry, firm when moist, sticky and slightly plastic when wet; moderately thick and thick clay films around pebbles; the amount and size of the pebbles vary with the degree of stratification; medium acid (pH 5.8).

CORTINA VERY GRAVELLY SANDY LOAM, MODERATELY DEEP: On a very gently undulating flood plain along the edge of a gravel pit; under fallowed barley; elevation of 210 feet (about 2½ miles southeast of Orland; north of Haigh Landing Field; SW¼SE¼ sec. 25, T. 22 N., R. 3 W.):

Ap—0 to 8 inches, light brownish-gray (2.5Y 6/2) very gravelly sandy loam, dark grayish brown (2.5Y 4/2) when moist; the gravel is dominantly white quartzite, varicolored chert, and sandstone; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; many very fine and fine roots; many, very fine to medium, irregular pores; slightly acid (pH 6.1); clear, smooth boundary.

C1—8 to 32 inches, similar to the Ap horizon but slightly acid (pH 6.4); a few very fine and fine roots; clear, wavy boundary.

IIC2—32 to 60 inches +, gray (2.5Y 5/1) channel sand and multicolored gravel; gravel is white quartzite, varicolored chert and jasper, and gray and olive sandstone; single grain and loose; neutral (pH 7.0).

DUBAKELLA STONY LOAM: On a 35 percent slope facing northeast in a stony area; under an open stand of Jeffrey pine and incense-cedar; elevation of 4,700 feet (about 1½ miles west-southwest of St. John Mountain and 1½ miles east-southeast of Upper Nye Camp):

O1&O2—2 inches to 0, fresh and partly decomposed litter made up of conifer needles and twigs; abrupt, smooth boundary.

A1—0 to 3 inches, reddish-brown (5YR 4/4) stony heavy loam, dark reddish brown (5YR 3/4) when moist; strong, fine, granular structure; soft when dry, friable when moist, nonsticky and nonplastic when wet; many very fine and fine roots; many, fine and very fine, irregular pores; neutral (pH 6.8).

B1t—3 to 10 inches, reddish-brown (5YR 4/5) gravelly clay loam, dark reddish brown (5YR 3/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine to medium roots; common, very fine and fine, irregular and tubular pores; a few, thin, patchy clay films on ped faces; neutral (pH 6.8); clear, wavy boundary.

B2t—10 to 18 inches, yellowish-brown (10YR 5/4) and strong-brown (7.5YR 5/4) gravelly clay loam; strong, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine to medium roots; common, very fine to fine, irregular and tubular pores; common thin clay films on ped faces and in pores; neutral (pH 7.0); abrupt, irregular boundary.

R—18 inches +, bluish-green, hard and fractured, partly weathered serpentine rock; cracks in the upper part are filled with soil material like that in the B2t horizon; neutral (pH 7.0).

EAST PARK GRAVELLY CLAY: On a 6 percent slope facing east, on a somewhat stony alluvial fan consisting of outwash from Henneke soils underlain by serpentine; under a sparse cover of annual grasses and forbs and a few perennial grasses used for grazing; elevation of 1,150 feet (about 2 miles northwest of Chrome; 400 feet north and 200 feet west of the east quarter corner, sec. 19, T. 22 N., R. 6 W.):

A11—0 to 7 inches, reddish-brown (5YR 4/3) gravelly clay, dark reddish brown (5YR 3/3) when moist; a few stones and cobblestones on the surface; strong, very coarse, prismatic primary structure and medium, subangular, blocky secondary structure; hard when dry, friable when moist, sticky and plastic when wet; many very fine and fine roots; common, very fine to fine, irregular and tubular pores; the gravel is mainly serpentine and generally is less than one-half inch in diameter; neutral (pH 6.8); clear, smooth boundary.

A12—7 to 20 inches, dark reddish-brown (5YR 3/3) gravelly clay, dark reddish brown (5YR 3/3) when moist; a few cobblestones; strong, very coarse, prismatic primary structure and blocky secondary structure; hard when dry, friable when moist, very sticky and plastic when wet; a few very fine roots; common, very fine and fine, irregular and tubular pores; slickensides common; neutral (pH 7.2); clear, smooth boundary.

AC—20 to 32 inches, reddish-brown (5YR 4/4) gravelly sandy clay, dark reddish brown (5YR 3/4) when moist; the gravel is large and more abundant than that in the A12 horizon; a few cobblestones; moderate, medium to coarse, subangular blocky structure; a few very fine roots; common, very fine to medium, irregular pores and a few tubular pores; common to many slickensides; mildly alkaline (pH 7.5).

C—32 to 60 inches +, reddish-brown (5YR 4/4) and brown (7.5YR 5/4) very gravelly sandy clay that contains cobblestones in places; dark reddish brown (5YR 3/4) and brown (7.5YR 4/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; many, fine to medium, irregular pores; mildly alkaline (pH 7.6); noncalcareous.

GOULDING ROCKY LOAM: On a 60 percent slope facing east; under shrubs and grasses in a burned over area; elevation of 2,150 feet (SE¼ sec. 21, T. 18 N., R. 7 W.; about 1½ miles southwest of Black Diamond Ridge Lookout):

O1&O2—¼ inch to 0, decomposing leaves and twigs from shrubs; lacking in places.

A11—0 to 4 inches, brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 3/4) when moist; moderate to strong, medium, granular structure; soft when dry, very friable when moist, nonplastic and very slightly sticky when wet; many fine and medium roots; many medium and coarse pores; very slightly acid (pH 6.7); clear, wavy boundary.

A12—4 to 16 inches, brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 4/4) when moist; the gravel increases in size and amount with increasing depth; moderate, coarse to very coarse, granular structure; slightly hard when dry, friable when moist, slightly plastic and slightly sticky when wet; a few fine and medium roots; common fine and medium pores; very slightly acid (pH 6.6); abrupt, irregular boundary.

R—16 inches +, fractured metavolcanic basic rock (greenstone) that is more massive with increasing depth and has soil material in cracks between the rocks.

HENNEKE STONY CLAY LOAM: On a 45 percent slope facing southeast; under shrubs; elevation of 1,750 feet; (NW¼ sec. 19, T. 22 N., R. 6 W.; approximately 2¼ miles northwest of Chrome):

O1&O2—½ inch to 0, fresh and partly decomposed litter made up of shrub leaves and twigs.

A1—0 to 3 inches, reddish-brown (5YR 4/3) stony clay loam, dark reddish brown (5YR 3/3) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly plastic and slightly sticky when wet; many fine and medium roots; many fine and medium pores; neutral (pH 6.8); clear, wavy boundary.

B21t—3 to 7 inches, dark reddish-brown (2.5YR 3/3) gravelly clay, dark reddish brown (2.5YR 3/4) when moist; moderate, coarse, subangular blocky structure; hard when dry, firm when moist, plastic and very sticky when wet; many fine, medium, and large roots; many very fine to medium pores; neutral (pH 6.8); clear, wavy boundary.

B22t—7 to 22 inches, dark reddish-brown (2.5YR 3/4) very gravelly clay, dark red (2.5YR 3/6) when moist; moderate, medium, subangular blocky structure; hard when dry, firm when moist, very plastic and very sticky when wet; many medium and large roots; common very fine to medium pores; neutral (pH 7.0); abrupt, irregular boundary.

R—22 inches +, bluish-green, hard and moderately fractured serpentine rock that is more massive with increasing depth; some soil material and a few medium and coarse roots along cracks in the rock.

HILLGATE LOAM: On a nearly level low terrace; under dryfarmed barley; elevation of 195 feet (about 2¼ miles south of Capay; 1,750 feet east-southeast of the intersection of Fourth Avenue and Wyo Road):

Ap—0 to 6 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) to dark grayish brown (10YR 4/2) when moist; a few quartzite and chert pebbles; moderate, fine to coarse, subangular blocky structure; hard when dry, friable when moist, very slightly sticky and very slightly plastic when wet; a few very fine roots; many, very fine and fine, irregular pores and common, very fine and fine, tubular pores; medium acid (pH 5.8); abrupt, smooth boundary.

A1—6 to 10 inches, similar to the Ap horizon, except massive; many very fine roots; strongly acid (pH 5.5); clear, wavy boundary.

A3—10 to 15 inches, brown (10YR 5/3) heavy loam, dark brown (10YR 3/3) when moist; a few pebbles of quartzite and chert; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; common, very fine to medium, irregular pores and many, very fine and fine, tubular pores; a few fine roots; a few, thin, patchy clay films in pores; medium acid (pH 5.9); clear, wavy boundary.

B1t—15 to 18 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 3/4) when moist; moderate, coarse, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; a few very fine roots; common, very fine to medium, irregular pores and many, very fine and fine, tubular pores; a few wormholes; common, moderately thick, nearly continuous clay films; medium acid (pH 5.9); clear, wavy boundary.

B2t—18 to 28 inches, brown (7.5YR 5/4) light clay, dark brown (7.5YR 3/4) when moist; strong, coarse and very coarse, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; a few, very fine to medium, irregular pores and common, very fine and fine, tubular pores; many, moderately thick to thick, continuous clay films on ped surfaces and in pores; slightly acid (pH 6.4); clear, wavy boundary.

B31t—28 to 37 inches, brown (7.5YR 5/4) silty clay loam mottled with light gray (2.5Y 7/2) in places; dark brown (7.5YR 3/4) and grayish brown (2.5Y 5/2) when moist; moderate, coarse and very coarse, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; common, very fine to medium, irregular pores and many, very fine and fine, tubular pores; moderately thick and thick, reddish-brown (5YR 4/4), continuous clay films in pores; a few slickensides; neutral (pH 7.2); gradual, wavy boundary.

B32t—37 to 54 inches +, similar to the B31t horizon, but has more light-gray mottles and is massive; neutral (pH 7.1).

HOHMANN ROCKY LOAM: On a 35 percent slope facing north-northeast, under an open stand of ponderosa pines and a few black oaks with an understory of deerbrush (east slope of St. John Mountain near Twin Springs; NE¼ sec. 8, T. 18 N., R. 7 W.):

O1—2½ inches to 1 inch, loose litter made up of pine needles and leaves and twigs from oaks and shrubs.

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

A1—0 to 4 inches, reddish-gray (5YR 5/2) gravelly heavy loam near gravelly clay loam, dark reddish gray (5YR 3/2) when moist; moderate, medium, granular structure; slightly hard when dry, friable when moist, slightly plastic and slightly sticky when wet; a few very fine pores; slightly acid (pH 6.2); clear, wavy boundary.

C1—4 to 12 inches, reddish-gray (5YR 5/2) gravelly clay loam, dark reddish brown (5YR 3/3) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; a few fine and medium roots; common fine and medium pores; medium acid (pH 6.0); clear, wavy boundary.

C2—12 to 29 inches, reddish-gray (5YR 5/2) near dark reddish-brown (5YR 3/3) gravelly clay loam, dark reddish brown (5YR 3/3) when wet; massive; hard when dry, firm when moist, sticky and plastic when wet; a few fine and medium roots; common fine and medium pores; slightly acid (pH 6.1); abrupt, irregular boundary.

R—29 inches +, fractured, slightly weathered metavolcanic basic rock; soil material and roots are along fracture lines.

HUGO LOAM: On a 40 percent slope facing north-northwest; under a recently cutover stand of yellow pine, Douglas-fir, and black oak; elevation of 4,100 feet (about 1 mile south of Lee Logan Camp; NW¼ sec. 15, T. 20 N., R. 9 W.):

O1&O2—1½ inches to 0, fresh and partly decomposed litter made up of needles, leaves, and twigs.

A1—0 to 5 inches, grayish-brown (10YR 5/2) loam that contains a few pebbles, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; many, fine, irregular pores; many fine roots; medium acid (pH 6.0); clear, wavy boundary.

A3—5 to 13 inches, brown (10YR 5/3) loam that contains a few pebbles, dark brown (10YR 4/3) when moist; moderate, fine and medium, granular structure; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; many, very fine and fine, irregular and tubular pores; many very fine to medium roots; medium acid (pH 5.8); gradual, wavy boundary.

B2t—13 to 29 inches, light yellowish-brown (10YR 6/4) gravelly heavy loam, yellowish brown (10YR 5/4) when moist; weak, fine and medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many, very fine and fine, irregular and tubular pores; many fine and medium roots and a few large roots; the gravel increases in size and amount with increasing depth; medium acid (pH 5.8); abrupt, irregular boundary.

R—29 inches +, fractured, partly metamorphosed sandstone and shale; partly weathered in the uppermost part but harder and more massive with increasing depth; in places soil material and a few large roots are along fracture lines.

HULLS GRAVELLY LOAM: On a 45 percent slope facing west; under grasses and bracken ferns and a few scrub Brewer oaks; elevation of 5,900 feet (about 2 miles northwest of Telephone Camp; NE¼ sec. 13, T. 22 N., R. 10 W.):

O1&O2—½ inch to 0, fresh and partly decomposed litter made up of grass and bracken fern leaves.

A11—0 to 6 inches, gray (2.5Y 5/1) gravelly loam, very dark gray (2.5Y 3/1) when moist; the gravel is schist fragments and quartzite; moderate, fine, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; soil feels like talc and has a metallic sheen; many, very fine and fine, irregular pores and common, very fine, tubular pores; many very fine and fine roots; strongly acid (pH 5.5); clear, wavy boundary.

A12—6 to 18 inches, gray (2.5Y 5/1) near grayish-brown (2.5Y 5/2) gravelly loam, very dark gray (2.5Y 3/1) near very dark grayish brown (2.5Y 3/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; soil feels like talc and has a metallic sheen; many, very fine and fine, irregular pores and a few, fine, tubular pores; many very fine and fine roots; medium acid (pH 5.6); gradual, wavy boundary.

C1—18 to 35 inches, light brownish-gray (2.5Y 6/2) gravelly loam, dark grayish brown (2.5Y 4/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; soil feels like talc and has a metallic sheen; many, very fine and fine, irregular pores and a few, fine, tubular pores; common fine roots; medium acid (pH 5.6); abrupt, irregular boundary.

R—35 inches +, strongly folded and fractured, grayish chlorite-mica-schist banded with quartzite veins and lenses; the cracks in the uppermost part contain soil material and a few fine and medium roots.

JACINTO FINE SANDY LOAM: On a 2 percent slope facing south; soil is slightly eroded by wind; under barley stubble; elevation of 175 feet about 6½ miles southeast of Orland; SE¼ sec. 8, T. 21 N., R. 2 W.):

Ap—0 to 8 inches, grayish-brown (2.5Y 5/2) light fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; massive; slightly hard when dry, friable when moist, nonsticky and very slightly plastic when wet; many fine roots; common fine and medium pores; slightly acid (pH 6.3); clear, smooth boundary.

A1—8 to 15 inches, grayish-brown (2.5Y 5/2) fine sandy loam, very dark grayish brown when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine and medium pores; very slightly acid (pH 6.8); clear, smooth boundary.

B2t—15 to 27 inches, grayish-brown (2.5Y 5/2) heavy fine sandy loam near sandy clay loam, very dark grayish brown (2.5Y 3/2) when moist; weak to moderate, coarse, angular blocky structure; hard when dry, firm when moist, slightly sticky and plastic when wet; a few fine roots; common very fine and fine pores; dark colloidal stainings on many ped faces; common, thin, continuous clay films on ped faces and in pores; neutral (pH 7.0); clear, smooth boundary.

B3t—27 to 38 inches, grayish-brown (2.5Y 5/2) heavy fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; massive to weak, coarse, subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; a few fine roots; common very fine and fine pores; a few, thin, patchy clay films; very mildly alkaline (pH 7.3); gradual, smooth boundary.

C1—38 to 60 inches +, light olive-brown (2.5Y 5/3) fine sandy loam, olive brown (2.5Y 4/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and very slightly plastic when wet; common very fine and fine pores; mildly alkaline (pH 7.5).

JOSEPHINE GRAVELLY LOAM: On a 40 percent slope facing northeast; under a moderately dense stand of mixed conifers and shrubs; elevation of 2,800 feet (about 6 miles southwest of Elk Creek along Ivory Mill Road; NW¼ sec. 27, T. 20 N., R. 7 W.):

O1&O2—½ inch to 0, fresh and partly decomposed forest litter and duff.

A1—0 to 4 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 3/3) when moist; moderate, medium, granular structure; soft when dry, very friable when moist, and slightly plastic and slightly sticky when wet; many very fine to medium roots; many very fine and fine pores; slightly acid (pH 6.1); clear, smooth boundary.

A3—4 to 11 inches, light-brown (7.5YR 6/4) gravelly light clay loam, reddish brown (5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly plastic and sticky when wet; many very fine to medium roots; many very fine and fine pores; medium acid (pH 5.7); clear, wavy boundary.

B2t—11 to 25 inches, red (2.5YR 4/6) gravelly clay, dark red (2.5YR 3/6) when moist; common, light-brown 7.5YR 6/4) mottles; massive; hard when dry, firm when moist, plastic and sticky when wet; roots same as in the A3 horizon; common very fine and fine pores; many thin to moderately thick clay films in pores and on ped faces; strongly acid (pH 5.3); clear, wavy boundary.

B3t—25 to 46 inches, red (2.5YR 5/6) gravelly clay, red (2.5YR 4/6) to dark red (2.5YR 3/6) when moist; massive; hard when dry, firm when moist, plastic and very sticky when wet; a few fine and medium roots; common very fine and fine pores; common thin clay films in pores that become few with increasing depth; medium acid (pH 5.7); abrupt, irregular boundary.

R—46 inches +, well-fractured, partly weathered, strongly folded schist; medium acid (pH 5.7); in places roots and soil material are along fracture lines.

KIMBALL LOAM: On a 2 percent slope on a partly dissected low terrace; under annual grasses and forbs used as a range for sheep; elevation of 195 feet (about 1½ miles south of Capay, and about 75 feet south-southeast of the intersection of Fourth Avenue and Lindsay Avenue):

A1—0 to 10 inches, brown (7.5YR 5/5) loam, dark brown (7.5YR 3/4) when moist; a few pebbles of quartzite and chert; massive; hard when dry, friable when moist, nonsticky and slightly plastic when wet; many very fine and fine roots; common, very fine and fine, tubular pores and very fine to medium irregular pores; medium acid (pH 5.7); clear, wavy boundary.

A3—10 to 16 inches, brown (7.5YR 5/5) slightly gravelly loam, dark brown (7.5YR 3/4) when moist; similar to the A1 horizon except contains a few, thin, patchy clay films in some pores; slightly acid (pH 6.0); abrupt, smooth boundary.

B21t—16 to 20 inches, reddish-brown (5YR 4/4) clay, yellowish red (5YR 4/6) when moist; moderate, medium, prismatic structure; extremely hard when dry, very firm when moist, very sticky and very plastic when wet; a few very fine roots; a few, very fine, tubular pores and very fine irregular pores; in most places pores are filled with colloidal clay; slightly acid (pH 6.2); clear, wavy boundary.

B22t—20 to 27 inches, reddish-brown (5YR 5/4) clay, yellowish red (5YR 4/5) when moist; strong, coarse, angular blocky structure; extremely hard when dry, very firm when moist, very sticky and very plastic when wet; a few very fine roots; a few, very fine, tubular pores and very fine and fine irregular pores; pores nearly filled with colloidal clay; common slickensides; slightly acid (pH 6.5); gradual, wavy boundary.

B31t—27 to 33 inches, mottled, reddish-brown (5YR 5/4) and light yellowish-brown (10YR 6/4) clay loam, yellowish red (5YR 4/5) and yellowish brown (10YR 5/4) when moist; a few small pebbles; massive; a few very fine roots; common, fine and very fine, tubular pores and very fine to medium irregular pores; moderately thick and thick continuous clay films in pores; neutral (pH 6.9); clear, wavy boundary.

B32t—33 to 60 inches +, mottled, reddish-brown (5YR 5/4) and light yellowish-brown (10YR 6/4) gravelly sandy clay loam, yellowish red (5YR 4/6) and yellowish brown (10YR 5/4) when moist; massive; a few very fine roots; common, very fine to medium, irregular pores and a few, very fine, tubular pores; moderately thick and thick nearly continuous clay films in pores and around pebbles; neutral (pH 6.7).

LANDLOW CLAY: In a nearly level, fallowed field of rice, at an elevation of 85 feet (about 5½ miles east-northeast of Butte City; SW¼ sec. 20, T. 19 N., R. 1 E.):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; common, strong-brown mottles; strong, very coarse, subangular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; many, very fine and fine, dead rice roots; many, fine, tubular and irregular pores; slightly acid (pH 6.1); clear, smooth boundary.

A12—9 to 17 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; common, strong-brown mottles; strong, medium to coarse, subangular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; a very dense plowpan in the uppermost 2 to 3 inches; a few very fine and fine roots; a few, fine, tubular pores in the plowpan and common, very fine and fine, tubular pores below; common slickensides; a few, fine, manganese pellets; slightly acid (pH 6.4); clear, wavy boundary.

AC—17 to 26 inches, dark grayish-brown (10YR 4/2) clay, near very dark grayish brown (10YR 3/2) when moist; a few, strong-brown mottles; moderate, medium to coarse, subangular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; a few fine roots; a few, fine, tubular pores: common slickensides; a few, fine, manganese pellets; neutral (pH 7.0); clear, wavy boundary.

Cca—26 to 35 inches, brown (10YR 5/3) clay, dark grayish brown (10YR 4/2) near dark brown (10YR 4/3) when moist; a few, strong-brown mottles; massive but breaks to coarse, subangular blocky structure; a few fine roots; a few, fine, tubular pores; common slickensides; a few, fine, manganese pellets; mildly alkaline (pH 7.6); slightly calcareous; lime segregated in soft masses; abrupt, wavy boundary.

C1m—35 to 37 inches, brown (10YR 5/3) extremely hard, indurated hardpan cemented with lime and silica and mottled with strong brown; medium to thick, platy structure; mildly alkaline (pH 7.7); strongly calcareous; lime concentrated along seams between plates; clear, wavy boundary.

C2m—37 to 60 inches, pale-brown (10YR 6/3), very hard material strongly cemented with lime and silica but less strongly cemented with increasing depth; moderately alkaline (pH 7.9); strongly calcareous.

LODO SHALY CLAY LOAM: On a 16 percent slope facing south; under annual grasses and forbs used for range; elevation of 820 feet (about 2¼ miles south-southwest of Chrome; SW¼ sec. 5 T. 21 N., R. 6 W.):

O1&O2—¼ inch to 0, fresh and partly decomposed leaves from grasses and forbs.

A11—0 to 1 inch, grayish-brown (2.5Y 5/2) shaly clay loam, very dark grayish brown (2.5Y 3/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist, nonplastic and nonsticky when wet; a few fine roots; common very fine to medium pores; slightly acid (pH 6.5); abrupt, wavy boundary.

A12—1 to 7 inches, grayish-brown (2.5Y 5/2) shaly clay loam, very dark grayish brown (2.5Y 3/2) when moist; weak, medium to coarse, subangular blocky structure that breaks readily to fine and medium, granular; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; many very fine and fine roots; common fine and medium pores; neutral (pH 6.8); abrupt, wavy boundary.

R—7 inches +, dark-gray shale; well fractured in the upper 2 to 3 inches but less fractured and more massive with increasing depth; almost impervious to penetration by water and roots.

LOS GATOS GRAVELLY LOAM: On a 35 percent slope facing north; under a dense stand of chamise and wedgeleaf ceanothus; elevation of 2,275 feet (about 3 miles west-southwest of Chrome along Hull Road; SW¼ sec. 36, T. 22 N., R. 7 W.):

O1&O2—½ inch to 0, litter made up of leaves and twigs from shrubs; the litter is thickest around the base of the plants.

A1—0 to 4 inches, brown (7.5YR 5/3) gravelly loam, dark brown (7.5YR 4/4) when moist; moderate, medium, granular structure; hard when dry, friable when moist, nonplastic and slightly sticky when wet; many fine and medium roots; many fine and medium pores; strongly acid (pH 5.4); clear, wavy boundary.

B1t—4 to 10 inches, brown (7.5YR 5/4) gravelly loam near clay loam, dark brown (7.5YR 4/4) when moist; massive; hard when dry, friable when moist, slightly plastic and slightly sticky when wet; a few fine and medium roots; many fine and medium pores; a few, thin, discontinuous clay films in pores and on ped faces; strongly acid (pH 5.4); clear, wavy boundary.

B2t—10 to 22 inches, brown (7.5YR 4/4) near reddish-brown (5YR 5/4) gravelly clay loam, yellowish red (5YR 4/4) when moist; massive; hard when dry, firm when moist, plastic and sticky when wet; a few fine and medium roots; common fine and medium pores; common, thin, continuous clay films in pores and along ped faces; strongly acid (pH 5.2); abrupt, wavy boundary.

R—22 inches +, well-fractured and partly weathered, strongly folded schistose rock; some soil material in cracks; a few large roots along fracture planes.

MARVIN SILTY CLAY LOAM: In a nearly level field of dryfarmed barley at an elevation of 77 feet (about 1½ miles southeast of Butte City; 75 feet east of southwest corner of sec. 34, T. 19 N., R. 1 W.):

Ap—0 to 8 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) when moist; a few faint mottles of yellowish brown (10YR 5/6); massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine and fine roots; many, very fine to medium, irregular pores and a few, very fine, tubular pores; slightly acid (pH 6.4); abrupt, smooth boundary.

A3—8 to 13 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) when moist; a few faint mottles of yellowish brown (10YR 5/6); moderate, medium and coarse, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; many very fine and fine roots; common, very fine and fine, irregular pores and common, very fine and fine, tubular pores; in places a few, thin, patchy clay films on ped faces; a few, fine pellets of iron and manganese; slightly acid (pH 6.4); clear, smooth boundary.

B1t—13 to 17 inches, grayish-brown (2.5Y 5/2) to dark grayish-brown (2.5Y 4/2) heavy silty clay loam, very dark grayish brown (2.5Y 3/2) when moist; moderate, medium and coarse, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; many very fine and fine roots; many, fine, irregular pores and common, very fine and fine, tubular pores; in places a few, thin, patchy clay films on ped faces and in pores; a few fine pellets of iron and manganese; slightly acid (pH 6.4); clear, smooth boundary.

B2t—17 to 29 inches, dark grayish-brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) to very dark gray (2.5Y 3/1) when moist; weak, coarse, prismatic structure to moderate, coarse, angular blocky; very hard when dry, firm when moist, sticky and plastic when wet; many very fine roots; a few, fine, irregular pores and fine and very fine tubular pores; common, moderately thick, continuous films on ped faces and in pores; a few fine pellets of iron and manganese; neutral (pH 6.8); clear, smooth boundary.

B3tca—29 to 42 inches, mottled, grayish-brown (2.5Y 5/2) and dark grayish-brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) to very dark gray (2.5Y 3/1) when moist; a few faint mottles of yellowish brown; moderate, medium and coarse, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; a few very fine roots; a few, fine, irregular pores and many, fine and very fine, tubular pores; common moderately thick, continuous clay films on ped faces and in pores; mildly alkaline (pH 7.8); slightly calcareous; lime is segregated in fine soft masses; gradual, smooth boundary.

C1ca—42 to 60 inches +, grayish-brown (10YR 5/2) to brown (10YR 5/3) silty clay loam, dark grayish brown (10YR 4/2) when moist; a few, faint mottles of yellowish brown; massive to weak, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; a few very fine roots; common, fine, irregular pores and common, fine and very fine, tubular pores; moderately thick nearly continuous clay films; moderately alkaline (pH 8.0); strongly calcareous; lime is disseminated and segregated in fine soft masses and in places along walls of pores.

MASTERSON GRAVELLY LOAM: On a 17 percent slope facing northwest; under a dense stand of red and white fir trees; elevation of 6,100 feet (on Brushy Mountain about 2½ miles south of Plaskett Guard Station; SW¼ sec. 2, T. 21 N., R. 9 W.):

O1—2 inches to ½ inch, loose litter made up of needles and twigs from red and white fir trees.

O2—½ inch to 0, very dark brown, partly decomposed organic matter.

A1—0 to 7 inches, brown (7.5YR 5/3) gravelly loam, dark brown (7.5YR 3/2) when moist; the gravel is platy schistose and angular fragments of quartzite; strong, medium, granular structure; soft when dry, very friable when moist, nonplastic and nonsticky when wet; feels like talc; many fine roots; many fine and medium pores; strongly acid (pH 5.3); clear, smooth boundary.

B2—7 to 21 inches, brown (7.5YR 5/3) gravelly loam, dark brown (7.5YR 4/4) when moist; the gravel increases in size and quantity with increasing depth; strong, medium, granular structure; soft when dry, very friable when moist, nonplastic and nonsticky when wet; feels like talc; many fine roots; many fine and medium pores; a few, thin, patchy clay films in pores; very strongly acid (pH 5.0); clear, wavy boundary.

C1—21 to 35 inches, light yellowish-brown (10YR 6/4) very gravelly loam, yellowish brown (10YR 5/4) when moist; moderate, medium to coarse, granular structure; soft when dry, very friable when moist, nonplastic and nonsticky when wet; feels like talc; a few fine and medium roots; many fine and medium pores; very strongly acid (pH 4.5); abrupt, irregular boundary.

R—35 inches +, shattered and partly weathered, strongly folded sericite schist that has many thin seams of quartzite; a few large roots along fracture lines.

MAYMEN GRAVELLY LOAM: On a 50 percent slope facing southeast in a moderately eroded to severely eroded area; under a semidense cover of chamise and wedgeleaf ceanothus; elevation of 2,000 feet (along Ivory Mill Road about 5 miles southwest of Elk Creek; NW¼ sec. 26, T. 20 N., R. 7 W.):

O1&O2—¼ inch to 0, loose litter of leaves; in many areas between shrubs this layer is lacking.

A1—0 to 5 inches, pale-brown (10YR 6/3) gravelly loam, dark grayish brown (10YR 4/2) when moist; angular fragments of schist and quartzite; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; feels like talc; many, very fine and fine, irregular pores and common, fine, tubular pores; many very fine to medium roots; medium acid (pH 6.0); clear, wavy boundary.

C1—5 to 9 inches, light yellowish-brown (10YR 6/4) very gravelly loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; feels like talc; many, very fine and fine, irregular pores and a few, fine, tubular pores; many fine and medium roots; medium acid (pH 6.0); abrupt, irregular boundary.

R—9 inches +, yellowish-brown, strongly folded and fractured sericite schist that has many seams and lenses of quartzite; soil material and roots are along fracture planes in the uppermost few inches.

MAYWOOD LOAM: On a nearly level flood plain of Walker Creek; under dryfarmed barley; elevation of 180 feet (about 2 miles north-northwest of Artois; 1,000 feet west and 200 feet south of center of sec. 28, T. 21 N., R. 3 W.):

Ap—0 to 8 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; many very fine and fine roots; common, very fine and fine, irregular pores; slightly acid (pH 6.5); clear, smooth boundary.

C1—8 to 26 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; massive, but stratified with thin layers or lenses of fine sandy loam, silt loam, and gravelly sandy loam; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; many very fine and fine roots; common, very fine and fine, irregular pores and a few, fine, tubular pores; a few, fine, distinct mottles of strong brown (7.5YR 5/6) in silt lenses; slightly acid (pH 6.3); abrupt, wavy boundary.

IIC2—26 to 60 inches +, multicolored channel sand and gravel; the gravel is mainly white quartzite and varicolored chert and gravel; single grained and loose; neutral (pH 7.0); intermittent high water table at a depth of 3 to 5 feet during the rainy season.

Millsap Loam: On a 50 percent slope facing east; elevation 1,500 feet; vegetation is chiefly annual grasses and blue oaks but includes a few scattered Digger pines and a few common manzanitas (about 5 miles southwest of Elk Creek; SW¼ sec. 23, T. 20 N., R. 7 W.):

O1&O2—¼ inch to 0, loose litter and duff consisting of grass and oak leaves.

A1—0 to 6 inches, pale-brown (10YR 6/3) heavy loam, brown (10YR 4/3) when moist; a few shale fragments; weak, thick, platy structure in the upper one-half inch, massive below; hard when dry, friable when moist, plastic and sticky when wet; many fine roots; common very fine and fine pores; slightly acid (pH 6.3); abrupt, wavy boundary.

B2t—6 to 17 inches, brown (10YR 4/3) shaly clay, dark brown (10YR 3/3) when moist; strong, very coarse, subangular blocky structure; very hard when dry, very firm when moist, plastic and sticky when wet; many fine and medium roots; a few fine and very fine pores; moderately thick continuous clay films along ped faces and in pores; medium acid (pH 6.0); abrupt, wavy boundary.

R—17 inches +, well-shattered, dark-gray shale that is massive with increasing depth; a few roots of trees and shrubs along cracks.

Millsholm Clay Loam: On a 20 percent slope facing southwest; under annual grasses and forbs used for range; elevation of 700 feet (about 2½ miles southeast of Fruto; NW¼ sec. 27, T. 20 N., R. 5 W.):

O1&O2—¼ inch to 0, fresh and partly decomposed litter from grasses and forbs.

A11—0 to ¾ inch, pale-brown (10YR 6/3) loam near clay loam, dark brown (10YR 4/3) when moist; weak, medium, platy structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; many fine roots; common very fine and fine pores; slightly acid (pH 6.2); abrupt, smooth boundary.

A12—¾ inch to 6 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) when moist; a few small shale fragments; moderate, medium to coarse, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; many very fine and fine roots; common very fine and fine pores; slightly acid (pH 6.2); clear, wavy boundary.

A13—6 to 16 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) when moist; some shale fragments; moderate, coarse, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; a few fine roots; common very fine and fine pores; a few, thin, discontinuous clay films on ped faces and in pores; very slightly acid (pH 6.6); abrupt, wavy boundary.

R—16 inches +, brown and grayish-brown, fractured shale and fine-grained sandstone; noncalcareous.

Millsholm Rocky Sandy Loam: On a 60 percent slope facing east; under annual grasses and blue oaks used as range; elevation of 900 feet (about 2½ miles south of Newville; SW¼ sec. 15, T. 22 N., R. 6 W.):

O1&O2—¼ inch to 0 of fresh and partly decomposed litter made up of grass and oak leaves and twigs; in many places this layer is thin or is absent.

A11—0 to 7 inches, brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; many fine roots; many, fine and medium, irregular pores; medium acid (pH 5.9); clear, wavy boundary.

A12—7 to 23 inches, brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; a few, fine and common, medium roots; many, fine and medium, irregular pores; slightly acid (pH 6.2); abrupt, wavy lower boundary.

R—23 inches +, hard, massive conglomerate cemented with iron and silica; partly weathered in the upper 2 to 3 inches.

Millsholm Gravelly Loam:[6] On a 55 percent slope facing southeast; under an open stand of blue oaks that includes a few Digger pines and shrubs and has a ground cover of annual grasses and forbs; elevation of 2,150 feet (about 3 miles southwest of Chrome; SW¼ sec. 36, T. 22 N., R. 7 W.):

O1&O2—1 inch to 0 of fresh and partly decomposed plant leaves and twigs.

A11—0 to 3 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) near dark grayish brown (10YR 4/2) when moist; the gravel consists of angular schistose fragments and quartzite; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; soil feels like talc; many, very fine and fine, irregular pores; many very fine and fine roots; slightly acid (pH 6.3); clear, wavy boundary.

A12—3 to 8 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) when moist; weak, medium to coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; soil feels like talc; surfaces of gravel have a thin coating of oriented sericite, which gives them a silvery sheen; many, very fine and fine, irregular pores; many very fine to medium roots; medium acid (pH 5.9); clear, wavy boundary.

C1—8 to 17 inches, light yellowish-brown (10YR 6/4) very gravelly loam, dark yellowish brown (10YR 4/4) near dark brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; feels like talc; surfaces of gravel have a thin coating of oriented sericite, which gives them a silvery sheen; many, very fine and fine, irregular pores; common fine and medium roots; medium acid (pH 5.9); abrupt, irregular boundary.

R—17 inches +, strongly folded and fractured schistose (sericite) rock that has many quartzite seams; partly weathered in upper part but becomes harder and less fractured with increasing depth; a few medium and large roots of oaks and shrubs along the cracks in the rock.

Moda Loam: In a nearly level, irrigated pasture at an elevation of 195 feet (about 5½ miles east-northeast of Orland; SE¼ sec. 9, T. 22 N., R. 2 W.)

[6] Formerly called Laughlin in material published in California.

A11—0 to 1 inch, brown (10YR 5/3) loam and a few quartzite pebbles, dark brown (10YR 3/3) when moist; weak, medium, platy structure; slightly hard when dry, friable when moist, nonsticky and slightly plastic when wet; a few fine roots; common very fine and fine pores; medium acid (pH 5.5); abrupt, smooth boundary.

A12—1 to 7 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) when moist; a few small pebbles; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; many fine roots; common very fine and fine pores; medium acid (pH 5.5); clear, smooth boundary.

A3—7 to 14 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) when moist; a few small pebbles; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; many very fine and fine roots; common fine pores and a few, thin, patchy clay films in pores; medium acid (pH 5.7); abrupt, smooth boundary.

B2t—14 to 21 inches, brown (7.5YR 5/4) near yellowish-red (5YR 5/6) clay, dark brown (7.5YR 4/4) near reddish brown (5YR 4/4) when moist; moderate, medium, prismatic structure in the uppermost 3 to 4 inches but becoming strong, medium to coarse, angular blocky with increasing depth; very hard when dry, very firm when moist, very sticky and very plastic when wet; a few fine roots between the peds; thick continuous clay films on ped faces and in tubular pores (old root channels); medium acid pH 5.8); abrupt, wavy boundary.

C1m—21 to 23 inches, brown (7.5YR 5/4) and light yellowish-brown (10YR 6/4) indurated hardpan cemented with iron and silica and with dark, metallic-colored coatings of manganese along seams and veins; massive; extremely hard when dry or moist; moderately thick clay films in veins and seams; slightly acid (pH 6.1); clear, wavy boundary.

C2m—23 to 30 inches, mottled, light yellowish-brown (10YR 6/4) and brown (7.5YR 5/4) hardpan strongly cemented with iron and silica but less strongly cemented with increasing depth; massive; dark manganese stainings and light-colored silica coatings in veins and along fissures; moderately thick clay films in old tubular pores and fissures; extremely hard when dry, extremely firm and brittle when moist; neutral (pH 6.9); clear, wavy boundary.

C3—30 to 54 inches +, light yellowish-brown (10YR 6/4) sandy clay loam, dark yellowish brown (10YR 4/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; neutral (pH 6.9) and intermittently calcareous.

MONTARA CLAY: On a 45 percent slope facing north; under cover mainly of grasses and shrubs but that includes a few scattered Digger pines; elevation of 1,200 feet (about 4 miles northwest of Elk Creek; SW¼ sec. 36, T. 21 N., R. 7 W.):

O1&O2—¼ inch to 0 of fresh and partly decomposed grass and leaves from shrubs.

A11—0 to 1½ inches, dark grayish-brown (2.5Y 4/2) near olive-gray (5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) near dark olive gray (5Y 3/2) when moist; strong, fine, granular structure; hard when dry, friable when moist, slightly sticky and plastic when wet; a few fine roots; many fine to medium voids; neutral (pH 7.0); abrupt, smooth boundary.

A12—1½ to 10 inches, olive-gray (5Y 4/2) clay, dark olive gray (5Y 3/2) when moist; strong, coarse, subangular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; many very fine and fine roots; many very fine and fine pores; mildly alkaline (pH 7.5); clear, wavy boundary.

A13—10 to 23 inches, olive-gray (5Y 4/2) gravelly clay, dark olive gray (5Y 3/2) when moist; strong, coarse to very coarse, angular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; many fine roots; common very fine and fine pores; many slickensides; mildly alkaline (pH 7.5); abrupt, irregular boundary.

R—23 inches +, hard, fractured, greenish-gray serpentine.

MYERS CLAY: In a nearly level field of dryfarmed barley rotated with range at an elevation of 145 feet (about 5 miles southwest of Willows; NW¼ sec. 31, T. 19 N., R. 3 W.):

Ap—0 to 6 inches, brown (10YR 5/3 to 5/2) clay, dark grayish brown (10YR 4/2) when moist; strong, medium and coarse, granular structure in the uppermost one-half inch, but below this depth strong, very coarse, prismatic primary structure and strong, medium to very coarse, subangular blocky secondary structure; hard when dry, firm when moist, sticky and plastic when wet; many, very fine to medium, irregular pores and a few, very fine, tubular pores; many very fine and fine roots; slightly acid (pH 6.2); abrupt, wavy boundary.

A11—6 to 11 inches, dark-brown (10YR 4/3 to 4/2) clay, dark brown (10YR 3/3 to 3/2) when moist; strong, very coarse, prismatic primary structure and strong, coarse and very coarse, angular blocky secondary structure; extremely hard when dry, very firm when moist, sticky and very plastic when wet; many very fine and fine roots; common, very fine and fine, irregular pores and common, fine and very fine, tubular pores; slightly acid (pH 6.3); clear, wavy boundary.

A12—11 to 29 inches, similar to above horizon except for many slickensides; slightly acid (pH 6.5) but is neutral (pH 7.1) with increasing depth; gradual, wavy boundary.

AC—29 to 43 inches, brown (10YR 4/3) clay, dark brown (10YR 3/3) when moist; moderate, very coarse, prismatic primary structure and strong, coarse, angular blocky secondary structure; extremely hard when dry, very firm when moist, very sticky and very plastic when wet; a few very fine and fine roots; common, very fine and fine, irregular pores and common, fine and very fine, tubular pores; common slickensides; mildly alkaline (pH 7.5); a few, fine, soft, white concretions of lime; clear, wavy boundary.

C1—43 to 60 inches +, yellowish-brown (10YR 5/4) light clay, dark yellowish brown (10YR 4/4) when moist; massive; hard when dry, firm when moist, sticky and plastic when wet; a few fine roots; common, fine and very fine, tubular pores and a few, fine, irregular pores; mildly alkaline (pH 7.6); slightly calcareous; lime is finely disseminated and segregated along the walls of tubular pores.

NACIMIENTO CLAY: On a 14 percent slope facing west in a dryfarmed safflower field at an elevation of 250 feet (about 5½ miles west-northwest of Willows; NW¼ sec. 35, T. 20 N., R. 4 W.):

Ap—0 to 10 inches, grayish-brown (2.5Y 5/2) near light olive-brown (2.5Y 5/3) clay, olive brown (2.5Y 4/3) when moist; moderate, fine and medium, granular structure in the upper 1 inch but strong, very coarse, prismatic primary structure and strong, medium to very coarse, angular blocky secondary structure below; very hard when dry, very firm when moist, sticky and very plastic when wet; many very fine and fine roots; common, very fine and fine, irregular and tubular pores; mildly alkaline (pH 7.6) and slightly calcareous; lime is disseminated and segregated in a few, fine and medium, hard concretions; clear, wavy boundary.

C1ca—10 to 23 inches, light olive-brown (2.5Y 5/3) clay, olive brown (2.5Y 4/3) when moist; strong, very coarse, prismatic primary structure and strong, medium to very coarse, angular blocky secondary structure; very hard when dry, firm when moist, sticky and very plastic when wet; a few very fine and fine roots; common, very fine and fine, irregular and tubular pores; common slickensides; mildly alkaline (pH 7.8) and moderately calcareous; lime is disseminated and segregated in a few, fine and medium, soft masses and hard concretions; gradual, wavy boundary.

C2ca—23 to 41 inches, clay that is similar to the horizon above, except slickensides are less common; in places lime is segregated in threads and filaments along old root channels and tubular pores; abrupt, wavy boundary.

C3—41 inches +, pale-olive (5Y 6/3), softly consolidated, calcareous siltstone, olive (5Y 5/3) when moist; weak, laminated structure; lime is concentrated in streaks and seams between laminations; common, yellowish-brown and brown mottles.

Nacimiento Clay: On an 18 percent slope facing southeast; elevation of 425 feet; under range of annual grasses and forbs rotated with dryfarmed grain (about 9 miles west-southwest of Willows; NW¼ sec. 30, T. 19 N., R. 4 W.):

Ap11—0 to 1 inch, light olive-brown (2.5Y 5/3) near brown (10YR 5/3) clay, olive brown (2.5Y 4/3) when moist; moderate, medium, platy structure; hard when dry, friable when moist, sticky and plastic when wet; many very fine and fine roots; mildly alkaline (pH 7.5); slightly calcareous; lime is both disseminated and segregated in a few, fine and medium, hard concretions; abrupt, smooth boundary.

Ap12—1 to 11 inches, light olive-brown (2.5Y 5/3) near brown (10YR 5/3) clay, olive brown (2.5Y 4/3) when moist; strong, very coarse, prismatic primary structure, and strong, coarse and very coarse, angular blocky secondary structure; very hard when dry, firm when moist, sticky and very plastic when wet; many very fine and fine roots; common, very fine to medium, irregular and tubular pores; mildly alkaline (pH 7.6); strongly calcareous; lime is both finely disseminated and segregated in a few, fine and medium, hard concretions; clear, wavy boundary.

ACca—11 to 22 inches, light olive-brown (2.5Y 5/3) clay, olive-brown (2.5Y 4/3) when moist; strong, very coarse, prismatic primary structure and strong, coarse, angular blocky secondary structure; very hard when dry, firm when moist, very sticky and very plastic when wet; many very fine and fine roots; common, very fine and fine, tubular pores and a few, fine and medium, irregular pores; common slickensides; mildly alkaline (pH 7.8); strongly calcareous; lime is both finely disseminated and segregated in a few, fine and medium, hard concretions; clear, wavy boundary.

Cca—22 to 31 inches, light yellowish-brown (2.5Y 6/3) clay, olive brown (2.5Y 4/4) when moist; massive, but breaks to moderate, coarse, subangular blocky structure; hard when dry, friable when moist; sticky and very plastic when wet; a few very fine roots; common, very fine and fine, tubular pores and a few, fine and medium, irregular pores; a few slickensides that decrease in number with increasing depth; mildly alkaline (pH 7.8); strongly calcareous; lime is both finely disseminated and segregated as mycelium along tubular pores and in a few, fine and medium, hard concretions; abrupt, irregular boundary.

R—31 inches +, hard, fractured, mottled pale-brown (10YR 6/3), yellowish-brown (10YR 5/6), and light olive-brown (2.5Y 5/4), fine-grained sandstone and shale; distinct, laminated structure; strongly calcareous; lime is concentrated in seams and pockets along fracture lines and between structural laminations.

Neuns Cobbly Loam: On a 35 percent slope facing southwest; under a semidense stand of ponderosa pine; elevation of 6,025 feet (about 1½ miles southeast of Plaskett Guard Station; NW¼ sec. 31, T. 22 N., R. 8 W.):

O1&O2—1 inch to 0, fresh and partly decomposed pine needles.

A1—0 to 3 inches, grayish-brown (10YR 5/2) cobbly loam, very dark grayish brown (10YR 3/2) when moist; strong, fine to medium, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; a few fine roots; many fine to medium pores; very strongly acid (pH 5.0); abrupt, smooth boundary.

B2—3 to 13 inches, brown (10YR 5/3) very gravelly loam, dark brown (10YR 4/3) when moist; moderate, medium, granular structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; many fine and medium roots; many fine and medium pores; very strongly acid (pH 5.0); clear, smooth boundary.

C—13 to 27 inches, light yellowish-brown (10YR 6/4 and 2.5Y 6/4) very gravelly loam, yellowish brown (10YR 5/4) when moist; moderate, medium, granular structure; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; a few fine and medium roots and a few large roots; many fine and medium pores; very strongly acid (pH 4.9); abrupt, irregular boundary.

R—27 inches +, hard, fractured, metavolcanic rock (greenstone); soil material and a few large tap roots are in the cracks and fissures between the rock.

Newville Gravelly Loam: On an 18 percent slope facing north-northeast; under annual grasses and forbs and blue oaks used for range; elevation of 525 feet (just west on Orland Buttes; NW¼ sec. 18, T. 22 N., R. 4 W.):

O1&O2—½ inch to 0, fresh and partly decomposed leaves and twigs.

A11—0 to 1 inch, grayish-brown (10YR 5/2) near brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) when moist; the gravel is mainly quartzite and chert; weak, medium, platy structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; many very fine and fine roots; many, fine, irregular pores; slightly acid (pH 6.2); abrupt, smooth boundary.

A12—1 to 7 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; massive; hard when dry, friable when moist, slightly sticky and nonplastic when wet; many fine and medium roots; many, fine and medium, irregular pores; slightly acid (pH 6.2); clear, wavy boundary.

A3—7 to 15 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; massive; hard when dry, friable when moist, slightly sticky and nonplastic when wet; many very fine and fine grass roots and fine and medium oak roots; many, fine and medium, irregular pores; a few, thin, patchy clay films in pores; medium acid (pH 6.0); abrupt, wavy boundary.

B2t—15 to 26 inches, brown (7.5YR 5/4) near reddish-brown (5YR 5/4) gravelly clay, reddish brown (5YR 4/4) when moist; moderate to strong, coarse, prismatic structure that is coarse and very coarse, subangular blocky with increasing depth; very hard when dry, very firm when moist, sticky and plastic when wet; a few medium and large oak roots; common, very fine and fine, tubular pores; thick continuous clay films in pores and around pebbles; medium acid (pH 5.9); gradual, wavy boundary.

B3t—26 to 48 inches +, mottled, light yellowish-brown (10YR 6/4) and brown (7.5YR 5/4), stratified very gravelly sandy clay loam and gravelly clay, yellowish brown (10YR 5/4) and reddish brown (5YR 4/4) when moist; massive; a few large oak roots; many, very fine and fine, irregular pores; thick nearly continuous clay films in pores and around pebbles; slightly acid (pH 6.3), but neutral (pH 7.0) with increasing depth; the thickness of the stratified layers and the amount and size of pebbles are variable.

ORLAND LOAM: On a nearly level flood plain; under annual grasses and forbs used for grazing; elevation of 305 feet (about 4 miles northwest of Orland; 900 feet west and 25 feet north of the south quarter corner of sec. 6, T. 22 N., R. 3 W.):

C1—0 to 11 inches, grayish-brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) when moist; a few small pebbles; weak, medium, platy structure in uppermost 1 inch, but massive below; slightly hard when dry, friable when moist, very slightly sticky and nonplastic when wet; many very fine and fine roots; common, very fine and fine, irregular pores and a few, fine, tubular pores; silvery sheen on pore surfaces; neutral (pH 6.9); clear, smooth boundary.
C2—11 to 39 inches, grayish-brown (2.5Y 5/2), stratified silt loam and loam and thin lenses of fine sand and gravel, dark grayish brown (2.5Y 4/2) when moist; a few, distinct mottles of strong brown (7.5YR 5/6) in the silty layers above the lenses of sand or gravel; massive to single grain; hard and loose when dry, friable and loose when moist, very slightly sticky to nonsticky and nonplastic when dry; many to few very fine roots; common, very fine to fine, irregular pores and many, very fine, tubular pores; silvery sheen on pore faces; neutral (pH 7.0) to mildly alkaline (pH 7.4); abrupt, smooth boundary.
IIC3—39 inches +, grayish-brown (2.5Y 5/2) very gravelly sand, dark grayish brown (2.5Y 4/2) when moist; the sand and gravel are mainly white quartzite, varicolored chert and jasper, and olive to gray sandstone fragments; single grain; loose when dry or moist; mildly alkaline (pH 7.4).

PARRISH GRAVELLY LOAM: On a 35 percent slope facing north; elevation of 2,600 feet; under a semidense stand of chamise in an area managed for wildlife and watershed (about 7 miles north-northwest of Stonyford along Elephant Hill Road, SE¼ sec. 26, T. 19 N., R. 7 W.):

O1&O2—¼ inch to 0, fresh and partly decomposed litter made up of chamise leaves and twigs.
A11—0 to 1 inch, light brownish-gray (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, thick, platy structure that breaks to moderate, fine, granular; soft when dry, very friable when moist, nonsticky when wet; a few roots; very porous; slightly acid (pH 6.1); abrupt, smooth boundary.
A12—1 to 6 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine and medium roots; common fine and medium pores; slightly acid (pH 6.2); clear, wavy boundary.
B1t—6 to 11 inches, brown (7.5YR 5/4) gravelly clay loam, dark brown (7.5YR 3/4) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; many fine and medium roots; common fine and medium pores; a few, thin, patchy clay films on ped faces and in pores; medium acid (pH 5.7); abrupt, wavy boundary.
B2t—11 to 25 inches, reddish-brown (5YR 4/5) gravelly clay, yellowish red (5YR 3/6) near dark red (2.5YR 3/6) when moist; moderate, medium, angular blocky structure; very hard when dry, firm when moist, very sticky and plastic when wet; a few medium to large roots; a few fine pores; common, moderately thick, continuous clay films on ped faces and in pores; strongly acid (pH 5.3); abrupt, irregular boundary.
R—25 inches +, hard, fractured, partly metamorphosed, fine-grained sandstone; a few medium and large tap roots along cracks in the bedrock.

PERKINS GRAVELLY LOAM: On a high terrace along a recent roadbed cut through a 2 percent slope under blue oaks and annual grasses and forbs used as range for sheep and cattle; elevation of 975 feet (about 2 miles southwest of Elk Creek; NW¼ sec. 18, T. 20 N., R. 6 W.):

O1&O2—½ inch to 0, fresh and partly decomposed leaves and twigs.
A11—0 to 7 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/4) near dark reddish brown (5YR 3/4) when moist; the gravel consists of angular quartzite and flat schistose fragments; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many, very fine and fine, irregular pores and common, fine, tubular pores; medium acid (pH 5.9); clear, wavy boundary.
A12—7 to 14 inches, reddish-brown (5YR 5/4) gravelly loam, dark reddish brown (5YR 3/4) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine and medium roots; many, very fine and fine, irregular pores and common, fine, tubular pores; the surfaces of voids and pebbles have a silvery sheen; medium acid (pH 6.0); clear, wavy boundary.
A3—14 to 22 inches, reddish-brown (5YR 5/4) light gravelly clay loam, dark reddish brown (5YR 3/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; common, fine, irregular and tubular pores; a few large and common fine and medium roots; a few, thin, patchy clay films in voids and around pebbles; the surfaces of pores and pebbles have a silvery sheen; slightly acid (pH 6.2); clear, wavy boundary.
B1t—22 to 34 inches, reddish-brown (5YR 5/4) gravelly clay loam, dark reddish brown (5YR 3/4) when moist; massive; hard when dry, firm when moist, sticky and plastic when wet; common, fine, irregular and tubular pores; a few fine, medium, and large roots; common, thin, patchy clay films; the surfaces of the pebbles and pores have a silvery sheen; medium acid (pH 6.0); clear, wavy boundary.
B2t—34 to 46 inches, reddish-brown (2.5YR 4/5) very gravelly clay loam, dark red (2.5YR 3/6) when moist; massive; very hard when dry, firm when moist, sticky and plastic when wet; common, very fine and fine, tubular pores and a few, fine, irregular pores; thick continuous clay films in voids and around pebbles; surfaces of pebbles and pores have a silvery sheen; strongly acid (pH 5.3); gradual, wavy boundary.
B3t—46 to 64 inches +, reddish-brown (2.5YR 4/5) very gravelly sandy clay loam, dark red (2.5YR 3/6) when moist; a few cobblestones in the lower part; massive; hard when dry, firm when moist, sticky and plastic when wet; a few medium and large roots; common very fine and fine, tubular and irregular pores; moderately thick to thick continuous clay films in voids and around pebbles and cobblestones; strongly acid (pH 5.3).

PLAZA SILT LOAM: Along the lower edge of an old alluvial fan in a nearly level, fallowed field of rice; elevation of 120 feet (about 2 miles east-northeast of Willows; NW¼ sec. 1, T. 19 N., R. 3 W.):

Ap—0 to 10 inches, light brownish-gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) when moist; common, distinct mottles of strong brown (7.5YR 5/6); moderate, fine to coarse, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; many very fine roots; many, very fine and fine, irregular pores and a few, very fine, tubular pores; medium acid (pH 5.8); clear, smooth boundary.

B2t—10 to 25 inches, light olive-brown (2.5Y 5/3) clay loam, dark grayish brown (2.5Y 4/2 to 4/3) when moist; common, distinct mottles of strong brown (7.5YR 5/6); strong, coarse, angular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; a few very fine roots; a few, very fine to medium, irregular pores and many, fine and very fine, tubular pores; grayish-brown (2.5Y 5/2), moderately thick, nearly continuous clay films on ped faces and moderately thick continuous films in pores; neutral (pH 7.0); clear, wavy boundary.

B3tca—25 to 34 inches, light olive-brown (2.5Y 5/3) clay loam, dark grayish brown (2.5Y 4/2 to 4/3) when moist; common, distinct mottles of strong brown (7.5Y 5/6); moderate, medium and coarse, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; a few, very fine and fine, irregular pores and common, fine and very fine, tubular pores; grayish-brown (2.5Y 5/2), thin, nearly continuous clay films on ped faces and thin continuous clay films in pores; moderately alkaline (pH 8.1); slightly calcareous; lime is disseminated and segregated in a few soft masses; gradual, smooth boundary.

C1ca—34 to 47 inches, light yellowish-brown (2.5Y 6/3) clay loam, olive brown (2.5Y 4/3) when moist; common, distinct mottles of strong brown (7.5YR 5/6); massive; hard when dry, friable when moist, slightly sticky and plastic when wet; a few, very fine to medium, irregular pores and common, fine and very fine, tubular pores; grayish-brown (2.5Y 5/2), thin, continuous clay films line the pores; moderately alkaline (pH 8.2); strongly calcareous; lime is disseminated and segregated in a few, small, soft masses; gradual, smooth boundary.

C2ca—47 to 60 inches +, mottled, light-gray (2.5Y 7/2) and pale-yellow (2.5Y 7/3) silty clay loam, grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/3) when moist; many, distinct mottles of strong brown (7.5YR 5/6); massive; common, very fine to medium, irregular pores and a few, fine, tubular pores; moderately alkaline (pH 8.1); strongly calcareous; lime is disseminated and segregated in a few, small, soft masses and hard concretions; fluctuating high water table.

Pleasanton Gravelly Loam: On an alluvial fan along a fresh cut in a streambank of an intermittent stream dissecting a 2 percent slope; under annual grasses and forbs, blue oaks, and scattered shrubs used as a range for sheep and cattle (about 5½ miles east of Newville in Masterson Hollow; NW¼ sec. 4, T. 22 N., R. 5 W.):

O1&O2—½ inch to 0, mixture of fresh and partly decomposed leaves and twigs.

A1—0 to 11 inches, grayish-brown (2.5Y 5/2) gravelly loam, very dark grayish brown (2.5Y 3/2 to 3/1) when moist; gravel, mainly of quartzite and chert, covers the surface; massive but breaks to weak, fine and medium, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine and fine roots; many, very fine to medium, irregular pores and a few, fine and very fine, tubular pores; medium acid (pH 6.0); clear, wavy boundary.

B1t—11 to 19 inches, grayish-brown (10YR 5/2) gravelly sandy clay loam, very dark grayish brown (10YR 3/2) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; many very fine and fine roots and a few medium roots; common, very fine to medium, irregular pores and common, fine and very fine, tubular pores; a few, thin, discontinuous clay films in pores and around pebbles; slightly acid (pH 6.1); clear, wavy boundary.

B2t—19 to 30 inches, grayish-brown (10YR 5/2) gravelly sandy clay loam, very dark grayish brown (10YR 3/2) when moist; massive; very hard when dry, firm when moist, very sticky and plastic when wet; a few very fine to medium roots; common, fine, irregular pores and common, fine and very fine, tubular pores; common, moderately thick, nearly continuous clay films in pores and around pebbles; slightly acid (pH 6.1); gradual, wavy boundary.

B3t—30 to 58 inches +, brown (10YR 5/3) gravelly sandy clay loam, dark brown (10YR 4/3) when moist; massive; a few medium roots of trees and shrubs; common, fine, irregular pores and common, fine and very fine, tubular pores; common, moderately thick, nearly continuous clay films, but less abundant than in the B2t horizon; medium acid (pH 6.0).

Polebar Loam: On a 35 percent slope facing south; under annual grasses and forbs used for range; elevation of 2,950 feet (about 7 miles northwest of the Colusa County line along Open Ridge Road; SW¼ sec. 34, T. 19 N., R. 7 W.):

O1&O2—¼ inch to 0, fresh and partly decomposed leaves from grasses and forbs.

A1—0 to 8 inches, brown (10YR 5/3) loam that contains gravel in some places, dark brown (7.5YR 3/3) when moist; weak, medium to coarse, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; many fine roots; common fine and medium pores; slightly acid (pH 6.2); abrupt, wavy boundary.

B2t—8 to 18 inches, reddish-brown (5YR 4/3) gravelly clay, dark reddish brown (5YR 3/3) when moist; moderate, coarse, angular blocky structure; very hard when dry, very firm when moist, very sticky and plastic when wet; a few fine roots; a few very fine and fine pores; many, moderately thick, continuous clay films on ped faces and in pores; slightly acid (pH 6.5) but neutral (pH 6.9) with increasing depth; clear, wavy boundary.

B3t—18 to 21 inches, mottled, dark-brown (10YR 4/3) and grayish-brown (2.5Y 5/2) gravelly clay, dark brown (10YR 3/4) and dark grayish brown (2.5Y 4/2) when moist; moderate, medium to coarse, subangular blocky structure; very hard when dry, very firm when moist, very sticky and plastic when wet; a few fine roots; common fine and very fine pores; common, thin, discontinuous clay films; mildly alkaline (pH 7.5); gradual, wavy boundary.

Cca—21 to 35 inches, light-gray (5Y 6/1) gravelly clay, olive gray (5Y 4/2) when moist; moderate, medium to coarse, subangular blocky structure; very hard when dry, very firm when moist, very sticky and plastic when wet; feels like talc; mildly alkaline (pH 7.8); strongly calcareous; lime is finely disseminated and segregated in soft blotches; abrupt, irregular boundary.

R—35 inches +, grayish, hard, fractured sandstone; partly metamorphosed in places; a few calcite seams are in the sandstone.

Porterville Clay: On a very gently sloping alluvial fan facing east-northeast; under annual grasses and forbs and blue oaks used as range for sheep and cattle; elevation of 1,250 feet (about 1½ miles west-northwest of Stonyford along the Colusa County line; 1/8 mile west of center of sec. 30, T. 18 N., R. 6 W.):

O1&O2—⅛ inch to 0, fresh and partly decomposed leaves and twigs.

A11—0 to 1½ inches, dark-brown (7.5YR 4/2) clay that contains gravel in a few places, dark brown (7.5YR 3/2) when moist; strong, fine and medium, granular structure; hard when dry, friable when moist, very sticky and very plastic when wet; many very fine roots; many, very fine to medium, irregular pores; very slightly acid (pH 6.6); clear, smooth boundary.

A12—1½ to 6 inches, dark reddish-brown (5YR 3/2), clay that contains gravel in a few places, dark reddish brown (5YR 3/3) when moist; strong, very coarse, prismatic primary structure and strong, fine to coarse, subangular blocky secondary structure; very hard when dry, firm when moist, very sticky and very plastic when wet; many very fine roots; many, very fine to medium, irregular pores and a few, fine, tubular pores; slightly acid (pH 6.4); clear, wavy boundary.

A13—6 to 16 inches, dark reddish-brown (5YR 3/2) clay that contains gravel in a few places, dark reddish brown (5YR 3/3) when moist; strong, very coarse, prismatic primary structure and strong, medium and coarse, subangular blocky secondary structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; a few very fine roots; many, very fine to medium, irregular pores and a few, fine and very fine, tubular pores; a few slickensides; slightly acid (pH 6.4); gradual, wavy boundary.

AC—16 to 27 inches, reddish-brown (5YR 4/3) gravelly clay, dark reddish brown (5YR 3/4) to reddish brown (5YR 4/4) when moist; massive; very hard when dry, firm when moist, very sticky and very plastic when wet; a few very fine roots; many, very fine to medium, irregular pores and a few, very fine, tubular pores; common slickensides; very slightly acid (pH 6.6); intermittently calcareous; lime is segregated in a few, fine, soft masses; clear, wavy boundary.

C1—27 to 40 inches +, brown (7.5YR 5/4) gravelly sandy clay loam, dark brown (7.5YR 4/4) when moist; massive; hard when dry, firm when moist, sticky and plastic when wet; many, very fine to medium, irregular pores; very slightly acid (pH 6.7); intermittently calcareous; lime is segregated in a few, fine, soft masses.

Redding Gravelly Loam: On a 1 percent slope on a terrace with low hummocks; under annual grasses and forbs used as range; elevation of 230 feet (about 6 miles south-southwest of Orland; NW¼ sec. 18, T. 21 N., R. 2 W.):

O1&O2—¼ inch to 0, fresh and partly decomposed leaves from grasses and forbs.

A1—0 to 7 inches, yellowish-red (5YR 5/6) gravelly loam, yellowish red (5YR 4/6) when moist; pebbles are mainly angular quartzite and chert; massive; hard when dry, friable when moist, slightly sticky and nonplastic when wet; common, very fine and fine, irregular pores and a few, fine, tubular pores; many very fine and fine roots; medium acid (pH 5.6); clear, wavy boundary.

A3—7 to 14 inches, yellowish-red (5YR 5/6) gravelly loam, yellowish red (5YR 4/5) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; common, fine, irregular and tubular pores; common very fine and fine roots; a few, thin, patchy clay films in pores and around pebbles; strongly acid (pH 5.4); abrupt, smooth boundary.

B2t—14 to 23 inches, reddish-brown (5YR 4/4) clay that contains gravel in a few places, dark yellowish red (5YR 3/6) when moist; strong, medium, prismatic structure but grades to strong, coarse, angular blocky at a depth of 3 to 4 inches; very thin, discontinuous, bleached material caps prisms; extremely hard when dry, extremely firm when moist, very sticky and very plastic when wet; a few very fine roots; common, very fine, tubular pores; thick continuous clay films on ped faces; in most places colloidal material has filled voids; a few slickensides in the lower part of this horizon; medium acid (pH 5.7); abrupt, wavy boundary.

Cm1—23 to 35 inches, yellowish-red (5YR 5/6) indurated, gravelly hardpan cemented with iron and silica, yellowish red (5YR 4/6) when moist; dark, metallic manganese stains along old seams and voids; thick dark-red (2.5YR 4/6) clay films in fissures; massive; very slightly acid (pH 6.6); clear, wavy boundary.

Cm2—35 to 54 inches +, mottled yellowish-red (5YR 5/6) and light yellowish-brown (10YR 6/4) gravelly material that is cemented with iron and silica but is less consolidated and less cemented with increasing depth, yellowish red (5YR 4/6) and yellowish brown (10YR 4/4) when moist; massive; common, dark manganese stainings along fissures and voids; common, very fine and fine, tubular and irregular pores; thick nearly continuous clay films in seams and around pebbles that are less prominent with increasing depth; neutral, but is very mildly alkaline (pH 7.2) with increasing depth.

Riz Silty Clay Loam: In a nearly level, abandoned ricefield, now used as range for sheep, that is strongly saline-alkali affected; under cover of annual grasses and salt-tolerant plants; elevation of 95 feet (about three-fourths mile south of Logandale and west of U.S. Highway 99W; SE¼ sec. 9, T. 18 N., R. 3 W.):

Ap—0 to 8 inches, upper one-fourth inch is light-gray (2.5Y 7/2) material that has weak, medium, platy structure, and below this is brown (10YR 5/3) and pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 3/3 and 4/3) when moist; common, fine, distinct mottles of strong brown (7.5YR 5/4); massive; hard when dry, friable when moist, sticky and plastic when wet; many very fine roots; many, very fine to medium, irregular pores and a few, fine and very fine, tubular pores; neutral (pH 7.1); abrupt, smooth boundary.

B21t—8 to 13 inches, brown (10YR 5/3) silty clay, dark brown (10YR 3/3) when moist; weak, medium and coarse, prismatic structure in the upper 2 to 3 inches and moderate, coarse, angular blocky structure below; very hard when dry, very firm when moist, very sticky and plastic when wet; many very fine and fine roots; common, very fine to medium, irregular pores and common, very fine and fine, tubular pores; a few, thin, discontinuous clay films; strongly alkaline (pH 8.7); clear, smooth boundary.

B22t—13 to 23 inches, brown (10YR 5/3) silty clay, dark yellowish brown (10YR 3/4) when moist; moderate, coarse, angular blocky structure; very hard when dry, very firm when moist, very sticky and plastic when wet; a few very fine roots; common, very fine to medium, irregular pores and common, very fine and fine, tubular pores; a few, thin, discontinuous clay films; very strongly alkaline (pH 9.2); slightly calcareous; contains finely disseminated lime; clear, wavy boundary.

B3t—23 to 34 inches, yellowish-brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) when moist; common, dark-colored manganese stainings; weak, medium to very coarse, subangular blocky structure; hard when dry, firm when moist, very sticky and plastic when wet; many, very fine and fine, irregular pores and common, very fine and fine, tubular pores; a few, thin, patchy clay films; very strongly alkaline (pH 9.5); slightly calcareous; contains finely disseminated lime; gradual, wavy boundary.

C1ca—34 to 46 inches, light yellowish-brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/6) when moist; common, dark-colored manganese stainings; massive; hard when dry, firm when moist, very sticky and plastic when wet; many, very fine to medium, irregular pores and common, very fine and fine, tubular pores; very strongly alkaline (pH 9.7); strongly calcareous; lime is finely disseminated and segregated in a few, soft, white (10YR 8/1) concretions; gradual, wavy boundary.

C2g—46 to 60 inches +, light yellowish-brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/6) when moist; common, dark-colored manganese stainings; massive; common, very fine and fine, irregular pores and a few, very fine, tubular pores; very strongly alkaline (pH 9.5); strongly calcareous; lime is finely disseminated and segregated in common, large, soft masses and a few, hard, medium, white (10YR 8/1) concretions; a few bluish-green gley spots.

SACRAMENTO CLAY: In a nearly level, small basin; under dryfarmed barley; elevation of 69 feet (about 2 miles east-southeast of Afton; SE¼ sec. 14, T. 18 N., R. 1 W.):

Ap—0 to 8 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; a few faint mottles of strong brown (7.5YR 5/6); strong, fine, granular structure to strong, fine and medium, subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; many very fine roots; many, very fine to medium, irregular pores; a few fine pellets of iron and manganese; slightly acid (pH 6.5); abrupt, smooth boundary.

A1—8 to 18 inches, dark-gray (2.5Y 4/1 to 3/1) clay, very dark gray (2.5Y 3/1) when moist; a few, faint mottles of strong brown (7.5YR 5/6); strong, coarse, angular blocky structure; very hard when dry; very firm when moist, very sticky and very plastic when wet; many very fine roots; common, very fine to medium, irregular pores and common, very fine and fine, tubular pores; common slickensides; a few fine pellets of iron and manganese; neutral (pH 7.0) but is mildly alkaline (pH 7.5) with increasing depth; gradual, smooth boundary.

ACca—18 to 44 inches, very dark grayish-brown (2.5Y 3/2) clay, very dark grayish brown (2.5Y 3/2 to 3/1) when moist; a few, faint mottles of strong brown (7.5YR 5/6); massive; very hard when dry, firm when moist, sticky and very plastic when wet; a few, fine, irregular pores and many, very fine and fine, tubular pores; a few very fine roots; a few slickensides; a few fine pellets of iron and manganese; moderately alkaline (pH 8.0); slightly calcareous; contains lime segregated mostly in small soft masses; gradual, smooth boundary.

C1ca—44 to 60 inches +, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; a few faint mottles of olive green; massive; very hard when dry, firm when moist, sticky and very plastic when wet; a few very fine roots; many, very fine and fine, tubular pores; a few fine pellets of iron and manganese; a few slickensides; moderately alkaline (pH 8.0); strongly calcareous; lime is mainly disseminated but also occurs as a few small concretions.

SEHORN CLAY LOAM: On a 45 percent slope facing north; elevation 750 feet; under annual grasses and forbs and blue oaks used as range for sheep and cattle (about 2½ miles southeast of Newville; SE¼ sec. 14, T. 22 N., R. 6 W.):

O1&O2—¼ inch to 0, fresh and partly decomposed, matted leaves and twigs.

A1—0 to 5 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; massive but breaks to moderate, fine and medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; many very fine and fine roots; many, fine and medium, irregular pores and common, very fine and fine, tubular pores; slightly acid (pH 6.4); abrupt, wavy boundary.

C1—5 to 13 inches, brown (10YR 4/3) to dark grayish-brown (10YR 4/2) clay, dark brown (10YR 3/3) when moist; strong, very coarse, subangular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; a few very fine roots; common, very fine to medium, irregular pores and a few, very fine and fine, tubular pores; a few slickensides; slightly acid (pH 6.4); clear, wavy boundary.

C2—13 to 27 inches, brown (10YR 4/3) to dark grayish-brown (10YR 4/2) clay, dark brown (10YR 3/3) when moist; a few shale fragments; strong, very coarse, angular blocky structure; a few very fine roots; common, very fine to medium, irregular pores and a few, very fine and fine, tubular pores; common slickensides; slightly acid (pH 6.4); abrupt, irregular boundary.

R—27 inches +, olive-gray (5Y 5/2), hard, fractured shale and very fine grained sandstone; in places dark manganese coatings are along fracture lines; rock is harder and less fractured with increasing depth.

SHEDD SILTY CLAY LOAM: On an 8 percent slope facing south-southwest; under range of annual grasses and forbs formerly dryfarmed to barley; elevation of 425 feet (about 1½ miles east of Orland Buttes; NW¼ sec. 4, T. 22 N., R. 4 W.):

Ap—0 to 9 inches, light-gray (2.5Y 7/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) when moist; massive but breaks to subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; many very fine and fine roots; common, fine and medium, irregular pores and a few, very fine, tubular pores; moderately alkaline (pH 7.9); strongly calcareous; lime is finely disseminated and segregated in a few, fine and medium, hard concretions; clear, smooth boundary.

A1—9 to 19 inches, light-gray (2.5Y 7/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) when moist; massive; hard when dry, firm when moist, slightly sticky and plastic when wet; common very fine and fine roots; common, fine and medium, irregular pores and very fine and fine tubular pores; moderately alkaline (pH 8.1); strongly calcareous; lime is finely disseminated and segregated in a few, fine and medium, hard concretions; clear, wavy boundary.

Cca—19 to 29 inches, pale-yellow (5Y 7/3) light silty clay, olive (5Y 5/3) near olive gray (5Y 5/2) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; a few very fine and fine roots; common, fine and medium, irregular pores and very fine and fine tubular pores; moderately alkaline (pH 8.1); strongly calcareous; lime is finely disseminated and segregated in threads (mycelium lime) and a few, fine and medium, hard concretions; abrupt, wavy boundary.

C2—29 inches +, light-gray (5Y 7/2), softly consolidated, very fine grained sandstone and siltstone, olive green when moist; fine to medium laminated structure; moderately alkaline; very calcareous; lime is concentrated in fine seams and pockets between laminations; common, yellowish-brown and brown mottles.

SHEETIRON GRAVELLY LOAM: On a 35 percent slope facing northwest; under a dense stand of yellow pine, Douglas-fir, and black oak with an understory of hoary manzanita; elevation of 4,200 feet (about 1 mile northeast of Alder Springs; near the center of sec. 24, T. 21 N., R. 8 W.):

O1&O2—1½ inches to 0, fresh and partly decomposed, matted conifer needles and leaves, and twigs from oaks and shrubs.

A1—0 to 3 inches, grayish-brown (2.5Y 5/2) gravelly loam, dark grayish brown (2.5Y 4/2) when moist; strong, fine and medium, granular structure; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; feels like talc; pebbles consist of fragments of angular quartzite and schistose rock; many, very fine and fine, irregular pores and a few, fine, tubular pores; many fine roots; medium acid (pH 5.6); clear, wavy boundary.

A3—3 to 15 inches, light yellowish-brown (2.5Y 6/3) gravelly loam, olive brown (2.5Y 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many, very fine and fine, irregular pores and a few, fine, tubular pores; many fine and medium roots; a thin coating of oriented sericite flakes around the pebbles; strongly acid (pH 5.3); gradual, wavy boundary.

B2t—15 to 28 inches, light yellowish-brown (2.5Y 6/3 to 6/4) gravelly loam near clay loam, olive brown (2.5Y 4/3 to 4/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, firm when moist, slightly sticky and slightly plastic when wet; feels like talc; many, very fine and fine, irregular pores and a few, fine, tubular pores; many fine and medium roots; a thin coating of oriented sericite is around the pebbles and in many places along the pore faces; strongly acid (pH 5.1); abrupt, irregular boundary.

R—28 inches +, strongly folded and fractured schist (sericite) and many seams of quartzite; partly weathered in the upper part but is harder and less fractured with increasing depth; a few medium and large roots along cracks in the rock.

STOCKTON CLAY: In a nearly level, fallowed field of rice, at an elevation of 80 feet (about 6 miles east of Butte City; 2,500 feet southwest of the Butte City Highway Bridge over Butte Creek):

Ap—0 to 8 inches, very dark gray (2.5Y 3/1) clay, black (2.5Y 2/1) when moist; a few, faint mottles of strong brown; fine, granular to coarse, subangular blocky structure; very hard when dry, firm when moist, very sticky and very plastic when wet; common very fine and fine roots; many tubular and irregular pores; medium acid (pH 5.8); abrupt, wavy boundary.

A1—8 to 25 inches, very dark gray (2.5Y 3/1) clay, black (2.5Y 2/1) when moist; a few, faint mottles of strong brown; coarse to very coarse, subangular blocky structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; common very fine and fine roots; common, very fine and fine, tubular and irregular pores; many slickensides; slightly acid (pH 6.3) but more alkaline with increasing depth; clear, wavy boundary.

AC—25 to 35 inches, very dark gray (2.5Y 3/1) clay, very dark gray (10YR 3/1) when moist; a few, faint mottles of strong brown; massive; very hard when dry, very firm when moist, very sticky and very plastic when wet; a few fine roots; common, very fine, tubular and irregular pores; many slickensides; neutral (pH 7.0) to mildly alkaline; slightly calcareous; contains segregated lime in fine soft masses; clear, wavy boundary.

C1ca—35 to 46 inches, very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) when moist; a few, faint mottles of strong brown; massive; very hard when dry, firm when moist, sticky and plastic when wet; a few fine roots; common, very fine, tubular pores; many slickensides; mildly alkaline (pH 7.5); strongly calcareous; contains segregated lime in fine- to medium-sized soft masses; a few fine pellets of manganese; gradual, wavy boundary.

C2ca—46 to 54 inches, very dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (10YR 3/2) when moist; a few faint mottles of strong brown; massive; hard when dry, friable when moist; sticky and plastic when wet; a few fine roots; a few, very fine, tubular pores; common slickensides; mildly alkaline (pH 7.7); strongly calcareous; lime is both finely disseminated and segregated in soft masses; clear, wavy boundary.

Cm—54 to 65 inches +, light brownish-gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; common mottles of strong brown; massive; weakly cemented with lime; very hard when dry, firm when moist, sticky and plastic when wet; a few slickensides; strongly calcareous.

STONYFORD GRAVELLY LOAM: On a 25 percent slope facing southwest; under a dense stand of chamise; elevation of 1,500 feet (about 3½ miles west of Stonyford in Colusa County; SW¼ sec. 35, T. 18 N., R. 7 W.):

O1&O2—¼ inch to 0, fresh and partly decomposed chamise leaves and twigs; the litter is as much as 2 inches thick around the base of chamise plants.

A1—0 to 2½ inches, brown (7.5YR 4/4) gravelly heavy loam near gravelly clay loam, dark reddish brown (5YR 3/4) when moist; the gravel generally is less than one-half inch in diameter; very weak, medium, subangular blocky structure that breaks to granular; soft when dry, very friable when moist, nonsticky and nonplastic when wet; many fine roots; very porous; slightly acid (pH 6.4); abrupt, wavy boundary.

B1t—2½ to 7 inches, reddish-brown (5YR 4/4) gravelly clay loam, dark reddish brown (5YR 3/4) when moist; weak, medium to coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine and medium pores; a few, thin, patchy clay films in pores; slightly acid (pH 6.3); clear, wavy boundary.

B2t—7 to 14 inches, reddish-brown (5YR 4/3) very gravelly clay loam, dark reddish brown (5YR 3/3) when moist; moderate, medium to coarse, subangular blocky structure; hard when dry, firm when moist, slightly sticky and plastic when wet; many medium roots and a few large roots; common fine and medium pores; thin to moderately thick nearly continuous clay films in pores and on ped faces; slightly acid (pH 6.3); abrupt, irregular boundary.

R—14 inches +, fractured, partly weathered, brown to yellowish-brown pillow basalt; in places soil material and a few large roots are along fracture lines; the basalt is more massive and less weathered with increasing depth.

SUNNYVALE CLAY: In a nearly level basin; under irrigated field crops in a fallowed field; elevation of 110 feet (one-fourth mile north of Bayliss; 200 feet west and 100 feet south of the northeastern corner of sec. 39, Rancho Jacinto):

Ap—0 to 9 inches, very dark gray (N 3/0 to 5Y 3/1) clay, black (5Y 2/1) when moist; the material in the uppermost 1 inch has fine granular structure and that below has strong, medium, subangular blocky; very hard when dry, very firm when moist, slightly sticky and plastic when wet; many very fine to medium roots; many, fine to medium, irregular pores; many worm channels and castings; mildly alkaline (pH 7.6); slightly calcareous; contains finely disseminated lime; abrupt, smooth boundary.

A12—9 to 19 inches, very dark gray (N 3/0 to 5Y 3/1) clay, black (5Y 2/1) when moist; very coarse prismatic primary structure and strong, medium to coarse, angular and subangular blocky secondary structure; very hard when dry, firm when moist, slightly sticky and plastic when wet; a few slickensides; many very fine to medium roots; many, fine, irregular and tubular pores; moderately alkaline (pH 8.2); strongly calcareous; lime is finely disseminated and segregated in fine soft masses; clear, wavy boundary.

A13ca—19 to 24 inches, like the A11 horizon, but hard when dry and friable when moist; moderately alkaline (pH 8.4); very strongly calcareous; lime is finely disseminated and segregated in fine to medium soft masses; clear, irregular boundary.

C1ca—24 to 34 inches, light-gray (5Y 6/1) clay loam, grayish brown (2.5Y 5/2) when moist; massive; hard when dry, friable when moist, very slightly sticky and slightly plastic when wet; a few krotovinas; a few fine to medium roots; common, very fine to fine, irregular and tubular pores; moderately alkaline (pH

8.1); very strongly calcareous; lime is finely disseminated and segregated in a few, medium, hard concretions; clear, wavy boundary.

C2ca—34 to 46 inches, light olive-gray (5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; common, distinct mottles of yellowish brown (10YR 5/4); a few fine to medium roots; common, very fine to medium, irregular and tubular pores; moderately alkaline (pH 8.0); strongly calcareous; lime is finely disseminated and segregated in a few medium to large concretions; water table is at a depth of 34 inches; clear, wavy boundary.

C3g—46 to 60 inches +, mottled light brownish-gray (2.5Y 6/2) and light yellowish-brown (10YR 6/4) clay loam, dark grayish brown (2.5Y 4/2) and yellowish brown (10YR 5/4) when moist; massive; a few fine roots; common, very fine and fine, irregular pores and a few, fine, tubular pores; common, medium, gleyed spots of olive green; mildly alkaline (pH 7.4); slightly calcareous; contains finely disseminated lime.

TEHAMA SILT LOAM: In a nearly level, unirrigated barley field used in rotation with dryland range; elevation of 175 feet (about 2 miles northeast of Artois; NE¼ sec. 35, T. 21 N., R. 3 W.):

Ap—0 to 9 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; common, very fine and fine, irregular pores and a few, very fine and fine, tubular pores; medium acid (pH 5.7); clear, smooth boundary.

B1t—9 to 12 inches, brown (10YR 5/3) light silty clay loam, dark brown (10YR 3/3) when moist; massive; hard when dry, firm when moist, sticky and plastic when wet; many very fine roots; a few, very fine and fine, irregular pores and many, very fine and fine, tubular pores; a few, thin, patchy clay films in the large pores and on ped faces; slightly acid (pH 6.0); clear, smooth boundary.

B21t—12 to 19 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; strong, coarse, angular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; many very fine roots; a few, very fine and fine, irregular pores and common, very fine and fine, tubular pores; many, moderately thick, continuous clay films in pores and on ped faces; slightly acid (pH 6.6); clear, wavy boundary.

B22t—19 to 27 inches, mottled brown (10YR 5/3) and pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 3/3) and brown (10YR 4/3) when moist; strong, coarse, subangular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; a few very fine roots; a few, very fine and fine, irregular pores and many, very fine and fine, tubular pores; many, moderately thick, continuous clay films in pores and on ped faces; mildly alkaline (pH 7.5); gradual, wavy boundary.

B3tca—27 to 38 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) when moist; moderate, coarse, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; a few very fine roots; many, very fine and fine, tubular pores; thin, continuous, brown (10YR 5/3) clay films line the pores and in places are on ped faces; mildly alkaline (pH 7.7); slightly calcareous; contains finely disseminated lime; gradual, wavy boundary.

C1ca—38 to 50 inches, pale-yellow (2.5Y 7/3) silty clay loam, light olive brown (2.5Y 5/4) when moist; massive; hard when dry, firm when moist, sticky and plastic when wet; a few, very fine, irregular pores and many, very fine and fine, tubular pores; thin, continuous, brown (10YR 5/3) clay films line the pores and in places are along fractured faces; moderately alkaline (pH 7.9); slightly calcareous; lime is finely disseminated and segregated in a few, small, soft masses; gradual, wavy boundary.

C2ca—50 to 60 inches +, light-gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; a few, very fine and fine, irregular pores and common, very fine and fine, tubular pores; thin, continuous, brown (10YR 5/3) clay films line the pores and in places are along fracture faces; moderately alkaline (pH 8.0); moderately calcareous; lime is finely disseminated and segregated in soft white (10YR 8/1) masses.

TOOMES EXTREMELY ROCKY SILT LOAM (formerly known as Hambright): On a 5 percent slope facing east; under annual grasses and forbs used for range; elevation 890 feet (on Orland Buttes about 8 miles west-northwest of Orland; SW¼ sec. 5, T. 22 N., R. 4 W.):

O2—¼ inch to 0, dark-colored, partly decomposed organic matter.

A11—0 to 7 inches, brown (10YR 5/3) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly plastic and slightly sticky when wet; many fine and medium roots; many fine to medium pores; strongly acid (pH 5.4); clear, smooth boundary.

A12—7 to 16 inches, brown (10YR 5/3) very gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly plastic and slightly sticky when wet; a few fine roots; common fine to medium pores; medium acid (pH 5.6); abrupt, irregular boundary.

R—16 inches +, dark-gray basalt that is free of olivine and has distinct columnar structure; soil material is in cracks and crevices of the rock; surface weathering of the rock is to a depth of about one-eighth inch.

TYSON GRAVELLY LOAM: On a 35 percent slope facing north; under a semidense stand of Brewer oak and buckbrush; elevation of 4,350 feet (about 2 miles northwest of St. John Mountain):

O1&O2—½ inch to 0, loosely matted, fresh and partly decomposed leaves and twigs from shrubs.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; strong, fine and medium, granular structure; loose when dry, very friable when moist, nonsticky and nonplastic when wet; feels like talc; many, very fine and fine, irregular pores; many very fine roots; slightly acid (pH 6.3); abrupt, wavy boundary.

B1t—5 to 15 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; feels like talc; many, very fine and fine, irregular pores and a few, fine, tubular pores; many very fine to medium roots; thin, patchy clay films in pores; thin coating of oriented sericite around pebbles; medium acid (pH 5.8); clear, wavy boundary.

B2t—15 to 23 inches, pale-brown (10YR 6/3) gravelly heavy loam, brown (10YR 4/3) when moist; massive, but breaks to moderate, fine and medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; feels like talc; common, very fine to medium, irregular pores and a few, fine, tubular pores; many fine and medium roots; thin nearly continuous clay films in pores; oriented sericite around pebbles; medium acid (pH 5.8); abrupt, irregular boundary.

R—23 inches +, strongly folded and fractured schist with veins of quartzite; in places soil material is in cracks between the fractured schist; a few fine and medium roots are along the fracture lines.

WILLOWS CLAY: In a nearly level, fallowed field of rice; soil is moderately saline-alkali; elevation of 100 feet (about 8½ miles south and 1 mile east of Willows; 100 feet south and 300 feet west of the northeast corner, sec. 29, T. 18 N., R. 3 W.):

Ap1—0 to ½ inch, dark grayish-brown (10YR 4/2) near dark-brown (10YR 4/3) clay, very dark grayish brown (10YR 3/2) when moist; common, fine, distinct mottles of strong brown (7.5YR 5/6); strong, fine and medium, granular structure; very hard when dry, firm when moist, slightly sticky and plastic when wet; sllightly acid (pH 6.2); abrupt, wavy boundary.

Ap2—½ inch to 9 inches, color and texture similar to those in Ap1 horizon; very coarse, prismatic primary structure and coarse and very coarse, subangular blocky secondary structure; very hard when dry, firm when moist, sticky and plastic when wet; common, very fine, tubular pores and many, fine and medium, irregular pores; a few fine roots; slightly acid (pH 6.1); abrupt, wavy boundary.

Ap3—9 to 13 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; common, distinct mottles of strong brown (7.5YR 5/6); common, fine, dark-colored manganese stains; very coarse, prismatic primary structure and very coarse, angular blocky secondary structure; very dense, plowpan layer; extremely hard when dry, very firm when moist, and sticky and plastic when wet; common, very fine, tubular pores and common, fine and medium, irregular pores; a few fine roots; a few very fine pellets of iron and manganese; neutral (pH 7.1); clear, wavy boundary.

AC—13 to 23 inches, dark grayish-brown (10YR 4/2) near dark-brown (10YR 4/3) clay, dark brown (10YR 4/3) when moist; a few mottles of strong brown (7.5YR 5/6); a few, dark-colored manganese stains; very coarse, prismatic primary structure and coarse, angular blocky, secondary structure; wide, deep, vertical cracks; extremely hard when dry, very firm when moist, sticky and plastic when wet; in places bluish-green gleying along roots; a few very fine roots; common, very fine, tubular pores; common slickensides and pressure faces; a few small pellets of manganese; mildly alkaline (pH 7.6); clear, wavy boundary.

Cca—23 to 34 inches, brown (10YR 4/3) clay, dark brown (10YR 4/3) when moist; a few mottles of strong brown (7.5YR 5/6); in places bluish-green gleying along old root channels; massive, but breaks to coarse and very coarse, angular blocky structure; extremely hard when dry, very firm when moist, sticky and plastic when wet; common, very fine and fine, tubular pores; a few very fine roots; common slickensides and pressure faces but less abundant than in horizon above; a few small pockets of gypsum crystals; moderately alkaline (pH 8.3); slightly calcareous; lime is segregated in hard, small concretions; exchangeable sodium is more than 15 percent; gradual, wavy boundary.

C1g—34 to 46 inches, brown (10YR 4.5/3) clay, dark brown (10YR 4/3) when moist; a few, distinct mottles of strong brown (7.5YR 5/6); dark-colored manganese stains; bluish-green gleying in spots and along tubular pores; massive, but breaks to coarse, subangular, blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; common, very fine and fine, tubular pores; a few slickensides and pressure faces; moderately alkaline (pH 8.5); slightly calcareous; lime is segregated in small hard concretions and soft masses; a few small pockets of gypsum crystals; exchangeable sodium is more than 15 percent; slightly saline; gradual, wavy boundary.

C2g—46 to 62 inches +, brown (10YR 5/3) near yellowish-brown (10YR 5/4) clay, dark brown (10YR 4/3) near dark yellowish brown (10YR 4/4) when moist; common, dark-colored manganese stains; common to many bluish-green gley spots; massive, but breaks to medium and coarse, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; common, very fine and fine, tubular pores; a few slickensides and pressure faces; moderately alkaline (pH 8.5); moderately calcareous; lime is finely disseminated and segregated in fine soft masses; exchangeable sodium is more than 15 percent; slightly saline; a few small pockets of gypsum crystals; water is at a depth of 60 inches.

WILLOWS CLAY, DENSE SUBSOIL: In a nearly level basin; under rice; soil is slightly saline-alkali; elevation of 80 feet (about 8 miles southeast of Willows; NW¼ sec. 4, T. 18 N., R. 2 W.):

Ap1—0 to 9 inches, gray (2.5Y 5/1) to grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) when moist; many, fine, prominent mottles of strong brown (7.5YR 5/6); massive, but breaks to moderate, fine to coarse, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; many very fine roots; many, very fine to medium, irregular pores; slightly acid (pH 6.0); abrupt, smooth boundary.

Ap2—9 to 13 inches, gray (2.5Y 5/1) to grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) when moist; a few, fine, prominent mottles of strong brown (7.5YR 5/6); massive, but breaks to strong, medium and coarse, subangular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; many very fine roots; common, very fine and fine, irregular pores and a few, very fine and fine, tubular pores; a few fine pellets of iron and manganese; a few slickensides; thin, patchy, dark-gray (5Y 4/1), colloidal coating lines tubular pores; neutral (pH 7.0); clear, wavy boundary.

AC—13 to 22 inches, grayish-brown (2.5Y 5/2) to dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; a few, fine, prominent mottles of strong brown (7.5YR 5/6); massive, but breaks to strong, coarse, angular blocky structure; very hard when dry, very firm when moist, sticky and plastic when wet; a few very fine roots; common, very fine and fine, irregular pores and common, very fine and fine, tubular pores; thin, dark-gray (5Y 4/1), colloidal coating lines tubular pores; common slickensides; mildly alkaline (pH 7.8); slightly calcareous; contains lime segregated in nearly white, fine, soft masses; gradual, wavy boundary.

C1ca—22 to 35 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; a few, fine, prominent mottles of strong brown (7.5YR 5/6); massive, but breaks to coarse, angular blocky structure; very hard when dry, very firm when moist, very sticky and plastic when wet; common, very fine and fine, irregular pores and common, very fine and fine, tubular pores; common slickensides; moderately alkaline (pH 8.4); more than 15 percent exchangeable sodium; strongly calcareous; lime is finely disseminated and segregated in nearly white, fine, soft masses; water table is at a depth of 26 inches; clear, wavy boundary.

C2m—35 to 46 inches, light brownish-gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; many, fine, distinct mottles of light yellowish brown (10YR 6/4) and a few mottles of bluish green; massive; weakly cemented with silica and lime; extremely hard when dry, extremely firm when moist, sticky and plastic when wet; common, very fine and fine, tubular pores; a few slickensides; strongly alkaline (pH 8.5); is more than 15 percent exchangeable sodium; strongly calcareous; lime is finely disseminated and segregated in medium soft masses and along walls of tubular pores; clear, wavy boundary.

C3g—46 to 56 inches +, light brownish-gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; a few mottles of light yellowish brown (10YR 6/4) and common, fine, bluish-green mottles; massive, but breaks to coarse, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; common, very fine and fine, tubular pores; a few slickensides; strongly alkaline (pH 8.5); is more than 15 percent exchangeable sodium; strongly calcareous; lime is finely disseminated and segregated in fine soft masses and along walls of tubular pores; lime content decreases with increasing depth.

Wyo Silt Loam: In a nearly level field of barley; elevation of 160 feet (about 1 mile west-southwest of the Hamilton City High School):

Ap—0 to 11 inches, grayish-brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) when moist; massive or weak, coarse, subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; many, very fine and fine, tubular pores and common, fine to medium, irregular voids; a few worm channels; common very fine and fine roots; very slightly acid (pH 6.8); clear, smooth boundary.

B2t—11 to 25 inches, grayish-brown (2.5Y 5/2) heavy silt loam, very dark grayish brown (2.5Y 3/2) when moist; weak, coarse to very coarse, angular blocky structure; common, dark grayish-brown, organic stainings on ped faces; hard when dry, firm when moist, slightly sticky and plastic when wet; many, very fine and fine, tubular pores and common, fine to medium, irregular voids; a few very fine and fine roots; thin nearly continuous clay films in pores; very slightly acid (pH 6.7), but is very mildly alkaline in the lower part of this horizon; clear, wavy boundary.

B3t—25 to 42 inches, grayish-brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) when moist; a few, dark grayish-brown, colloidal stainings on ped faces; massive; hard when dry, firm when moist, slightly sticky and plastic when wet; many, very fine and fine, tubular pores and a few, fine and medium, irregular voids; a few very fine roots; thin nearly continuous clay films in pores and voids; mildly alkaline (pH 7.8); clear, wavy boundary.

C1—42 to 50 inches, light yellowish-brown (2.5Y 6/3) silt loam, dark grayish brown (2.5Y 4/2) near olive brown (2.5Y 4/3) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; many, very fine and fine, tubular pores and a few, fine and medium, irregular pores; a few very fine roots; a few, thin, patchy clay films; moderately alkaline (pH 8.2); moderately calcareous; lime is finely disseminated and segregated along surfaces of tubular pores; gradual, wavy boundary.

C2—50 to 60 inches +, similar to the C1 horizon, except that material is slightly calcareous and contains no clay films.

Yolo Clay Loam: In a nearly level field of barley; elevation of 160 feet (about 4 miles northwest of Willows; NE¼ sec. 36, T. 20 N., R. 4 W.):

Ap—0 to 9 inches, brown (10YR 5/3) near grayish-brown (10YR 5/2) clay loam, dark brown (10YR 3/3) near very dark grayish brown (10YR 3/2) when moist; weak, coarse to very coarse, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; many, very fine and fine, tubular and irregular pores; common worm channels; a few very fine roots; very slightly acid (pH 6.6); abrupt, smooth boundary.

C1—9 to 19 inches, brown (10YR 5/3) silty clay loam stratified with thin layers of very fine sandy loam and silt loam, dark brown (10YR 3/3) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; many, very fine and fine, tubular pores and a few, fine and medium, irregular voids; common worm channels; many very fine roots; thin, patchy, colloidal coatings along old root and worm channels; very mildly alkaline (pH 7.2); clear, wavy boundary.

C2—19 to 32 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; many, very fine and fine, tubular pores and common, fine, irregular pores and worm channels; a few very fine roots; thin, patchy, colloidal coatings in many old roots and worm channels; a few, faint mottles of strong brown in the lower 6 inches; very mildly alkaline (pH 7.2); abrupt, wavy boundary.

IIAb—32 inches +, dark grayish-brown (2.5Y 4/2) clay; very dark grayish brown (2.5Y 3/2) when moist.

Yorkville Clay Loam: On a 40 percent slope facing southwest; under a mixture of annual and perennial grasses used for summer range; elevation of 3,200 feet (about 2½ miles southeast of Sheetiron Mountain along Open Ridge Road; NE¼ sec. 25, T. 19 N., R. 8 W.):

O1&O2—¼ inch to 0, fresh and partly decomposed leaves of grass.

A1—0 to 6 inches, gray (2.5Y 5/1) clay loam, very dark gray (2.5Y 3/1) when moist; a few angular pebbles; moderate, coarse, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; many very fine and fine roots and pores; slightly acid (pH 6.6); clear, wavy boundary.

B1t—6 to 14 inches, gray (2.5Y 5/1) clay loam near clay, very dark gray (2.5Y 3/1) when moist; a few pebbles; strong, very coarse, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; a few very fine and many fine roots; common, very fine and fine, irregular and tubular pores; common, moderately thick, nearly continuous clay films on ped faces; neutral (pH 7.0); clear, wavy boundary.

B2t—14 to 38 inches, gray (5Y 5/1) gravelly clay, dark olive gray (5Y 3/2) when moist; moderate, very coarse, subangular blocky structure; very hard when dry, very firm when moist, very sticky and plastic when wet; a few very fine and fine roots; common very fine pores; common moderately thick clay films; many slickensides; mildly alkaline (pH 7.8); slightly calcareous; clear, irregular boundary.

R—38 inches +, hard, fractured, gray sandstone that is partly metamorphosed and in places is serpentinized along pressure faces; slightly calcareous; a few seams of calcite.

Zamora Silty Clay Loam (formerly known as Codora): On a nearly level, young flood plain; under dry-farmed barley; elevation of 85 feet (about three-fourths mile northeast of Butte City; NW¼ sec. 28, T. 19 N., R. 1 W.):

Ap—0 to 6 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) when moist; medium, granular to coarse, subangular blocky structure; hard when dry, firm when moist, slightly sticky and plastic when wet; many very fine and fine roots; many, very fine to medium, irregular pores and a few, very fine, tubular pores; very slightly acid (pH 6.7); abrupt, smooth boundary.

A1—6 to 11 inches, similar to the Ap horizon, except has moderate, coarse, subangular blocky structure; very slightly acid (pH 6.7); clear, smooth boundary.

B21t—11 to 22 inches, grayish-brown (10YR 5/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) when moist; dark grayish-brown (2.5Y 4/2), discontinuous, colloidal stainings on aggregates; moderate, coarse, subangular blocky structure; many very fine roots; common, very fine to medium, irregular pores and many, very fine and fine, tubular pores; common, thin, patchy clay films; neutral (pH 7.1); clear, smooth boundary.

B22t—22 to 38 inches, grayish-brown (10YR 5/2) to light brownish-gray (10YR 6/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; a few very fine roots; common, very fine, irregular pores and many, very fine and fine, tubular pores; a few, thin, patchy clay films; neutral (pH 7.2), but is mildly alkaline (pH 7.5) with increasing depth; clear, smooth boundary.

C1—38 to 60 inches +, pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 3/3) when moist; massive; hard when dry, firm when moist, slightly sticky and plastic when wet; a few very fine roots; common, very fine and fine, irregular pores and many, very fine and fine, tubular pores; moderately alkaline (pH 8.1); slightly calcareous; in places lime is disseminated and segregated along walls of tubular pores.

Laboratory Analyses

In this section the results of the physical and chemical analyses of representative soils are given. Then results of the mineralogical analyses of clay fractions of some representative soils are shown.

Physical and Chemical Analyses [7]

The results of the physical and chemical analyses of representative soils of the county are given in tables 12 and 13. The soil samples were air dried, crushed with a rubber-tipped pestle, and then screened through a 2-millimeter, round-holed sieve. After they had been rubbed relatively clean, the coarse fragments larger than 2-millimeters in diameter were weighed to determine the percentage of gravel and were then discarded. The material that passed through the sieve was thoroughly mixed, and subsamples of this were used for the laboratory analyses. Methods used in obtaining the data are described in the paragraphs that follow. All results are expressed on an ovendry basis.

Size class and diameter of particles.—The amount of sand, as shown in table 12, was determined through the use of 10 grams of ovendried soil to which water and Calgon (a sodium hexametaphosphate) had been added. This mixture was shaken overnight in a reciprocating shaker. The soil was then wet sieved through a 300-mesh screen, transferred to an evaporating dish, ovendried, and weighed. The total sand was expressed in percentage of the weight of the original ovendried sample. The dried sand was then fractionated through a nest of sieves in a mechanical shaker, and each fraction was weighed.

The amount of clay (particles below 2 microns in size) was determined by the hydrometer method. Fifty grams of soil, together with calgon as a dispersing agent, were shaken overnight in a reciprocating shaker and then transferred to a 1,000-centimeter cylinder. Hydrometer readings were taken at the proper intervals to record the amount of clay remaining in suspension. The results were expressed as a percentage of the ovendried soil.

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The percentage of silt was determined by adding the percentage of sand and the percentage of clay and then subtracting the total from 100 percent.

Bulk density.—The bulk density (table 12) was determined by the zinc chloride method. A representative lump of the air-dried soil was given a thin coating of paraffin and then dropped into successive solutions of zinc chloride made up to standard true densities. The lowest density solution in which the lump will float gives the bulk density of the lump of soil.

Moisture equivalent.—The moisture equivalent, shown in table 12, represents approximately the normal field capacity—the amount of water that is held in a soil after a heavy rain or an irrigation—where drainage downward is free and uninterrupted.

Moisture equivalents were determined by the standard method in which 30 grams of saturated soil were subjected to a force of 1,000 gravity in a centrifuge. The results were reported as the percentage of moisture retained, as calculated on the ovendry basis. A few soil samples were too compact to allow free passage of water, and water was retained on the surface of the soil after the centrifuge run. When this occurred, the procedure was repeated with another sample; waxed paper liners were used in the centrifuge cups to facilitate drainage.

Pressure membrane studies.—Another method of measuring the force with which the soil is able to hold water is that of subjecting saturated soil to pressure and determining the amount of water the soil is able to retain (table 12). The soil samples were put into small rings on a membrane placed over a porous plate, were saturated with water, and were then placed in the pressure plate apparatus. The desired pressure was obtained with nitrogen gas. The samples were held for 24 hours under 15 atmospheres pressure. The amount of moisture retained was then determined. The amount of moisture retained at 15 atmospheres pressure corresponds fairly closely with the permanent wilting point.

Reaction.—The Beckman glass-electrode pH meter was used for the determination of the reaction of each soil shown in tables 12 and 13. Approximately 50 grams of soil were saturated with distilled water and allowed to stand for 1 hour before the reading was made. A pH value of 7.0 designates a neutral soil. Values decreasing from 7.0 designate increasingly acid soils; values increasing from 7.0 designate increasingly alkaline soils.

Calcium carbonate.—The amount of calcium carbonate (lime), as shown in table 12, was determined for all soils having a pH value of more than 7.0. The Williams method was used. A known weight of soil was treated with hydrochloric acid in a sealed jar. The resulting pressure of the carbon dioxide gas produced was measured with a mercury manometer. The manometer was calibrated by measuring the pressure when pure calcium carbonate was treated similarly.

Phosphate.—The amount of water-soluble phosphate was (table 12) determined by the modified Bingham method. The soil was extracted with water and an aliquot of this water extract was tested. Phosphate ion in an acidic solution forms a relatively water-stable complex with a molybdate ion, which in the presence of stannous chloride turns blue. The intensity of the blue color developed is a measure of the amount of phosphate present in the aliquot sample.

TABLE 12.—*Physical and chemical analyses of*

[Dashes indicate not

Soil name and sample number	Depth	Size class and diameter of particles: Coarse fragments (greater than 2 mm.)	Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Total sand	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Altamont clay (56–11–27)	0–1	12	0.6	0.9	1.1	2.3	3.7	8.6	41	50
	1–6	12	.8	1.1	.8	2.4	3.8	8.9	39	52
	6–18	12	.9	.5	.8	2.1	3.3	7.6	36	56
	18–29	13	.6	.8	.7	2.1	3.8	8.0	37	55
	29–43	12	.7	.6	.9	2.8	5.6	10.6	41	48
	43+	2	.2	.5	.9	4.0	6.8	12.4	54	34
Altamont clay (58–11–2)	0–2	----------	1.3	1.0	.8	1.7	2.8	7.6	37	55
	2–11	----------	.2	.7	.7	1.5	2.8	5.9	34	60
	11–20	1	.2	.5	.5	1.2	2.4	4.8	33	62
	20–26	8	.2	.6	.5	1.4	2.7	5.4	34	61
	26–34	51	2.1	3.0	1.0	1.8	3.7	11.6	31	57
	34+	(1)	----------	----------	----------	----------	----------	----------	----------	----------
Arbuckle gravelly loam (11)	0–13	----------	10.4	6.8	7.3	8.3	10.6	43.4	39	18
	13–21	----------	8.5	8.3	5.7	8.5	10.2	41.2	39	20
	21–32	----------	8.8	6.7	7.0	7.8	9.0	39.3	37	24
	32–60	----------	8.6	8.5	5.1	7.6	10.2	40.0	36	24
Artois gravelly loam (58–11–4)	0–9	17	2.7	3.0	3.5	10.2	10.3	29.7	46	24
	9–17	21	2.3	2.2	3.8	9.9	10.0	28.2	44	28
	17–21	16	3.1	2.3	2.7	8.3	9.1	25.5	36	39
	21–31	8	2.0	2.0	2.5	7.8	9.1	23.4	35	42
	31–38	10	1.7	1.7	2.3	8.5	9.8	24.0	37	39
	38–60	1	.8	.6	.8	3.3	5.0	10.5	43	46
Ayar clay (58–11–14)	0–10	2	.9	1.8	3.1	9.1	8.6	23.5	30	46
	10–17	2	.8	1.9	3.0	8.8	8.4	22.9	26	51
	17–32	3	1.5	2.2	3.1	7.6	8.3	22.7	26	51
	32–34	----------	----------	----------	----------	----------	----------	----------	----------	----------
	34+	4	9.2	11.7	6.7	13.8	11.8	53.2	31	16
Burris bouldery clay (57–11–1)	0–½	23	.4	1.7	1.4	3.0	3.0	9.5	33	57
	½–7	29	.3	.4	.6	1.1	2.0	4.4	27	69
	7–19	34	.3	.2	.3	.3	2.3	4.0	26	70
	19–31	42	.5	.4	.8	2.0	3.4	7.1	23	70
	31–46	48	1.5	1.8	1.3	2.9	4.2	11.7	25	63
Capay clay (9)	0–9	----------	.3	.5	1.1	4.6	6.4	12.9	38	49
	9–21	----------	.2	.3	.5	3.8	5.7	10.5	37	53
	21–34	----------	.1	.3	.6	3.9	6.9	11.8	32	51
	34–45	----------	.4	1.3	1.4	6.6	10.2	19.9	40	40
	45–60+	----------	.1	.3	.8	6.6	12.6	20.4	48	32
Castro clay (58–11–20)	0–4	----------	.3	.5	1.0	5.4	8.2	15.4	40	45
	4–10	----------	.3	.5	.9	5.6	8.1	15.4	40	45
	10–17	----------	.3	.5	.9	5.7	8.5	15.9	36	48
	17–32	----------	.1	.5	1.1	6.4	9.9	18.0	38	44
	32–42	----------	----------	----------	----------	----------	----------	----------	----------	----------
	42–60	----------	12.9	7.6	2.5	8.0	20.0	51.0	36	13
Clear Lake clay (58–11–17)	0–8	4	.9	1.3	2.2	7.4	8.7	20.5	32	47
	8–20	5	.7	1.1	2.3	7.4	8.8	20.3	25	55
	20–29	9	1.4	1.7	2.6	7.0	8.7	21.4	24	55
	29–40	11	1.5	2.7	3.8	9.1	10.0	27.1	20	53
	40–52	20	1.8	3.5	5.4	11.8	9.6	32.1	23	45
Contra Costa clay loam (56–11–24).	0–5	19	2.3	2.5	2.9	7.0	9.9	24.6	37	38
	5–12	2	1.7	3.0	2.3	7.2	10.5	24.7	37	38
	12–21	8	1.8	2.3	2.9	6.8	10.3	24.0	34	42
	21–34	33	4.5	3.8	3.8	7.9	9.3	29.3	31	40
	34+	(1)	----------	----------	----------	----------	----------	----------	----------	----------

See footnotes at end of table.

some representative soils of Glenn County, Calif.

present or not determined]

Bulk density	Moisture equivalent	Moisture held at tension of 15 atmospheres	Reaction	Calcium carbonate	Phosphate	Organic carbon	Total nitrogen	C/N ratio
Gm./cc.	*Percent*	*Percent*	*pH*	*Percent*	*Ppm.*	*Percent*	*Percent*	
1.9	27.7	17.5	6.8	----------	0.21	1.16	0.114	10
2.0	28.0	18.1	6.3	----------	.06	.97	.102	10
2.0	28.0	18.8	6.6	----------	.08	.57	.075	8
2.0	28.5	18.7	7.7	2.6	.04	.39	.060	7
1.9	29.2	16.0	7.7	8.0	.04	.04	.047	----------
1.8	28.8	14.8	7.7	3.2	----------	.09	.067	----------
1.8	34.1	21.3	6.6	----------	.70	1.89	.182	10
1.9	31.8	21.0	6.5	----------	.06	.90	.092	10
1.9	30.6	20.6	6.8	----------	.06	.65	.067	10
1.9	20.8	20.9	7.4	1.2	.05	.51	.061	8
1.8	28.8	19.0	7.6	3.4	.11	.42	.044	10
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1.6	16.1	7.3	5.8	----------	.46	.38	.048	8
1.7	16.3	8.0	5.9	----------	.41	.27	.042	6
1.6	16.9	9.0	5.9	----------	.32	.24	.039	6
----------	17.4	10.0	6.0	----------	.19	.15	.028	5
1.7	19.6	8.4	6.0	----------	.26	.64	.069	9
1.8	20.0	9.9	6.2	----------	.56	.43	.049	9
1.9	25.3	14.8	6.5	----------	.24	.36	.050	7
2.0	27.0	16.2	6.6	----------	.13	.33	.043	8
2.0	25.2	15.2	6.7	----------	.15	.24	.037	6
1.9	27.4	17.1	6.9	----------	.11	.17	.034	5
1.7	32.2	21.0	7.4	7.0	.19	1.55	.152	10
1.7	31.1	21.5	7.6	9.1	.14	.93	.092	10
1.8	31.7	20.7	7.6	15.8	.10	.86	.070	12
1.2	----------	----------	7.8	70.5	----------	.77	----------	----------
1.3	----------	----------	7.9	43.1	.03	.46	----------	----------
1.7	55.4	41.0	6.2	----------	4.40	4.06	.349	12
2.0	61.6	36.7	6.1	----------	.99	1.41	.116	12
2.0	64.3	39.3	6.5	----------	.20	.79	.077	10
2.0	70.1	39.3	7.2	.0	.27	.42	.044	8
1.9	52.1	36.3	7.7	13.0	.10	.06	.030	----------
----------	28.7	20.8	6.3	----------	.14	1.14	.109	10
1.8	28.7	20.3	7.0	.1	.06	.55	.062	9
1.8	27.1	19.8	7.7	1.0	.08	.47	.053	9
1.8	25.4	17.1	8.1	9.0	.13	----------	.034	----------
1.6	22.8	14.4	----------	1.7	.45	----------	.038	----------
1.6	29.2	18.3	7.6	.6	.35	2.36	.201	12
1.7	31.2	18.8	7.7	1.0	.11	1.28	.111	12
1.8	29.9	18.7	8.1	9.9	.60	.02	.075	8
1.6	29.2	17.5	8.2	12.9	.06	----------	.047	4
1.8	----------	----------	8.4	46.1	----------	----------	----------	(2)
1.7	18.4	5.9	8.1	17.3	.24	.04	.031	----------
1.7	32.2	25.5	6.4	----------	.07	----------	----------	----------
2.0	30.9	24.8	6.7	----------	.03	----------	----------	----------
1.9	31.2	24.3	7.3	1.6	.03	----------	----------	----------
1.9	31.2	23.9	7.5	10.4	.03	----------	----------	----------
1.8	29.2	21.9	7.6	10.7	.12	----------	----------	----------
1.6	24.6	14.7	6.9	----------	.36	1.75	.133	13
1.7	24.3	15.0	6.7	----------	.08	1.49	.116	13
1.8	24.2	15.5	6.7	----------	.03	.78	.075	10
1.8	23.9	14.5	6.5	----------	.03	.63	.061	10
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TABLE 12.—*Physical and chemical analyses of some*

Soil name and sample number	Depth	Size class and diameter of particles: Coarse fragments (greater than 2 mm.)	Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Total sand	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Corning gravelly loam (58–11–3).	0–8	24	10. 0	13. 2	6. 8	8. 8	8. 1	46. 9	42	11
	8–14	30	11. 2	11. 4	6. 0	7. 6	7. 6	43. 8	41	15
	14–20	10	5. 2	4. 5	2. 9	5. 4	4. 9	22. 9	20	57
	20–27	17	3. 4	4. 2	3. 1	7. 9	6. 8	25. 4	22	53
	27–40	13	1. 7	2. 9	3. 8	10. 2	10. 0	28. 6	39	32
	40–60	73	17. 7	16. 1	12. 6	12. 9	3. 0	62. 3	4	34
Cortina very gravelly sandy loam (4).	0–8	----------	11. 3	21. 8	18. 5	18. 5	7. 8	77. 9	13	9
	8–32	----------	----------	----------	----------	----------	----------	77. 9	12	10
	32–60	----------	----------	----------	----------	----------	----------	92. 1	1	7
Goulding rocky loam (56–11–21).	0–4	54	28. 2	13. 5	7. 7	5. 9	4. 3	59. 6	20	20
	4–16	58	15. 6	13. 3	6. 6	8. 4	6. 0	49. 9	25	25
	16+	(1)	----------	----------	----------	----------	----------	----------	----------	----------
Henneke stony clay loam (56–11–12).	0–3	44	12. 3	7. 9	7. 8	9. 7	6. 3	44. 0	21	35
	3–7	35	4. 7	6. 0	4. 8	8. 2	5. 8	29. 5	22	49
	7–22	61	11. 8	9. 9	7. 2	7. 9	5. 9	42. 7	8	49
	22+	(1)	----------	----------	----------	----------	----------	----------	----------	----------
Hillgate loam (58–11–8)	0–6	6	. 9	1. 9	3. 0	10. 4	13. 7	29. 9	52	18
	6–10	5	. 8	1. 4	2. 3	10. 2	12. 3	27. 0	55	18
	10–15	6	. 6	1. 5	2. 8	10. 4	13. 0	28. 3	47	25
	15–18	3	. 6	1. 3	2. 1	8. 5	11. 5	24. 0	42	34
	18–28	2	. 5	1. 0	1. 8	8. 3	11. 2	22. 8	39	38
	28–37	1	. 4	. 7	1. 3	6. 1	10. 6	19. 1	45	36
	37–54	2	. 6	. 6	1. 3	5. 8	10. 5	18. 8	45	36
Hohmann rocky loam (56–11–20).	0–4	29	8. 0	7. 3	4. 9	4. 6	5. 5	30. 3	38	32
	4–12	23	7. 3	8. 8	3. 6	4. 3	4. 9	28. 9	37	34
	12–29	33	5. 3	5. 8	2. 6	3. 6	5. 2	22. 5	38	40
	29+	(1)	----------	----------	----------	----------	----------	----------	----------	----------
Hulls gravelly loam (13)	0–6	45	14. 1	9. 9	7. 7	6. 7	5. 3	43. 7	37	19
	6–18	23	11. 7	10. 8	5. 4	6. 8	5. 7	40. 4	40	20
	18–35	26	13. 6	8. 6	7. 7	5. 2	7. 0	42. 1	41	17
	35+	(1)	----------	----------	----------	----------	----------	----------	----------	----------
Jacinto fine sandy loam (10)	0–10	----------	. 4	4. 2	12. 6	31. 8	20. 3	69. 3	25	6
	10–21	----------	. 3	2. 0	12. 1	29. 6	19. 7	63. 7	24	12
	21–38	----------	. 2	3. 7	10. 7	29. 3	17. 9	61. 5	21	18
	38–60	----------	----------	----------	----------	----------	----------	----------	----------	----------
Josephine gravelly loam (56–11–15).	0–4	38	15. 7	12. 5	5. 8	8. 0	7. 2	49. 2	33	18
	4–11	33	9. 6	12. 0	5. 6	7. 7	6. 4	41. 3	32	27
	11–25	49	9. 2	6. 6	4. 8	5. 4	5. 0	31. 0	27	45
	25–46	48	10. 9	8. 3	3. 4	5. 2	5. 5	33. 3	20	47
	46+	(1)	----------	----------	----------	----------	----------	----------	----------	----------
Kimball loam (5)	0–16	----------	----------	----------	----------	----------	----------	42. 8	40	17
	16–27	----------	----------	----------	----------	----------	----------	26. 6	27	46
	27–33	----------	----------	----------	----------	----------	----------	40. 3	31	29
	33–60	----------	----------	----------	----------	----------	----------	53. 7	17	29
Landlow clay (58–11–11)	0–9	----------	. 2	. 3	. 4	3. 3	6. 3	10. 5	39	51
	9–17	----------	(3)	. 2	. 4	2. 6	7. 1	10. 3	36	54
	17–26	----------	. 1	. 1	. 2	2. 4	6. 5	9. 3	35	56
	26–35	----------	. 2	. 5	. 5	2. 9	6. 8	10. 9	36	53
	35–37+	(4)	----------	----------	----------	----------	----------	----------	----------	----------
Los Gatos gravelly loam, (18).	0–10	27	14. 5	11. 8	10. 0	6. 7	5. 4	48. 4	32	20
	10–22	43	16. 7	13. 5	5. 5	6. 5	5. 7	47. 8	26	26
	22+	(1)	----------	----------	----------	----------	----------	----------	----------	----------

See footnotes at end of table.

representative soils of Glenn County, Calif.—Continued

Bulk density	Moisture equivalent	Moisture held at tension of 15 atmospheres	Reaction	Calcium carbonate	Phosphate	Organic carbon	Total nitrogen	C/N ratio
Gm./cc.	*Percent*	*Percent*	*pH*	*Percent*	*Ppm.*	*Percent*	*Percent*	
1.8	14.4	4.4	5.9		0.56	0.65	0.060	11
1.8	14.2	5.2	5.8		.05	.22	.032	7
1.9	39.4	22.5	5.9		.02	.47	.065	7
2.0	37.0	23.3	6.2		.11	.29	.046	6
1.8	28.5	17.1	6.0		.09	.11	.028	4
	21.4	12.9	5.8		1.88	.05	.014	4
	8.7		5.8					
	8.2		6.4					
	3.4		7.0					
	21.3	9.7	6.7		.85	1.37	.113	12
	21.1	10.3	6.6		.60	.87	.072	12
1.2	34.9	22.2	6.8		.07	3.88	.221	18
1.2	36.6	25.2	6.8		.05	2.40	.150	16
1.3	45.5	33.0	7.0		.06	.96	.081	12
1.7	18.6	8.0	5.8		.08	.69	.074	9
1.7	18.2	8.0	5.5		.06	.61	.066	9
1.8	17.8	10.1	5.9		.03	.40	.050	8
1.9	21.0	14.3	5.9		.02	.33	.056	6
1.9	22.0	15.3	6.4		.02	.26	.052	5
2.0	21.5	14.5	7.2		.02	.12	.039	3
1.9	22.4	14.8	7.1	.0	.03	.12	.039	3
	27.5	11.4	6.2		.82	2.51	.091	28
	25.6	11.2	6.0		.35	1.60	.063	25
	23.9	13.0	6.1		.06	.48	.028	17
1.5	27.0	10.4	5.5		1.29	2.20	.189	12
1.5	26.4	10.0	5.6		.63	1.31	.148	9
	23.5	8.8	5.6		.20	.70	.130	6
1.7	10.0	4.0	5.5		.38	.33	.042	8
1.6	11.8	5.9	6.4		.41	.22	.046	5
1.7	14.1	7.7	7.0	.1	.23	.16	.043	4
1.6	24.7	8.4	6.1		.33	1.75	.101	17
1.6	24.7	10.7	5.7		.23	1.11	.081	14
1.6	27.8	17.3	5.3		.03	.69	.073	9
1.6	27.4	17.6	5.7		.03	.21	.065	3
1.9	12.5		5.7					
2.0	36.8		6.2					
1.9	20.8		6.9					
2.0	1 .5		6.7					
1.8	30.0	24.3	6.1		.04	.90	.077	12
2.0	31.2	24.7	6.4		.03	.52	.052	10
2.0	31.6	24.5	7.0	.0	.05	.38	.041	9
1.9	32.6	26.1	7.6	.7	.08	.36	.040	9
1.6			7.7	17.9				
1.9	20.9	11.9	5.4		.08	.92	.090	10
1.8	20.3	12.0	5.2		.02	.19	.078	

TABLE 12.—*Physical and chemical analyses of some*

Soil name and sample number	Depth	Size class and diameter of particles: Coarse fragments (greater than 2 mm.)	Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Total sand	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Marvin silty clay loam (58–11–12).	0–8	----	0. 4	0. 5	0. 3	1. 4	5. 8	8. 4	63	29
	8–13	----	(3)	. 6	. 5	1. 1	2. 1	4. 3	60	36
	13–17	----	(3)	. 4	. 5	1. 4	1. 8	4. 1	56	40
	17–29	----	(3)	. 2	. 4	1. 2	1. 7	3. 5	52	44
	29–42	----	(3)	. 2	. 3	1. 2	2. 1	3. 8	53	43
	42–60	----	. 4	. 8	. 7	2. 6	3. 3	7. 8	52	40
Masterson gravelly loam (15)	0–7	----	15. 8	8. 0	6. 9	6. 1	5. 5	42. 3	46	12
	7–21	----	12. 9	9. 8	4. 5	6. 0	5. 4	38. 6	47	14
	21–35	----	13. 9	9. 0	7. 5	7. 1	8. 0	45. 5	44	11
	35+	(1)	----	----	----	----	----	----	----	----
Maymen gravelly loam (56–11–26).	0–5	42	16. 2	14. 8	6. 8	10. 9	7. 2	55. 9	24	20
	5–9	63	13. 1	13. 4	6. 6	11. 2	7. 9	52. 2	22	26
	9+	(1)	----	----	----	----	----	----	----	----
Millsap loam (56–11–16)	0–6	16	6. 1	5. 8	3. 2	5. 7	5. 7	26. 5	48	26
	6–17	30	5. 5	3. 9	2. 1	1. 6	1. 5	14. 6	25	60
	17+	(1)	----	----	----	----	----	----	----	----
Millsholm clay loam (58–11–14).	0–¾	0	3. 3	2. 7	1. 3	3. 0	13. 3	23. 6	52	24
	¾–6	0	. 8	1. 4	. 8	2. 5	11. 8	17. 3	52	31
	6–16	1	1. 6	1. 3	. 9	2. 3	11. 5	17. 6	47	35
	16+	(1)	----	----	----	----	----	----	----	----
Millsholm rocky sandy loam (56–11–10).	0–7	67	20. 4	10. 4	9. 2	18. 7	7. 7	66. 4	16	18
	7–23	54	15. 9	9. 0	12. 4	21. 3	8. 0	66. 6	14	19
	23+	(1)	----	----	----	----	----	----	----	----
Moda loam (57–11–5)	0–7	12	3. 5	2. 6	4. 7	13. 2	17. 4	41. 4	46	13
	7–14	12	3. 9	3. 5	4. 0	13. 4	17. 4	42. 2	43	15
	14–21	9	2. 5	2. 3	3. 5	9. 4	10. 5	28. 2	30	42
	21–30	(4)	----	----	----	----	----	----	----	----
	30–54	5	. 4	. 7	2. 8	11. 1	14. 2	29. 2	48	23
Myers clay (58–11–7)	0–1	----	. 2	. 4	. 4	1. 9	4. 0	6. 9	39	54
	1–6	----	. 1	. 3	. 4	2. 0	3. 5	6. 3	38	56
	6–11	----	(3)	. 1	. 2	1. 8	3. 8	5. 9	36	58
	11–29	----	(3)	. 1	. 2	1. 7	4. 0	6. 0	36	58
	29–43	----	. 1	. 2	. 1	1. 7	3. 4	5. 5	40	54
	43–60	----	. 3	1. 0	4. 4	12. 4	7. 5	25. 6	33	41
Nacimiento clay (8)	0–10	----	. 5	. 4	. 8	3. 4	7. 1	12. 2	44	44
	10–41	----	. 1	. 3	. 7	3. 5	6. 7	11. 3	40	49
	41+	(1)	----	----	----	----	----	----	----	----
Neuns cobbly loam (14)	0–3	45	19. 4	11. 2	4. 7	6. 6	6. 9	48. 8	45	6
	3–13	59	14. 6	8. 6	6. 4	6. 0	7. 0	42. 6	48	9
	13–27	43	16. 1	8. 8	3. 8	5. 7	6. 3	40. 7	50	9
	27+	(1)	----	----	----	----	----	----	----	----
Newville gravelly loam (56–11–28).	0–2	24	7. 7	7. 8	8. 5	9. 3	9. 9	43. 2	44	13
	2–7	32	10. 2	11. 1	7. 7	9. 8	8. 4	47. 2	39	14
	7–15	28	10. 5	9. 4	9. 8	9. 5	8. 9	48. 1	35	17
	15–26	48	16. 3	14. 5	5. 8	7. 2	4. 5	48. 3	9	43
	26–48	74	24. 7	16. 3	7. 7	4. 6	3. 0	56. 3	6	38
Orland loam (6)	0–11	----	----	----	----	----	----	37. 0	47	16
	11–19	----	----	----	----	----	----	33. 2	50	17
	19–39	----	----	----	----	----	----	32. 3	48	20
	39–60	----	----	----	----	----	----	81. 2	6	13

See footnotes at end of table.

representative soils of Glenn County, Calif.—Continued

Bulk density	Moisture equivalent	Moisture held at tension of 15 atmospheres	Reaction	Calcium carbonate	Phosphate	Organic carbon	Total nitrogen	C/N ratio
Gm./cc.	*Percent*	*Percent*	*pH*	*Percent*	*Ppm.*	*Percent*	*Percent*	
1.5	29.0	11.7	6.4		0.73	1.59	0.136	12
1.6	30.4	14.7	6.4		.49	1.39	.116	12
1.7	29.9	16.3	6.4		.64	1.08	.090	12
1.9	29.1	18.3	6.8		.40	.86	.076	11
1.9		19.2	7.9	.3	.53	.56	.056	10
1.8		18.4	8.0	2.0	1.37	.28	.036	8
	32.8	11.7	5.3		.13	4.09	.146	28
	29.3	11.4	5.0		.04	1.73	.085	35
	26.6	9.0	4.5		.02	.58	.050	20
1.5	22.7	7.8	6.0		.83	2.50	.165	15
1.6	21.2	9.0	6.0		.13	.93	.116	8
	20.7	10.9	6.3		.23	.71	.093	8
	27.7	18.0	6.0		.03	.56	.084	7
	23.1	10.9	6.2		.65	1.41	.134	11
	22.0	12.1	6.2		.05	.50	.058	9
	22.3	13.0	6.6		.05	.39	.050	8
	16.8	8.1	5.9		.94	1.04	.108	10
	15.9	8.6	6.2		.45	.59	.058	10
1.6	15.4	3.8	5.5		.08			
1.7	14.6	4.6	5.7		.02			
2.0	26.3	17.1	5.3		.02			
2.0			6.1					
1.9	19.3	10.9	6.9		.14			
1.9	28.8	20.5	6.2		.21	1.06	.093	11
1.8	30.0	21.9	6.2		.17	1.01	.089	11
1.9	29.8	22.8	6.3		.10	.66	.064	10
2.0	29.4	22.2	7.1	.1	.28	.49	.047	10
2.0	29.5	20.9	7.4	.4	.47	.39	.046	8
1.8	25.2	17.3	7.6	.4	1.31	.18	.024	8
1.5	31.1	21.7	7.6	1.1	.09	.85	.095	9
1.9	30.6	23.3	7.8	2.3	.03	.48	.063	8
	27.6	10.8	5.0		.33	5.52	.101	55
	23.4	8.8	5.0		.12	1.05	.036	29
	23.2	6.4	4.9		.04	.39	.021	19
1.3	21.6	9.6	6.2		1.36	3.49	.243	14
1.8	14.5	4.6	6.2		.18	.52	.024	21
1.8	14.3	5.3	6.0		.07	.31	.038	8
1.9	24.1	15.0	4.9		.05	.26	.038	7
	23.0	14.5	6.3		.22	.11	.020	5
1.6	16.2		6.9					
1.3	17.0		7.0					
1.4	17.5		7.2					
	5.8		7.4					

TABLE 12.—*Physical and chemical analyses of some*

Soil name and sample number	Depth	Size class and diameter of particles: Coarse fragments (greater than 2 mm.)	Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Total sand	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Parrish gravelly loam (56–11–17).	0–1	22	15. 0	14. 1	7. 3	8. 9	5. 7	51. 0	33	16
	1–6	16	11. 6	13. 0	7. 8	10. 0	6. 0	48. 4	30	22
	6–11	25	10. 8	9. 0	8. 8	8. 3	5. 2	42. 1	27	31
	11–25	43	11. 6	7. 4	2. 7	3. 4	3. 4	28. 5	20	52
	25+	(1)	----	----	----	----	----	----	----	----
Perkins gravelly loam (58–11–18).	0–7	19	6. 1	7. 1	5. 1	9. 2	8. 0	35. 5	43	21
	7–14	15	4. 5	6. 4	5. 3	10. 2	9. 2	35. 6	40	24
	14–22	16	4. 5	5. 2	4. 3	9. 1	7. 7	30. 8	39	30
	22–34	27	5. 7	6. 1	4. 3	9. 0	7. 5	32. 6	33	34
	34–46	56	12. 0	10. 3	4. 0	5. 8	5. 2	37. 3	26	37
	46–64	73	15. 3	18. 4	7. 0	6. 6	3. 5	50. 8	15	34
Plaza silt loam (57–11–2)	0–10	1	. 2	. 3	1. 7	11. 9	15. 5	29. 6	51	19
	10–25	1	. 1	. 1	1. 2	10. 0	11. 8	23. 2	43	34
	25–34	1	. 9	. 9	1. 7	10. 9	12. 9	27. 3	40	33
	34–47	1	. 8	. 9	2. 0	10. 1	11. 1	24. 9	46	29
	47–60	1	. 9	1. 0	. 9	4. 7	5. 4	12. 9	58	29
Pleasanton gravelly loam (58–11–19).	0–11	56	17. 0	11. 4	6. 6	10. 2	7. 8	52. 8	24	23
	11–19	44	12. 2	9. 8	5. 7	10. 8	8. 6	47. 1	23	30
	19–30	50	13. 9	10. 8	6. 5	11. 0	7. 8	50. 0	20	30
	30–54	46	11. 2	9. 1	6. 2	14. 2	11. 1	51. 8	20	28
Polebar loam (56–11–18)	0–8	15	9. 2	8. 5	5. 5	9. 9	11. 1	44. 8	37	18
	8–18	25	6. 7	5. 0	5. 0	7. 7	9. 5	33. 9	32	34
	18–35	36	5. 8	5. 1	2. 8	5. 9	9. 5	29. 1	34	37
	35+	(1)	----	----	----	----	----	----	----	----
Porterville clay (58–11–15)	0–1	15	2. 7	2. 8	2. 2	4. 2	4. 8	16. 7	34	49
	1–6	12	2. 8	2. 5	1. 8	3. 3	4. 3	14. 7	33	52
	6–16	14	2. 9	3. 0	1. 9	3. 4	3. 8	15. 0	30	55
	16–27	58	9. 5	7. 5	4. 3	6. 8	5. 4	33. 5	19	48
	27–40	65	12. 9	14. 1	8. 6	10. 8	7. 0	53. 4	18	29
Redding gravelly loam (58–11–6).	0–7	25	6. 4	8. 7	6. 3	12. 0	11. 3	44. 7	41	14
	7–14	21	7. 6	8. 6	5. 9	10. 6	11. 4	44. 1	39	17
	14–23	6	5. 3	5. 9	3. 9	7. 1	6. 2	28. 4	20	52
	23–36	13	(5)	----	----	----	----	----	----	----
	36–54	(6)	----	----	----	----	----	----	----	----
Riz silty clay loam (57–11–3)	0–8	----	. 4	. 3	. 5	4. 3	11. 1	16. 6	50	33
	8–13	----	. 0	. 0	. 3	3. 9	11. 0	15. 2	44	41
	13–23	----	. 0	. 0	. 2	2. 6	8. 8	11. 6	46	42
	23–34	----	. 1	. 1	. 2	2. 7	8. 4	11. 5	47	41
	34–46	2	. 7	. 5	. 3	3. 3	10. 5	15. 1	47	38
	46–60	4	. 7	. 3	. 9	8. 2	14. 6	24. 7	36	39
Sehorn clay loam (56–11–22)	0–5	----	1. 0	. 7	1. 2	4. 1	11. 5	18. 5	48	34
	5–13	----	. 5	. 9	1. 8	3. 2	10. 1	15. 5	39	46
	13–27	3	. 7	. 8	. 9	3. 1	10. 7	16. 2	38	46
	27+	(1)	----	----	----	----	----	----	----	----
Shedd silty clay loam (3)	0–19	----	. 6	. 9	2. 5	4. 4	6. 6	15. 0	47	38
	19–29	----	. 4	1. 1	1. 5	3. 5	4. 8	11. 3	48	41
	29–60	(7)	----	----	----	----	----	48. 2	30	22
Sheetiron gravelly loam (16)	0–5	43	17. 7	10. 6	8. 0	7. 3	5. 9	49. 5	37	14
	5–15	39	15. 5	12. 3	5. 0	7. 3	7. 0	47. 4	32	21
	15–28	41	14. 7	9. 4	7. 4	7. 6	6. 9	46. 0	29	25
	28+	(1)	----	----	----	----	----	----	----	----

See footnotes at end of table.

representative soils of Glenn County, Calif.—Continued

Bulk density	Moisture equivalent	Moisture held at tension of 15 atmospheres	Reaction	Calcium carbonate	Phosphate	Organic carbon	Total nitrogen	C/N ratio
Gm./cc.	*Percent*	*Percent*	*pH*	*Percent*	*Ppm.*	*Percent*	*Percent*	
--	20.0	8.5	6.1	--	0.15	2.49	0.161	15
--	19.0	7.4	6.2	--	.06	1.49	.112	13
--	19.3	10.4	5.7	--	.03	.90	.093	10
--	24.4	15.3	5.3	--	.03	.64	.078	8
--	--	--	--	--	--	--	--	--
1.8	20.3	12.4	5.9	--	1.03	1.34	.127	11
1.7	18.2	12.0	6.0	--	.42	.63	.073	9
1.8	18.7	13.8	6.2	--	.07	.26	.052	5
1.8	19.0	14.0	6.0	--	.03	.19	.048	4
1.9	19.8	14.3	5.3	--	.03	.16	.045	3
--	18.9	13.3	5.3	--	.03	.18	.043	4
1.7	19.9	5.8	5.8	--	.19	--	--	--
2.0	20.1	10.8	7.0	.0	.06	--	--	--
2.0	21.1	11.3	8.1	2.7	.07	--	--	--
1.9	22.9	10.7	8.2	3.5	.20	--	--	--
1.6	28.1	11.4	8.1	3.8	.15	--	--	--
1.9	17.0	11.6	6.0	--	1.37	1.74	.126	14
1.9	17.9	13.0	6.1	--	.82	.69	.070	10
2.0	18.8	13.1	6.1	--	.66	.34	.044	8
2.0	18.2	13.1	5.7	--	.26	.27	.036	8
--	17.1	7.3	6.2	--	.14	1.10	.100	11
--	19.7	13.7	6.5	--	.04	.57	.068	8
--	18.2	10.0	7.8	3.4	.04	.25	.035	--
--	--	--	--	--	--	--	--	--
1.7	31.0	21.9	6.6	--	.26	1.25	.109	11
1.8	31.6	22.6	6.4	--	.07	1.00	.090	11
1.9	34.6	24.9	6.4	--	.04	.75	.068	11
1.9	38.6	27.6	6.6	--	.04	.31	.028	11
1.9	27.8	20.4	6.7	--	.04	.16	.010	--
1.8	13.6	5.5	5.6	--	.06	.43	.049	9
1.9	14.0	5.6	5.4	--	.14	.19	.025	8
2.0	38.0	27.2	5.7	--	.10	.32	.054	6
1.9	--	--	6.6	--	--	.07	.023	--
2.0	--	--	7.2	.1	--	--	--	--
1.4	33.5	12.4	7.1	.0	.74	--	--	--
1.8	39.5	17.7	8.7	.0	.70	--	--	--
1.9	43.8	19.2	9.2	.1	.78	--	--	--
1.9	47.6	21.9	9.5	.2	.92	--	--	--
1.9	50.6	23.1	9.7	1.8	.85	--	--	--
2.0	53.0	24.0	9.5	5.6	.49	--	--	--
--	25.8	14.5	6.4	--	.73	1.34	.118	11
--	26.5	17.0	6.3	--	.08	.75	.070	11
--	27.0	17.8	6.4	--	.07	.66	.065	10
--	--	--	--	--	--	--	--	--
1.8	25.7	17.1	7.9	6.8	.05	.55	.100	6
1.7	28.7	18.8	8.1	18.0	.04	[3]	.069	--
1.8	20.8	11.1	8.1	8.0	.04	[3]	.029	--
1.6	27.6	12.2	5.6	--	.99	2.53	.094	27
1.8	23.0	13.2	5.3	--	.15	.68	.067	10
1.7	23.5	15.0	5.1	--	.05	.55	.067	8
--	--	--	--	--	--	--	--	--

TABLE 12.—*Physical and chemical analyses of some*

Soil name and sample number	Depth	Size class and diameter of particles								
		Coarse fragments (greater than 2 mm.)	Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Total sand	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Stockton clay (58–11–10)	0–8	----------	0.2	0.4	0.6	2.2	4.5	7.9	35	57
	8–16	----------	.1	.3	.5	1.8	4.2	6.9	34	59
	16–25	----------	(3)	.2	.4	2.0	4.6	7.2	34	59
	25–35	----------	.1	.4	.5	1.9	4.1	7.0	31	59
	35–46	----------	.2	.8	.8	2.5	5.3	9.6	33	57
	46–54	----------	.4	1.9	1.7	4.1	7.0	15.1	34	51
	54–65	(4)	----------	----------	----------	----------	----------	----------	----------	----------
Stonyford gravelly clay loam (57–11–6).	0–2½	30	11.6	10.6	5.6	8.3	5.9	42.0	34	24
	2½–7	20	7.6	5.4	4.4	8.9	7.4	33.7	34	32
	7–14	45	10.2	7.3	6.2	9.3	8.1	41.1	26	33
	14+	(1)	----------	----------	----------	----------	----------	----------	----------	----------
Sunnyvale clay (58–11–2)	0–9	----------	.5	1.0	1.7	4.9	5.9	14.0	40	46
	9–19	----------	.6	.9	1.7	4.9	5.8	13.9	39	48
	19–24	----------	.4	1.0	2.1	6.0	6.6	16.1	37	47
	24–34	----------	.7	2.2	3.9	9.4	8.5	24.7	39	36
	34–46	----------	.4	1.1	2.4	7.0	8.0	18.9	33	38
	46–60	----------	(3)	.1	1.2	8.9	17.0	27.2	41	32
Tehama silt loam (58–11–1)	0–7	----------	.2	.5	.7	3.1	7.3	11.8	70	18
	7–9	1	.1	.3	.7	1.4	8.5	11.0	68	21
	9–12	1	.1	.2	.5	.6	8.4	9.8	60	30
	12–19	1	.1	.2	.3	2.0	6.9	9.5	55	35
	19–27	----------	.1	.1	.2	1.6	7.0	9.0	54	37
	27–38	----------	.9	.7	.3	1.1	4.7	7.7	57	35
	38–50	----------	.1	.2	.2	.6	2.7	3.8	57	39
	50–60	----------	.3	.2	.3	5.5	11.2	17.5	50	33
Toomes extremely rocky silt loam (56–11–9).	0–6	37	2.8	2.3	3.0	6.8	12.7	27.6	57	15
	6–16	67	2.0	2.8	2.1	5.4	11.6	23.9	56	20
	16+	(1)	----------	----------	----------	----------	----------	----------	----------	----------
Willows clay (56–11–1)	0–1	----------	.3	.5	.7	4.8	7.7	14.0	42	44
	1–6	----------	.2	.3	.6	5.2	8.2	14.5	40	45
	6–13	----------	----------	----------	.5	4.1	7.2	11.8	34	54
	13–23	----------	----------	.1	.3	3.6	7.3	11.3	31	58
	23–34	----------	.3	.5	.4	4.0	7.8	13.0	33	54
	34–46	----------	1.0	.8	.5	1.8	11.7	15.8	37	47
	46–62	----------	.4	.8	.5	3.4	7.1	12.2	44	44
Willows clay, dense subsoil (59–11–2).	0–9	----------	.5	.6	1.1	5.9	7.9	16.0	40	44
	9–13	----------	.1	.4	1.2	3.9	9.2	14.8	31	54
	13–22	----------	.1	.4	1.2	3.9	9.5	15.1	32	53
	22–35	----------	.4	1.1	1.8	8.4	9.4	21.1	33	46
	35–46	----------	.6	1.8	3.1	12.0	14.5	32.0	32	36
	46–56	----------	.1	1.1	4.0	17.2	14.3	36.7	29	34
Wyo silt loam (1)	0–11	----------	----------	----------	----------	----------	----------	23.9	52	24
	11–29	----------	----------	----------	----------	----------	----------	23.7	53	23
	29–43	----------	----------	----------	----------	----------	----------	26.7	51	22
	43–50	----------	----------	----------	----------	----------	----------	20.2	58	22
	50–60	----------	----------	----------	----------	----------	----------	27.1	53	20
Yolo clay loam, moderately deep over clay (58–11–16).	0–9	----------	.2	.5	.9	7.7	13.1	22.4	49	29
	9–19	----------	----------	(3)	.1	4.7	16.4	21.2	51	28
	19–32	----------	(3)	(3)	.1	1.8	7.0	8.9	59	32
Zamora silty clay loam (57–11–4).	0–6	----------	.4	.1	.2	.9	2.1	3.7	65	31
	6–11	----------	.3	.2	.2	.9	2.2	3.8	64	32
	11–22	----------	.0	.0	.1	.8	2.0	2.9	59	38
	22–38	----------	.0	.0	.0	.7	3.0	3.7	57	39
	38–60	----------	.4	.2	.3	1.5	4.2	6.6	61	32

[1] Parent rock.
[2] Caliche.
[3] Trace.
[4] Hardpan.

representative soils of Glenn County, Calif.—Continued

Bulk density	Moisture equivalent	Moisture held at tension of 15 atmospheres	Reaction	Calcium carbonate	Phosphate	Organic carbon	Total nitrogen	C/N ratio
Gm./cc.	*Percent*	*Percent*	*pH*	*Percent*	*Ppm.*	*Percent*	*Percent*	
1.8	36.0	28.6	5.8	----------	0.07	1.05	0.094	11
2.0	35.0	28.7	6.3	----------	.12	.80	.068	12
1.9	35.4	28.5	6.4	----------	.11	.66	.057	12
2.0	34.9	29.3	7.0	.6	.20	.59	.049	12
1.9	35.5	29.9	7.5	2.7	.37	.50	.039	13
1.8	34.8	29.8	7.7	6.3	.71	.36	.030	12
----------	----------	----------	7.6	4.9	----------	----------	----------	----------
1.3	28.9	20.8	6.4	----------	.37	4.95	----------	----------
1.3	28.5	23.1	6.3	----------	.11	2.10	----------	----------
1.6	30.2	24.3	6.3	----------	.04	1.07	----------	----------
----------	----------	----------	----------		----------	----------	----------	----------
1.6	31.8	22.3	7.6	.9	.35	2.36	.201	12
1.8	30.2	19.1	8.2	4.6	.11	1.28	.111	12
1.7	29.9	18.7	8.4	13.9	.60	.62	.075	8
1.7	26.4	13.8	8.1	22.2	.06	----------	.047	----------
1.7	27.6	14.2	8.0	9.5	.07	.30	.047	----------
----------	23.2	12.6	7.4	.4	.24	.04	.031	----------
1.7	22.4	6.6	5.6	----------	.31	.82	.083	10
1.7	21.2	7.1	5.7	----------	.23	.61	.073	8
1.8	21.4	10.2	6.0	----------	.16	.52	.072	7
1.9	22.0	11.8	6.6	----------	.07	.53	.067	8
1.9	22.1	12.1	7.5	.0	.06	.29	.059	5
1.9	24.0	12.0	7.7	2.2	.16	.19	.050	4
1.8	27.6	13.4	7.9	1.0	.42	.16	.050	3
1.8	26.0	11.2	8.0	3.1	.54	.20	.049	4
----------	23.9	10.1	5.4	----------	.57	1.54	.152	10
----------	23.9	11.3	5.6	----------	.31	.96	.089	11
----------	----------	----------	----------	----------	----------	----------	----------	----------
1.6	25.2	14.8	6.1	----------	.11	1.11	.105	11
1.7	25.4	18.3	5.8	----------	.07	1.03	.093	11
2.0	29.1	19.0	6.4	----------	.09	.70	.068	10
2.0	31.6	17.8	7.2	.0	.18	.61	.064	10
1.9	32.4	16.3	7.5	.1	.07	.43	.047	9
1.9	27.5	16.4	7.9	.3	.31	.21	.033	6
1.8	27.2	15.3	7.8	.2	.91	.21	.026	8
1.5	27.6	15.9	6.0	----------	.12	1.39	.123	11
2.0	27.4	15.6	8.0	.0	1.65	.59	.066	9
2.0	28.9	14.9	7.8	.1	2.10	.48	.054	9
1.9	29.2	12.5	8.4	.3	1.33	.29	.043	7
1.9	25.2	11.7	8.5	.4	.86	.17	.040	----------
1.8	21.1	9.4	8.5	.2	.96	.16	.040	----------
1.7	22.4	----------	6.8	----------	----------	----------	----------	----------
1.8	22.1	----------	6.7	----------	----------	----------	----------	----------
1.6	21.0	----------	7.7	----------	----------	----------	----------	----------
1.7	23.2	----------	8.3	----------	----------	----------	----------	----------
1.6	21.5	----------	8.2	----------	----------	----------	----------	----------
1.6	24.6	12.8	6.6	----------	.25	----------	----------	----------
1.5	24.1	12.0	7.2	.1	.14	----------	----------	----------
1.5	28.9	14.5	7.2	.2	.11	----------	----------	----------
1.3	29.3	12.6	6.7	----------	1.50	----------	----------	----------
1.4	29.0	12.1	6.7	----------	1.30	----------	----------	----------
1.4	28.3	13.9	7.1	.0	.34	----------	----------	----------
1.4	27.6	15.5	7.2	.0	.24	----------	----------	----------
1.4	27.3	14.5	8.1	1.3	1.30	----------	----------	----------

[5] Indurated hardpan.
[6] Weakly cemented hardpan.
[7] Parent material.

Organic carbon.—The total carbon (table 12) was determined by the dry combustion method. A weighed sample of soil was placed in a muffle and ignited at 900° C. in an oxygen stream. Any compound containing carbon was thus oxidized, and the carbon was released as carbon dioxide, which was then absorbed. The increase in weight of the absorbent (ascarite is used) is a direct measure of the carbon dioxide produced. The weight of organic carbon was determined by subtracting the weight of carbon in calcium carbonate, if present, from the weight of total carbon. The weight of organic carbon is converted to the weight of organic matter by multiplying by the factor 1.724.

Total nitrogen.—Nitrogen, as shown in table 12, was determined by the Kjeldahl method. A weighed sample of soil was digested by boiling it in sulfuric acid in the presence of a mixture of copper sulfate, ferrous sulfate, and potassium sulfate, which converted the organic nitrogen to the ammonia form. After the addition of concentrated sodium hydroxide, the ammonia was driven off by steam distillation, collected in a boric acid solution of 3 percent, and then titrated with hydrochloric acid; an indicator made by mixing methyl red and bromcresol green was used.

Cation-exchange capacity.—The cation-exchange capacity of selected soils is shown in table 13. Initially, the soil exchange sites were saturated with barium ions, using a barium chlorite solution. The soil was then brought to equilibrium with a saturated gypsum solution and filtered. The remaining calcium in the filtrate was determined by the versenate method. The loss in calcium from the saturated gypsum solution is an indirect measure of the cation-exchange capacity of the soil.

Extractable cations.—In determining the extractable cations, as shown in table 13, neutral normal ammonium acetate was employed as the extracting agent for noncalcareous soils. For calcareous soils, barium chloride triethanolomine was used to extract calcium and magnesium, and neutral normal ammonium acetate was used to extract sodium and potassium. Calcium and magnesium were determined by titration with versenate; and sodium and potassium were determined by emission flame spectrophotometry.

Base saturation.—The percent base saturation (table 13) was determined by dividing the sum of the extractable bases by the cation-exchange capacity and multiplying the result by one hundred.

TABLE 13.—*Chemical analyses of selected soils of Glenn County, Calif.*

Soil name	Depth	Reaction	Cation-exchange capacity (meq. per 100 grams dry soil)	Extractable cations (meq. per 100 grams dry soil)				Base saturation
				Calcium	Magnesium	Sodium	Potassium	
	Inches	*pH*						*Percent*
Altamont clay	0–2	6.6	38.0	24.9	8.4	0.2	2.1	94
	2–11	6.5	38.5	27.3	7.1	.2	1.1	93
	11–20	6.8	38.5	29.4	5.6	.2	.8	93
	20–26	7.4	36.0	31.8	5.3	.3	.7	>100
Altamont clay (formerly known as Walker)	0–1	6.8	34.5	13.7	12.2	.6	.4	78
	1–6	6.3	34.0	14.5	12.5	.6	.5	83
	6–18	6.6	35.5	18.0	10.5	.4	.5	83
	18–29	7.7	31.8	20.8	7.7	.2	.6	92
	29–43	7.7	28.5	19.0	6.2	.3	.8	92
	43+	7.7	21.0	14.5	5.0	.3	1.3	100
Contra Costa clay loam	0–5	6.9	36.5	23.6	7.8	.1	.8	88
	5–12	6.7	36.2	25.0	7.2	.2	.6	91
	12–21	6.7	37.0	26.1	8.9	.2	.4	96
	21–34	6.5	36.0	27.4	10.4	.2	.3	>100
Henneke stony clay loam	0–3	6.8	33.5	9.4	16.3	.2	.5	79
	3–7	6.8	35.0	6.9	23.3	.2	.5	91
	7–22	7.0	37.0	4.9	29.4	.2	.4	94
Hohmann rocky loam	0–4	6.2	17.5	8.4	1.7	.1	1.1	65
	4–12	6.0	15.5	6.4	1.6	.1	.9	58
	12–29	6.1	14.5	5.9	2.0	.2	.8	61
Hulls gravelly loam	0–6	5.5	16.0	1.1	5.6	.1	.4	45
	6–18	5.6	15.0	.8	5.7	.1	.3	46
	18–35	5.6	10.0	.5	3.2	.1	.2	40
Josephine gravelly loam	0–4	6.1	12.0	5.9	1.2	.1	.7	66
	4–11	5.7	14.8	5.1	2.4	.2	.8	57
	11–25	5.3	15.8	4.7	3.4	.2	.8	58
	25–46	5.7	16.4	2.4	7.0	.2	.6	62
Los Gatos gravelly loam	0–10	5.4	12.5	4.8	2.4	.1	.5	62
	10–22	5.2	16.5	6.4	5.7	.1	.4	76

TABLE 13.—*Chemical analyses of selected soils of Glenn County, Calif.*—Continued

Soil name	Depth	Reaction	Cation-exchange capacity (meq. per 100 grams dry soil)	Extractable cations (meq. per 100 grams dry soil)				Base saturation
				Calcium	Magnesium	Sodium	Potassium	
	Inches	*pH*						*Percent*
Masterson gravelly loam	0–7	5.3	15.5	5.4	0.1	0.1	0.6	40
	7–21	5.0	9.8	2.2	.1	.1	.4	29
	21–35	4.5	6.5	.8	.1	.1	.1	17
Maymen gravelly loam	0–5	6.0	17.2	7.8	1.6	.1	.3	57
	5–9	6.0	16.7	8.5	2.8	.2	.2	70
Millsap loam	0–6	6.3	18.5	9.9	6.2	.1	.4	90
	6–17	6.0	36.8	19.5	15.5	.2	.5	97
Millsholm clay loam	0–1	6.2	31.5	14.3	10.6	.2	.7	82
	1–8	6.2	37.7	18.5	13.4	.2	.3	86
	8–17	6.6	39.2	20.1	14.6	.2	.3	89
Neuns cobbly loam	0–3	5.0	15.2	6.4	.9	.1	.3	51
	3–13	5.0	7.5	2.5	.3	.1	.1	40
	13–27	4.9	5.5	1.9	.3	.1	.1	44
Parrish gravelly loam	0–1	6.1	22.6	9.4	3.8	.1	.3	60
	1–6	6.2	21.0	9.6	4.4	.2	.3	69
	6–11	5.7	25.3	9.1	9.7	.2	.1	75
	11–25	5.3	34.6	8.3	21.7	.2	.1	88
Polebar loam	0–8	6.2	19.0	8.3	6.1	.1	.2	77
	8–18	6.5	29.0	13.0	12.0	.1	.1	87
	18–35	7.8	----------	----------	----------	.2	.1	----------
Sehorn clay loam	0–5	6.4	36.8	15.6	14.6	.1	.9	85
	5–13	6.3	41.8	19.4	17.2	.2	.7	90
	13–27	6.4	42.8	20.8	18.3	.2	.4	93
Shedd silty clay loam	0–19	7.9	26.5	22.0	2.2	.2	.5	94
	19–29	8.1	25.8	22.5	2.5	.2	.4	99
	29+	8.1	14.8	12.8	1.4	.2	.3	99
Sheetiron gravelly loam	0–5	5.6	17.0	7.9	1.8	.1	.8	62
	5–15	5.3	11.0	5.1	.9	.1	.3	58
	15–28	5.1	11.5	4.0	1.2	.1	.4	50

Mineralogical Analyses of Clay Fractions [8]

Selected samples from profiles of some representative soils of the county were analyzed for their content of clay minerals by differential thermal analyses and the X-ray diffraction method. The results of these tests are shown in table 14, and the methods used in the analyses are discussed in the paragraphs that follow.

Analysis of the soil colloids was by X-ray through the modified salted paste method. The clay suspension obtained from soil dispersed with Calgon was flocculated with sodium chloride (NaCl). After the supernatant liquid has been decanted, the clay is centrifuged and the supernatant solution is decanted. The clay paste in the centrifuge cup is then dispersed in about 10 milliliters of a glycerol-ethanol (1:2) solution and is centrifuged again until the clay all settles to the bottom of the cup. The solution is then poured out, and the clay paste is placed on a glass plate and thoroughly mixed to insure uniform sampling. The paste is then packed in a specially prepared hypodermic needle and forced out of the needle in rods of uniform size. The rods are placed on a thin sheet of Mylar plastic and X-rayed by the flat cassett method.

Differential thermal analysis (d.t.a.) curves of the soil clay were made by standard d.t.a. procedures and calibrated with simultaneously run d.t.a. curves of inorganic substances of known melting and inversion points and of known heats of fusion and decomposition.

The clay mineralogy of the soils of Glenn County seems to be related to the kind of parent material or rock from which the soils formed. No relationship between the kind of clay or the relative amount of each kind of clay and the vegetation, climate, or age was observed. For example, of the soils in the mountains, the Goulding and Neuns formed from similar material. Goulding soils, however, are in areas where the climate is fairly dry and formed under brush, whereas Neuns soils are in more humid areas under timber. Both soils, however, contain equivalent amounts of the same clays.

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TABLE 14.—*Analyses of clay fractions of selected soils*

Soil type	Depth	Kaolinite	Montmorillonite	Vermiculite	Mica	Quartz	Feldspars	Remainder [1]
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Soils from metavolcanic rock; in the mountains:								
Goulding rocky loam	4–16	40	2	50	5	1	----	2
Hohmann rocky loam	4–12	45	----	40	5	2	----	8
Neuns cobbly loam	3–13	40	----	55	5	----	----	----
Soils from basic, igneous rock; in the mountains:								
Stonyford gravelly clay loam	0–3	28	30	30	5	----	----	7
	7–14	27	50	10	3	----	----	10
Toomes extremely rocky silt loam	6–12	50	35	10	2	2	----	1
Soils from schistose rock; in the mountains:								
Hulls gravelly loam	6–18	[2] 29	----	6	55	(3)	(4)	10
Josephine gravelly loam	4–11	30	3	50	8	1	----	8
	25–46	30	3	50	10	3	----	4
Masterson gravelly loam	4–19	[2] 40	----	40	10	----	----	10
Maymen gravelly loam	5–9	30	----	50	10	3	(3)	7
Parrish gravelly loam	1–6	35	2	55	8	(3)	(3)	----
	11–25	28	5	55	2	1	(4)	9
Polebar loam	0–8	[2] 45	----	50	3	2	----	----
	18–35	[2] 45	----	50	3	1	----	1
Sheetiron gravelly loam	5–15	[2] 45	----	30	15	(4)	(4)	10
Soils from noncalcareous sedimentary rock; in the foothills:								
Contra Costa clay loam	5–12	40	15	30	5	4	----	6
	21–34	35	10	45	2	3	----	5
Lodo shaly clay loam	0–7	30	----	50	9	10	----	1
Millsap loam	6–17	20	5	60	5	4	----	6
Millsholm clay loam	6–16	28	25	35	5	4	(4)	3
Sehorn clay loam	5–13	35	25	30	2	4	----	4
Soils from calcareous sedimentary rock; in the foothills:								
Altamont clay	0–2	35	40	15	2	5	----	3
	11–20	35	45	10	2	5	----	3
	26–34	35	45	10	2	5	----	3
Altamont clay (formerly Walker)	6–18	40	45	4	8	3	----	----
	43+	38	45	4	5	2	----	6
Ayar clay	0–10	10	75	5	5	----	----	5
	17–32	10	75	5	5	----	----	5
Nacimiento clay	1–11	40	44	10	2	4	----	----
	22–31	35	45	10	2	3	----	5
Soils from alluvium: Well-drained, fine-textured soils; on alluvial fans—								
Myers clay	1–6	35	40	10	----	5	1	9
	11–18	35	40	10	----	5	1	9
	29–43	35	45	10	----	5	1	4
Porterville clay	1–6	15	70	7	----	----	----	8
	16–27	15	70	7	----	----	----	8

See footnotes at end of table.

TABLE 14.—*Analyses of clay fractions of selected soils*—Continued

Soil type	Depth	Kaolinite	Montmorillonite	Vermiculite	Mica	Quartz	Feldspars	Remainder [1]
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Soils from alluvium—Continued								
Poorly drained, fine-textured soils; in basins—								
Burris cobbly clay	1–7	----------	90	----------	--------	----------	----------	10
	31–46	----------	90	----------	--------	----------	----------	10
Castro clay	0–4	30	30	10	20	7	----------	3
	17–32	40	30	10	1	2	----------	17
	42–60	45	35	10	3	3	----------	4
Clear Lake clay	0–8	35	50	5	--------	2	----------	8
	20–29	35	50	5	--------	5	----------	5
	40–52	35	50	5	--------	5	----------	5
Landlow clay	0–9	35	35	5	3	5	2	15
	17–26	35	45	5	2	5	2	6
Marvin silty clay loam	0–8	35	45	10	2	5	1	2
	17–29	35	45	10	2	5	1	2
	42–60	35	45	10	2	5	1	2
Stockton clay	0–8	30	50	5	--------	3	----------	12
	16–25	35	50	5	--------	3	----------	7
	25–35	35	50	5	--------	3	----------	7
Sunnyvale clay	0–9	30	35	10	15	----------	----------	10
	34–46	40	30	10	2	----------	----------	18
Willows clay, dense subsoil	0–9	40	30	20	--------	5	1	4
	13–22	40	30	20	--------	5	1	4
	35–46	40	25	25	--------	5	1	4
Well-drained, moderately fine textured soils; on recent flood plains—								
Yolo clay loam	0–9	35	40	5	3	6	1	10
	19–32	35	40	7	3	6	2	7
Well-drained, medium and moderately fine textured soils; on young alluvial fans—								
Jacinto fine sandy loam	10–21	40	?	25	20	[5]	[4]	15
Zamora silty clay loam	0–6	35	30	5	7	5	2	16
	11–22	35	40	10	4	5	2	4
	38–46	35	45	10	2	5	2	1
Well-drained, medium-textured soils; on old alluvial fans—								
Hillgate silt loam	0–6	35	10	30	5	5	1	14
	18–28	35	15	35	5	2	1	4
	37–54	35	25	25	5	2	1	7
Tehama silt loam	0–7	40	10	25	10	5	1	9
	19–27	40	15	25	10	5	1	4
	38–50	40	17	25	10	5	1	2
Well-drained, gravelly soils; on terraces—								
Artois gravelly loam	0–9	30	15	25	--------	10	----------	20
	21–31	30	35	25	--------	5	----------	5
	38–60	30	35	20	--------	10	----------	5
Corning gravelly loam	0–8	30	10	30	--------	10	----------	20
	14–20	30	35	30	--------	3	----------	2
	27–40	30	35	30	--------	3	----------	2

See footnotes at end of table.

TABLE 14.—*Analyses of clay fractions of selected soils*—Continued

Soil type	Depth	Kaolinite	Montmorillonite	Vermiculite	Mica	Quartz	Feldspars	Remainder [1]
Soils from alluvium—Continued	*Inches*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Well-drained, gravelly soils; on terraces—Continued								
Newville gravelly loam	2–7	40	5	40	10	5	----------	----------
	15–26	30	35	30	5	1	----------	----------
	26–48	20	50	25	3	1	----------	1
Redding gravelly loam	6–7	35	----------	15	--------	10	----------	40
	14–23	30	45	20	--------	3	----------	2
	25–36	30	43	20	--------	5	----------	2
Somewhat poorly drained and poorly drained, medium and moderately fine textured soils on rims of basins—								
Plaza silt loam	1–10	35	25	10	5	5	1	19
	25–34	35	25	10	10	5	1	14
	34–47	35	35	15	5	5	1	4
Riz silty clay loam	0–8	35	45	10	--------	7	1	2
	23–34	35	45	10	--------	6	1	3
	46–60	35	45	10	--------	5	1	4

[1] Includes free Fe_2O_3, Al_2O_3, SiO_2, and amorphous constituents.
[2] Kaolinite and chlorite.
[3] Distinct trace.
[4] Faint trace.
[5] Definite quantity present.

In the Goulding, Hohmann, and Neuns soils, formed in material from metavolcanic rock, kaolinite and vermiculite are the main clay minerals. These are about equal in amount and make up from 80 to 95 percent of the clay fraction. Mica and other miscellaneous minerals account for the remainder.

The clay minerals of the Stonyford and Toomes soils, formed in material from basalt, a basic igneous rock, are primarily kaolinite, montmorillonite, and vermiculite. Montmorillonite and kaolinite generally are more prevalent than vermiculite in these soils.

The soils from schistose rock have about the same clay mineralogy as the soils from metavolcanic rocks, except for the Hulls. The Hulls soils are from mica-chlorite schist, and the major clay minerals are mica and chlorite. Kaolinite and vermiculite are the major clay minerals in the other soils from schistose rock, but vermiculite generally is more abundant. Minor clays are chlorite, mica, and miscellaneous accessory minerals. The presence of chlorite and the slightly greater content of mica than in the soils from metavolcanic rock appear to reflect the greater degree of metamorphism and minor mineralogical differences of the schistose parent material.

The soils of the Contra Costa, Lodo, Millsap, Millsholm, and Sehorn series, formed in material from noncalcareous sedimentary rock, are high in vermiculite and low in montmorillonite. The near absence of montmorillonite and the abundance of vermiculite in the Lodo and Millsap soils, formed in material from Knoxville shale, support the geologic separation of the Knoxville formation from the lower Cretaceous beds, material in which the Contra Costa, Sehorn, and Millsholm soils formed.

In soils formed in residuum from unaltered sedimentary rock, the clay minerals are chiefly kaolinite, montmorillonite, and vermiculite. The correlation in these soils between the relative abundance of the major clay minerals and the presence or absence of lime in the parent material appears to be good. Except for the Ayar soils, kaolinite accounts for about a third of the clay fraction of these soils. In the Altamont, Ayar, and Nacimiento soils, from calcareous sedimentary rock, the content of montmorillonite is high and that of vermiculite is low.

The soils formed in alluvium have essentially the same clay mineralogy as the soils or rocks from which their parent material was derived. The Porterville and Burris soils, on outwash from soils formed in material from basalt, are high in montmorillonite; kaolinite and vermiculite, if present, are minor in amount. On the other hand, the Artois, Corning, Newville, and Redding soils, which are on terraces and are gravelly and have a claypan, contain fairly equal amounts of kaolinite, montmorillonite, and vermiculite.

All nongravelly soils formed in alluvium contain from 30 to 40 percent of kaolinite. The soils that formed in alluvium from sedimentary rock or from various sources, such as the Castro, Clear Lake, Marvin, Myers, Riz, Sunnyvale, Yolo, and Zamora, generally contain from 30 to 50 percent montmorillonite and only 10 percent or less of vermiculite. Soils formed primarily in alluvium from schistose rock, such as the Hillgate, Plaza, Tehama, and Willows (dense subsoil phase), typically have 30 percent or less of montmorillonite and 10 percent or more of vermiculite. The alluvium in which the Landlow and Stockton soils formed generally is considered to be from basic rock, but the clay mineralogy implies a more mixed geologic source for the parent material of these two soils.

In evaluating the age factor in the clay mineralogy of soils formed in alluvium, time apparently has no marked effect. The content of clay minerals in the young Yolo and Zamora soils, for example, and in the older Tehama and Hillgate soils is almost identical. In contrast the data for the Clear Lake and Myers soils and for the Plaza and Tehama soils indicate that poorly drained soils have slightly more montmorillonite and less vermiculite than their well-drained counterparts from the same parent material.

General Nature of the County

In this section the physiography, relief, and drainage of Glenn County are discussed. Then facts are given about the climate, water supply, settlement and development, and land ownership and farm use.

Physiography, Relief, and Drainage

Glenn County is partly in the Northern California Coast Ranges and partly in the Sacramento Valley, which is in the Great Valley of California.

The Coast Ranges, or uplands, occupy about 60 percent of the county. They consist of two distinct parts: (1) the western mountainous area and (2) the central foothills. The Sacramento Valley consists of four parts: (1) the terraces, (2) the alluvial fans, (3) the flood plains, and (4) the basins.

The western mountainous area is steep and rugged. It ranges in elevation from about 1,200 to 7,448 feet, and the highest elevation is at Black Butte Mountain. Much of the area at elevations of more than 6,000 feet is on the tops of rocky mountains under sparse stands of timber. In most places the soils overlie schistose and partly metamorphosed sedimentary rocks that are steeply tilted, folded, and faulted. Near Black Butte Mountain and St. John Mountain, and in a few other local areas, the bedrock consists of metavolcanic rock. In the area between the mountains and foothills where the two come into contact, the soils overlie serpentine. The width of the serpentine formations varies, though the area is mostly narrow.

The central foothills consist of smooth, rolling to steep hills and narrow valleys. Elevation ranges from about 200 feet in the valleys to about 2,000 feet on the tops of the hills. The trend of the area and the rock formations is from north to south. The rock formations consist mainly of beds of sandstone, shale, and conglomerate that are partly folded and steeply tilted in places. Overlying these hard sedimentary rocks, in the northern part of the foothills, are gravelly, nonmarine materials. At Orland Buttes a basalt lava flow caps the bedrock.

The Sacramento Valley makes up the eastern part of the county. This area consists of nearly level terraces, smooth alluvial fans, narrow flood plains, and basins. Some of the areas are flooded at times.

The terraces in the Sacramento Valley consist of nearly level soils on remnants of old dissected terraces. The soils overlie alluvium deposited mainly by Stony Creek. They are well above the present bed of the creek and are not subject to flooding.

The alluvial fans are made up of smooth and very gently sloping soils on alluvium. The alluvium was laid down by Stony Creek and minor streams that drain the foothills. The fans have coalesced to form a broad area along the eastern edge of the foothills. Some areas, and especially those adjacent to the streams, are subject to flooding and deposition of new materials when rainfall is heavy.

The flood plain consists of a narrow area parallel to the Sacramento River. Most soils in this area lie within the levee system that borders the river and are subject to annual flooding. Many old meander scars and some oxbow lakes are in the area. The native vegetation has been cleared from most soils of the flood plain, and the soils are now used intensively for field, forage, and orchard crops.

There are two main basin areas. They are the Colusa Basin, which is west of the Sacramento River between the flood plain and the alluvial fans, and the Butte Sink, which is east of the river. The soils in these areas are nearly level and are poorly drained. They are flooded occasionally in winter. In many places they contain excess salts and alkali and have an intermittent high water table. In large areas drainage ditches have been constructed and the soils partly reclaimed.

Most of the mountains and foothills are well drained, but parts of the valley are poorly drained. The streams in the mountains have a dendritic, or treelike, pattern. The Black Butte River, Corbin Creek, and many other streams drain the area west of the crest of the Coast Ranges. These streams flow into the Eel River, one of the major streams draining the northern part of the Coast Ranges. The mountains east of the crest are drained by small creeks that empty into Stony Creek, which flows south to north and then northeastward through the foothills and drains into the Sacramento Valley Drainage Basin. Drainage in the foothills is by intermittent streams that flow only during the wet winter and spring months. Among the minor streams that drain the foothills are French, Hunter, Logan, Walker, Willow, and Wilson Creeks. These streams flow east and southward into the Colusa Basin and rarely reach the Sacramento River.

The Sacramento Valley is drained chiefly by Stony Creek, Butte Creek, and the Sacramento River, all of which flow the year round. Stony Creek flows from the mountainous uplands, through the foothills, and enters the Sacramento Valley just east of the Orland Buttes. It crosses the valley in a southeasterly direction and drains into the Sacramento River at a point about 5 miles southeast of Hamilton City. Butte Creek, which forms part of the eastern boundary of the county, originates in the Cascade Range east of Chico in Butte County. It flows southward and drains into the Butte Sink. The Sacramento River, which is the chief source of surface irrigation water in the county, flows southward through the center of the Sacramento Valley, joins the San Joaquin River in the delta, and then flows into San Francisco Bay and the Pacific Ocean.

Climate[9]

In Glenn County summers are hot and dry, and winters are cool and wet. Sunshine is abundant during the growing season, and winds are light. Lack of rain in summer makes irrigation necessary for intensive farming. Precipitation in winter, however, is sufficient for

[9] Data furnished by the office of C. ROBERT ELFORD, State climatologist, U.S. Weather Bureau, San Francisco, Calif.

forage plants to provide adequate grazing in spring and for some dryfarmed crops.

The mountains in the western part of the county form a barrier to the moderating influence of the sea on the climate in the Sacramento Valley. As a result, the differences in temperature are chiefly that the frost season lasts longer in the mountains than in the valley, and thus, the growing season there is shorter. The mountains receive abundant precipitation in winter, and the rainy season lasts longer than in the Sacramento Valley. Elevations in the western part of the county are as much as 5,000 feet in many parts of the mountains and are more than 7,000 feet in some places. At the higher elevations much of the precipitation in winter falls as snow, but the snow melts quickly as the weather warms in spring.

Temperature and growing season.—The mean annual temperature varies somewhat throughout the county. It ranges from about 62° F. on the valley floor to about 60° in the foothills and decreases to the lower fifties at the higher elevations in the mountains. Temperatures in July have exceeded 100° throughout the county, and extremes as high as 117° have been recorded in the Orland area in the northeastern part of the county and as high as 112° to 115° elsewhere in the valley and foothills. The maximum in the mountains probably ranges from 105° to 110°. The mean maximum temperature in July ranges from nearly 98° in the northeastern part of the county to about 96° in the southeastern part, and it decreases to the low nineties in the mountains. Monthly minimum, maximum, and average temperatures for the county are shown in figure 12.

Winter temperatures are mild. The mean minimum temperature in January decreases from about 36° in the valley, to about 34° in the foothills, and to about 30° in the mountains. Occasionally the temperature is as low as 10° to 20° in open areas at lower elevations, and as low as zero in some mountain valleys and at higher elevations.

The growing season, which is the interval between the last temperature of 32° F. or lower in spring and the first in fall, ranges from 160 days at the high elevations to 260 days in the Sacramento Valley (fig. 13). If 28° temperatures are used as a base, the growing season is lengthened to 220 days in the mountains and 300 days in the valleys. The average date for the last 32° temperature in spring is progressively later with increasing elevation. It ranges from about the middle of March in the valley to about the first of May along the western edge of the county; and in fall, the average date of the first 32° temperature ranges from about the middle of October in the mountains to about the middle of November in the valley.

Precipitation.—Annual precipitation is about 15 inches in the driest, southeast corner of the county. At the highest elevations in the western part of the county, however, precipitation is more than 60 inches a year. Total annual precipitation varies considerably from year to year. In 1 year out of 10, for example, the average annual precipitation ranges from less than 10 inches in the southeast corner of the county to about 30 inches in the mountains.

Winter storms that move through the county bring the heaviest rains. As often as once in 2 years the intensity of rainfall can be expected to be as much as 0.50 inch in 1 hour, 1.30 to 1.50 inches in 6 hours, and 2.00 to 2.50 inches in 24 hours. The probability is that only once in a hundred years will the average intensity of precipitation be in 1 hour as much as 1.25 inches. Once in every 100 years, the average intensity of precipitation in 6 hours ranges from 2.50 to 3.00 inches, and in 24 hours from 3.50 to 5.00 inches. Days that have a measurable amount of precipitation average between 60 and 70 a year.

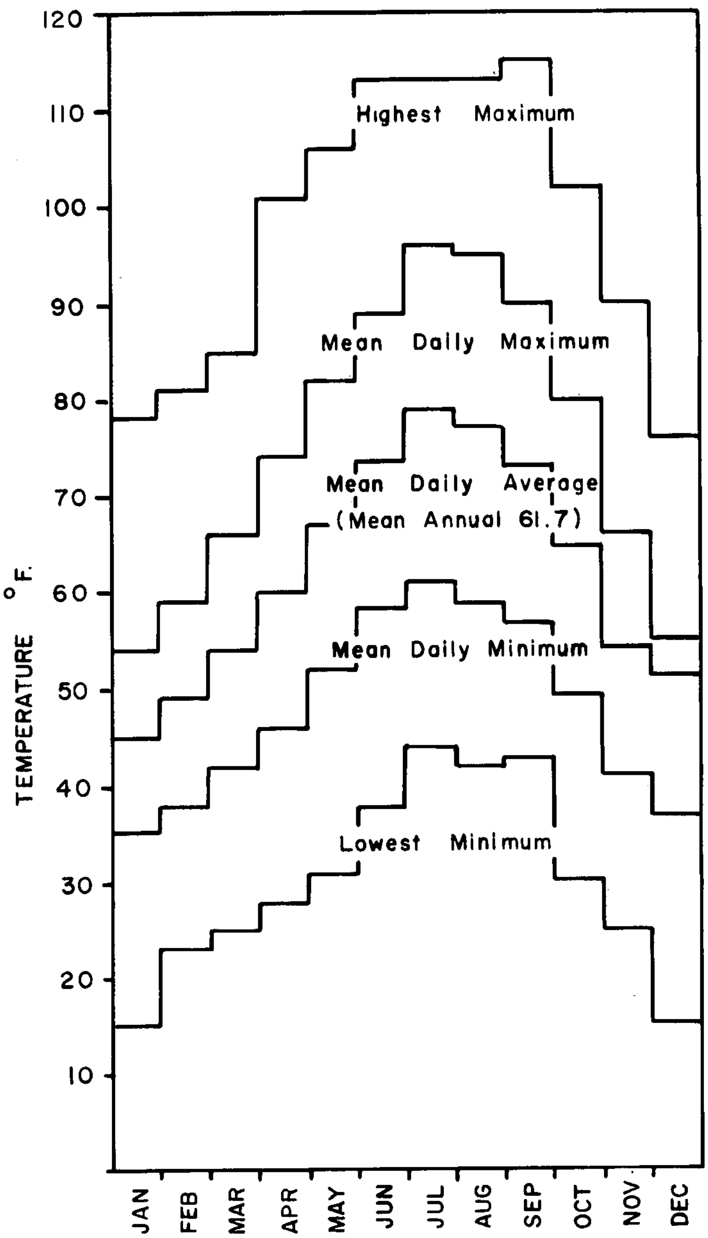

Figure 12.—**Monthly minimum, maximum, and average temperatures for Glenn County.**

Thunderstorms can be expected about 5 days a year in the valley, but they are likely to occur more often in mountain areas. These storms generally are not severe, though hail and strong winds sometimes occur.

The average annual snowfall is less than 1 inch in the Sacramento Valley and ranges from 4 to 8 inches on the lower slopes of the mountains, to the west. No

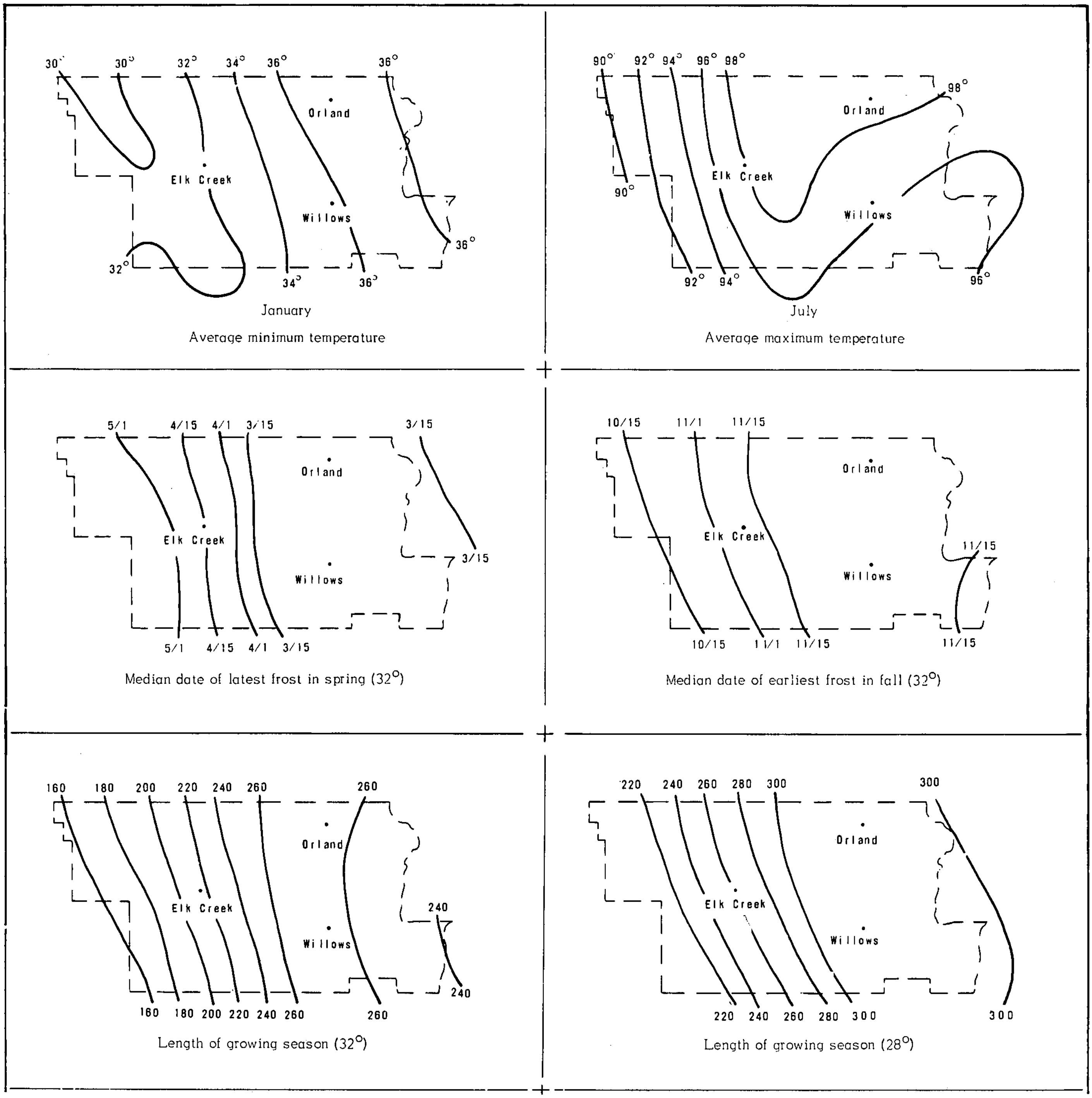

***Figure 13.*—Temperature, frost data (32°), and length of growing season in Glenn County.**

measurement of snow accumulation has been made at some of the higher elevations, but it is estimated that the annual accumulation in such areas ranges from 50 to 75 inches.

Evaporation.—Evaporation from the surface of open areas of water ranges from 60 to 70 inches a year. In winter evaporation from such areas is a little less than 2 inches a month, but in the warm summer months evaporation increases to more than 11 inches in July.

Evapotranspiration.—Shown in figure 14 are the calculated potential and actual evapotranspiration in different parts of the county. The data were computed by the Thornthwaite method (*12*) and show areas where there is a deficit or surplus of soil moisture.

Evapotranspiration is the combined loss of moisture from the soil through evaporation from the soil and by transpiration from plants. Potential evapotranspiration is the amount of moisture lost from a soil covered with

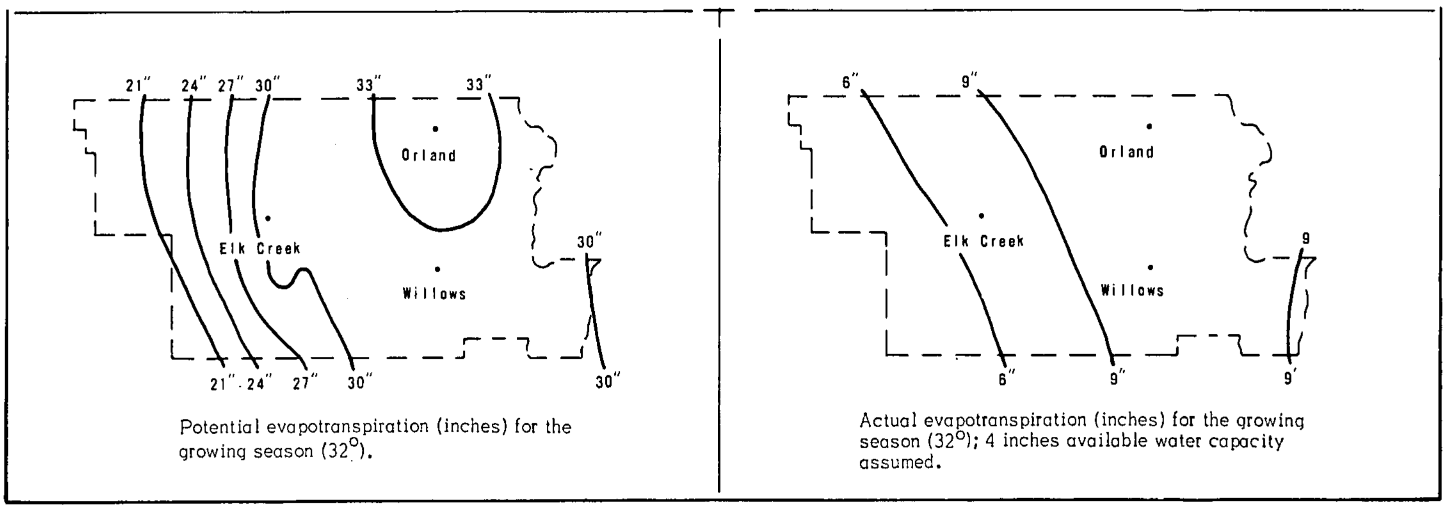

***Figure 14.*—Potential and actual evapotranspiration for the growing season in Glenn County.**

vegetation and continually wetted to field capacity, which is the largest amount of moisture a soil will hold under free drainage, after the excess water has drained away following a rain or an irrigation. Actual evapotranspiration is the amount of moisture lost from a soil that receives only the moisture normally available.

In the warmer, lower parts of the county a plant growing throughout the year would make use of about 40 inches of moisture if water were available, and one growing in the upland would make use of about 25 inches. Plants sensitive to frost, however, would be limited to about 34 inches in the valley and less than 21 inches in the mountains. These ratings indicate the amount of moisture a crop might use if the supply of moisture were not limited and therefore an amount closely equivalent to the amount needed for crops grown under irrigation.

Where irrigation water is not available, it is important to know the amount of moisture a crop might use under dryfarmed conditions. If we assume that the soils are capable of storing 4 inches of available moisture in the root zone, dryfarmed crops growing the year around would use 11 to 12 inches in the valley and more than 15 inches in the mountains. If we consider only the frost-free season, we find an actual plant use of about 10 inches in the low areas and 6 inches in the mountains.

The yield of dry plant material is approximately proportional to the amount of moisture lost by the plant through transpiration. Consequently, a comparison of the potential and actual evapotranspiration values gives a rough approximation of the plant production to be expected under irrigation and under dryfarming. Under irrigation, yields could be expected to increase nearly threefold in the valleys and foothills. The increase in the mountains would also be large, but because of the cooler temperature and shorter growing season in the mountains, potential production under irrigation or dryfarming would be about two-thirds that in the valley.

Wind.—Wind direction generally is from the north in winter and from the south in summer, and windspeed averages from 6 to 8 miles per hour. Winds generally are gentlest in fall and strongest in winter. Windspeed in winter reaches 50 miles per hour as often as once in 2 years and as much as 90 miles an hour once in 50 to 100 years.

Strong winds from the north blow over the county from time to time. Late in winter and early in spring these winds bring cold, dry weather, but similar winds late in spring and summer bring dry, warm weather. As a result, these north winds quickly remove moisture from the soil surface, dry out crop plants and trees, and cause a serious fire hazard.

Relative humidity and sunshine.—Relative humidity in the Sacramento Valley in winter is nearly 90 percent at night, but it drops to about 70 percent during the day. In summer relative humidity ranges from about 60 percent at night to 25 percent during the day. Humidity figures are not available for the mountain area, but it is likely that ratings will be 10 percent higher than in the valley. In summer when wind blows from the north, relative humidity may decrease to less than 10 percent.

The sun shines more than 90 percent of the day during the summer, but it shines only about 50 percent of the day during the winter. During a year there typically are about 207 clear days, 67 partly cloudy days, and 91 cloudy days. Dense fogs can be expected in the valley for 10 to 15 days each year, and occasionally they last for several days.

Water Supply

Most farms in the county obtain water for domestic use from drilled wells or springs. Water for livestock is furnished by streams, springs, wells, or farm ponds. Irrigation water is obtained from ground water sources and from major streams. In recent years, however, the overdraft of water from underground sources has exceeded the annual ground water recharge by more than 50 percent.

For Willows, Orland, Hamilton City, and other communities in the county, water for domestic and industrial use is obtained from wells.

Settlement and Development

Permanent settlement of Glenn County began after surveys made in the 1840's by General John Bidwell. Because of the transportation advantages, the first communities were established along the Sacramento River. Later inland communities were established, and after the Northern Railway, now the Southern Pacific, was constructed most of the settlements along the river moved to shipping points along the railroad. In 1891 the area, originally part of Colusa County, was officially recognized as a county and named for Dr. Hugh J. Glenn, a prominent early pioneer and landowner.

The population of the county has more than tripled from 5,510 in 1900 to 17,245 in 1960. Willows, the county seat and largest city, now numbers 4,139, and Orland, the business center for the northern part of the county, 2,534. The population is mostly rural, but the number of people living in rural areas is decreasing. In 1950 about 80 percent of the population was in rural areas, but this percentage decreased to about 61 percent in 1960.

Industries in the county are mostly those that process agricultural and forest products. Among the principal businesses are rice dryers, fruit and nut processing plants, commercial feedlots and warehouses, nurseries, chemical and fertilizer companies, and companies that provide airplanes for seeding and fertilizing crops and for control of pests, weeds, and fires. Other plants process seed, milk, honey, feed, or sugarbeets. There also are some livestock auction yards and slaughterhouses. The amount of timber produced is small, though an estimated 67.5 million board feet of timber was cut in 1962.

Few mineral resources of economic importance are available for development in the county. Some chromite and manganese deposits were mined during the war years, but natural gas and sand and gravel are the chief mineral resources.

Transportation in the county is provided by rail, highway, and air facilities. A main line of the Southern Pacific Railroad traverses the county north to south through the towns of Orland and Willows. A branch line of this railroad serves the smaller communities along the west side of the Sacramento River. U.S. Highway 99W and State Routes 45, 47, and 88 pass through the county, and more than 850 miles of improved roads connect rural areas with the various communities. Improved soil surfaced roads transect the Mendocino National Forest, but these are closed most of the winter and spring by snow. The Willows Airport and two auxiliary airfields east of Orland accommodate small commercial aircraft and privately owned planes.

Nearly all farms in the county have electricity and telephones. Natural gas is available to many homes in the Sacramento Valley. Except for a few isolated ranches, all farm homes have daily mail service. A radio station is operated in the city of Willows, and daily newspapers are published in Orland and Willows.

Elementary and secondary schools serve all parts of the county, though many rural elementary school districts have consolidated recently because of dwindling enrollments. The children are transported to and from the schools by bus.

The county library at Willows maintains branch facilities at Orland and Bayliss. Other communities and rural areas are served by a mobile library. A modern county hospital is located at Willows. Most churches are in the towns of Orland and Willows, but several denominations have churches in some of the smaller communities of the county.

Many rural organizations are active in the county. These provide educational facilities and information to promote better farming practices and serve as social centers for the adults and youth of the county.

Recreation is readily available in the county. Besides the Mendocino National Forest, which occupies most of the western mountainous area of the county, there are five county parks. Here are provided improved facilities for camping and picnicking. Four lakes, many perennial streams, and numerous farm ponds provide fishing, boating, and water sports. Hunting and other outdoor activities are available in all areas.

In the mountains the many tributary creeks of Stony Creek and the Eel River provide trout fishing. The mountains are a natural habitat for deer, black bear, bobcats, coyotes, raccoons, and red and gray foxes. In addition doves, band-tail pigeons, and quail are numerous. Wildlife in the foothills includes deer, dove, quail, and pheasant. Here some fishing is provided in the Stony Gorge and Black Butte Reservoirs, on Stony Creek, but these manmade lakes are warm and are better suited to boating and other water sports. Scattered throughout the foothills are many stock ponds, some of which have been stocked with bass and bluegill for private fishing.

In the valley in the eastern part of the county is the Sacramento National Wildlife Refuge, which is part of the Pacific Flyway. This sanctuary serves as a rest stop for millions of migratory waterfowl and as a brooding area for resident birds. Private gun clubs near the refuge offer facilities for hunting ducks and geese, and hunting clubs maintain pheasant shooting areas for their members. Dove and quail also are hunted in the valley.

The Sacramento River, which forms a part of the eastern boundary of the county, provides good fishing for salmon, steelhead, striped bass, black bass, catfish, shad, and sturgeon. It also provides boating, water-skiing, and swimming for many.

Land Ownership and Farm Use

Tribes of Digger Indians lived in Glenn County until about the time the area was surveyed in the early 1840's. After that several large grants of land were secured by early settlers from the Mexican Government. These tracts covered parts of the river bottoms and lower lying plains and included the Larkins Childrens Rancho, Rancho Jacinto, and Rancho Capay. Litigation concerning these claims continued in the United States courts for many years, and eventually all of the original grants were subdivided and sold to private owners.

About three-fourths of the land in the county is in private ownership, mainly in farms. A considerable acreage, however, is in public ownership. Of this, about 187,000 acres in the western part of the county is in the Mendocino National Forest. Among other land owned by the Federal Government are 12,000 acres, managed by the Bureau of Land Management; 2,841 acres, managed by the Bureau of Reclamation; and 8,555 acres, managed by the Fish and Wildlife Service. Urban areas and roads occupy about 9,100 acres.

According to the 1964 Census of Agriculture, 74.9 percent of the land area of Glenn County is in farms. The farms number 1,312, and the average size is 481 acres. Only about 9 percent of the acreage is in farms consisting of more than 1,000 acres, but these large holdings account for more than two-thirds of the acreage in farms. On most of the large ranches, the growing of dryfarmed grain and the raising of livestock are the main uses. Most of the farms are owned by the operators, but some are rented, and a few are operated by managers.

Nearly half of the land in farms is in crops, and most of the rest consists of pastured range or woodland. Almost half of the acreage in cropland is used for irrigated crops. Rice, alfalfa and other hay crops, pasture, ladino clover grown for seed, sugarbeets, fruits, and nuts are the chief irrigated crops. The chief dryfarmed crops are small grains, grain hay, safflower, and milo.

Much of the income from farms in the county comes from livestock. The principal livestock is beef cattle, but large numbers of sheep and lambs are raised or pastured in the county. Dairying produces fresh milk for the market, as well as for plants that manufacture dairy products. Hogs are raised on a few farms, though their number varies widely from year to year. Turkeys, turkey eggs for hatching, and chicken eggs for sale in the market are the chief poultry products, but they are of minor importance. Bees, honey, and other apiary products provide an additional source of income on some of the farms.

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Glossary

Aggregate. Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alluvium. Fine material, such as gravel, sand, silt, or clay, deposited on land by streams.

Available moisture holding capacity (also termed available water holding capacity). The differences between the amount of water in a soil at field capacity and the amount in the same soil at the permanent wilting point. Commonly expressed as inches of water per inch depth of soil.

Base saturation (soil chemistry). The degree to which a material is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of carbonates of calcium or magnesium in many soils. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

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.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Hard grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds that cement the soil grains together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

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; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle to moderate 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; tends to stretch somewhat and pull apart rather than 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 and brittle; little affected by moistening. A *weakly cemented* mass is brittle and hard, but it can be broken in the hands. A *strongly cemented* mass is brittle; it is too hard to be broken in the hand but can easily be broken with a hammer. An *indurated* mass is very strongly cemented and brittle, does not soften under prolonged wetting, and a sharp blow with a hammer is required to break it.

Drainage, natural. Refers to moisture conditions that existed during the development of the soil, 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 different classes of natural drainage are recognized.

Excessively drained soils are commonly very porous and very rapidly permeable and have low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and some soils have mottling in the lower B and C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottlings below 6 to 16 inches in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Fallow. Cropland left idle in order to restore productivity, mainly through accumulation of water, nutrients, or both. The soil ordinarily is tilled but not planted, for at least one growing season, to control weeds, to aid in decomposition of plant residues, and to encourage the storage of moisture for the succeeding grain crop.

Fertility, soil. The quality that enables a soil to provide the proper elements and compounds, in adequate amounts and in proper balance, for the growth of specified plants when other growth factors such as moisture, light, temperature, and the physical condition (or tilth) of the soil, are favorable.

Field capacity (moisture). The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A dense and brittle pan or layer in soils that is very low in organic matter and clay but rich in silt or very fine sand. The layer is seemingly cemented when dry, has a hard or very hard consistence, and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan has a tendency to rupture suddenly if pressure is applied, rather than to undergo slow deformation. The layer generally is mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick and generally occur below the B horizon at a depth of 15 to 40 inches from the surface.

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

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or some other substance.

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

Igneous rock. A rock produced by the cooling of melted mineral material. Examples: Granite, andesite, diorite, and basalt.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Lime. Chemically, lime is calcium oxide (CaO), but as the term is commonly used, it is also calcium carbonate ($CaCO_3$) and calcium hydroxide ($Ca(OH)_2$). Agricultural lime refers to ground limestone, hydrated lime, or burned lime, with or without magnesium minerals. Basic slag, oystershells, and marl also contain calcium.

Metamorphic rocks. Rocks of any origin that have been completely changed physically by pressure, heat, and movement. Such rocks are nearly always crystalline. Examples: Mica schist and serpentine.

Microrelief. Minor surface irregularities of the land, such as low mounds or shallow pits. Some of these are termed hogwallow microrelief.

Morphology, soil. The makeup of the soil, including the texture, structure, consistence, color, and other physical, chemical, mineralogical, and biologic properties of the various horizons that make up the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Parent material, soil. The horizon of weathered rock or partly weathered material from which the soil formed; horizon C in the soil profile.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

pH.—See Reaction.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. See Horizon, soil.

Reaction, soil. The degree of acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction, because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed in words as follows:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6–7.3
Very strongly acid	4.5–5.0	Mildly alkaline	7.4–7.8
Strongly acid	5.1–5.5	Moderately alkaline	7.9–8.4
Medium acid	5.6–6.0	Strongly alkaline	8.5–9.0
Slightly acid	6.1–6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff. The rate at which water is removed by flow over the surface of the soil. Relative terms are *very rapid*, *rapid*, *medium*, *slow*, *very slow*, and *ponded*.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; or contains harmful salts and has a highly alkaline reaction; or contains harmful salts and exchangeable sodium and is strongly alkaline in reaction. The salts, exchangeable sodium, and alkaline reaction occur in the soil in such locations that growth of most crop plants is less than normal.

Sand. Individual fragments of rocks or minerals that have diameters ranging from 0.05 millimeter (0.002 inch) to 2.0 millimeters (0.079 inch). Most sand grains consist of quartz, but they may be of any mineral composition. The term sand is also applied to a soil that contains 85 percent or more sand and not more than 10 percent of clay.

Sedimentary rock. A rock largely composed of particles deposited from suspension in water.

Silt. Mineral particles in a soil that range in diameter from (0.002 millimeter) (0.000079 inch) to 0.05 millimeter (0.02 inch). The term silt is also applied to a 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 base of a slip surface on a relatively steep slope; and in swelling clays, where there is marked change in moisture content.

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

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

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 (1) *single grain* (each grain by itself, as in dune sand) (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly the part of the profile below plow depth and above the substratum.

Substratum. The soil material below the surface soil and the subsoil; the C or R horizon.

Surface soil or layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). A level or gently undulating old alluvial plain bordering a stream valley, river, lake, or the sea. Elevation is intermediate between that of the flood plain and the upland.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. (See also Clay, Sand, and Silt). The basic textural classes, in order of increasing proportions of fine particles are as follows: *sand, loamy sand, sandy loam, loam, silt loam, silt, 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."

Water table. The highest level within the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Water table, perched. The upper surface of a body of free ground water that is separated from an underlying body of ground water by unsaturated material.

GUIDE TO MAPPING UNITS

[For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs.

[See table 1, p. 12, for the approximate acreage and proportionate extent of the soils, table 4, p. 94, for estimated yields of principal crops, and table 5, p. 100, for the Storie index rating of the soils. For information significant to engineering, see section beginning on p. 114. Dashes indicate that Gravel pits is not placed in a capability unit, because it is not suited to crops]

Map symbol	Mapping unit	Described on page	Capability unit	
			Symbol	Page
AaA	Altamont clay, 0 to 3 percent slopes	17	IIIs-5	83
AaC	Altamont clay, 3 to 15 percent slopes	16	IIIe-5	81
AaD	Altamont clay, 15 to 30 percent slopes	17	IVe-5	83
AaE	Altamont clay, 30 to 50 percent slopes	17	VIe-5	85
AbC	Altamont gravelly clay, 3 to 15 percent slopes	17	IIIe-5	81
AcD	Altamont rocky clay loam, 15 to 30 percent slopes	17	VIs-8	86
AcE	Altamont rocky clay loam, 30 to 50 percent slopes	17	VIs-8	86
AdC	Altamont soils, 3 to 15 percent slopes	18	IIIe-5	81
AdD	Altamont soils, 15 to 30 percent slopes	18	IVe-5	83
AdE	Altamont soils, 30 to 65 percent slopes	17	VIIe-5	87
AfD	Altamont-Gullied land complex, 10 to 30 percent slopes	18	IVe-5	83
AfsD	Altamont-Gullied land complex, shallow, 10 to 30 percent slopes	18	IVe-5	83
AfE	Altamont-Gullied land complex, 30 to 50 percent slopes	18	VIe-5	85
AfsE	Altamont-Gullied land complex, shallow, 30 to 65 percent slopes	18	VIIe-5	87
AgE	Altamont-Rocky gullied land complex, 15 to 45 percent slopes	18	VIs-8	86
AhC	Altamont-Contra Costa clays, 8 to 15 percent slopes	18	IIIe-5	81
AhD	Altamont-Contra Costa clays, 15 to 30 percent slopes	18	IVe-5	83
AhE	Altamont-Contra Costa clays, 30 to 50 percent slopes	18	VIe-5	85
AkE3	Altamont and Millsholm soils, 30 to 65 percent slopes, severely eroded	18	VIIs-8	87
AmC	Altamont-Nacimiento association, 3 to 15 percent slopes	18	IIIe-5	81
AnC	Altamont-Shedd association, 3 to 15 percent slopes	18	IIIe-5	81
AoA	Arbuckle gravelly loam, 0 to 2 percent slopes	19	IIs-4	81
AoB	Arbuckle gravelly loam, 2 to 8 percent slopes	19	IIe-4	80
AoxA	Arbuckle cobbly loam, 0 to 3 percent slopes	20	IIIs-4	83
Ap	Arbuckle gravelly loam, water table, 0 to 2 percent slopes	19	IIIw-3	82
Ar	Arbuckle gravelly loam, clayey substratum, 0 to 2 percent slopes	19	IIIs-3	82
As	Arbuckle gravelly sandy loam, 0 to 2 percent slopes	19	IIs-4	81
At	Artois loam	21	IIIs-3	82
Au	Artois clay loam	21	IIIs-3	82
Av	Artois gravelly loam	20	IIIs-3	82
Aw	Artois gravelly clay loam	21	IIIs-3	82
AxC	Ayar clay, 3 to 15 percent slopes	21	IIIe-5	81
AyD	Ayar-Nacimiento clays, 10 to 30 percent slopes	21	IVe-5	83
BcB	Burris clay, 1 to 8 percent slopes	22	IIIw-5	82
BuD	Burris bouldery clay, 10 to 30 percent slopes	22	VIs-5	86
ByC	Burris cobbly clay, 3 to 15 percent slopes	22	VIs-5	86
CaA	Capay clay, 0 to 2 percent slopes	22	IIIw-5	82
CaB	Capay clay, 2 to 8 percent slopes	23	IIIe-5	81
Cb	Castro clay	23	IIIw-5	82
Cba	Castro clay, slightly saline-alkali	23	IIIw-5	82
Cbb	Castro clay, moderately saline-alkali	23	IIIw-6	82
Cc	Clear Lake clay	24	IIIw-5	82
CdsF	Colluvial land, sedimentary rocks	24	VIIe-4	87
CduF	Colluvial land, serpentine rocks	24	VIIIs-9	88

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page
CdvF	Colluvial land, volcanic rocks	24	VIIs-7	87
CeA	Columbia fine sandy loam, 0 to 2 percent slopes	26	IIw-2	80
CeB	Columbia fine sandy loam, 2 to 8 percent slopes	26	IIw-2	80
Cf	Columbia fine sandy loam, moderately deep over sand and gravel, 0 to 2 percent slopes	27	IIIw-0	82
CgA	Columbia loamy fine sand, coarse variant, 0 to 2 percent slopes	27	IIIw-3	82
CgB	Columbia loamy fine sand, coarse variant, 2 to 8 percent slopes	27	IIIw-0	82
ChA	Columbia silt loam, 0 to 2 percent slopes	25	IIw-2	80
ChB	Columbia silt loam, 2 to 8 percent slopes	26	IIw-2	80
Ck	Columbia silt loam, moderately deep over clay loam, 0 to 1 percent slopes	26	I-1	79
Cl	Columbia silt loam, moderately deep over claypan, 0 to 1 percent slopes	26	IIIs-3	82
Cm	Columbia silt loam, moderately deep over gravel, 0 to 2 percent slopes	26	IIIw-0	82
Cn	Columbia silt loam, shallow over clay, 0 to 1 percent slopes	26	IIIw-5	82
Co	Columbia silt loam, shallow over clay, channeled, 0 to 3 percent slopes	26	VIw-1	86
CpB	Columbia silt loam, water table, 1 to 8 percent slopes	26	IIIw-3	82
CrB	Columbia soils, channeled, 0 to 10 percent slopes	27	VIw-1	86
CsB	Contra Costa clay, shallow, 3 to 8 percent slopes	28	IVe-5	83
CtE	Contra Costa clay loam, 30 to 65 percent slopes	27	VIe-5	85
CuE2	Contra Costa clay loam, shallow, 30 to 65 percent slopes, eroded	28	VIe-5	85
CvE	Contra Costa-Millsholm clay loams, 30 to 65 percent slopes	28	VIe-5	85
CwA	Corning gravelly loam, 0 to 2 percent slopes	28	IVs-3	84
CwB	Corning gravelly loam, 2 to 8 percent slopes	28	IVe-3	83
CwxB	Corning-Gullied land complex, 2 to 10 percent slopes	29	IVe-3	83
CxC	Corning-Newville gravelly loams, 3 to 15 percent slopes	29	IVe-3	83
CyC	Corning-Newville-Gullied land complex, 3 to 15 percent slopes	29	IVe-3	83
CzB	Corning-Redding gravelly loams, 1 to 5 percent slopes	29	IVe-3	83
Czg	Cortina gravelly loam, water table	30	IVs-4	84
Czh	Cortina gravelly fine sandy loam	29	IIIs-4	83
Czk	Cortina gravelly fine sandy loam, shallow	30	IVs-4	84
Czr	Cortina very gravelly sandy loam	29	IVs-4	84
Czs	Cortina very gravelly sandy loam, shallow	29	IVs-4	84
Czt	Cortina very gravelly sandy loam, moderately deep	29	IVs-4	84
DuE	Dubakella stony loam, 30 to 50 percent slopes	30	VIs-7	86
EaD	East Park clay, black variant, 10 to 30 percent slopes	31	IVe-9	84
EcB	East Park gravelly clay, 2 to 10 percent slopes	30	IVe-9	84
Er	Eroded land, alluvial material	31	VIIIw-4	88
EsE	Eroded land, shale material	31	VIIIs-8	88
GoE	Goulding rocky loam, 30 to 50 percent slopes	32	VIIs-7	87
GoF	Goulding rocky loam, 50 to 65 percent slopes	31	VIIIs-7	88
Gp	Gravel pits	32	-------	--
Gr	Gravelly alluvial land	32	VIw-1	86
HcD	Henneke stony clay loam, 10 to 30 percent slopes	33	VIIs-9	87
HcE	Henneke stony clay loam, 30 to 65 percent slopes	32	VIIIs-9	88
HgA	Hillgate loam, 0 to 2 percent slopes	33	IIIs-3	82
HgB	Hillgate loam, 2 to 8 percent slopes	33	IIIe-3	81
HgxB	Hillgate-Gullied land complex, 2 to 10 percent slopes	33	IIIe-3	81
HhB	Hillgate loam, moderately deep, 0 to 10 percent slopes	33	IIIe-3	81
HhxB	Hillgate-Gullied land complex, moderately deep, 2 to 10 percent slopes	34	IIIe-3	81

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page
Hl	Hillgate clay loam, 0 to 3 percent slopes	33	IIIs-3	82
HmA	Hillgate gravelly loam, 0 to 2 percent slopes	33	IIIs-3	82
HmB	Hillgate gravelly loam, 2 to 8 percent slopes	33	IIIe-3	81
HmxB	Hillgate-Gullied land complex, gravelly, 2 to 10 percent slopes	34	IIIe-3	81
Hn	Hillgate gravelly loam, water table, 0 to 2 percent slopes	33	IIIw-3	82
HoE	Hohmann rocky loam, 30 to 65 percent slopes	34	VIIs-7	87
HpD	Hohmann rocky loam, deep, 10 to 30 percent slopes	34	VIs-7	86
HrE	Hugo loam, 20 to 50 percent slopes	35	VIe-1	85
HtD	Hugo loam, moderately deep, 10 to 30 percent slopes	35	IVe-4	83
HtE	Hugo loam, moderately deep, 30 to 50 percent slopes	34	VIe-1	85
HtF	Hugo loam, moderately deep, 50 to 65 percent slopes	35	VIIe-1	86
HuD	Hulls gravelly loam, 10 to 30 percent slopes	36	VIe-8	86
HuE	Hulls gravelly loam, 30 to 50 percent slopes	35	VIe-8	86
HuF	Hulls gravelly loam, 50 to 65 percent slopes	36	VIIe-8	87
JaA	Jacinto fine sandy loam, 0 to 2 percent slopes	36	I-1	79
JaB	Jacinto fine sandy loam, 2 to 8 percent slopes	36	IIe-1	79
JgD2	Josephine gravelly loam, 10 to 30 percent slopes, eroded	37	IVe-4	83
JgE	Josephine gravelly loam, 30 to 50 percent slopes	36	VIe-4	85
JgE2	Josephine gravelly loam, 30 to 50 percent slopes, eroded	37	VIe-4	85
JmE	Josephine-Maymen gravelly loams, 30 to 50 percent slopes	37	VIIIs-8	88
JsE	Josephine-Sheetiron gravelly loams, 30 to 50 percent slopes	37	VIIIs-8	88
Kb	Kimball loam, 0 to 2 percent slopes	37	IIIs-3	82
KbB	Kimball loam, 2 to 10 percent slopes	38	IIIe-3	81
KmA	Kimball gravelly loam, 0 to 2 percent slopes	38	IIIs-3	82
KmB	Kimball gravelly loam, 2 to 10 percent slopes	38	IIIe-3	81
KnB	Kimball-Gullied land complex, 2 to 10 percent slopes	38	IIIe-3	81
La	Landlow clay	38	IIIw-5	82
Lc	Landlow clay loam	39	IIIw-5	82
LmD	Lodo-Gullied land complex, 10 to 30 percent slopes	39	VIIs-8	87
LmE	Lodo-Gullied land complex, 30 to 50 percent slopes	39	VIIs-8	87
LoD	Lodo-Millsap-Gullied land complex, 10 to 30 percent slopes	39	VIe-3	85
LoE	Lodo-Millsap-Gullied land complex, 30 to 65 percent slopes	39	VIIe-3	87
LsD	Lodo-Tehama clay loams, 10 to 30 percent slopes	39	VIIs-8	87
LsE	Lodo-Tehama clay loams, 30 to 50 percent slopes	40	VIIs-8	87
LtD	Lodo-Tehama-Gullied land complex, 10 to 30 percent slopes	40	VIIs-8	87
LtE	Lodo-Tehama-Gullied land complex, 30 to 50 percent slopes	40	VIIs-8	87
LuE	Los Gatos gravelly loam, 30 to 50 percent slopes	40	VIIe-8	87
LuF	Los Gatos gravelly loam, 50 to 65 percent slopes	40	VIIe-8	87
LvD	Los Gatos gravelly loam, schist bedrock, 10 to 30 percent slopes	40	VIe-8	86
LvE	Los Gatos gravelly loam, schist bedrock, 30 to 50 percent slopes	40	VIIe-8	87
LvF	Los Gatos gravelly loam, schist bedrock, 50 to 65 percent slopes	40	VIIe-8	87
LxE	Los Gatos-Josephine gravelly loams, 30 to 50 percent slopes	40	VIIe-8	87
LyE	Los Gatos-Parrish gravelly loams, 30 to 50 percent slopes	41	VIIe-8	87
Ma	Marvin silty clay, 0 to 1 percent slopes	42	IIIw-5	82

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page
Maa	Marvin silty clay, slightly saline-alkali, 0 to 1 percent slopes	42	IIIw-5	82
Mab	Marvin silty clay, moderately saline-alkali, 0 to 1 percent slopes	42	IIIw-6	82
MaoB	Marvin silty clay, overflow, 0 to 5 percent slopes	42	IVw-1	84
MbA	Marvin silty clay loam, 0 to 2 percent slopes	41	IIs-3	81
MbB	Marvin silty clay loam, 2 to 10 percent slopes	41	IIe-3	80
Mba	Marvin silty clay loam, slightly saline-alkali, 0 to 1 percent slopes	41	IIIw-3	82
Mbb	Marvin silty clay loam, moderately saline-alkali, 0 to 1 percent slopes	42	IIIw-6	82
McD	Masterson gravelly loam, 10 to 30 percent slopes	42	IVe-4	83
McE	Masterson gravelly loam, 30 to 50 percent slopes	43	VIe-4	85
MdD	Masterson gravelly loam, moderately deep, 10 to 30 percent slopes	43	IVe-4	83
MdE	Masterson gravelly loam, moderately deep, 30 to 50 percent slopes	43	VIe-4	85
MdgD	Maymen gravelly loam, 10 to 30 percent slopes	43	VIIs-8	87
MdgE	Maymen gravelly loam, 30 to 65 percent slopes	44	VIIIs-8	88
MdkE	Maymen gravelly loam, shallow over schist, 30 to 65 percent slopes	43	VIIIs-8	88
MdmE	Maymen gravelly loam, schist bedrock, 30 to 65 percent slopes	43	VIIIs-8	88
MdoD	Maymen-Los Gatos gravelly loams, 10 to 30 percent slopes	44	VIIs-8	87
MdoE	Maymen-Los Gatos gravelly loams, 30 to 65 percent slopes	44	VIIs-8	87
MdpD	Maymen-Parrish gravelly loams, 10 to 30 percent slopes	44	VIIs-8	87
MdpE	Maymen-Parrish gravelly loams, 30 to 65 percent slopes	44	VIIs-8	87
Mdw	Mixed alluvial land	47	Vw-2	85
Me	Maywood loam, shallow over gravel	44	IVs-4	84
MfE	Millsap loam, 30 to 50 percent slopes	45	VIe-3	85
MfF	Millsap loam, 50 to 65 percent slopes	45	VIIe-3	87
MgF	Millsholm cherty loam, 50 to 65 percent slopes	46	VIIe-8	87
MhE	Millsholm gravelly loam, 30 to 50 percent slopes	47	VIe-41	85
MhF	Millsholm gravelly loam, 50 to 65 percent slopes	47	VIIe-8	87
MkE	Millsholm gravelly loam, schist bedrock, 30 to 50 percent slopes	46	VIe-41	85
MkF	Millsholm gravelly loam, schist bedrock, 50 to 65 percent slopes	46	VIIe-8	87
MlD	Millsholm rocky loam, 10 to 30 percent slopes	46	VIs-8	86
MlE	Millsholm rocky loam, 30 to 50 percent slopes	46	VIIs-8	87
MmD	Millsholm rocky loam-Gullied land complex, 15 to 30 percent slopes	47	VIs-8	86
MmE	Millsholm rocky loam-Gullied land complex, 30 to 65 percent slopes	47	VIIs-8	87
MnD	Millsholm clay loam, 10 to 30 percent slopes	45	IVe-5	83
MnE	Millsholm clay loam, 30 to 50 percent slopes	46	VIe-5	85
MnE2	Millsholm clay loam, 30 to 65 percent slopes, eroded	46	VIIs-8	87
MngD	Millsholm clay loam-Gullied land complex, 10 to 30 percent slopes	47	IVe-5	83
MoD	Millsholm rocky clay loam, 10 to 30 percent slopes	46	VIs-8	86
MoE	Millsholm rocky clay loam, 30 to 65 percent slopes	46	VIIs-8	87
MpE	Millsholm rocky clay loam-Gullied land complex, 15 to 50 percent slopes	47	VIIs-8	87
MrD	Millsholm rocky sandy loam, 10 to 30 percent slopes	46	VIs-8	86
MrE	Millsholm rocky sandy loam, 30 to 50 percent slopes	46	VIIs-8	87
MrE2	Millsholm rocky sandy loam, 30 to 50 percent slopes, eroded	46	VIIs-8	87
MsE	Millsholm-Gullied land complex, 30 to 50 percent slopes	47	VIe-5	85

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page
MtD	Millsholm very rocky loam, 15 to 45 percent slopes	46	VIs-8	86
MuE	Millsholm very rocky sandy loam, 30 to 65 percent slopes	46	VIIs-8	87
MvE	Millsholm soils, 30 to 50 percent slopes	47	VIIs-8	87
MwE2	Millsholm-Contra Costa clay loams, 30 to 50 percent slopes, eroded	47	VIe-5	85
MxE	Millsholm-Contra Costa complex, 30 to 50 percent slopes	47	VIIs-8	87
MyE2	Millsholm-Lodo complex, 30 to 50 percent slopes, eroded	47	VIIs-8	87
Mz	Moda loam	48	IIIs-3	82
MznE	Montara clay, 20 to 50 percent slopes	48	VIIs-9	87
MzrA	Myers clay, 0 to 3 percent slopes	49	IIIs-5	83
MzrB	Myers clay, 3 to 10 percent slopes	49	IIIe-5	81
MzyA	Myers clay loam, 0 to 3 percent slopes	49	IIs-3	81
MzyB	Myers clay loam, 3 to 8 percent slopes	49	IIe-3	80
MzxB	Myers-Gullied land complex, 3 to 10 percent slopes	50	IIIe-5	81
NaC	Nacimiento clay, 3 to 15 percent slopes	50	IIIe-5	81
NaD	Nacimiento clay, 15 to 30 percent slopes	50	IVe-5	83
NaE	Nacimiento clay, 30 to 50 percent slopes	50	VIe-5	85
NcD	Nacimiento soils, 10 to 30 percent slopes	50	IVe-5	83
NcE	Nacimiento soils, 30 to 50 percent slopes	50	VIe-5	85
NdD	Nacimiento-Gullied land complex, 15 to 30 percent slopes	50	IVe-5	83
NdE	Nacimiento-Gullied land complex, 30 to 50 percent slopes	50	VIe-5	85
NfD	Nacimiento-Altamont association, 10 to 30 percent slopes	51	IVe-5	83
NgD	Nacimiento-Altamont-Gullied land complex, 15 to 30 percent slopes	50	IVe-5	83
NhC	Nacimiento-Contra Costa association, 3 to 15 percent slopes	51	IIIe-5	81
NhD	Nacimiento-Contra Costa association, 15 to 30 percent slopes	51	IVe-5	83
NhE	Nacimiento-Contra Costa association, 30 to 50 percent slopes	51	VIe-5	85
NkD	Nacimiento-Contra Costa-Gullied land complex, 15 to 30 percent slopes	51	IVe-5	83
NkE	Nacimiento-Contra Costa-Gullied land complex, 30 to 50 percent slopes	51	VIe-5	85
NmD	Neuns cobbly loam, 10 to 30 percent slopes	51	VIs-7	86
NmE	Neuns cobbly loam, 30 to 50 percent slopes	51	VIs-7	86
NmF	Neuns cobbly loam, 50 to 65 percent slopes	52	VIIs-7	87
NnD	Neuns cobbly loam, deep, 10 to 30 percent slopes	52	VIs-7	86
NnE	Neuns cobbly loam, deep, 30 to 50 percent slopes	52	VIs-7	86
NoD	Neuns cobbly loam, shallow, 10 to 30 percent slopes	52	VIs-7	86
NoE	Neuns cobbly loam, shallow, 30 to 50 percent slopes	52	VIs-7	86
NvC	Newville gravelly loam, 3 to 15 percent slopes	53	IVe-3	83
NvD	Newville gravelly loam, 15 to 30 percent slopes	52	VIe-3	85
NvE	Newville gravelly loam, 30 to 50 percent slopes	53	VIIe-3	87
NvF2	Newville gravelly loam, 50 to 65 percent slopes, eroded	53	VIIe-3	87
NwD	Newville-Gullied land complex, 8 to 30 percent slopes	53	VIe-3	85
NwE	Newville-Gullied land complex, 30 to 50 percent slopes	53	VIIe-3	87
NxE	Newville-Lodo-Gullied land complex, 30 to 50 percent slopes	53	VIIe-3	87
Oa	Orland loam	54	IIs-0	80
Od	Orland loam, very deep	54	I-1	79
Odp	Orland loam, deep over claypan	54	IIs-3	81

Map symbol	Mapping units	Described on page	Capability unit Symbol	Capability unit Page
Omp	Orland loam, moderately deep over claypan	54	IIIs-3	82
Omr	Orland loam, moderately deep over gravel	54	IIIw-0	82
Oms	Orland loam, moderately deep over gravelly loam	54	I-1	79
Osg	Orland loam, shallow over gravel	55	IVs-4	84
Osm	Orland loam, shallow over gravelly loam	55	IIs-4	81
Owo	Orland loam, shallow over gravel, overflow	55	VIw-1	86
Ox	Orland-Cortina complex	55	IIIw-0	82
PaE	Parrish gravelly loam, 30 to 50 percent slopes	55	VIIe-3	87
PbE	Parrish gravelly loam, shallow, 30 to 50 percent slopes	55	VIIe-3	87
PbF	Parrish gravelly loam, shallow, 50 to 65 percent slopes	55	VIIe-3	87
PcD	Parrish-Gullied land complex, 10 to 30 percent slopes	56	VIe-3	85
PcE	Parrish-Gullied land complex, 30 to 50 percent slopes	56	VIIe-3	87
PdD	Parrish-Yorkville-Gullied land complex, 10 to 30 percent slopes	56	VIe-3	85
PdE	Parrish-Yorkville-Gullied land complex, 30 to 50 percent slopes	56	VIIe-3	87
PeA	Perkins gravelly loam, 0 to 3 percent slopes	56	IIs-4	81
PeC	Perkins gravelly loam, 3 to 15 percent slopes	56	IIe-4	80
Pf	Plaza silt loam	57	IIIw-3	82
Pfa	Plaza silt loam, slightly saline-alkali	57	IIIw-3	82
Pg	Plaza silty clay loam	57	IIIw-3	82
Pga	Plaza silty clay loam, slightly saline-alkali	57	IIIw-3	82
Ph	Plaza silt loam, dense subsoil	57	IIIw-3	82
Pha	Plaza silt loam, dense subsoil, slightly saline-alkali	57	IIIw-3	82
Pk	Plaza silty clay loam, dense subsoil	57	IIIw-3	82
Pka	Plaza silty clay loam, dense subsoil, slightly saline-alkali	58	IIIw-3	82
Pkb	Plaza silty clay loam, dense subsoil, moderately saline-alkali	58	IIIw-6	82
PmA	Pleasanton gravelly loam, 0 to 2 percent slopes	58	IIs-4	81
PmB	Pleasanton gravelly loam, 2 to 10 percent slopes	58	IIe-4	80
Pn	Pleasanton gravelly sandy clay loam, 0 to 2 percent slopes	58	IIs-4	81
Po	Pleasanton very gravelly sandy loam, 0 to 2 percent slopes	58	IIIs-4	83
PpE	Polebar loam, 30 to 50 percent slopes	59	VIIe-3	87
PrE	Polebar-Gullied land complex, 30 to 50 percent slopes	59	VIIe-3	87
PsE	Polebar-Millsholm-Gullied land complex, 30 to 50 percent slopes	59	VIIe-3	87
PtA	Porterville clay, 0 to 2 percent slopes	60	IIIs-5	83
PtB	Porterville clay, 2 to 10 percent slopes	60	IIIe-5	81
Rg	Redding gravelly loam, 0 to 3 percent slopes	60	IVs-8	84
Rh	Riverwash	61	VIIIw-4	88
Rlb	Riz gravelly loam, moderately saline-alkali	62	IIIw-6	82
Rma	Riz silt loam, slightly saline-alkali	62	IIIw-3	82
Rmb	Riz silt loam, moderately saline-alkali	62	IIIw-6	82
Rnb	Riz silty clay loam, moderately saline-alkali	62	IIIw-6	82
Rnc	Riz silty clay loam, strongly saline-alkali	61	IVw-6	84
RosF	Rock land, sedimentary rocks	62	VIIIs-7	88
RouF	Rock land, serpentine	62	VIIIs-9	88
RovF	Rock land, volcanic rocks	62	VIIIs-7	88
RpF	Rock outcrop	63	VIIIs-7	88
Sa	Sacramento clay	63	IIIw-5	82
SbC	Sehorn soils, 3 to 15 percent slopes	64	IIIe-5	81
SbD	Sehorn soils, 15 to 30 percent slopes	64	IVe-5	83
SbE	Sehorn soils, 30 to 65 percent slopes	63	VIe-5	85
ScD	Sehorn-Gullied land complex, 10 to 30 percent slopes	64	IVe-5	83
ScE	Sehorn-Gullied land complex, 30 to 50 percent slopes	64	VIe-5	85
SdC	Sehorn-Millsholm association, 8 to 15 percent slopes	64	IIIe-5	81
SdD	Sehorn-Millsholm association, 15 to 30 percent slopes	64	IVe-5	83

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page
SdE	Sehorn-Millsholm association, 30 to 65 percent slopes	64	VIe-5	85
SeD	Sehorn-Millsholm-Gullied land complex, 15 to 30 percent slopes	64	IVe-5	83
SeE	Sehorn-Millsholm-Gullied land complex, 30 to 65 percent slopes	64	VIIe-5	87
SfC	Shedd silty clay loam, 3 to 15 percent slopes	64	IIIe-5	81
SfD	Shedd silty clay loam, 15 to 30 percent slopes	65	IVe-5	83
SfE	Shedd silty clay loam, 30 to 50 percent slopes	65	VIe-5	85
SgD	Shedd-Altamont association, 10 to 30 percent slopes	65	IVe-5	83
ShC	Shedd-Altamont-Gullied land complex, 8 to 15 percent slopes	65	IIIe-5	81
SkD	Sheetiron gravelly loam, 10 to 30 percent slopes	66	IVe-4	83
SkE	Sheetiron gravelly loam, 30 to 50 percent slopes	65	VIe-4	85
SkF	Sheetiron gravelly loam, 50 to 65 percent slopes	66	VIIe-4	87
SlD	Sheetiron gravelly loam, shallow, 10 to 30 percent slopes	66	VIe-4	85
SlD2	Sheetiron gravelly loam, shallow, 10 to 30 percent slopes, eroded	66	VIe-4	85
SlE	Sheetiron gravelly loam, shallow, 30 to 50 percent slopes	66	VIe-4	85
SlE2	Sheetiron gravelly loam, shallow, 30 to 50 percent slopes, eroded	66	VIe-4	85
SlF	Sheetiron gravelly loam, shallow, 50 to 65 percent slopes	66	VIIe-4	87
SlF2	Sheetiron gravelly loam, shallow, 50 to 65 percent slopes, eroded	66	VIIe-4	87
Sm	Stockton clay	66	IIIw-5	82
Sn	Stockton clay, moderately deep	67	IIIw-5	82
So	Stockton clay, very deep	67	IIIw-5	82
Sp	Stockton clay, deep, overflow	67	IVw-1	84
Sr	Stockton clay, moderately deep, overflow	67	IVw-1	84
Ss	Stockton clay, moderately deep, frequent overflow	67	VIw-1	86
StE	Stonyford clay, 30 to 65 percent slopes	67	VIIe-5	87
SuE	Stonyford gravelly clay loam, 20 to 50 percent slopes	67	VIIIs-8	88
SuE2	Stonyford gravelly clay loam, 20 to 50 percent slopes, eroded	67	VIIIs-8	88
SuF	Stonyford gravelly clay loam, 50 to 65 percent slopes	67	VIIIs-8	88
SuF2	Stonyford gravelly clay loam, 50 to 65 percent slopes, eroded	67	VIIIs-8	88
SvE	Stonyford-Henneke complex, 30 to 65 percent slopes	68	VIIIs-8	88
Sw	Sunnyvale clay	68	IIIw-5	82
Sxa	Sunnyvale silty clay, slightly saline-alkali	68	IIIw-5	82
Sy	Sunnyvale silty clay loam	69	IIIw-3	82
Ta	Tehama loam, moderately deep over gravel, 0 to 2 percent slopes	69	IIIw-0	82
Tb	Tehama loam, deep to gravel, 0 to 3 percent slopes	69	IIs-3	81
TcA	Tehama clay loam, 0 to 2 percent slopes	69	IIs-3	81
TcB	Tehama clay loam, 2 to 10 percent slopes	69	IIe-3	80
Tf	Tehama fine sandy loam, 0 to 3 percent slopes	69	IIs-3	81
Tg	Tehama gravelly loam, 0 to 3 percent slopes	69	IIs-4	81
Th	Tehama gravelly loam, moderately deep over hardpan, 0 to 2 percent slopes	69	IIIs-3	82
Tk	Tehama gravelly fine sandy loam, moderately deep over gravel, 0 to 2 percent slopes	70	IIIs-4	83
Tm	Tehama silt loam, 0 to 3 percent slopes	69	IIs-3	81
Tn	Tehama silt loam, water table, 0 to 2 percent slopes	70	IIIw-3	82
ToB	Tehama-Gullied land complex, 2 to 10 percent slopes	70	IIe-3	80
TpF	Terrace escarpments	70	VIIe-3	87
TrD	Toomes very rocky silt loam, 10 to 30 percent slopes	70	VIIs-7	87
TsC	Toomes extremely rocky silt loam, 5 to 30 percent slopes	70	VIIs-7	87

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page
TtE	Tyson gravelly loam, 30 to 50 percent slopes	71	VIIe-8	87
TuD	Tyson gravelly loam, deep, 10 to 30 percent slopes	71	VIe-8	86
TuE	Tyson gravelly loam, deep, 30 to 50 percent slopes	71	VIe-8	86
TvE2	Tyson gravelly loam, shallow, 30 to 50 percent slopes, eroded	71	VIIIs-8	88
TvF2	Tyson gravelly loam, shallow, 50 to 65 percent slopes, eroded	71	VIIIs-8	88
Wca	Willows clay, slightly saline-alkali	72	IIIw-5	82
Wcb	Willows clay, moderately saline-alkali	72	IIIw-6	82
Wcc	Willows clay, strongly saline-alkali	72	IVw-6	84
Wd	Willows clay, dense subsoil	73	IIIw-5	82
Wda	Willows clay, dense subsoil, slightly saline-alkali	72	IIIw-5	82
Wdb	Willows clay, dense subsoil, moderately saline-alkali	73	IIIw-6	82
Wdc	Willows clay, dense subsoil, strongly saline-alkali	73	IVw-6	84
Wg	Wyo loam, deep over gravel	74	IIs-0	80
Wh	Wyo gravelly loam, moderately deep over gravel	74	IIIs-4	83
Wm	Wyo gravelly clay loam	74	IIs-4	81
Wn	Wyo silt loam	73	I-1	79
Wo	Wyo silt loam, moderately deep over clay	74	IIIs-3	82
Wp	Wyo silt loam, deep over claypan	74	IIs-3	81
Wsa	Wyo silt loam, slightly saline-alkali	74	IIs-6	81
Wsw	Wyo silt loam, water table	74	IIIw-3	82
Yc	Yolo clay loam	74	I-1	79
Yd	Yolo clay loam, moderately deep over clay	75	IIIs-3	82
Yf	Yolo clay loam, deep over claypan	75	IIs-3	81
Yg	Yolo clay loam, moderately deep over hardpan	75	IIIs-3	82
Yh	Yolo clay loam, shallow over clay	75	IIIs-3	82
Yma	Yolo clay loam, slightly saline-alkali	75	IIIw-5	82
Yo	Yolo silt loam, silty clay loam substratum	75	IIs-3	81
YvE	Yorkville clay loam, 30 to 65 percent slopes	75	VIIe-3	87
Za	Zamora silty clay, 0 to 2 percent slopes	76	I-1	79
ZbA	Zamora silty clay loam, 0 to 2 percent slopes	76	I-1	79
ZbB	Zamora silty clay loam, 2 to 8 percent slopes	77	IIe-1	79
Zc	Zamora silty clay loam, deep over hardpan, 0 to 2 percent slopes	77	IIs-3	81
Zd	Zamora silty clay loam, deep over silty clay, 0 to 2 percent slopes	77	IIs-3	81
Zma	Zamora silty clay loam, slightly saline-alkali, 0 to 2 percent slopes	77	IIs-6	81
Zmb	Zamora silty clay loam, moderately saline-alkali, 0 to 2 percent slopes	78	IIIw-6	82