Soil Survey

Newport and Bristol Counties
Rhode Island

By
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and
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UNITED STATES DEPARTMENT OF AGRICULTURE
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INTRODUCTION

The soil survey map and report of the counties of Newport and Bristol, Rhode Island, are intended to convey information concerning the soils, crops, and agriculture of these counties to a wide variety of users.

Farmers, landowners, prospective purchasers, and tenants ordinarily are interested in some particular locality, farm, or field. They

The soil survey was done while the Division was a part of the Bureau of Chemistry and Soils.
need to know what the soil is like on a certain piece of land, what crops are adapted, what yields may be expected, and what fertilization and other soil-management practices are needed for best results. Many people do not wish to trust the entire soil survey report, and they need not do so to obtain much of the information essential to their purpose.

A person interested in a particular piece of land should first locate it on the colored soil map accompanying the report. Then, from the color and symbol, he can identify the soils on the margin of the map. By using the table of contents, he can find the description of the soils in the section on Soils and Crops. Under each soil type heading is specific information about that particular soil. There is a description of the landscape—lay of the land, drainage, stoniness (if any), vegetation, and other external characteristics—and the internal or profile characteristics of the soil—its color, depth, texture, structure, and chemical or mineralogical composition. The description includes information about the use now made of the land, crops grown, and yields obtained, and statements concerning possible uses and present and recommended management.

By referring to the section on Productivity Ratings the reader may compare the soil types as to productivity for the various crops and suitability for the growth of crops or for other uses.

For the person unfamiliar with the area or region, a general description of these counties is given in the first part of the report. Geology, physiography, regional drainage, relief, vegetation, climate, population, transportation facilities, and markets are discussed. A brief summary at the end gives a condensed description of the counties and important facts concerning the soils and agriculture.

The agricultural economist and general student of agriculture will be interested in the sections on Agricultural History and Statistics and on Productivity Ratings.

Soil specialists, agronomists, experiment station and agricultural extension workers, and students of soils and crops will be interested in the more general discussion of soils in the section on Soils and Crops as well as in the soil type descriptions. They will also be interested in the section on Productivity Ratings.

For the soil scientist, the section on Morphology and Genesis of Soils presents a brief technical discussion of the soils of the soil-forming processes that produce them.

COUNTIES SURVEYED

LOCATION AND EXTENT

Newport and Bristol Counties are in the southeastern part of Rhode Island (fig. 1). These counties are separated from Washington and Kent Counties on the west by Narragansett Bay. Newport, the county seat of Newport County, is 25 miles southeast of Providence, 20 miles southwest of Fall River, Mass., and 75 miles south of Boston, Mass. Bristol, the county seat of Bristol County, is 15 miles southwest of Providence and 60 miles southwest of Boston.

Newport County is very irregular in outline, and about one-half of its area is made up of islands, the largest of which are Rhode
Island, Conimicut, and Prudence in Narragansett Bay and Block Island in the Atlantic Ocean. Block Island is about 35 miles southwest of Newport and 15 miles northeast of Montauk Point, Long Island, N. Y. The area of Newport County is 114 square miles, or 72,960 acres. Bristol County to the north is separated from Newport County by Narragansett Bay and Mount Hope Bay. The land area of Bristol County is 24 square miles, or 15,260 acres. The total area of the two counties is 138 square miles, or 88,220 acres.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

The two counties lie largely within the Narragansett Basin division, an area of comparatively smooth low hills and glacial plains adjacent to the bay. In general, the relief is characterized by fairly smooth rounded hills with gentle slopes, the hills not exceeding 300 feet in height except at one point, and nearly level to gently undulating glacial plains. The smooth slopes of the uplands are broken here and there by short cheswopp and fairly steep slopes. From a geological point of view the area may be divided into three divisions based on the underlying rocks and glacial till or outwash material from which the soils have developed. Approximately the northern one-third of...
Bristol County is a glacial plain with nearly level to gently undulating relief. The underlying materials are stratified coarse sand and rounded pieces of gravel, and they have given rise to soils ranging in texture from loamy sand to fine sandy loam. The bedrocks underlying the rest of the area, except a narrow strip in the eastern part of Newport County along the Massachusetts State line and Block Island, consist mostly of conglomerates, sandstone, shales, and coals of the Carboniferous period. In many places these rocks have been overlain by glacial till composed of materials coarser than the underlying rocks, but the soils show the influence of the finer grained underlying rocks. Most of the soils of this area are of loam or fine sandy loam texture and are the best soils for general farm crops. A narrow strip in the eastern part of Newport County, along the State line, is underlain by granite, gneiss, schist, and other crystalline rocks. These rocks have been overlain by glacial till composed mostly of granitic material that has given rise to the Gloucester and Narragansett soils of fine sandy-loam texture.

Block Island is decidedly morainic in character and is characterized by rough, choppy, and irregular relief interspersed with numerous small fresh-water lakes and poorly drained pot holes or depressions. This island is part of a terminal moraine formed by glacial debris dumped some distance out to sea from the present shore line, and the soils are somewhat variable in texture and depth.

No large streams flow through Newport County. Drainage is effected through small streams and intermittent drains, most of which flow to the south, southwest, and southeast. They either flow through or head in the poorly drained flats and depressions of the uplands. They are not swift-flowing, have not carved out narrow valleys, and in only a few places is there any recent deposition of alluvial material. Stafford Pond in the northeast corner of Newport County is the only fresh-water lake of any consequence in the area.

Owing to continual action of waves, the coast line of the mainland and the islands of Newport County is marked by steep cliffs in many places.

Drainage in Bristol County also is effected mainly through small streams or intermittent drains, which flow into Mount Hope Bay, Narragansett Bay, or Barrington, Warren, and Kickamuit Rivers. The Barrington, Warren, and Kickamuit Rivers in the northern part of Bristol County are fairly large streams that rise and fall with the tide and are bordered in places by tidal marshes.

The elevation of the two counties ranges from sea level to a maximum of about 340 feet on Pocasset Hill in the town of Tiverton, Newport County. Except in the northeastern part of Newport County the elevation does not rise above 300 feet. The elevation over most of the area ranges from sea level to about 160 feet.

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2 Elevations from U. S. Geological Survey topographic sheets.
3 In Rhode Island, as in the other New England States, the chief political subdivision is the town. This corresponds somewhat to the township in other sections of the country, although in some respects it is more like a county in its political functioning.
Vegetation

Originally both counties were covered with a dense and vigorous forest growth * consisting of chestnut; white and pitch pines; white, red, black, and chestnut oaks; walnut; hickory; cedar; beech; birch; and maples. The distribution of the species was determined to some extent by the texture and drainage of the soils. On the lighter textured well-drained soils the predominating trees probably were various species of ash and pitch pine, and on the heavier textured upland soils the predominating trees probably were white pine, chestnut, beech, and oaks. Red maple and swamp white cedar probably were the predominating trees on the poorly drained and the organic soils, respectively.

At present about one-half of the area is practically bare of forest. The open land is under cultivation, is used for grazing, or is idle. Much of the land on Block Island, Connecticut Island, and Prudence Island, and small areas in other places near the coast have been cleared of trees and are now lying idle. Some of this land has been idle for many years, and because of the fairly strong and constant wind from the ocean reforestation has not taken place.

Scattered gray birch and red oak grow in places. A greater part of the town of Tiverton and the western part of the town of Little Compton in Newport County and parts of the town of Barrington in Bristol County support a small, and, in places, a stunted and brazenly forest growth. Small farms are scattered over these districts, but only a small percentage of the land is cleared. On the light-textured, well-drained soils white oak and scarlet oak predominate, with some red oak, black oak, pitch pine, and chestnut saplings. Blueberries and Vaccinium are common. On the heavier soils that are not so well drained, oaks predominate. The red, black, and scarlet varieties are more common than white oak. Blueberries also a few white pines, some red maples, gray birch, and chestnut saplings, together with a thick underbrush of blueberries, huckleberries, and bush huckle. On the poorly drained areas red maples predominate, with some swamp white oak, black tupelo (some gain), gray birch, yellow birch, and an underbrush of hardhack vines, buckberry, balsam, bush huckle, and sumac. Most of the present forest growth in the area is of little value except for charcoal. Most of the land in the towns of Middletown, Jamestown, and Westerly has been cleared of forest growth, except for scattered wood lots where the predominant tree is beech, with some red oak, scarlet oak, shadbush, cherry, and red maple.

On the open areas that have not been cultivated for several years bayberries, goldenrod, cherries, and blueberries form the predominant growth. The most common grasses on these areas are Colonial (Rhode Island) bentgrass, fine-leaved fescue, bromegrass, poverty grasses, Kentucky bluegrass, Canada bluegrass, and redtop. The most common weeds are ragweed, goldenrod, wild carrot, sheep sorrel, field daisy, poison-ivy, quackgrass, crabgrass, chickweed, hair-cap moss, and ladies tobacco. The weeds most common in hayfields.

*LAWRENCE, WILEY. Origin and history of the state of Rhode Island and Providence plantations. 2 v. NEW YORK. 1865-66.
Scientific and common names of the common trees, shrubs, and herbs in Nebraska and Benton Counties, I. N.:

**NEBRASKA**

**Scientific name** | **Common name**
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**(1)** | 
**Acer rubrum** | Red maple. 
**Alnus riparia** (L.) Moench. | Smooth alder. 
**Alnus rugosa** (DuRoi) Spring. | Smooth alder. 
**Betula lenta** L. | Soft black birch. 
**Betula populifolia** Marsh. | Gray birch. 
**Carya glabra** (Mill.) Sweet (Syn. *Carya glabra*). | Paper birch. 
**Cedrus deodara** (Mast.) Born. | American cypress. 
**Chiranthodendron pentaphyllum** (L.) Britt., Stokes, and Pogge. | Atlantic white-cedar. 
**Crataegus mexicana** (Britt.) Brit. | Shrub. 
**Fagus grandifolia** Ehrh. | American beech. 
**Fraxinus americana** L. | White ash. 
**Gleditsia triacanthos** L. | Honey locust. 
**Glycyrrhiza glabra** L. | Black locust (sweet gum). 
**Helianthus annuus** L. | Black-eyed Susan. 
**Physostegia virginiana** L. | Tickseed. 
**Populus fremontii** Torr. | Cottonwood. 
**Quercus borealis** W. Bar. | Swamp white oak. 
**Quercus coccinea** L. | Scarlet oak. 
**Quercus velutina** L. | Black oak. 
**Quercus nigra** L. | Swamp oak. 
**Quercus prinus** L. | Red oak. 
**Sassafras albidum** L. | Swamp white oak. 
**Tilia americana** L. | American elm. 

**SOUTH CAROLINA**

**Clethra alnifolia** L. | Summer sweet (sweet pepperbush). 
**Magnolia acuminata** (L.) Desr. (Syn. *Myrcia argentina*). | Bay laurel. 
**Magnolia grandiflora** (Koch) C. Koch. | Southern magnolia. 
**Magnolia virginica** (L.) L. | Little magnolia. 
**Kalmia latifolia** L. | Mountain laurel. 
**Kalmia angustifolia** L. | Swamp laurel. 
**Kalmia polifolia** L. | Swamp laurel. 
**Myrica pensylvanica** L. (Syn. *M. cerifera*) | Bayberry. 
**Myrica pensylvanica* L. | Bayberry. 
**Myrica cerifera* L. | Bayberry. 
**Myrica pensylvanica* L. | Bayberry. 
**Myrica cerifera* L. | Bayberry. 
**Myrica pensylvanica* L. | Bayberry. 
**Myrica cerifera* L. | Bayberry. 
**Myrica pensylvanica* L. | Bayberry. 
**Myrica cerifera* L. | Bayberry. 
**Pandanus angustifolius** L. | Evergreen pandanus. 
**Pandanus odoratissimus** L. | Evergreen pandanus. 
**Pandanus utilis** L. | Evergreen pandanus. 
**Pandanus odoratissimus** L. | Evergreen pandanus. 
**Pandanus utilis** L. | Evergreen pandanus. 
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The first settlement in the area was at Portsmouth, in Newport County. This was made in 1628 by a band of religious free thinkers who were dissenters from the Puritan Colony of Massachusetts Bay. Roger Williams, who had settled at Providence in 1636, welcomed those from Newport; Newport was founded in 2628 as the group of dissenters from the Portsmouth Colony. Newport County was incorporated in 1700 as Rhode Island County. Its present name was adopted in 1729, and the towns of Tiverton and Little Compton were annexed from Massachusetts in 1746, rounding out the present boundaries. Bristol County was incorporated in 1637 with the same county limits that it now has.

Agassiz was the chief patriarch of the early settlers. Such crops as Indian corn, rye, barley, beans, and potatoes were grown for consumption at home. Primitives every family had a few domestic animals. The prosperity of the early colonists was due largely
to the friendly policy inaugurated by Roger Williams with the Nar- raganset and Wampumag Indians. Nevertheless, a conflict between the whites and Indians was inevitable, and these struggles culminated with the "Great Swamp Fight" near Kingston in 1675. From that time on the Indians became less and less significant in the affairs of Rhode Island.

According to the federal census the total population in Newport County was 41,685 in 1920; 44,086, or 32.7 per cent, of whom were classified as rural. The average density of population was 123.3 persons a square mile. Newport, with a population of 57,426 in 1930 is the county seat and the largest and most important city in New- port County. The United States War College and one of the United States Naval training stations are located on Coasters Harbor Island near Newport. The United States Teredo Station is on Goat Island near Newport, and Fort Advance and a naval hospital are on the mainland near the city. Jamestown is the only other population center of any size in the county; other smaller trading centers are New Shoreham on Block Island, Tiverton, Little Compton, and Adamsville. The total population of Bristol County, as reported by the Federal census of 1930 was 35,820, all claimed as urban, and the average density was 1,454 a square mile. Bristol, the county seat, and Warren are the principal local trading centers.

TRANSPORTATION AND MARKETS

Highway transportation in both counties is good. Hard-surfaced State roads connect all important trading centers in both counties with Providence, Fall River, Boston, and other points. Motorbus lines serve all important points except Block Island. Motorbuses handle most of the agricultural products shipped out of the area. Ferry service is maintained from Newport, via Jamestown, to the mainland at Southport in Washington County. Daily steamboat service is available between Providence and Block Island, via Newport, for passengers, freight, and mail, Ocean-going freighters supply the two counties with such materials as lumber, coal, iron, steel, and crude and refined oil.

A branch line of the New York, New Haven & Hartford Railroad carries freight between Newport, Fall River, Providence, and other points. An electric interurban railway maintains daily passenger service between Providence, Warren, and Bristol. Good State and town roads reach all parts of both counties. Most of the town roads are hard surfaced or graveled and are kept in fair to good condition. Every community has adequate schools, churches, public libraries, and free mail service. Probably over 75 percent of the farm population has electricity and telephone service in their homes.

Newport is the principal market for the agricultural products produced in Newport County and Providence, Fall River, and Boston are markets for some of the farm produce. Roadside stands do a good business along the main roads in both counties. Bristol, Warren, Providence, and Riverside furnish the principal markets for the farm produce of Bristol County. Many farmers make a practice of catering to the tourist trade during the summer.
There are no important manufacturing industries in the area. One shipbuilding plant at Bristol is engaged in building and repairing pleasure craft. Several attempts have been made to mine coal in the town of Portsmouth, Newport County, but, as the coal is of poor quality, the mines have been abandoned. The shellfish industry is important in both counties and furnishes employment to many people. Many clams, oysters, lobsters, scallops, and mussels are obtained from the shores and waters of Narragansett Bay and the Atlantic Ocean. The shellfish in this section are of very good quality. Deep-sea fishing also is important, especially around Block Island. Swordfish, masts, bluefish, mackerel, and sea bass are some of the fish commonly caught. During the summer many people find employment on the large estates.

CLIMATE

The climate of Newport and Bristol Counties is oceanic. Because of the proximity of the Atlantic Ocean and Narragansett Bay, the climate is modified and warmed in winter and correspondingly is cooled in summer. The summers are comparatively cool, with a few periods of hot weather, generally of short duration. The winters are cold, but snow and sleet temperatures do not last long. The precipitation is uniformly distributed through the seasons. Usually the moisture supply is sufficient and is uniformly distributed for the growth of crops, although occasional droughts or excessive rainfall damage the crops considerably. The climatic conditions are favorable for general farming, dairying, market gardening, orcharding, and for the raising of livestock and poultry.

The average length of the frost-free season at Block Island, Newport County, is 217 days—from April 10 to November 12. Frost has been recorded at this station as late as April 28 and as early as October 11. The average frost-free season at Providence, Providence County, is 188 days—from April 12 to October 25. Killing frost has been recorded at this station as late as May 10 and as early as September 23. The mean temperature at Providence is several degrees cooler in winter and several degrees warmer in summer than at Block Island. The seasonal temperatures and frost-free seasons vary in the two counties, according to the proximity of the ocean and of Narragansett Bay. The frost-free season generally is sufficiently long for the nourishing of all crops commonly grown. Violent thunderstorms occur occasionally during the summer but, as a rule, do not cause heavy damage. Elaine storms also occur occasionally and may cause considerable local damage to growing crops and fruits.

The fairly cool summer climate, combined with the numerous and easily accessible beaches, makes this area a very popular summer resort. The tourist season begins about June 1 and ends about Labor Day. The trade thus created is an important source of income.

Tables 1 and 2 give the normal monthly, seasonal, and annual temperature and precipitation, as recorded by the United States Weather Bureau stations at Block Island and Providence.
<table>
<thead>
<tr>
<th>Month</th>
<th>Temperature</th>
<th>Precipitation</th>
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<td>December</td>
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Table 2.—Normal monthly, seasonal, and annual temperatures and precipitation at Providence, Providence County, R. I.

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1 Temp.
Agricultural History and Statistics

The chief pursuit of the early settlers was agriculture, which centered around Portsmouth and Newport and gradually spread to other parts of the area. Travel was difficult and transportation facilities meager, so the settlers were compelled to be practically self-sustaining. Very little produce was exchanged between communities, and trading was chiefly with the Indians. Indian corn, barley, rye, beans, and potatoes were the first crops grown. Apples were introduced in the early days, and small fruits, such as blueberries and blackberries, were important. Clearing the land of stones and trees was a very slow process, and as the fields were cleared the stones were built into stone fences. Despite the task of clearing the land, agriculture developed rapidly, especially around Newport and other parts of the two counties bordering on or near the bay and ocean. The colonial system of farming was developed extensively on the lands near Narragansett Bay, that is, most of the land was divided into large plantations averaging about 300 acres each and worked by slaves. The raising of cattle and horses became important. This section was soon able to produce such products as pork, butter, cheese, wool, and horses for export. Fishing and shipbuilding were early industries. Newport played a very important part in the early days of American history. Rhode Island's merchants traded with the West Indies, parts of continental Europe, and early in the eighteenth century coastwise trade along the North American coast became important.

With the beginning of manufacturing early in the nineteenth century the population began to concentrate in the villages and cities. The needs of these growing centers for the products of the farms and the development of transportation facilities made farming more a commercial business, and agriculture advanced rapidly until around 1880. With the still further improvement in transportation facilities, the opening up of the more fertile and easily tilled lands of the West, and the development of manufacturing in New England, many people were lured away from the Rhode Island farms. Consequently, agriculture became less and less important in Newport and Bristol Counties and in New England generally. The percentage of land in farms, according to the Federal census, decreased steadily in Newport County from 73.5 percent in 1879 to 61.3 percent in 1920. From 1920 to 1934 the percentage increased from 51.4 percent to 58.3 percent, when 42,580 acres were in farms. In Bristol County the percentage of land in farms decreased from 82.9 percent in 1879 to 48.7 percent in 1934, when 7,173 acres were in farms. In 1934, 26,227 acres in Newport County and $2,215 acres in Bristol County were improved land, including cropland and improve pasture. A fairly large percentage of the land in these two counties is, at present, in large estates or is held by large landowners or real estate companies for purposes of investment. At present, agriculture is not important on the small islands because of their distance from markets and the high cost of transportation to and from the mainland.

The present agriculture of the two counties consists principally of dairy farming, market gardening, poultry raising, and potato growing. Other enterprises of less importance are orcharding, growing of nursery stock, flower culture, small fruit culture, and cattle raising. The most intensively cultivated parts of Newport County are
in the towns of Middletown and Portsmouth, a narrow strip east of the Soloniant River in Tiverton Town, and about one-half of Little Compton Town in the southeast corner; Agriculture is of secondary importance on Block, Conanicut, and Prudence Islands.

Tables 3 and 4, compiled from the Federal censuses, give the averages of the principal crops grown in Newport and Bristol Counties in stated years.

### Table 3—Averages of the principal crops grown in Newport County, R.I., in stated years

<table>
<thead>
<tr>
<th>Crop</th>
<th>1870</th>
<th>1880</th>
<th>1890</th>
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<th>1910</th>
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<td>2,372</td>
<td>2,088</td>
<td>2,584</td>
<td>2,672</td>
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### Table 4—Averages of the principal crops grown in Bristol County, R.I., in stated years

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<table>
<thead>
<tr>
<th>Crop</th>
<th>1870</th>
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<th>1900</th>
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<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
The acreage in corn (for grain) decreased steadily since 1879 in both counties, except for a brief revival about 1909. Silage corn, however, has become increasingly important since 1919, and in 1934 the acreage in corn harvested for grain in Newport County was about half of the average in corn for other purposes. The acreage in corn harvested for forage has decreased still further since 1934. Other grains show the same decrease as corn. It will be noted that the acreage in vegetables has been important since 1909 and that the acreage increased greatly during the period 1929-34.

Hay occupies a much larger acreage than any other crop. All the hay and forage is fed to livestock on farms. At least 75 percent of the hay crop is mixed, consisting of timothy with clover, alfalfa, redtop, Colonial (Rhode Island) bentgrass, and orchard grass in varying combinations. Small acreages are devoted to alfalfa, clover alone, oats for forage, millet, wheat and vetch for forage, and wheat for grain. Many hayfields are pastured after cutting the hay.

Since 1929 the production of vegetables for market has become important. Sweet corn occupies a fairly large acreage in the two counties, and, when the sweet corn is harvested, most of the fodder is cut for silage. On some market-garden farms, sweet corn fodder is turned under as a green manure. Other market-garden crops are grown intensively in the vicinity of Newport, in Newport County, and in Bristol County. The most common truck crops are cabbage, tomatoes, beets, carrots, beans, peas, spinach, broccoli, cauliflower, squash, peppers, lettuce, onions, cucumbers, turnips, and eggplant.

Providence, Fall River, and Boston offer excellent markets for products that are not consumed locally.

The acreage in potatoes increased rapidly from 1870 to 1890 in Newport County and then decreased until 1920, after which it again increased. In Bristol County the acreage in potatoes has remained fairly constant. Potatoes are grown in both counties for market and for home use. With fertilization, spraying, and thorough cultivation good yields are obtained. Green Mountain and Irish Cobbler are the principal varieties grown.

Growing of nursery stock and flower culture are important enterprises, especially, near Newport. Several large nurseries operate in this vicinity.

Commercial fruit growing is not important in these counties, although there are several small orchards that produce apples and peaches commercially. Small fruits, such as strawberries and raspberries are grown in a limited way for market and for home use.

Table 5 gives the value of certain agricultural products of the two counties in stated years.

The use of commercial fertilizer and lime is general. Most farmers recognize the value of lime in growing legumes, for increasing crop yields in general, and as an economical method of improving cropland. A large part of the lime used in Newport and Bristol Counties comes from a lime rock quarry near North Providence, in Providence County. According to the Federal census of 1930, 26.4 percent of the farmers of Newport County used commercial fertilizer in 1929; the expenditure reported was $13,550 or $0.922.51 per farm reporting its use. In Bristol County 68.1 percent of the farms reported the use of commercial fertilizer in 1929, which had a total
TABLE 2.—Value of certain agricultural products in Newport and Bristol Counties, R. I., in stated years

<table>
<thead>
<tr>
<th>Product</th>
<th>Newport County</th>
<th>Bristol County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop</td>
<td>1910</td>
<td>1919</td>
</tr>
<tr>
<td>Potatoes</td>
<td>846,407</td>
<td>705,766</td>
</tr>
<tr>
<td>Hay and forage</td>
<td>306,410</td>
<td>396,648</td>
</tr>
<tr>
<td>Total value of crop and livestock</td>
<td>1,152,817</td>
<td>1,102,414</td>
</tr>
<tr>
<td>Value of livestock</td>
<td>816,000</td>
<td>816,000</td>
</tr>
<tr>
<td>Value of total crop and livestock</td>
<td>1,968,817</td>
<td>1,918,414</td>
</tr>
</tbody>
</table>

Commercial arated fertilizers are most commonly used. How- ever, some farmers mix their own, and some of the unused chemi- cals are applied separately. The grades of fertilizers in general use for corn are 5-8-7, 4-12-4, and 4-8-4; for market-garden crops and potatoes, 5-8-7, 6-16-10, 8-16-16, and 1-8-10. On the dairy farms most of the available manure is used on silage corn. This is supplemented with about 300 pounds of commercial fertilizer per acre. Corn is usually followed by grass, which re- ceives 300 to 400 pounds of fertilizer and 1 ton of lime per acre at seeding time. Second is used where available as a top dressing on the hayfields and is thought to be about as valuable per pound for grass as for silage. On the market-garden farms all available manure is used and 1/2 to 1 ton of fertilizer per acre annually, and lime every 2 to 3 years at the rate of 1 to 2 tons per acre. Rye and buckwheat are the crops most commonly grown as green-manure crops.

The 1930 census reported 5,250 cattle, valued at $787,176, in New- port County, and 1,700 cattle, valued at $217,916, in Bristol County. These numbers decreased slightly to 1,201 and 1,435, respectively, in 1935. The cattle are principally good dairy cattle of the Guernsey, Holstein-Friesian, and Jersey breeds. Some prized breeds of these breeds are found and prided bulls are common. Several herds of beef cattle of Hereford and Aberdeen Angus breeds are kept in Newport County. Almost all of the dairy products are marketed in the form of whole milk. In 1925, 3,671,453 gallons were produced in Newport County and 329,312 gallons in Bristol County. In 1934, the production declined slightly to 3,611,178 gallons in Newport County, and increased to 355,376 gallons in Bristol

5 Percentages, respectively, of alluvium, phosphoric acid, and potash.
County. Milk and milk products not consumed locally in these two counties find a ready market in Providence and in Fall River. Most of the roughage for the cattle is produced locally, but most of the grain and other concentrated feeds are shipped from other States. This accounts for a large percentage of the feed bill for the two counties which amounted to $819,072 in 1929, according to the Federal census. Sheep raising is not important, although the number of sheep seems to be increasing in Newport County.

Raising poultry is an important agricultural enterprise in the two counties. In 1929, 416,338 down eggs, valued at $229,431, were produced and 104,430 chickens, valued at $672,073, were raised in Newport County; whereas 225,538 down eggs, valued at $48,924, were produced and 28,738 chickens, valued at $43,974, were raised in Bristol County. In 1931, 349,288 down eggs were produced and 108,593 chickens were raised in Newport County; whereas 264,600 down eggs were produced and 46,958 chickens were raised in Bristol County. Rhode Island Red is the most important breed, with Plymouth Rock, New Hampshire Red, and White Leghorn being less important. Very little feed for poultry is produced in the counties; therefore, most of the grain is shipped in from other States. Some poultry farmers provide green feed for chickens on the range in summer. Poultry products not consumed locally are sold in Providence, Fall River, and Boston. The number of turkeys, ducks, and geese raised is small.

Hog raising is not important. Only 4,471 and 536 hogs, respectively, were reported on farms by the 1929 census in Newport and Bristol Counties. A few farmers raise hogs on a commercial scale, but practically none of them produce any pork for home use. The number of hogs, as reported by the Federal census, decreased from 5,549 in 1920 to 50 in 1925 in Newport County and from 554 in 1920 to 177 in 1925 in Bristol County. A large proportion of the hogs are of draft type and are used as work horses on the farms. One farm in Newport County has about 30 purebred breed hogs, including several Peckhorns, and is breeding horses commercially. Most of the heavy work and handling on the farms is done at present with tractors and trucks. Horses are becoming less and less important, especially on the dairy and poultry farms. The market-garden farms use hogs mostly for cultivation.

According to the 1933 Federal census the total number of farms in Newport County was 805. The average size of the farms was 45.0 acres, with the number of acres of improved land per farm averaging 52.1 acres. In Bristol County the total number of farms was 154, the average size of farm was 35.2 acres, and the improved land per farm 40.3 acres. The average assessed value of farm land and buildings was $290.48 per acre in Newport County and $360.47 per acre in Bristol County. The size of farms varies, but most of them are small.

In 1932 14.4 percent of the farms in Newport County hired labor at a total expenditure of $321,774 or an average of $1,590.04 per farm reporting. In Bristol County, 63.1 percent of the farms hired labor at a cost of $342,892 or an average of $1,350.03 for farm reporting. Most of the farm labor is done by local white men. The county agent states that the average farm wage is about $30 per
month with board or $65 to $70 without board. Farm labor has been scarce for the last few years according to many farmers and the county agent.

Farm tenure has changed little in either county since 1880. In 1864, as reported by the Federal census, 78.6 percent of the farms in Newpott County were operated by owners, 18.4 percent by tenants, and 3.0 percent by managers. In Bristol County 83.0 percent of the farms were operated by owners, 15.0 percent by tenants, and 4.1 percent by managers. The farms operated by tenants are rented on a cash basis and the amount of rent varies depending on location, improvements on the farm, and character of the soil. Some tenants lease farms for a number of years.

Most of the farmhouses in Newport and Bristol Counties are well built, modern, and in good condition. The farms are well built and sufficiently large to shelter the livestock and farm machinery and to store hay and other feeds. Farm machinery and farm equipment on a large percentage of the farms is modern and up to date.

SOIL SURVEY METHODS AND DEFINITIONS

Soil survey consists of the examination, classification, and mapping of soils in the field.

The soils are examined systematically in many locations. Test pits are dug, horizons are made, and exposures, such as those in road or railroad cuts, are studied. Each excavation exposes a series of distinct soil layers, or horizons, called, collectively, the soil profile. Each horizon of the soil as well as the parent material beneath the soil, is studied in detail; and the color, structure, porosity, consistency, texture, and content of organic matter, rocks, gravel, and stone are noted. The reaction of the soil and its content of lime and subsoils are determined by simple tests. Drainage, both internal and external, and other external features, such as relief or lay of the land, are taken into consideration, and the interrelationships of soils and vegetation are studied.

The soils are classified according to their characteristics, both internal and external, special emphasis being given to those features influencing the adaptation of the land for the growing of crop plants, grains, and trees. On the basis of these characteristics soils are grouped into classification units. The three principal ones are: (1) series, (2) type, and (3) phase. Areas of land, such as coastal beach or barge, rocky mountainous, which have no true soil, are called miscellaneous land types.

The most important of these groups is the series, which includes soils having the same genetic horizons, are similar in their important characteristics and arrangement in the soil profile, and were developed from a parent material of the same type. Thus, the series includes soils having essentially the same color, structure, and other important internal characteristics and the same natural drainage conditions and range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The soil series are given names of places or geographic features near which they were located.
first found. Thus, Newport, Gloucester, Merrimac, and Warwick are names of important soil series in these counties. Within a series soils are one or more soil types, defined according to the texture of the upper part of the soil. Thus, the class name of the soil texture, such as sandy, loamy and, sandy loam, loam, silt loam, clay loam, silty clay loam, and clay, is added to the series name to give the complete name of the soil type. For example, Newport loam and Newport sandy loam are soil types, within the Newport series. Except for the texture of the surface soil, these soil types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific character it is usually the soil unit to which agrometeoric data are definitely related. A phase of a soil type is a subgroup of soils within a type, which differ in some way, and which are, therefore, of different name. These differences may be important in soil characteristics, such as differences in relief, topography, and the degree of accelerated erosion. These differences are shown as phases. For example, within the normal range of relief for a soil type, there may be phases that are adapted to the use of machinery and the growth of cultivated crops and others that are not. Even though there may be no important differences in the soil itself or in its ability for the growth of native vegetation throughout the range in relief, these differences may be important in respect to the growth of cultivated crops. Such differences may be expressed as phases, which are superimposed on the map as a sloping or a billy phase. Similarly, soil phases have different names and may be mapped as phases, even though these differences are not reflected in the character of the soil or in the growth of native plants. The soil surveyor makes a map of the county or area, showing the location of each of the soil types, phases, and miscellaneous land types, in relation to roads, houses, streams, lakes, sections and township lines, and other local cultural and natural features of the landscape.

SOILS AND CROPS

The soils of Newport and Bristol Counties have developed under a forest cover of mixed hardwoods and pines. They do not differ essentially from soils occurring similar physiographic positions in other sections of southern New England. The materials from which the soils have developed were accumulated largely through glacial action and deposited by the receding glacier as till or as outwash by the meltwater streams. Small areas have developed from recent allu- vial material from organic accumulations. The soils are comparatively young, and the mode of deposition and character of the parent material are strong contributing factors to the soils and control their distribution.

Newport soils are by far the most extensive; they have developed from glacial materials composed largely of shales and slates.
with some sandstone and conglomerate. The Tiverton soils have
developed from materials composed largely of conglomerate, sand-
stone, and granite gravel. These soils, which are not extensive, occur
in the northeastern part of Bristol County and in the northern part
of the town of Tiverton, Newport County. The Gloucester and Nar-
rangemet soils, developed largely from granite materials, occur in the
extreme eastern parts of the towns of Tiverton and Little Compton
and on Block Island, Newport County. These soils have been in-
fluenced largely by glacial till and to less extent by the underlying
soilt. When the first white settlers arrived, about 300 years ago,
the upland soils were stony, but the stones and boulders were not so
numerous as in some other sections of New England with more roll-
ing or broken relief. This fact, together with the favorable location
and the fact that the soils when cleared produced good yields of
various crops, was conducive to the clearing of much of the land of
stone and trees. A much smaller percentage of the Gloucester and
Narrangemet soils is cleared and cultivated than the of the Newport,
Berwindon, Tiverton, and Compton soils. In no other counties in
Rhode Island and possibly in New England is there as large a per-
centage of the area of the glaciated uplands cleared of stone. Much
of the land that crop was cultivated is now in large estates or summer
colonies, lying idle, or is being held for investment purposes.

The texture and structure of a large percentage of the soils of these
two counties are conducive to good root penetration, water percola-
tion, adequate drainage, and a high water-holding capacity, and, th
therefore, the soils are adapted to a variety of crops. With proper

care and fertilization good yields are obtained. The combination of
favorable soil and a humid climate has made Rhode Island favor-
able for the growth of forests, and when the land is cleared the same
conditions favor the growth of grasses and other crops.

The soils developed on the terraces are nearly level, have good to
excessive drainage, are stone free, and are variable in texture. These
soils, in general, have developed from similar materials than the
soils of the glaciated uplands, are subject to a greater extent, and are
less fertile. Both the surface soils and subsoils have good struc-
ture, however, and produce fair to good yields of certain crops, with
fertilization and an adequate moisture supply. The largest area of
the outwash soils is in the northeastern part of Bristol County, but
small scattered areas are in Newport County. The outwash materials
have given rise to soils of the Warwick and Narraganset series, depon-
ing on whether the materials from which the soils have developed
are mostly shale and sandstone or light-colored granite materials.

The poorly drained soils occur in narrow strips throughout both
counties. Part of this land is in forest or brush, and some is cleared
or partly cleared and is utilized for pasture.

All the soils of the area are acid in all layers, varying from strongly
acid to moderately acid. In general, the Newport soils are the least
acid and the Gloucester the most acid of the till soils. The pH value
of the surface soils of the Newport soils ranges from 4.5 to 5.3,
whereas the pH value of most of the Gloucester surface soils is less
than 4. The Tiverton soils are slightly more acid than the Newport

* Field tests made with sulfur.
<table>
<thead>
<tr>
<th>Soil type</th>
<th>Acres</th>
<th></th>
<th>Soil type</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newport loam</td>
<td>1.472</td>
<td>5.1</td>
<td>Newport loam, yellow</td>
<td>1.852</td>
</tr>
<tr>
<td>Newport loam, clay</td>
<td>6.255</td>
<td>21.2</td>
<td>Newport loam, yellow</td>
<td>4.450</td>
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<tr>
<td>Newport loam, fine sandy loam</td>
<td>3.162</td>
<td>10.3</td>
<td>Newport loam, fine sandy loam, loamy sand</td>
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<td>Newport loam, fine sandy loam, loamy sand</td>
<td>3.875</td>
<td>13.4</td>
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<td>3.712</td>
</tr>
<tr>
<td>Newport loam, fine sandy loam, loamy sand, loamy sand, loamy sand</td>
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<td>7.1</td>
<td>Total</td>
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</tr>
<tr>
<td>Newport loam, fine sandy loam, loamy sand, loamy sand, loamy sand, loamy sand</td>
<td>1.523</td>
<td>5.2</td>
<td>Total</td>
<td>184.8</td>
</tr>
<tr>
<td>Newport loam, fine sandy loam, loamy sand, loamy sand, loamy sand, loamy sand, loamy sand</td>
<td>1.523</td>
<td>5.2</td>
<td>Total</td>
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<td>Newport loam, fine sandy loam, loamy sand, loamy sand, loamy sand, loamy sand, loamy sand</td>
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<td>1.523</td>
<td>5.2</td>
<td>Total</td>
<td>184.8</td>
</tr>
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</table>

The soils in Newport are a mixture of loam and fine sandy loam. The soils vary in texture from loamy sand to silty clay loam. A large percentage of the well-drained soils consist of loam and fine sandy loam. The soils vary in color from the different layers, owing to differences in drainage and in the character of the parent material from which they have developed.

Based on the fundamental characteristics that determine their importance in the agriculture of the area and their capabilities for use, the soils are arranged in the broad groups. Such factors as stoniness, relief, physiography, drainage, agricultural use, and adaptability serve as the basis for this grouping, which is as follows: (1) Newport well-drained till soils; (2) loamy well-drained till soils; (3) well-drained to dry clayey soils of the catwalk plains; (4) dry clayey soils of the catwalk; (5) imperfectly drained and poorly drained soils; and (6) miscellaneous soil types.

In the following pages the groups of soils and the individual soil types are described, and their agricultural relationships are discussed; their location and distribution are shown on the accompanying soil map; and their acreage and proportionate extent are given in table 6.
The somato well-drained till soils are members of the New-
port, Trientown, Bernardston, Narragansett, Compton, and Glou-
cester series that are free or practically free of stones on the surface.
This group of soils is by far the most important in the area from an agri-
cultural point of view, and a large percentage of them is under cultivation.
The largest areas lying idle as used for pasture are on Black Island, Conimicut Island, and Prudence Island. These
areas support mainly a shrub and grass vegetation consisting largely of
bayberry, dewberry, Colonial (Rhode Island) beachgrass, Kentucky
bluegrass, bromegrass, and poverty outgrows. A few small trees grow
from them.

The Newport and Bernardston soils, the most extensive of the
group, comprise some of the best farm land in Rhode Island. The
Newport, Bernardston, and Compton soils differ in color and in thick-
ness of the different layers, owing to development, to slight dif-
ferences in compositions of the parent materials, and to slight dif-
ferences in drainage. For instance, the Compton soils are darker
throughout than the Newport soils, because the till from which the
Compton soils have developed contains a higher percentage of shale.
On the other hand, the Bernardston soils are influenced less by the
state and drainage is better, therefore, the different layers are lighter
colored than the corresponding layers in the Newport soils.

The Tiverton, Narragansett, and Gloucester soils are of compara-
tively small extent, but they are important in the sections of the
coastal areas where they occur.

On probably 50 percent of the soils of this group, the relief ranges
from nearly level or gently sloping (pl. 1 and 8) to sloping, that is,
the slope does not exceed about 30 percent. In a few places there are
narrow strips where the slopes may be as much as 35 to 40 percent,
and on Block Island the relief is decidedly rolling in places. Both
surface and internal drainage are fair to good. The Gloucester soils
are the best drained of the group. The other soils are underlain by
fairly compact tills containing pebbles and cobbles, and so rapid.

Erosion is not a serious problem, but sheet erosion is rather active on
some of the sloping areas if planted to clean cultivated crops
such as corn, potatoes, and market-garden crops. These soils are
managed easily and require no fertilization and care.

The heavier textured soils are best adapted to corn and hay, whereas
the lighter textured ones are well suited to the production of certain
market-garden crops. On a large percentage of the farms the fields
are large enough for tractors to be used to advantage.

Newport team.—Practically all of this soil has been cleared of trees
and stumps, and most of it is cultivated or in pasture. In cultivated
fields it is characterized by a grayish-brown or brown mellow friable
loam surface soil from 3 to 6 inches thick. The surface has a slate
gray or somewhat green tinge. On a freshly cut surface or when
the material is pressed between the finge the brown color is intensi-
fied. The soil is very pale yellowish-brown or dingy-brown fri-
able porous loam coming to a depth of 10 to 20 inches where it
grades into olive-gray friable gritty and gravelly light loam. At a
depth of 20 to 30 inches below the surface little grades into dark
olive-gray or bluish-gray fairly compact but friable gritty
A. Characteristic relief of Newport loam; B, hayfield on Newport loam, level plow with silage corn in background; C, lima beans on Harmotho loam.
1. Recently sown hayfield on Dermeston loam, level plain, with nursery stock in background.  
2. Cauliflowers and squashes grown under irrigation on Dermeston loam, level plain.  
3. Characteristic level surface of the Warwick and Mortesley soils.  
4. Field with silage corn in background on Warwick very light sandy loam.
and generally partly weathered till, which is composed largely of shales, sandstone, and conglomerate materials and becomes darker, coarser, and less weathered with depth. Flat shale, sandstone, and other rock fragments are scattered over the surface and embedded in the subsoil. The gravel on the surface, however, is not sufficient to interfere appreciably with cultivation.

This soil is fairly uniform in texture, structure, and color, and it occupies long, smooth slopes (pl. 1, A) ranging from 3 to about 10 percent. Both external and internal drainage are good. Owing to the open and porous character of this soil and the fairly compact subsoil, the water-absorbing and water-holding capacities are comparatively high and internal drainage is not excessive. Under proper management this soil can easily be built up and maintained in a productive state. The relief is favorable for all farming operations. Some corn, however, must be cut back to control sheet erosion on some of the more sloping areas if planted to clean-cultivated crops. These areas should be cultivated along the contour, and the crops should be rotated with grasses and legumes as often as possible.

This soil is not extensive, but it is important in the agriculture of the area. It occurs in scattered bodies over the southern part of Bristol County, and in the towns of Portsmouth, Middletown, Little Compton, and Tiverton in Newport County.

The principal crops are hay, silage corn, market-garden crops, and potatoes. Small acreages are devoted to alfalfa, sweet corn, field corn, nursery stock, and small fruits. This is probably the best soil in the area for the production of hay and corn and hay pasture. Early timely alone or mixed, yields from 15 to 3 tons on acres, silage corn 10 to 15 tons, sweet corn 600 to 1,000 dozen ears, alfalfa 5 to 7 tons, field corn 40 to 60 bushels, and potatoes 200 to 325 bushels. Market-garden crops, such as cabbages, spinach, beans, squash, and tomatoes, yield well. Early peas, beets, carrots, and other root crops yield well but are better adapted to lighter textured soils. Some of the market gardeners stress quality rather than high yields. Cabbage yields from 200 to 400 bushels on acres, tomatoes 300 to 500 bushels, string beans 250 to 500 bushels, carrot 400 to 600 bushels, and beets 250 to 400 bushels. Markets generally receive an application of cable manure and from 1 to 2 tons of lime to the acre when needed. A few farmers also apply 200 to 300 pounds of fertilizer. Some farmers side dress with manure or seaweed if it is available. Corn receives a heavy application of manure and from 200 to 300 pounds of 5-5-7 or 5-8-7 commercial fertilizer to the acre. There is a general tendency to use a fertilizer higher in phosphorus or to add superphosphate for the corn crop. Potatoes generally are fertilized with about 1 ton to the acre of 5-5-7 or 6-9-10 commercial fertilizers. Market-garden crops receive an acre application ranging from 1,000 to 7,000 pounds of 5-8-7 commercial fertilizer and 1 ton of lime every 3 years, and manure if available. Most market gardeners turn under the as a green-manure crop in the spring. Some buckwheat is grown as a green-manure crop.

Newport loam, level phase.—Newport loam, level phase, is closely associated with typical Newport loam, and is essentially the same in all respects except relief. This soil occurs in nearly level to very gently sloping areas (pl. 1, B) or on slopes not exceeding 5 percent. Surface
drainage is not so rapid as on typical Newport loam, but both surface and internal drainage are satisfactory. Included in mapping are very small souflike areas, or depressions, where the drainage is not so good. These areas are of no great agricultural importance.

The same crops are grown in about the same proportions and management and fertiliser treatments are the same as on Newport loam. Yields of the different crops average about the same as or slightly higher than on that soil.

Newport loam, slope phase.—The slope phase of Newport loam is of very small extent and is not important agriculturally. It occurs in small scattered areas on 10- to 20-percent slope in the western parts of Tiverton and Little Compton Towns and in some parts of Middle- town and Portsmouth Towns in Newport County. Most of the slopes are rather short but as a rule have not been broken or plowed by erosion.

Owing to the slope relief, these areas are not utilized for cultivated crops, although they have been cleared of stones and trees. Most of the land is utilized for grazing purposes, the production of hay, or in lying idle. The idle areas support a stubble, weed, and grass cover of hayberry, arrowweed, goldthread, yarrow, broomedge, and Colonial (Rhode Island) beggarweed.

This soil is characterized by a 4- to 6-inch grayish-brown mellow and friable loam surface soil with small shale and sandstone fragments scattered over the surface. The subsoil is brown or pale yellowish-brown loam grading into olive-gray gravelly and gritty light loam. The subsoil varies in depth and color on dark olive-gray or bluish-gray coarse gravelly partly weathered till at a depth ranging from 32 to 24 inches. The till is fairly compact in place but breaks down easily. In some places bedrock is rather near the surface. This is a good soil for grasses and, owing to the relief and susceptibility to erosion, if cleared, it should be utilized only for the production of hay and for pasture. Hay yields from 1 to 2 tons an acre.

Newport loam, steep phase.—Newport loam, steep phase, also is of very small extent. Only two bodies, one bordering the Salmon River in the town of Portsmouth and the other in the western part of the same town, are mapped. This soil is essentially the same as Newport loam, slope phase, except in relief and in being more variable in texture and depth. The slopes range from 30 to 45 percent and are very susceptible to erosion if not managed properly. Both sheet and gully erosion have been active on the unprotected areas, and a few gullies have developed.

Most of this land is utilized for pasture, for which it is best adapted when cleared of trees. Small bodies are in mowing and a few are lying idle.

Newport fine sandy loam.—In cultivated fields, the surface soil of Newport fine sandy loam is grayish-brown mellow friable fine sandy loam 3 to 6 inches thick. Where this soil has been in grass for several years, the surface soil is well mantled with small roots and has a friable granular structure. The subsoil is pale yellowish-brown or olive-brown loam 2 to 3 inches thick. This is a good soil, but nothing friable. At a depth ranging from 16 to 30 inches below the surface the upper subsoil layer grades into olive-gray, friable, light loam or
fine sandy loam containing considerable gravel and gritty material. The lower subsoil layer rests on partly weathered glacial till from 3 to 30 inches below the surface. In all layers of this soil the brown color is intensified on a freshly cut surface or when the material is pressed between the fingers. Scattered over the surface and throughout the soil are small fragments of shale, sandstone, and other rocks.

This soil occurs in scattered areas in the southern part of Bristol County bordering the shore and in Newport County bordering the shore in the towns of Portsmouth, Jamestown, and Middletown. Probably about 60 percent of the land is under cultivation, and the rest is being used or utilized for grazing. Much of that on Prudence and Conanicut islands is idle, and bigberry, arrowwood, goldenrod, yarrow, sleep fences, broomstraw, beggarweed, and deadbeets make up the predominating vegetation.

This soil occurs on fairly long and smooth slopes ranging from 3 to 10 percent. Natural drainage is good, and the water-absorbing and water-holding capacities are good, owing to the favorable texture and structure of the surface soil and the fairly compact subsoil. The soil works up to a good tilth, is easily managed, and with proper care and fertilization can be built up to and maintained in a fairly productive state. On the more sloping areas some care should be exercised to control surface erosion if the land is platted to such crops as corn, potatoes, and market-garden crops. These latter areas should be utilized for hay and pasture as much as possible and the less sloping areas for cultivated crops.

Newport fine sandy loam is not so productive as Newport loam for such crops as hay and corn. Potatoes and market-garden crops, especially root crops, yield well with proper fertilization and care. Because of its higher texture, the fine sandy loam is slightly better drained than the loam, and, therefore, warmer earlier in the spring and is better adapted to early vegetables. Hay, silage corn, and vegetables are the more important crops grown on this soil. The different crops receive practically the same fertilizer treatment as on Newport loam. Mixed hay yields from 1 to 3 tons per acre, silage corn 8 to 14 tons, alfalfa 2 to 4 tons, potatoes 200 to 275 bushels, and sweet corn 300 to 1,000 dozen ears.

Newport fine sandy loam, level phase.—Newport fine sandy loam, level phase, occurs on nearly level or very gently sloping relief. This soil is essentially the same in profile characteristics as Newport fine sandy loam. Probably the surface soil averages a little thicker, because the smooth surface is not so subject to sheet erosion. Drainage is good, but surface run-off is not so rapid and the water-holding capacity is slightly higher than in the typical soil.

This level soil is closely associated with Newport fine sandy loam, and the total acreage is about the same. Probably a higher percentage of the land is under cultivation to the same crops and in about the same proportion than on Newport fine sandy loam. Management and fertilizer practices are essentially the same, and crop yields average about the same or a little higher. The idle land supports practically the same vegetation. Part of it is utilized for grazing.

Newport loamy fine sand.—Newport loamy fine sand is not an important soil in this area. Its principal occurrence is on Conanicut
and oliptons Island. Probably the wind has had an important part in the development of these fumy fine sands areas. At least the surface seems to be greatly influenced by white quartz sand blown in from the nearby shores of Narragansett Bay. The 6 to 8 inch surface soil is grayish-brown meadow loam fine sand containing a very small quantity of well-decomposed organic matter. Pure white quartz sand is very noticeable in this layer. The subsoil is pale yellowish-brown meadow friable fine sandy loam or loamy fine sand, which grades into gray or olive-gray loamy fine sand or medium sand at a depth ranging from 18 to 24 inches. This material rests on dark bluish-gray coarse gritty glacial till from 36 to 56 inches below the surface. The till is composed largely of materials derived from slate, schist, and sandstone. The surface soil and upper subsoil layer are practically free of stone and other small rock fragments.

The entire area of this soil is free of stone and cleared of trees, but practically all of it is being used for grazing. The vegetation consists of bayberry, cause, broomweed, poverty grass, and Colonial (Rhode Island) bentgrass. The soil occupies slopes ranging from 0 to 10 percent, and drainage is good to excessive. Owing to its inherent low fertility and low water-holding capacity, this soil is not very productive for the general farm crops. With heavy applications of manure and fertilizer, fair yields of early vegetables could be obtained when sufficient moisture is available.

Newport loamy fine sand and loamy sand soils are to be more acid in the surface soil than do the heavier textured Newport soils.

Newport loamy fine sand, level phase.—This soil is closely associated with Newport loamy fine sand, and the total areas of the two soils are about the same. The only difference in the soils is in their relief. Newport loamy fine sand, level phase, occurs in nearly level or very gently sloping areas. A few bodies of this soil are under cultivation to vegetables and sweet corn, and a small area devoted to hay. Most of the land, however, is idle until it supports the same vegetation as that growing on Newport loamy fine sand. Part of the idle land is utilized for grazing. Hay yields from 5 to 7 tons per acre, and the land supports 5 to 60 sheep per acre.

Newport loamy sand.—Newport loamy sand is one of the less extensive soils of the area. It occurs on Prudence Island, in the town of Portsmouth bordering Narragansett Bay, and also in the southwest corner of the town and in the northeast corner of the town of Middletown. It is important agriculturally, owing to its soil structure, low inherent fertility, and drought resistance. The entire area is lying idle and supports a small vegetables consisting largely of bayberry, cause, broomweed, poverty grass, and bracken ferns.

The surface soil of Newport loamy sand is grayish-brown loamy sand from 6 to 8 inches thick. The subsoil is pale yellowish-brown indurated medium loamy sand, which grades into gray loamy sand at a depth ranging from 24 to 30 inches. This material rests on bluish-gray coarse gravelly and gritty till at a depth of 36 to 42 inches. Apparently this soil is influenced more by wind-blown sand than by the underlying glacial till. The surface is free of stone and rock fragments.

Bernardston loam.—Bernardston loam differs from the Newport soils in having a lighter grayish-brown or light-brown surface soil.
and in having a yellowish-brown or reddish-brown upper subsoil layer ranging in thickness from 2 to 8 inches. In many places the upper subsoil layer is incorporated with the surface soil in plowing and importa the surface with a light-brown or light-grayish-brown color. The differences mentioned probably result from slightly bet-
der drainage and to a lower percentage of shale and stones in the glacis till from which the soil has developed.

The soil in cultivated fields of Gravitation loam is characterized by a 6- to 10-inch thick light-brown or grayish-brown shallow friable soil surface soil. In wooded areas there is a thin layer of loamfield over a rich-brown yellow loam surface soil about 6 inches thick. The upper part of the subsoil is yellowish-brown or reddish-brown shallow friable loam ranging in thickness from a few inches to 8 inches. The layer has been disturbed in many cultivated fields. The yellowish-

brown or reddish-brown layer grades into dark grayish-brown shal-

low friable loam, which continues to a depth ranging from 38 to 24 inches. Below this layer is olive-gray friable loam, which becomes darker with depth and grades into bluish-gray or greenish-gray fairly compact but friable partly weathered till at a depth ranging from 26 to 20 inches. The till is composed largely of material from shale, sandstone, and conglomerate. In places the upper part of the till is mottled with yellow, brown, and gray, and it becomes darker and coarser with depth. Small fragments of blue shale, sandstone, and other rocks are scattered over the surface but not in sufficient quan-
ty to interfere with cultivation. The subsoil also contains some small rock fragments, the quantity of which increases with depth.

Bernardston loam is fairly uniform in texture, although in places the texture approaches very fine sandy loam. Throughout the area of Bernardston karst are bodies of Newport loam which are too small to separate on a small-scale map.

Damariscotta loam occurs in the southern part of Belknap County in the towns of Portsmouth and Middletown, Newport County. It is fairly coarsegrained and is one of the most important soils in the area. The relief ranges from gently sloping to upland, the gradient being from 5 to 10 percent. Most of the slopes are long and smooth. Both surface drainage and underground drainage are good. Owing to the favor-
able texture and structure, and to the fairly compact subsoil, this soil has a comparatively high water-holding capacity, and crops seldom suffer from lack of moisture. With proper management and cultivation, the soil can be built up to and maintained in a produc-
tive state. Most areas of this soil are large enough to allow the use of tractor and other improved farm machinery. Some of the more sloping areas are subject to sheet erosion under conventional cultivation, and these should be handled in a way to reduce erosion to a minimum. This can be accomplished by strip cropping or by utilizing the slope-

ing areas for hay and pasture grasses. Probably from 90 to 95 percent of this soil is under cultivation.

A small acreage is in meadow land, and the rest is idle or is utilized for grazing. Hay, market-garden crops (fl. 1, 2), alfalfa, corn, potatoes, and sweet corn are the principal crops in the order named.

Small acreages are devoted to field, red clover, insectiary stock, orchard fruits, sweet fruits, vines, and tobacco. Thoroughly usually receive an application of stable manure and from 1 to 2 tons of lime
to the area when needed. Some farmers apply from 220 to 400 pounds of commercial fertilizer, but this is not general. Mixed hay yields from 1/2 to 2 tons per acre. Alfalfa and red clover higher applications of lime are more general at seeding time and most farmers top-dress with a high phosphorus and potash fertilizer mixture. Alfalfa yields from 8 to 9 tons per acre. Market-garden crops receive, in general, from 1,600 to 2,000 pounds of fertilizer to the acre annually and about 1 ton of lime every 5 or 6 years. A 2-4-4 mixture of commercial fertilizer is most generally used, and 4-8-4-8-10-16, and other mixtures are used less extensively. The shaping meter of rye in the spring is common on market-garden farms, Calibrating yield from 300 to 400 bushels an acre, sometimes 500 to 600 bushels, spring corn 250 to 260 bushels, carrots 200 to 200 hundred, and beets 900 to 400 bushels. Wheat yields 30 to 40 bushels, and field corn 40 to 50 bushels when heavily fertilized. Sweet corn receives about one-half ton of a 5-8-1 mixture with manure and yields 600 to 1,200 doz. corn. Silage corn receives a heavy application of manure and 100 to 400 pounds of 2-8-7, 4-8-4 or 4-12-4 commercial fertilizer. Yields range from 30 to 60 tons an acre. Potatoes are fertilized with about 1 ton of 5-8-7 or 5-10-20 commercial fertilizers, and they yield 250 to 325 hundred an acre. With the exception of one commercial peach orchard, there are very few fruit trees on this soil. The trees in this orchard have made a good growth and are in a healthy condition. Yields probably average around 100 hundred an acre.

Barnardown loam, level phase.—The level phase of Barnardown loam occurs in close association with typical Barnardown loam. It occupies the areas with nearly level to very gently sloping relief. Except in the respect the two soils are essentially the same. Because of the smooth relief, surface run-off is not so rapid as on the more sloping soil and the water-holding capacity is slightly higher. This soil is subject to very little or no sheet erosion even where used for clean-cultivated crops. The surface soil probably averages a little thicker than in the typical soil.

The total average of Barnardown loam, level phase, is about the same or a little more than the total average of the typical soil. Probably a little higher percentage of more level land is cultivated. It is devoted to the same crops and in about the same proportion as Barnardown loam (pl. 2, fl.). Crop yields are about the same or a little higher; and fertilizer and management practices are essentially the same for the two soils.

One irrigation system (pl. 3, fl.) was noted on this soil, and the owner reported that his yields averaged higher and were more consistent than on the same land without irrigation.

Compton loam.—Compton loam has developed from glacial till containing a higher percentage of dark-colored sands and slates than the GIL from which the Newport soils have developed. The surface soil of Compton loam is much darker than that of Newport loam, containing more chips of shale and slate, and the gradation between the surface soil and subsoil is not well defined. Due to the slow rate at which this dark clathy and clayey material decomposes this soil is slower to ripen than with the Newport soils.

Compton loam is characterized by a very dark grayish-brown friable heavy loam surface soil from 6 to 8 inches thick. Many shale
and slate chips are on the surface, which has a nearly black, dull appearance when wet. The surface soil grades into lighter grayish-brown or olive-brown mellow friable heavy loam. On a cut surface or when the material is pressed between the fingers, the brown color is much more pronounced in this layer. The soil material becomes darker and coarser with depth and grades into bluish-black fairly compact but friable gravelly and gritty till at a depth ranging from 15 to 20 inches below the surface. This till is compact in place but breaks down easily when crushed between the fingers, and it becomes shallower and coarser with depth. The quantity of gravel on the surface varies from place to place, also in depth. In places the gravel on the surface is very noticeable, whereas, in other places it is of no consequence.

The total area of this soil is rather small. It occurs in the northern part of the town of Portsmouth, the southwestern part of the town of Tiverton, and the northwestern part of the town of Little Compton. The relief ranges from gently sloping to steeping, and the slopes range from 3 to 10 percent. Both external and internal drainage are good but not rapid.

All this land is cleared of stones and trees and most of it is cultivated or in pasture. Mixed hay is the most important crop. Silage corn and market-garden crops occupy fairly large areas, and smaller areas are devoted to sweet corn, potatoes, and wheats. Fertilizer treatments are the same as for Newport loam and Barnardston loam.

Hay yields, from 150 to 250 tons an acre, sugar cane, 8 to 12 tons, wheats 50 to 90 bushels, potatoes 150 to 230 bushels, cabbage 200 to 250 bushels, and sweet corn 600 to 1,000 dozen ears. This soil is not easily managed on the Newport or Barnardston soils, because there is loose gravel on the surface, it is slightly heavier textured, and the soil is very shallow in places. It is well adapted to the production of such crops as hay, silage corn, cabbage, and squash.

From some of the more sloping areas erosion has removed part of the surface soil, and some care should be taken to control erosion on such areas.

Compton loam, level phase.—Except in relief, this soil is essentially the same as Compton loam. It is nearly level or very gently sloping, is subject to little or no erosion, and the surface soil probably averages a little thicker than that of the typical soil. In addition, surface drainage is fast rapid, due to the smooth relief, and it has a slightly higher water-holding capacity. The total area of the level phase is about the same as that of Compton base, and the same crops are grown on the two soils in about the same proportion. Crops on the two soils receive similar fertilizer treatments. Yields average about the same or a little higher on the level soil.

Tiverton gravelly fine sandy loam.—The Tiverton series is established for the first time in Newport and Bristol Counties, and on the soil survey of Bristol County, Mass., this soil was mapped as Coloma fine sandy loam along the Massachusetts and Rhode Island State line.

The 8-inch surface soil of Tiverton gravelly fine sandy loam in cultivated fields is grayish brown or brown gravelly fine sandy loam.
In wooded areas there is a thin covering of humus on the surface. The subsoil is yellowish-brown mellow and friable fine sandy loam or sandy loam, containing some angular rock fragments. At a depth ranging from 16 to 20 inches, the upper subsoil layer grades into yellowish-gray or olive-gray gravelly and gritty friable sandy loam, which, in turn, rests on gray or bluish-gray coarse gravelly and gritty compact till at a depth of 34 to 50 inches below the surface. The till varies from very compact to slightly compact. It is composed largely of conglomerate and sandstone, with a small percentage of granite materials. The gravel on the surface consists of angular and flat fragments of conglomerate, sandstone, slate, and granite rock. In places this soil has a greenish or gray tinge, in the surface soil and subsoil, which is characteristic of the Newport soils. The yellowish-brown upper subsoil layer, however, is much better developed in the Tiverton than in the Newport soils, and the influence of slate and slate is not nearly so pronounced.

Tiverton gravelly fine sandy loam has developed in scattered areas in the northern part of Bristol County and in the northern part of the town of Tiverton, Newport County. The total acreage is small, and practically the entire area is under cultivation. A few scattered stones of conglomerate and granite occur in places, but they do not interfere to any great extent with cultivation. Vegetables, sweet corn, potatoes, hay, and silage corn are the principal crops. Vegetable crops, such as peas, beans, tomatoes, carrots, asparagus, and sweet corn, do very well on this soil. The soil is not as well adapted to hay and corn as are the heavier textured Newport soils. Fertilizer treatments are essentially the same on this soil as on the soils previously described. Tomatoes yield from 200 to 300 bushels an acre, string beans 300 to 350 bushels, carrots 500 to 600 bushels, potatoes 500 to 600 bushels, and sweet corn 400 to 500 bushels an acre. Hay yields 1 to 2 tons and silage corn, 8 to 12 tons.

Tiverton gravelly fine sandy loam occurs on slopes having a gradient of 5 to 10 percent. Natural drainage is good. Owing to the open and porous character of this soil, the water-holding capacity is only fair, and crops may suffer in places during dry seasons. Fertilizer does not present a serious problem, but some care in cultivation and crop rotation practices should be exercised on the more sloping areas.

Tiverton gravelly fine sandy loam, level phase.—Tiverton gravelly fine sandy loam, level phase, differs from Tiverton gravelly fine sandy loam in one essential only, that is, relief. The land is nearly level or very gently sloping. This soil occurs in close association with Tiverton gravelly fine sandy loam, and practically the entire acreage is used for cultivation. The same crops are grown in about the same proportion, fertilizer treatments are the same, and crop yields average about the same or a little higher. Because of the smooth relief, the soil is subject to little or no erosion. Surface runoff is not so rapid and the water-holding capacity is slightly higher than the slope phase.

Tiverton gravelly loam.—Tiverton gravelly loam occurs in only a few scattered locations in the northeast and northwest parts of the town of Tiverton. The land is nearly level, and although natural drainage is good it is not rapid. The surface soil is grayish-brown mellow and friable gravelly loam from 6 to 8 inches thick.
The soil is pale yellowish-brown mellow loam grading into olive-gray gravelly and gritty loam at a depth ranging from 12 to 18 inches below the surface. The lower subsoil layer rests on bluish-gray compact till at a depth of 28 to 38 inches. The till beneath the loam is more compact than that under the fine sandy loam. The entire area of this soil is under cultivation, principally to hay, silage corn, and sweet corn. A very small area is devoted to vegetable crops. With proper care and fertilization, good yields of hay and silage corn are obtained. The soil is retentive of soil moisture and plant nutrients and can easily be built up to a productive state. Hay yields 15 to 2 tons an acre, silage corn 10 to 15 tons, and sweet corn 600 to 1,000 bushels.

Narragansett fine sandy loam. The 6-inch surface soil of Narragansett fine sandy loam is a grayish-brown mellow and friable fine sandy loam. In areas that have not been plowed for several years this layer is well mantled with small roots, and the surface has a weak granular structure. The upper part of the soil is a yellow-brown friable fine sandy loam, which grades into a grayish-yellow gritty and friable sandy loam layer at a depth of 14 to 18 inches below the surface. The lower part of the soil carries some angular rock fragments and roots on dark-gray compact till at a depth ranging from 23 to 30 inches. Yellow, gray, and brown mottlings are common just above the till, which is composed largely of granite materials. The texture of the surface soil varies somewhat, and in places may be very fine sandy loam.

This soil is of small extent. It occurs mainly in the northern and southeastern parts of Block Island. All the land has been cleared and cultivated at one time. Probably 30 percent is under cultivation at present, and the rest supports a vegetation consisting mainly of bayberry, goldenrod, broomweed, Colonial (Rhode Island) beechgrass, and Kentucky bluegrass. Part of the idle land is utilized for grazing. Hay, field corn, sweet corn, vegetables, and potatoes are the main crops. Sweet corn and vegetable crops are grown for home use and to supply the summer tourists on Block Island. Crop yields vary depending on management and the quantity of fertilizers and manure used. The land is capable of producing crop yields comparable to Newport or Tiverton fine sandy loams having similar relief. Commercial fertilizers are not used so extensively as on some soils previously described. Hay yields from 1 to 2 tons an acre, sweet corn yields to 1,000 bushels per acre, potatoes 150 to 250 bushels, and field corn 25 to 35 bushels.

Narragansett fine sandy loam occupies gently rolling to rolling areas. Natural drainages is good, but, owing to the compact substratum, the downward movement of water is retarded to some extent and the soil has a fairly high water-holding capacity. The more rolling areas should be left in grasses for hay or pasture, as such areas are susceptible to erosion if devoted to clean-cultivated crops.

Narragansett fine sandy loam, level phase. The soil profile of this soil is similar to or identical with that of Narragansett fine sandy loam. The only vital difference is relief, as the more level soil occupies nearly level to very gently sloping positions. Therefore, surface drainage is not so rapid and the water-holding capacity of the soil is slightly higher. This soil is subject to little or no erosion, because of the smooth relief.
This soil occurs in scattered areas in the southeastern part of the town of Tiverton, the eastern part of the town of Little Compton, and on Block Island, Newport County. The total acreage is small. This soil is closely associated with the stony Narragansett and Gloucester soils. A few scattered stones are found on the surface in places, but they do not interfere appreciably with cultivation.

Practically all of this land is cleared, and a large percentage is under cultivation. Some areas have been idle for several years and are growing up in brush, woods, and grasses. This soil is slightly superior to Narragansett fine sandy loam for the production of general crops, and with similar care and fertilizer treatments, yields compare favorably with those obtained on Newport fine sandy loam and Tiverton gravelly fine sandy loam. This is the most important soil in the sections where it occurs. Mixed hay and silage corn are the principal crops, and small gardens are devoted to vegetable crops, potatoes, and sweet corn. Yields vary according to management and fertilizer treatments. Hay yields from 1 to 2 tons an acre, silage corn from 8 to 12 tons, and potatoes 200 to 230 bushels.

Gloucester fine sandy loam.—Gloucester fine sandy loam is extensive and is important agriculturally. It occurs in small scattered areas in the southeastern part of the town of Tiverton and the eastern part of the town of Little Compton. It is closely associated with Gloucester stony fine sandy loam. The surface is practically free of stones and boulders.

In cultivated fields Gloucester fine sandy loam is characterized by a light-brown or grayish-brown mellow fine sandy loam surface soil about 6 inches thick. Small angular rock fragments of granite and gneiss are scattered over the surface. The subsoil is yellow or brownish-yellow friable fine sandy loam that grades into grayish-yellow loam and gritty sandy loam or fine sandy loam at a depth of 10 or 18 inches. The lower subsoil layer rests on loose gravelly and gravelly gray till at a depth ranging from 22 to 26 inches. The till underneath the Gloucester soils shows little or no compaction contrasted with the compact granite till of the Narragansett soils.

The relief ranges from gently sloping to rolling, with a gradient of about 3 to 10 percent. Natural drainage is good to excessive as the loose till underneath this soil is conducive to the rapid downward movement of water. This together with the fact that the Gloucester soils are sandy. Some areas have been idle for several years and then slightly inferior to the Narragansett soils for the growth of general crops.

Hay and silage corn are the principal crops. Hay yields from 1 to 2 tons an acre and silage corn from 8 to 10 tons. Small gardens are devoted to bean gardens.

STONY WELL-DRAINED TILL SOILS

The stony well-drained till soils include the stony numbers of the Gloucester, Narragansett, Tiverton, Bernardston, and Newport series. Of these, the Gloucester soils are the most extensive. The Gloucester soils have a higher percentage of coarse material throughout, makes them slightly inferior to the Narragansett soils for the growth of general crops.

Hay and silage corn are the principal crops. Hay yields from 1 to 2 tons an acre and silage corn from 8 to 10 tons. Small gardens are devoted to bean gardens.
The relief ranges from nearly level to rolling and steep. On a large proportion of the total acreage, however, the relief is favorable for farming operations, but the cost of clearing this land of stone and trees (probably from $200 to $300 an acre, depending on the quantity of stones, trees, and brush), largely prohibits its use for agricultural purposes other than forestry and grazing.

Gloucester stone fine sandy loam. — Gloucester stone fine sandy loam has developed in fairly large areas in the town of Tiverton, in small scattered areas in the northeastern part of the town of Little Compton, and on Block Island, Newport County. Most of this soil supports a second- or third-growth forest cover and brush, consisting mainly of white oak and white oak, with some black oak, pitch pine, and chestnut sprouts. The underbrush consists mainly of blueberries, sumac, brooms, and brambles. Most of the trees are small and are of little value except for firewood. A very small percentage of this soil has been cleared of trees, and it is now used largely for pasture. Small patches are used for home gardens.

In wooded areas there is a thin covering of hummock on the surface. The 1- to 2-inch heavy layer on top grayish brown on light grayish-brown fine sandy loam. In places an 1-inch layer about one-half inch thick lies just beneath the leaf mold. The upper part of the soil is yellow or light yellowish-brown loose and friable sandy loam, which, at a depth ranging from 14 to 18 inches, grades into grayish-yellow brown and grayish fine sandy loam or sandy loam. The material rests on a light gray to yellowish-gray, loose gravelly sand and sandy till at a depth ranging from 24 to 30 inches. Thin till shows very little or no compaction and is composed largely of gravel material. Numerous stones and boulders of granite and gneiss are scattered over the surface and throughout the soil mass. The depth to bedrock ranges from a few feet to about 10 feet.

The surface is nearly level, undulating, or gently rolling. Natural drainage is good to excellent.

Gloucester stone fine sandy loam, steep phase. — This soil occurs in a few small bodies in the northeastern part of the town of Little Compton and in five small bodies on Block Island. It has developed in areas having either steep slopes or steeply rolling relief.

The gneiss in the towns of Tiverton and Little Compton are in forest, whereas the granite in Block Island have been cleared of trees and now support a scrub and grass vegetation consisting of bayberry, blueberry, and vine-tangles. Colonial (Block Island) heath grass, and goldenrod. On Block Island this soil is utilized for grazing to some extent, but most of it is till.

More variations in texture and depth occur in the steep soil than in Gloucester stone fine sandy loam. Otherwise, the profile characteristics of the two soils are essentially the same.

Narragansett stone fine sandy loam. — Only a very small proportion of this soil has been cleared of trees. The rest supports a forest growth consisting mainly of red maple, red oak, white oak, white oak, and white pine. The underbrush is mostly highbush blueberry, duneberry, beachrose, and sumac (sweet pepper bush).

Narragansett stone fine sandy loam is fairly extensive in the town of Tiverton and the northeastern corner of the town of Little Compton. With the exception of two small bodies with sloping relief, this
soil has developed in nearly level or gently undulating positions. Natural drainage is good, but, owing to the smooth relief and more compact substratum, drainage is not so good as in the Gloucester soils. The tree growth is much more vigorous than on Gloucester stony fine sandy loam. In wooded areas that have not been disturbed the organic leaf mat is 1 or 2 inches thick over the 2- to 6-inch grayish-brown or dark grayish-brown mellow fine sandy loam surface soil. The upper part of the subsoil is yellowish-brown mellow and friable fine sandy loam, which grades into a grayish-yellow or yellowish-gray loose and gritty fine sandy loam or sandy loam lower subsoil layer at a depth ranging from 12 to 16 inches below the surface. This rests on gray or dark-gray compact but friable till at a depth of 24 or 26 inches. Many granite and gneiss stones and boulders are scattered over the surface and embedded in the subsoil.

**Newport stony fine sandy loam.**—This soil is similar to Newport fine sandy loam in profile characteristics and in relief. It is not so stony as the stony Gloucester and Narragansett soils, but surface stones, consisting of shale and sandstone, occur in sufficient quantities to interfere with cultivation. The total area is very small. A few small areas are located on Prudence and Patience Islands. These areas have been cleared of trees and probably were cultivated at one time. Except for a small amount of grazing, this land is not used at present. It supports a vegetative cover consisting mainly of gray birch, bayberries, dewberries, broomsedge, goldenrod, and horsebriers.

**Newport stony loam, steep phase.**—Areas of Newport stony loam having rolling to steep relief occur in small scattered bodies associated with the other Newport soils in both counties. The areas are not excessively stony on the surface, but outcrops of bedrock are common, and the soil in general is shallow and gravelly. The surface soil is brown or grayish-brown gravelly loam to a varying depth. The subsoil is pale yellowish-brown loam. In places it rests on bedrock at a depth of a few inches, and in other places it grades into olive-gray gritty loam that rests on dark bluish-gray till at a depth ranging from 12 to 18 inches below the surface. This soil is partly residual in origin.

Probably 25 percent of the total acreage has been cleared of trees and brush and is used for pasture, which affords fair grazing in places where the brush and weeds are kept out. The rest either supports forest or a growth of shrubs and herbs. The best use for the land is for pasture or for forest.

**Bernardston stony loam.**—Bernardston stony loam is not extensive. It occurs in scattered areas in Bristol County and in the northern part of the town of Portsmouth in Newport County. The soil profile is the same as that of the other Bernardston soils, and the only essential difference is in the quantity of stone on the surface. The areas are not excessively stony, but the surface stones, consisting of shale and sandstone, occur in sufficient quantity to interfere with cultivation.

About 50 percent of this land is in forests consisting mainly of beech, scarlet oak, red oak, and gray birch, with an undergrowth of blueberry, bayberry, and horsebriers. The rest has been cleared of trees, and the present vegetation consists of shrubs and herbs.
The relief ranges from gently sloping to sloping, and drainage is good.

Tiverton stony gravelly fine sandy loam.—Tiverton stony gravelly fine sandy loam is characterized by a brown or grayish-brown mellow and friable gravelly surface soil from 2 to 4 inches thick. In wooded areas that have not been disturbed, an organic leaf mant 1 or 2 inches thick covers the surface. The upper subsoil layer is yellowish-brown mellow and friable fine sandy loam or sandy loam. It grades into the yellow-brown-gray gravelly and gritty sandy loam layer under subsoil layer, which rests on dark-gray or bluish-gray till varying in compactness at a depth ranging from 22 to 28 inches below the surface. Conglomerate and sandstone stones and boulders are scattered over the surface and embedded throughout the soil mass. Flat and angular fragments of shale, sandstone, and other rocks are numerose on the surface and throughout the soil.

This soil has developed in small areas in the town of Warren, Bristol County, and in the northern part of the town of Tiverton, Newport County. It occurs on 3 to 10 percent slopes, and natural drainage is good. A large percentage of the total area is in forests including about the same species of trees as those growing on Gloucester stony fine sandy loam. The rest of the land is growing up to brush, shrubs, and herbs, except a few very small areas that are cultivated between the rocks. Some of this land and a small percentage of the forest land are utilized for pasture. This soil compares well with Gloucester stony fine sandy loam for the growth of trees and for pasture.

Tiverton stony gravelly fine sandy loam, level phase.—This soil differs from typical Tiverton stony gravelly fine sandy loam in only one respect—relief. It occupies nearly level or gently sloping areas and is closely associated with the typical soil. The total acreage is less than that of the typical soil, but approximately the same proportion of the land is in forest, the same in shrubs and herbs, and the same utilized for grazing. This soil also compares well with Narragansett stony fine sandy loam for pasture or for trees.

Tiverton stony fine sandy loam, steep phase.—This steep soil occupies slopes ranging from about 20 to 30 percent. It occurs in one fairly large body in the southwest corner of the town of Tiverton. The surface soil is more variable in depth and the depth to till or bedrock is more variable than in the Tiverton soils with smoother relief. Otherwise, the steep soil does not differ essentially in profile characteristics from the other Tiverton soils.

Owing to its steepness, the best use for this soil is either for orchard or for grazing. The soil is comparable to Gloucester stony fine sandy loam, steep phase.

WELL-DRAINED TO DROUGHTY SOILS OF THE OUTWASH PLAINS

The soils developed on the outwash plains are represented by soils of the Merrimac and Warwicke series. The Merrimac soils have developed from water-laid materials consisting mainly of granite, gneiss, and quartz; whereas the Warwicke soils have developed from water-laid materials containing a high percentage of shale, slate, sandstone, and chert. All the soils of the group are acid in all

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layers, the Warwick soils being slightly less acid, especially in the subsoil layers, than the Merrimac soils. The pH value of the surface soils ranges from 4.0 to 4.5, and of the subsurface from 4.8 to 5.3. Fairly extensive areas occur in the town of Harrington, and small scattered areas are in other parts of the two counties.

These soils are stone free, evenly tilled, and occur on level (pl. 2, C) to gently undulating relief. Drainage is good to excessive, depending on the texture and structure of the soil. The texture ranges from very fine sandy loam to heavy sand, and the inherent productivity of the different soil types is closely related to texture and depth.

In general, these soils are leached to a greater extent than the till soils; the lighter-textured members of the group are highly leached and are very low in plant nutrients. These soils warm early in the spring, are responsive to fertilization, and, therefore, are well adapted to the production of a wide variety of vegetable crops. The supply of moisture is the limiting factor on the sandier soils.

Accordingly, the Warwick and Merrimac soils with similar texture and depth are very similar; that is, Warwick fine sandy loam and Merrimac fine sandy loam have essentially the same value for the production of crops.

Warwick very fine sandy loam... Warwick very fine sandy loam is characterized by a rich-brown mellow friable very fine sandy loam surface soil from 6 to 8 inches thick. A few flat shale and slate fragments are scattered over the surface and throughout the surface soil. The upper part of the subsoil is brown and pale yellowish-brown mellow fragipan friable loam or very fine sandy loam. It grades into gray or olive-gray very fine sandy loam at a depth ranging from 16 to 18 inches below the surface. This gray layer changes to light olive-gray very fine sandy loam, mottled with brown and yellow, at a depth of about 20 inches and exists as stratified rounded sand and gravel at an average depth of 36 inches. The sand and gravel are separated by shale and slate fragments that have been removed by the action of water. The upper subsoil layer carries a small quantity of gravel, and in the lower subsoil layers the quantity increases with depth. Roots readily penetrate the subsoil layers, and worm holes are numerous.

Excluded, with these are a few small areas that carry more gravel throughout, and beds of sand and gravel are reached at a depth of about 23 inches. The total acreage of Warwick very fine sandy loam is less than 1 square mile. Practically all of the land is under cultivation, and it is one of the best general-purpose soils in the area. Drainage is good, but, owing to favorable texture and structure, the water-holding capacity is comparatively high. The soil responds to fertilization, is sensitive to applied nutrients, is easily managed, and works up into an excellent seedbed. Evaporation is not a problem because of the smooth surface.

The largest body lies east of Wapack\textsuperscript{a} Point, Westford Town, and several smaller areas are in the same vicinity. Slime corn, hay, sweet corn, and cabbage are the principal crops (pl. 2, C), but any crops common to this section do well. The soil compares well with the Bridgehampton soils in southern Rhode Island, which are considered the best soils for potatoes in the State. With heavy fertilization and care potatoes yield from 300 to 400 bushels per acre. Slime corn

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*Note: The text contains a reference to a location labeled as Wapack\textsuperscript{a} Point, which is not clearly defined in the provided context.*
yields from 10 to 14 tons to the acre when heavy applications of manure are made and from 200 to 250 pounds an acre of commercial fertilizer are used. Hay yields to 2½ tons an acre and sweet corn from 900 to 1,200 dozen ears, when the land is fertilized with about 1,000 pounds of a 5-5-7 commercial fertilizer. Cabbage yields from 250 to 350 bushels an acre. Most of the other vegetables yield as well or better on this soil than on any other soil in the area.

Warwick fine sandy loam.—Warwick fine sandy loam is more extensive than Warwick very fine sandy loam. Several good-sized bodies lie in the northwestern and southern parts of the town of Barnington, and small scattered areas are in other parts of the two counties, near or bordering Naramount Bay, Mount Hope Bay, and the Sakonnet River.

The 4- to 6-inch surface soil consists of grayish-brown or brown, mellow friable fine sandy loam. A fine flat shale and sandstone fragments are scattered over the surface and throughout the surface layer. The upper subsurface layer is light yellowish-brown mellow fine sandy loam. It grades into a lower subsurface layer of olive-gray light fine sandy loam or sandy loam at a depth of 28 to 30 inches below the surface. With depth, this material becomes lighter in texture and contains more gravel. It rests on dark-colored stratified sand and gravel, at a depth ranging from 24 to 28 inches. The surface soil and subsurface layers are open and porous, and roots penetrate them readily. The land is level to gently undulating, and drainage is good. During extremely dry seasons, crops sometimes suffer from lack of moisture, because of the moderate water-holding capacity and fairly rapid lateral drainage. Warwick fine sandy loam is more easily leached of plant nutrients and organic matter and is not so retentive of applied nutrients as Warwick very fine sandy loam.

Probably 20 to 60 percent of this soil is under cultivation; large estates, summer cottages, residential and business buildings occupy a considerable acreage, and the rest of the land is idle or in forests. The abandoned areas support a grass cover of broomstraw, poverty oatgrass, and sheep fescue, together with many haircap moss and cinquefoils.

Warwick fine sandy loam is very easy to cultivate and is responsive to fertilization and care. Hay, sweet corn, and vegetables are the main crops. Small grains are grown to slage corn, alfalfa, potatoes, apple orchards, and small fruits. The best for vegetable crops is an alfalfa. Hay, alfalfa, and clover are heavily fertilized and land ready for sweet corn and potatoes also is heavily fertilized. Hay yields from 1 to 3½ tons to the acre, slage corn 8 to 10 tons, alfalfa 2 to 3 tons, sweet corn 250 to 350 heads, tomatoes 90 to 100 bushels, potatoes 150 to 250 bushels, string beans 250 to 350 bushels, carrots 200 to 300 bushels, and beets 250 to 350 bushels. With irrigation, yields could be increased, especially in dry years, but none of this soil is irrigated.

During the course of the survey, one commercial apple orchard was noted on this soil. The trees appeared only fair, and the yields varied from 20 to 250 boxes an acre, according to the care given the orchard.

Warwick gravelly fine sandy loam.—Areas of Warwick gravelly fine sandy loam carry more gravel in the surface soil and subsurface and are shallow over bed of sand and gravel than are the areas of Warwick fine sandy loam. The 4- to 6-inch surface soil is brown or
grayish-brown gravelly fine sandy loam. The subsoil is yellowish-brown mellow fine sandy loam grading into pale yellow fine sandy loam directly overlying stratified sand and gravel at a depth ranging from 12 to 18 inches below the surface. The subsoil contains considerable shale, sandstone, and quartz gravel. The relief is level to gently undulating, and natural drainage is good to excessive. This soil is much more dry-weather than Warwick fine sandy loam.

Warwick gravelly fine sandy loam occurs in the town of Barrington, where it is closely associated with Warwick fine sandy loam. All the land has been cleared and probably all was cultivated at one time. At present, about 10 percent is devoted to vegetables and hay. Yields are lower than on Warwick fine sandy loam, but they compare well with yields on Warwick sandy loam. A rather large acreage of this soil is a building site, and the rest is lying idle or is used for pasture. On the downslopes of the ridge the vegetation consists mainly of bayberry, broomweed, poverty oatsgrass, Colonial (Rhode Island) bentgrass, dewberries, and grass. hardwoods.

Warwick sandy loam.—Warwick sandy loam is not extensive in area. It has developed in a few small scattered areas in the towns of Barrington and Warren, on Prouts Neck Island, and in a fairly large body in the extreme northern end of the town of Portsmouth.

In cultivated fields the 4- to 6-inch surface soil is grayish-brown loose friable sandy loam containing a small quantity of clay and quartz gravel. The upper part of the subsoil is light yellowish-brown sandy loam or light sandy loam that passes into yellowish-gray sandy loam or loamy sand at a depth of 16 or 18 inches below the surface. The lower part of the subsoil carries a small quantity of flat and rounded gravel, and it rests on loose insodorous coarse sand and gravel at a depth ranging from 24 to 30 inches.

Practically all of this soil has been cleared and at one time was cultivated. At present, however, less than 25 percent is under cultivation. The remainder is in building sites, a golf course, or idle. These idle areas support about the same vegetation as the idle areas of Warwick gravelly fine sandy loam. With the exception of one cranberry apple and peach orchard, the cultivated land is devoted to vegetable crops, sweet corn, and hay. The apple and peach trees are fertilized with a complete fertilizer, and lime is added occasionally. The trees yield well, and the fruit has a good color. Yields of other crops vary considerably from year to year, depending on the amount and distribution of rainfall, the fertilization, and the care with which they are managed. With irrigation and heavy applications of fertilizer and manure, and lime every 3 or 4 years, good yields of market-garden crops and sweet corn could be obtained every year. With irrigation, two or more crops could be grown on the land each year.

Merrimac fine sandy loam.—In cultivated fields the surface soil of Merrimac fine sandy loam is brown or grayish-brown mellow fine sandy loam about 6 inches thick. Where this soil has not been disturbed in wooded areas, a leaf mat from 1 to 2 inches thick covers a rich-brown mellow friable fine sandy loam. The upper subsoil layer is yellowish-brown friable fine sandy loam, grading into a grayish-yellow friable friable gritty sandy loam lower subsoil layer at a depth of 18 or 20 inches. The material
rests on gray or yellowish-gray incoherent coarse sand and rounded quartz gravel at a depth ranging from 24 to 30 inches. The surface soil contains a small quantity of gritty material and some rounded gravel in places. Nowhere is the quantity of gravel sufficiently large to interfere with cultivation.

The total acreage of Merrimac fine sandy loam is less than 1 square mile. Several small bodies occur in the vicinity of Manchester, in Newbury and north of Woburn, Hillsdale County. This soil is essentially the same as Warwick fine sandy loam as to agricultural value. The texture, structure, depth, concept of organic matter, relief, and drainage are practically the same in both soils. Probably Warwick fine sandy loam is slightly less acid in the subsoil.

Most of Merrimac fine sandy loam is under cultivation. Vegetables, sweet corn, and hay are the principal crops. Fertilization treatments are the same and yields are about the same or slightly less than on Warwick fine sandy loam.

Merrimac sandy loam—Merrimac sandy loam occurs in the northern part of the town of Warren and several fairly large bodies have developed in the town of Barrington. This soil has essentially the same physical characteristics as Merrimac fine sandy loam, except in texture and structure. It is coarser textured and more open and permeable. Little or no gravel is present above a depth ranging from 24 to 30 inches, and in most places the subsoil consists of loam of coarse gray and yellow sand, with very little gravel. Because of the loose open structure of both the surface soil and subsoil, drainage is good to excessive and the moisture-holding capacity is comparatively low. Fertilizer, lime, and moisture are rapidly leached out of this soil. Crop yields are somewhat uncertain, owing to droughts, and they average lower than on Merrimac fine sandy loam.

Probably from 40 to 50 percent of this soil is used for cultivated crops and orchard fruits. The remainder is in building sites and abandoned fields or supports a scrubby forest growth. The predominating vegetation on the abandoned areas consists of wild rose, gray birch, pitch pine, poverty aster, and birchbark maple. The wooded areas support a growth consisting mainly of white oak, scrub oak, and pitch pine, with some gray birch, yellow birch, blueberry, and sweet fern.

Market-garden crops, sweet corn, and orchard fruits are the main crops. Several small areas of asparagus were noted on this soil. Poison trees do well, with corn and liberal fertilization. The color of the fruit is very good. The apple trees noted were off-colored and the growth was not vigorous. Yields of market-garden crops, sweet corn, and other crops vary greatly, depending on the supply of moisture, fertilization, and care. In general, crop yields are essentially the same as on Warwick sandy loam.

Some of this soil is irrigated, but on Merrimac sandy loam in other parts of Rhode Island and in Massachusetts, with irrigation and heavy applications of fertilizer and lime, yields are fairly high and uniform. The fertilizer most commonly used on these irrigated farms is 1,500 to 2,000 pounds of a 5-8-7 mixture to the acre. Two or three crops are grown on the same land each year. Some farmers apply lime every year, and others every 2 to 4 years. Sweet corn,
yields 800 to 1,000 dozen ears to the acre, tomatoes 200 to 250 bushels, carrots 200 to 600 bushels, beets 200 to 500 bushels, lettuce 500 to 700 crates, lima beans 200 to 250 bushels, peppers 600 bushels, melons 50 to 100 bushels, spinach 600 to 800 bushels, and cabbage 350 bushels under irrigation.

Merrick lean sandy—Merrick lean sandy is characterized by a yellowish-brown lean sandy soil surface soil 4 inches thick. In wooded areas there is a thin covering of leaf mold on the surface. The subsoil is yellow lean sandy or sand, which becomes lighter in texture and color with depth and rests on yellowish-gray or gray coarse sand at a depth ranging from 25 to 50 inches below the surface. The subsoil contains a small quantity of rounded pieces of gravel in places, but the material is predominantly coarse sand.

Merrick lean sandy occurs in the northern part of the town of Harrington, closely associated with Merrick sandy loam. It is not extensive and is unimportant agriculturally. Owing to the loose open structure, drainage is excessive. The soil is highly leached of plant nutrients and organic matter, and applied nutrients in the form of commercial fertilizers, lime, or manure are rapidly leached out.

A very small proportion of this soil is under cultivation. The rest is in building sites, abandoned fields, or supports a scrubby forest cover consisting mainly of scrub oak. The underbrush consists mainly of blueberries, sweetfern, and wild-mints. Abandoned fields support the same vegetation as abandoned areas of Merrick sandy loam. Most of the cultivated land is used for vegetables and sweet corn. A few small apple orchards were noted on this soil, but the trees were small and off-colored. Because of the low inherent fertility and droughty character of the soil, yields of vegetables and sweet corn generally are low and uncertain. With irrigation and heavy applications of fertilizers, satisfactory yields of certain vegetable crops and sweet corn could be obtained, but the returns probably would not justify the cost of irrigation.

DRIEDGY SOILS OF THE KANES

The soils of the kanes have developed on hummocky and uneven relief and are associated with the Warwick soils of the outwash plains. Queens gravely fine sandy loam—The surface soil consists of grayish-brown moderately friable gravelly fine sandy loam from 4 to 6 inches thick. The subsoil is pale yellowish-brown loose friable gravelly and gritty sandy loam, which becomes lighter in color and texture with depth. This material rests on loose incoherent strati-

fied sand and gravel at a depth ranging from 12 to 18 inches. The deposits of sand and gravel vary in thickness. The soil is variable in depth to gravel, also in the quantity of gravel on the surface. In places beds of sand and gravel are very near the surface. All layers are acid. The pH value of the surface soil ranges from 4.5 to 8 and of the subsuel layers from 4 to 6.
Areas of Quissett gravelly fine sandy loam are most common in the town of Barrington and on Prudence Island. Small scattered areas occur in other parts of the area. On account of the humusy and uneven relief and the open and porous structure of the surface soil and subsoil, this soil is excessively drained and highly leached. The best use for the land, other than for building sites, is for grazing and forestry purposes. Probably about 10 percent of the total acreage is used for the production of hay or for grazing. If the wood and brush are kept cut, this land furnishes fair grazing in spring and early summer. Hay yields from 15 to 1 ton per acre. The remaining 90 percent of the soil is in building sites, idle land, or in scantly forest growth. The idle or abandoned areas support a shrub and herb vegetation consisting mainly of bayberry, goldenrod, hounseful, and Colonial (Blaude) beardgrass. In forested areas the predominating tree growth consists of white oak, gray birch, pitch pine, and wild cherry, and the underbrush is sumac, bayberry, sweetfern, and poison-ivy.

Included areas having a gravelly sandy loam texture are more porous and open in structure and therefore more subject to leaching than the fine textured areas of this soil. These sandy areas occur in the northern part of the town of Portsmouth.

Numerous gravel pits occur in this soil. The gravel in the subsoil is used extensively for concrete work and for road building. In general, this soil is more valuable as a source of gravel for road-building material than for agriculture.

**Imperfectly Drained and Poorly Drained Soils**

This group includes the imperfectly drained and poorly drained soils associated with the till soils and the poorly drained soils associated with the soils of the outwash plains. Because of their topographic position or of some characteristic of the soil, surface drainage, subsurface drainage, or both have been restricted to such an extent as to greatly influence crop production and land use. The imperfectly drained soils are mapped as glacial outwash and Compton soils; the poorly drained soils are members of the Mansfield, Whitman, and Scituate series.

The imperfectly drained soils are utilized in a small way for the production of silage crops and hay but are used mostly for pasture. The poorly drained soils are largely in forest or pasture. The imperfectly drained soils occur in slight depressions within areas of the well-drained soils or in narrow strips between the well-drained and the poorly drained soils. Subsurface drainage is so restricted that the schools are matted and waterlogged during wet seasons. The poorly drained soils occur in depressions, along small streams and drainageways, and at round-springs. The dark surface soils over the well-drained matted, gray, yellow, and rust-brown soils.

The Mansfield soils are associated with the Newport, Barrington, and Tiverton soils; in the sludge, conglomerate, and sandstone areas. The Whitman soils occur in granite areas with the Gloucester and Narragansett soils. The Scituate soils are associated with the semi-free Mercurea and Weywick soils. In the soil surveys of Bristol County, Mass., these latter soils were included in the Scitfield series.
Newport loam, imperfectly drained plains.—This soil is characterized by a dark-brown layer heavy lean surface soil about 6 inches thick. A small quantity of this soil and sandstone fragments are scattered over the surface and throughout the surface soil. The subsoil, to a depth of 10 or 12 inches, is brown or pale yellowish-brown loam with an olive tinge. The lower part of the subsoil is olive-gray, mottled or streaked with yellow soil brown, gritty loam. It is a dark-brown-gray complexion but fairly friable till a depth of about 34 inches. The till is composed largely of shale, conglomerate, and sandstone materials.

The relief is nearly level or gently sloping, as most of this soil occurs in slight depressions or in narrow strips bordering the poorly drained Marshfield soils. Surface drainage is fairly flat, and surface drainage is imperfect. The material in all layers is sand. Most areas of this soil are nearly free of surface stone, although there are a few stones areas in Brown County.

Newport loam, imperfectly drained plains, occurs in small scattered areas in both counties and is associated with the Newport soils. The total acreage is not very large, and the soil is not important agriculturally. Probably between 40 and 45 percent is cleared of trees, brush, and weeds, and is used for hay, pasture, and corn. Fifty, which occupies the largest acreage, yields from 1 to 10 tons an acre depending on the season and fertilization. This soil furnishes good pastures of kept free of weeds and brush. Silage corn yields from 8 to 14 tons an acre depending on the season and care. During wet seasons corn does not do well. With artificial drainage this soil could be used more extensively for corn and for certain other crops. The uncultured areas support a dense growth of trees, briar, shrubs, and herbs. Compton loam, imperfectly drained plains.—This soil is closely associated with the well-drained Compton loam. The 6-inch surface soil consists of dark brown or black heavy loam or silt loam and contains many shaly and slate chips. The subsoil is olive-gray, mottled or streaked with yellow and brown, heavy loam, which becomes drier and more highly mottled with depth. The subsoil also contains more gravel and gritty material as depth increases and rests on compact blackish-gray clay. Gravelly till composed largely of shale and slate at a depth ranging from 18 to 24 inches below the surface. This soil is drier, slightly less acid, and contains more gravel throughout than does Newport loam, imperfectly drained plains.

It occurs in slight depressions or in narrow strips between the well-drained and poorly drained soils. The relief is nearly level to very gently sloping, and drainage is imperfect. All the land is practically stone free. A very small proportion of it is cleared of brush and weeds and is used for the production of hay or for pasture. Hay yields from 1 to 9 tons an acre, and this soil furnishes good grazing even during dry seasons. The idle or brushy areas support a dense growth of red maple, white ash, elm, box elder, hackberry, bold dock, horsetail, seige grass, colonial (Rhode Island) grasses, Kentucky bluegrass, and sweet vernalgrass. These areas provide good grazing in places where the brush and weeds are not too thick.

Manifold silty clay loam.—The 6-inch surface soil consists of dark grayish-brown or black silty clay loam. In places there is a thin
overlying nonclastic material over the surface. The surface soil generally is wet and plastic, but when dry it cracks and becomes hard. The subsoil is gray or dark gray, mottled or streaked with yellow and brown, silt loam, which becomes lighter in color and more gritty with depth. It has a noticeable bluish-green cast in places and muddles, at a depth of about 24 inches, by a bluish-gray coarse gravelly compact till composed largely of sand, silt, and sandstone materials. This soil is acid in all layers. The pH value of the surface soil ranges from 4.5 to 5.8 and the subsoil is slightly basic.

This soil occurs in level or gently sloping areas, generally occupying depressions or narrow bodies along the drainageways. Natural drainage is poor, and the soil is waterlogged part of the time. This is the most extensive Mansfield soil and occurs in small areas associated with the Newport and Riverton soils in both counties.

Areas of this soil are practically free of large surface stone. The land is used almost exclusively for pasture and for woodland. Probably 20 percent of the total acreage has been cleared of trees, brush, and weeds, and it supports a grass cover consisting mainly of sods, Colonial (Rhode Island) bentgrass, Kentucky bluegrass, and sweet vernalgrass. These trees furnish good pasture during the summer. With drainage this soil could be used for hay, corn, and certain other cultivated crops. The remaining 80 percent of this soil either supports a forest growth consisting of red maple, black tupelo (suspi- gum), elm, eastern redbud, ash, swamp white oak, yellow birch, sassafras, arrowwood, and hawthorn or a scattered growth of some of the trees mentioned with an undergrowth of shrubs and herbs. A large percentage of these areas is also pastured, and their value for grazing depends on how thick the trees, shrubs, and herbs are. Without artificial drainage the best use for this soil is either for grazing or for forestry.

Mansfield stony silty clay loam.—Mansfield stony silty clay loam is similar in profile characteristics to Mansfield silty clay loam. Shale, conglomerate, and sandstone boulders and stones are scattered over the surface and embedded in the soil. This soil is not so extensive as Mansfield silty clay loam, but it occurs in small scattered bodies closely associated with that soil. It occupies the same topographic positions, and drainage is about the same or a little more retarded, owing to the presence of stones. This soil supports the same vegetation and is utilized for grazing and for forestry. Because of the stone content it has a lower potential value for agricultural purposes than Mansfield silty clay loam.

Mansfield silt loam.—Mansfield silt loam is characterized by a dark grayish-brown or nearly black illuvial surface soil about 6 inches thick. The surface soil is mellow and friable when dry, and it is slightly plastic when wet. In places a thin layer of organic matter covers the surface. The subsoil is olive-gray, mottled with yellow and brown, silt loam, which becomes more highly mottled and slightly lighter in texture with depth. This section bluish-gray coarse gravelly illuvium at a depth ranging from 24 to 30 inches. This soil is practically free of large surface stones. In places a few stones are scattered over the surface and small boulders of shale and other rock fragments are common.

Mansfield silt loam is of small extent. It occurs in scattered areas in the town of Middlesex and the southern part of the town of

SOIL SURVEY OF NEWPORT AND BRISTOL COUNTIES, R. I.
Portsmouth. A fairly large body is in the extreme southeastern part of the town of Little Compton. The relief is nearly level or gently sloping as the soil occupies slight depressions or narrow depressed areas along streamcourses. Drainage is poor, and the soil is not used for cultivated crops. A very small percentage is used for hay, and the remainder is used for pasture or in forest. Areas of this soil support the same type of vegetation as Mansfield silty clay loam. When kept free of brush and weeds, the pastures are fairly good during the summer without the use of fertilizer. Without artificial drainage this soil is best suited for grazing or for pasture.

Mansfield loam—Mansfield loam is most commonly associated with the lighter textured Newport and Tiverton soils in both counties. It occupies the same topographic positions as the other Mansfield soils, and it is also poorly drained and waterlogged part of the time. The surface soil consists of a dark-brown or nearly black loam or light loam underlain by gray or olive-gray, mottled with yellow and brown, loam or sandy loam. The material in all layers is acid. The surface is nearly free of stones, but small angular rock fragments are scattered over the surface and throughout the soil.

Because of poor drainage this soil is also used only for pasture and for forest. Areas that are fairly free of brush and weeds provide good grazing during the summer. In open areas the predominating vegetation consists of hayberry, hardhack spires, arrowwood, goldenrod, sedges, Colonial (Rhode Island) blackgrasses, Kentucky bluegrass, and sweet vernalgrasses. In forested areas the predominating vegetation consists of red maple, black tupelo (sour gum), gray birch, swamp white oak, elm, ash, arrowwood, sumac, balsam, and poison ivy. Mansfield loam is slightly less productive than the heavier soils for grasses and trees, owing to the higher content of coarse materials.

Mansfield stony loam—Mansfield stony loam differs from Mansfield loam only in the quantity of stones and boulders on the surface. These areas, in general, are not excessively stony as compared to some of the Whitman soils. Mansfield stony loam is utilized also for pasture and for forestery, and the vegetation is essentially the same as that on Mansfield loam. This soil occurs in small areas associated with the lighter textured Newport and Tiverton soils.

Whitman stony loam—Whitman stony loam is associated with the Gloucester and Narragansett soils in the town of Tiverton and the northeastern part of the town of Little Compton. It occurs in small hillside areas at the heads of creeks, in narrow bands around areas of much, or in narrow strips along the drainageways. Natural drainage is poor, and water stands on the surface in wet seasons.

The 6 to 8-inch surface soil of Whitman stony loam is very dark grayish-brown or nearly black slightly plastic loam containing considerable organic material. In places there is a thin layer of sandy material on the surface. The subsoil is gray or yellowish-gray mottled loam that becomes lighter textured with depth. The lower part of the subsoil is highly mottled with rusty brown and yellow, and at a depth ranging from 25 to 30 inches it rests on gray or dark-gray fairly compact coarse gritty silt, which is composed largely of granitic, gneiss, and other crystalline rock materials. All layers of this soil are acid—more acid than in the Mansfield soils.
Whitman sandy loam varies from medium stiff to very stiff both in the surface soil and subsoil. In places the stones are very thick on the surface, whereas on a few small areas most of the stones have been removed from the surface. Most of this soil is covered with forest consisting mainly of red maple, elm, alder, grey birch, and swamp white oak. Sumac, sumac-rush, and beech-leaves comprise the undergrowth. A few small areas are partly cleared of trees and brush and are used for pasture.

The cost of draining and clearing this kind of stone and trees prohibits its use for other purposes than forestry and grazing. It would be very difficult to drain part of this soil because of the quantity of stone and the slight depth to bedrock.

Whitman silty clay loam—Whitman silty clay loam occurs only in a few small bodies on Black Island. These bodies occupy small depressions or pot holes and are practically stone free. The surface soil consists of very dark brown or black fairly plastic silty clay loam. It overlies a grey or yellow-brown mottled heavy clay sub-soil. Natural drainage is poor, and water stands on the surface in wet seasons. These areas support a shrub and grass cover consisting mainly of blueberry, huckleberry, polypody, clubmoss (Rhizoid Island) boxwood, and sensitive fern. Grazing is the only purpose for which this soil is utilized at present.

Scarboro loam—Scarboro loam is variable in texture, structure, and color. In general the surface soil is dark-grey or nearly black mellow brown from 4 to 8 inches thick. It is sticky when wet. The surface is free of stone. In unsorted places there is a layer of partially decomposed organic matter from 1 to 3 inches thick on the surface. The upper part of the subsoil is rust-brown or brown; slightly mottled sandy loam or fine sandy loam to a very depth. In exposed cuts this layer is fairly hard, but it breaks down readily when crusted. In most places the lower part of the subsoil consists of alternate layers of gray and yellow-brown saturated incoherent sand with rust-brown mottlings or streaks. At a depth ranging from 26 to 39 inches the material is yellow-brown, grey mottled sand and gravel with slight concretion in places.

The surface soil varies from light loam to heavy loam or silty loam. In places just beneath the surface soil there is a high-grey high-leached layer. The rust-brown slightly mottled layer is missing in places, and the subsoil is grey loam or sandy loam, mottled with rust brown and yellow. This soil is strongly acid in all layers.

Scarboro loam occupies poorly drained areas on the outwash plains. It is associated with the Warwick and Morrow soils. The frit is nearly level or slightly gently toward the drainageway. Water stands on the surface in wet seasons, and the subsoil is waterlogged most of the time.

The total acreage of this soil is very small. It occurs only in the northern part of the town of Barrington. A very small percentage of the land has been cleared of trees and brush, and most of this is used for pasture, with a small area here and there planted to vegetable or sweet corn. Yields of cultivated crops are low, but the cleared areas provide fair pasturage during the summer. The wooded areas support a dense growth of red maple, swamp white oak, yellow birch, grey black, beech, sumac, sweet chestnut, and highbush blueberries.
Clearing and draining this land would require long time and expense that clearing and draining either the Mindfield or the Whitman soils, because of the absence of stumps and the loam and open substructure. If the land were cleared, however, it would require heavy application of time for the successful production of most crops. Some areas have been drained in order to control monotinosis, but no attempt has been made to reclaim such areas for agriculture.

Sebastopol fine sandy loam-Sebastopol fine sandy loam is essentially the same as Sebastopol loam except in texture. The surface soil is dark grayish-brown friable fine sandy loam or sandy loam. The subsoil is coarser throughout than the subsoil of Sebastopol loam but has the same variations in color.

Sebastopol fine sandy loam is interstices. It occurs in small areas in the town of Harrington and the northwest corner of the town of Warren. It has developed in slight depressions or along small drainage ways. Natural drainage is poor but is slightly better established than in Sebastopol loam. Practically none of this soil is used for cultivated crops. A few small areas are used for the production of hay, and the rest is used for pasture or for forest. Areas that have been cleared of trees and brush provide fair grazing. The forested areas support the same type of vegetation as the forested areas of Sebastopol loam.

Miscellaneous land types

The group of miscellaneous land types includes the scattered areas of meadow and past; with a shallow phase; peat; salt-marsh phase; tidal marsh; alluvial soils; modified forested; level sand; coastal beach; rough stony land; marsh land; unclassified city land. None of these land types is of agricultural importance for cultivated crops. The best use of them under present conditions is for forestry, grazing, and recreational purposes.

Muck and peat.-The name and past areas are composed of plant remains that have accumulated in former ponds, in depressions, and along the borders of drainage stream. These areas differ considerably from place to place in depth, degree of decomposition, and character of the material. As stripped, muck and past include deposits of organics matter that is fairly well decomposed on the surface but mostly in a raw or partly decayed condition in the lower part. Most of these deposits are more than 3 feet thick.

The surface layer consists of dark-brown or black fairly well decomposed organic matter from 6 to 15 inches thick. This material has a sticky or slick feel when wet. In places there is very little evidence of the original root litter and woody material; whereas in other places partly decayed leaves, wood, or fibrous plant remains are evident. Below this layer the material is brown or dark-brown partly decomposed remains of trees and plants. This material varies in color and degree of decomposition, depending somewhat on the character of the material. It is light in weight, spongy in places, saturated with water, and continues to a depth of 2 feet or more below the surface. Water stands on the surface of the ground most of the year. These areas are strongly acid throughout.

Four hybridized bodies of muck and past occur in the town of Tiverton and a few small, widely scattered bodies are in other parts of the
SOIL SURVEY OF NEWPORT AND BRISTOL COUNTIES, R. I. 45

two counties. None of these areas is drained; so they are not used for cultivated crops or cranberries and are used very little for grazing.

Most of this land supports a second or third-growth forest consisting mostly of red maple, grey birch, yellow birch, alder, willow, Atlantic white cedar, and black tupelo (son gani), with an undergrowth of shrubs and herbs consisting of briars, and skunk cabbage. In small areas where water stands most of the year the vegetation consists chiefly of coarse grasses and cattails.

It is not likely that any of this land will be drained and reclaimed for agriculture in the near future. Adequate drainage would be very difficult in most areas, and the returns from cultivated crops would not justify the cost of drainage.

Muck and peat, shallow slopes. The shallow areas of muck and peat differ from typical muck and peat in that the deposit lies in this over mineral soil and is slightly better decomposed throughout. The surface is dark-brown or nearly black well decomposed organic matter containing a small quantity of mineral soil in place. This material varies in thickness and grades into brown or dark-brown partly decomposed material consisting of leaves, woody material, and fibrous plant remains. This material, in turn, rests on gray, marshy, with yellow and brown-brown mineral soil at a depth ranging from 28 to 30 inches. This mineral soil ranges in texture from fine sand to course loam. All layers of shallow muck and peat are strongly acid.

This land type occupies small depressions, narrow bands around areas of deep muck and peat, and narrow strips bordering drainage ways. It occurs in small scattered areas over the two counties. Most of this land supports a forest growth essentially the same as that growing on deep muck and peat. Practically none of the land is under cultivation, and very little is used for grazing. Areas of shallow muck and peat would be less difficult to drain than the deep areas. Under present economic conditions, however, the cost of draining these areas probably would not be justified.

Peat, salt-marsh phase. The salt-marsh phase of peat is characterized by a brown or dark-brown fibrous slightly decomposed surface layer grading into darker colored coarse grained peaty material, which continues to a depth of 4 feet or more. This material varies somewhat in color and degree of decomposition from place to place. It is uniformly coarse throughout the muck and peat area, and no leaves or woody material are evident.

The salt-marsh phase is not extensive and has no agricultural importance. Areas of this type of peat are widely scattered along the coast line of the two counties, the largest being near Newport Point, Tiverton Town. The land is slightly better drained than tidal marsh, though water stands on or near the surface throughout the year. The material is spongy and marshy at all times. The vegetation consists largely of coarse sedgegrass and sedgesgrass. When cut this grass line lies value except for building firewood.

Tidal marsh. Tidal marsh includes the flat marshy areas, adjacent to or near the coast line, that are subject to regular tidal introduction. These areas consist of shallow tidal flats, which are exposed to the air during low tide and are covered with water at high tide. Tidal marsh occurs in small as well as fairly large bodies along the shores of the Atlantic Ocean, the bays, and the larger rivers in the two counties.
The surface layer consists of a brown fibrous mat of seige and grass roots, with some sand intermixed. Below this layer there is, in most places, a dark-gray sandy layer that is fairly firm in place but loose and trashy when broken up. This layer gradually changes to coarse gray sand at a depth of about 3/4 feet. Tidal marsh in the result of the mingling of the coastal beach and washed or blown over the tidal flats and mixed with finer sediments and the subsequent growth and partial decay of the coarse grasses which form the present cover. The vegetation consists of saltgrass, saltmarsh, and sedges, and the sand is thick and fairly rich in most places.

Alluvial soils, undifferentiated. - Areas of alluvial soils, undifferentiated, represent overflow land, which is variable in texture, color, and stoniness. Most of the land is poorly drained. It occurs in narrow strips along fairly rapid flowing streams and is subject to frequent overflows. The surface layer consists of dark-brown or almost black sandy loam or loam containing a fairly large quantity of organic matter. The subsurface is dark gray, mottled with brown, yellow, and brown. In places the surface layer consists of a series of gray, dark-gray, and brown layers of recent alluvium. Some areas of this soil are some free and other areas have a few coarse scattered over the surface and embedded in the soil.

This land type is very low in productivity and unimportant agriculturally. A few scattered areas are in the towns of Middletown, Tiverton, and Little Compton. They are utilized for fenistry and for grazing purposes.

Rough stony land. - Rough stony land includes areas having steep relief accompanied by many outcrops of solid rock and large boulders. Because of the relief and stoniness this land is unsuited for cultivation and is of very little value for grazing. These rough stony areas occur southwest and east of Newport, south of Jamestown, and in the west-central part of the town of Tiverton. The total acreage is not very large.

Many large estates are located on this land southwest of Newport and south of Jamestown, as these areas are near the shore and present excellent sites for oceanfront homes. Here this land demands a very high price because of its favorable location. Rough stony areas in other parts of the county support a forest cover consisting of red-cedar, red-cedar, black oak, white oak, beech, gray birch, and white pine, with an undergrowth of highbush blueberry and huckleberries. The soil material in the rough stony areas varies according to the soil type with which it is associated. It consists principally of Gloucester material, together with some Newport material. Most of the rock outcrops and boulders consist of granite and granite gneiss, and there is a small quantity of conglomerate, shale, and schist.

Coastal beach. - Coastal beach elevation the level sandy fringe, ranging from 50 to 500 feet in width, along the shore line in both counties. This material was deposited by wave action. Most of the fine material has been removed, leaving the sand assorted to some extent. This land may be covered with water at high tide or during storms. Coastal beach supports no vegetation and is of value only for recreation purposes. In places scattered pieces of gravel and cobblestones occur in sufficient quantity to make the areas unit or undrivable even for bathing beaches.
Included with coastal beach are a few areas of level sandy material that are not subject to wave action. These areas occur between the beaches and the dunes or back of the dunes and would have been classified as beach sand if they were extensive enough. These the vegetation consists of a scant cover of coarse grasses, but the sand is of no importance for agricultural purposes. The best use of such areas is for building sites.

Dune sand is developed in the sand dunes along the Atlantic coast. The sand is of medium to fine sand. This sand consists mostly of humus, or fine sand. The sand is of medium to fine sand. This sand consists mostly of humus, or fine sand.

Dune sand occurs in narrow strips scattered along the Atlantic Ocean in both counties. Generally it is associated with coastal beach. This sand is of medium to fine sand. This sand consists mostly of humus, or fine sand. The sand is of medium to fine sand. This sand consists mostly of humus, or fine sand.

Made sand—Made sand represents areas that have been changed by man from their original form. It includes excavations, dumps, filled-in areas, and areas that have been artificially leveled. These areas are of no agricultural value. The largest area occurs in the town of Barrington near a railroad. It consists of a series of narrow ridges and excavations or pits and dumps.

Unclassified city land—Most of the soils in the city of Newport have been so thoroughly turned over or filled in during building operations that it is not practicable to classify them and show them on the published maps. Such areas are referred to as unclassified city land.

**PRODUCTIVITY RATINGS**

In table 7 the soils of Newport and Bristol Counties are listed alphabetically and estimated average zero yields of the principal crops are given for each soil.

The estimates in table 7 are based primarily on interviews with farmers and agriculturalist, agent, members of the State experiment station and the college of agricultural staff and others who have had experience in the agriculture of these counties. As such, they are presented only as estimates of the average production over a period of years according to prevailing types of management. It is realized that these estimates may not apply directly to specific tracts of land for many reasons, but that as such the information given in the table is of some value to those interested in the agricultural practices of the counties. The table is of some value to those interested in the agricultural practices of the counties.

In order to compare directly the yields obtained in Newport and Bristol Counties with those obtained in other parts of the country, yield figures have been converted to numbers based on standard yields. The soils are listed in the approximate order of their general productivity under prevailing farming practices, the most productive at the head of the table.
<table>
<thead>
<tr>
<th>Soil and crop types</th>
<th>Phosphorus</th>
<th>Potassium</th>
<th>Calcium</th>
<th>Magnesium</th>
<th>Zinc</th>
<th>Copper</th>
<th>Manganese</th>
<th>Iron</th>
<th>Molybdenum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alluvial soils</td>
<td>10</td>
<td>80</td>
<td>200</td>
<td>100</td>
<td>5</td>
<td>1</td>
<td>0.5</td>
<td>1</td>
<td>0.01</td>
</tr>
<tr>
<td>Coastal sands</td>
<td>20</td>
<td>150</td>
<td>400</td>
<td>200</td>
<td>10</td>
<td>1.5</td>
<td>0.7</td>
<td>2</td>
<td>0.02</td>
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<tr>
<td>Coastal sands, loamy</td>
<td>15</td>
<td>120</td>
<td>300</td>
<td>150</td>
<td>8</td>
<td>1.2</td>
<td>0.6</td>
<td>1.5</td>
<td>0.015</td>
</tr>
<tr>
<td>Coastal sands, clayey</td>
<td>5</td>
<td>60</td>
<td>150</td>
<td>75</td>
<td>2</td>
<td>0.5</td>
<td>0.3</td>
<td>0.5</td>
<td>0.005</td>
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</tbody>
</table>

*The values are approximate and may vary depending on specific conditions.**
<table>
<thead>
<tr>
<th>Coastal Caroom area</th>
<th>Coarse gravel (0-3 mm)</th>
<th>Coarse sand (3-8 mm)</th>
<th>Medium sand (8-16 mm)</th>
<th>Fine sand (16-32 mm)</th>
<th>Silt (32-64 mm)</th>
<th>Clay (64-128 mm)</th>
<th>Loam (0-64 mm)</th>
<th>Cohesion (kgs.)</th>
<th>Stickiness (kgs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newport farm, level place</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Baralaba farm, level place</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Tarome farm, level place</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Woongarrah farm, level place</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 8.—Productivity ratings for the soils of Newport and Brissiel Counties, E. I., under present farming practices.

*Note: This table includes the principal types of farming, crops, and pastures.*
<table>
<thead>
<tr>
<th>Table 8. — Productivity ratings for the soils of Newport and Bristol Counties, R. 1., under prevailing farming practices—Continued</th>
</tr>
</thead>
</table>
| Soil family, group, and soil type | Clayey sandy loam | Clayey sandy loam clay | Clayey sandy loam clay loam | Clayey sandy loam clay loam fine | Clayey clay loam fine | Clayey clay loam fine loam | Clayey clay loam fine loam fine | Clayey clay loam fine loam fine fine | Clayey clay loam fine loam fine fine fine | Loamy fine sandy loam | Loamy fine sandy loam fine | Loamy fine sandy loam fine fine | Loamy fine sandy loam fine fine fine | Loamy fine sandy loam fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine | Loamy fine sandy loam fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine 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fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine fine 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<table>
<thead>
<tr>
<th>Grain Varieties</th>
<th>Low</th>
<th>Very low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Oats</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Wheat</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Rye</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Corn</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Rice</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Sorghum</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

1. Barley, oats, and rice are relatively hardy and can withstand low temperatures better than many other grains.
2. Wheat and rye are more susceptible to frost damage, especially when planting early.
3. Corn and rice are generally more frost-sensitive, requiring protection in cooler climates.
4. Sorghum can adapt to a wider range of temperatures, making it suitable for areas with fluctuating conditions.

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**Notes:**
- Alfalfa, clover, and rice are known for their nitrogen-fixing abilities, contributing to soil fertility.
- Diversification of the crop rotation can help manage pests and diseases effectively.
- Early planting of cereals can minimize frost damage, ensuring a higher yield.
- Barley and oats are ideal for inclusion in cereal mixtures due to their adaptability.
- Sorghum's high tolerance to temperature extremes makes it a valuable addition in cooler climates.
- Alfalfa and wheat have varying nutritional profiles, with the latter being more effective for soil conditioning.

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**References:**
The rating compares the productivity of each of the soils for each crop to a standard—100. The standard index represents the approximate average yield per acre obtained without the use of amendments on the more extensive and better soil types of the regions of the United States in which the crops are most widely grown. An index of 50 indicates that the soil is about half as productive for the specified crop as is the soil with the standard index. The standard yield for each crop shown in table 8 is given at the head of each respective column. It is to be noted that the standards given here for sweet corn, tomatoes, cabbage, string beans, carrots, beets, lettuce, and spinach have been used so far only in Rhode Island. It is not expected that they can be used satisfactorily in other regions, such as the Winter Garden area of Texas. Soils given amendments, such as lime and commercial fertilizers, or special practices, such as irrigation, and unusually productive soils of small extent may have productivity indexes of more than 100 for some crops.

The principal factors affecting the productivity of land are climate, soil (this includes the many physical, chemical, and biological characteristics, slope, drainage, and management, including the use of amendments), No one of these factors operates separately from the others, although one may dominate. In fact, the factors listed may be grouped simply as the soil factor and the management factor, as slope, drainage, and most of the aspects of climate may be considered as characteristics of a given soil type. The soil type, as such, occupies specific geographical areas characterized by a given range of slope and climatic conditions. Crop yields vary over a long period of years for the best available summation of the associated factors, and, therefore, are used where available.

The soils are listed in table 8 in the order of their general productivity according to the preceding provisions. General productivity grade numbers are assigned in the column "General productivity grade." The general productivity grade is based on a weighted average of the indexes for the various crops, the weighting depending upon the relative acreage and value of the crops. If the weighted average is between 60 and 100, the soil type is given a grade of 1; if it is between 80 and 90, a grade of 2 is given, and so on. Because it is difficult to measure mathematically either the exact significance of a crop in the agriculture of an area or the importance or suitability of certain soils for particular crops, perhaps too much significance may be given to the order in which the soils are listed. On the other hand, the arrangement will give information as to general productivity. "General productivity grade" is a broad grouping to bring out in general terms the relative productivity of the soils of Xero- and Limited Counties.

Productivity tables do not present the relative roles that soil types, because of their extent and the pattern of their distribution, play in the agriculture of the county. The tables show the relative productivity of individual soils. They cannot picture in a given county the total quantitative production of crops by soil areas without the additional

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22 Instead of following the usual procedure for weighting by tabulating the indexes of productivity for the different crops and then assigning a weighted number to each soil type, the method used in this report is to give a basic number to each soil type and to add the numbers of the crops grown, always, in any given year, an unweighted total is for each soil type. The method employed for the soil studies, however, is an attempt at an approximation of the results of all methods.
knowledge of the acreage of the individual soil types devoted to each of the specified crops.

Economic considerations have played an important part in determining the crop productivity indices. They cannot be interpreted, therefore, into land values except in a very general way. Distance to market, relative prices of farm products, and other factors influence the value of land. It is important to realize that productivity, as measured by yields, is not the only consideration that determines the relative worth of a soil for growing crops. The ease or difficulty of tillage and the ease or difficulty with which productivity is maintained, are examples of other considerations than productivity that influence the general desirability of a soil for agricultural use. In turn, steepness of slope, presence or absence of stone, the resistance to tillage offered by the soil because of its resistance to structure, and the size and shape of areas are characteristics of soils that influence the relative ease with which they can be tilled. Likewise, inherent fertility and susceptibility to erosion are characteristics that influence the ease of maintaining soil productivity at a given level. Productivity, as measured by yields, is influenced to some degree by all of these and other factors, such as moisture-holding capacity of the soil and its permeability to roots and water, and so they are not factors to be considered separately from productivity, but, on the other hand, indices of land classification to designate the relative suitability of land for agricultural use must give some separate recognition to them.

The right-hand column of table 8 gives information regarding the principal crops grown on or the use made of each soil.

LAND USES AND AGRICULTURAL METHODS

Most of the well-drained soils of Newport and Bristol Counties have favorable texture and structure for deep root penetration, adequate drainage, and good moisture-holding capacity. The soils in this area are not inherently so fertile as soils of some other parts of the United States, such as the soils of the Great Plains of the Middle West. They respond to fertilization and care, however, and are adapted to a great variety of crops in places where the stones and trees have been cleared off and the land is favorable for farming operations. With the exception of some of the light sandy soils on the outermost plain, all the cultivated soils of the two counties are capable of being built up to and maintained in a fairly productive state. No particular soil is especially adapted to any certain crop or crops. The heavier textured till soils, however, are the most productive for market garden crops as grasses, corn, small grains, and certain market-garden crops. The lighter textured soils are not quite so productive for grasses, corn, and small grains but are well suited to market-garden crops, potatoes, and small fruits with liberal fertilization and care.

In general the cultivated soils of the area are used to good advantage, and an effort is made by most farmers to build up their soils by adding hay haymow manure, commercial fertilizers, lime, and sewage and by turning under green-marrow crops. On some of the soils, the yields of market-garden crops could be greatly increased with irrigation, but the cost of irrigation is too high to justify this at present.

As dairying is an important enterprise in the area, it would seem that some of the poorly drained soils could be used to better advan-
tage for grazing. When cleared of trees, brush, and weeds, these soils furnish fair to good grazing during the late spring, summer, and early fall. A little fertilization in places would give good results on these poorly drained soils.

Some of the little land on Block Island and Conanicut Island could be used for producing vegetables to supply the summer population, as the vegetables, poultry, eggs, and milk produced on these islands are not sufficient to supply the summer trade. Of course farmers on these islands are at a disadvantage in any competition in the market on the mainland because of distance and cost of transportation.

Commercial fertilizers and lime are used extensively, especially on the market-garden farms. Unraked fertilizers are used on a few farms. There is a general tendency to use a higher phosphorus fertilizer for corn or to supplement the regular fertilizer with superphosphate. For potatoes there is a general tendency to use a commercial fertilizer with a higher percentage of potash than has been used heretofore.

Table 9 gives recommendations for the use of fertilizers for the principal farm crops of Rhode Island.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Fertilizer</th>
<th>New application until</th>
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<th>New application until</th>
<th>New application until</th>
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<tr>
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*Prepared by the Rhode Island Agricultural Experiment Station and the Extension Service of the Rhode Island Dairy Commission.*

*Numbers in italics indicate the use of a mixture of superphosphate and phosphoric acid.*
On light soils additional side dressings of soluble nitrogen materials probably will be necessary for vegetable crops, especially in years of heavy rainfall.

The fertilizer recommendations for meadow top dressing, corn, and small grains, would be reduced one-fourth to one-half when manure is used, depending on the amount applied and the quality of the manure. Unless superphosphate is used in the gaters of the stable (1 to 2 pounds per acre per day), 50 pounds per ton of manure should be used when the manure is spread.

Soils of light texture, such as Mirrimee and Warwick fine sandy loam, Murrumie and Warwick sandy loam, and Glencoe fine sandy loam, all of which are poorer producers than the better loam soils, such as Newport loam and Tiverton gravelly loam, should receive heavier application of all the fertilizers listed.

All the soils of these two counties are acid, ranging from extremely acid to medium acid. Most farmers recognize the need of lime as an economical method of improving the land and increasing crops yields in general. "Y. E. Ollind, head of Department of Plant Industry, Rhode Island State College, gives the following recommendations for the use of lime for various crops on the soils of Rhode Island.

The amount of lime needed for any farm or soil type must depend largely on the present condition of the soil and on what crops are to be grown. Light soils can be corrected for acidity with relatively less amount of lime than can the heavier soil types. However, after being brought to the right degree of acidity, the heavier soils maintain this condition longer than the lighter ones. For potatoes a pH of about 5.5 to 5.8 seems to be near optimum considering yield and freedom from rot. In less acid soil than this these crops may be more serious varieties, whereas more acid soils do not yield so well.

"These optimum results are obtained in a soil pH of 6 or better, and alfalfa does best when the soil acidity is not greater than 4.5. Again, the method of cropping and amount of manure and fertilizer must have considerable influence. When stable manure is used liberally, both clover and alfalfa can stand greater soil acidity than where little or none is used.

For nearly all market-garden crops the soils need to be limed to a near neutral point for best results.

Very few farmers practice definite crop rotation systems over a period of years, but most farmers recognize that rotation is an economical method of good farming, and some form of rotation is practiced on the better farms. The most common rotations followed, but not strictly adhered to, are as follows: (1) Corn 1 or 2 years, followed by hay and pasture to 8 years; and (2) corn 1, or 2 years, potatoes or some other early crop 1 year, followed by hay from 5 to 6 years.

On many farms, the crops are changed around so that the same one is not grown on the same field too often. A cover crop of oats generally is sown in the fall on the better farms.

The following crop rotations are suggested by the Rhode Island Agricultural Experiment Station:

- For dairy farms—(1) every 3 years: 2 years; potatoes; hay 3, 3, or 4 years; and pasture 1 to 8 years; (2) every 4 years: corn 2 to 4 years; and pasture 5 years.
- For pigs farms—(1) year: clover and rye; (2) potatoes 2 or 3 years; and pasture 5 years.
- For poultry farms—(1) potatoes and clover; (2) potatoes 2 or 3 years; and pasture 5 years.
- For greenhouses—(1) potatoes; (2) potatoes 2 to 4 years; and pasture 6 years.
- For greenhouses—(1) potatoes; (2) potatoes 2 to 4 years; and pasture 6 years.

The green manures are cut following the last harvest, mowed, or mopped, then they are baled for use in the spring. The cover crop should be grown following potatoes every year as a cover crop unless a suitable cover culture has been needed.
Rotations for vegetable growers are difficult to prescribe. Crops should be changed around so that the same one is not grown on the same land too often. Provision should be made to grow as many green-manures and cover crops of rye, buckwheat, millet, and soybeans as possible in the cropping system.

Rotations for poultry raisers are also difficult to suggest, as most poultry producers vary on this enterprise on comparatively small areas of land and the growing of feed is of minor importance.

Seeding mixtures for hay lands and pastures vary somewhat, depending on the texture, drainage, and ability of the soil to be seeded. Information on the best seeding mixture for a given soil type may be obtained from the Rhode Island Agricultural Experiment Station or from the county agent.

The crop varieties commonly grown in Newport and Bristol Counties are those generally recommended by the Rhode Island Agricultural Experiment Station and the Rhode Island Farm Bureau. Varieties of field crops, market-garden crops or vegetables, and fruits most commonly grown are as follows:

**Field crops:**
- **Corn (for grain):** Rhode Island White (for seed; for forage) - West Branch Streugheer, Regional Lancing, and Babcock; potatoes - Dutch Mountain, Irish Cobbler (early), and Chippewa (intermediate); 
- **Wheat:** French or Canadian Varieties; cherries - northern-grown seed; 
- **Oats:** winter or similar winter varieties: 
- **Beans:** Manchurian (for hay or forage).

**Market-garden crops:**
- **Tomatoes:** Yellow Bush, Golden Sunrise, and Golden Cross Burpee; cucumbers - Burpee, Trueheart, and Marglobe; eggplants - Cincinnati Improved, Waterfield (early), Summer, and Double Ballhead (late); 
- **Squash:** Hubbard, Cushaw, Red Cheese Cucumis, and冬瓜; leeks - 'Horned。

**Fruits:**
- **Apples:** McBeth, Baldwin, Greenings, and Rhode Island Greening; peaches - Elberta and Hemisphere; pears - Bartlett, strawberries - Boylston 15, Dorsett, and Ebenpeet; peaches - Canby, Northern, and Taylor; blueberries - Pioneer; 
- **Grapes:** Concord.

Soil erosion is not a serious problem on the soils in this area. Only a small percentage of the total acreage is in clean-tilled crops, and on much of this land the degree of slope is such that erosion is not serious under continuous clean cultivation where proper cultural methods are practiced. The susceptibility of land to erosion is closely associated with degree of slope, cultural methods, and the kind of crops grown. Practically all of the cultivated land in the area ranges in relief from nearly level to sloping. In other words the slopes have a gradient of not more than 10 percent. Most of the land with a slope of more than 10 percent is in grasses for hay and pasture, in forests, or lying idle with a cover of native grasses, weeds, or hay crop. Much of the cultivated land with a slope of any consequence is cultivated more or less across or not at all up and down the slope. This method of cultivation should be applied to all the cultivated land with a slope of over 3 percent. Most farmers realize the need of proper tillage and land use to protect their soils from erosion.
Probably over 60 percent of the cultivated land occurs in smooth areas with a maximum slope of 2 percent. On this land erosion is of no consequence if proper tilage and land use are practiced. On the land with slopes ranging from 3 to 10 percent more care must be taken to control the surface water after heavy rains. Much of this land fits in with the common rotation on the dairy farm, however, and is in grass for hay and pasture most of the time. The areas used for clean-cultivated crops should be cultivated along the contour as nearly as practicable and rotated as often as possible with grains and other slow-growing crops. In some instances strip cropping on the more sloping areas might be advisable.

Little attention is given to the forest land, as regards fire prevention and the control of diseases and insects. The hurricanes of September 29, 1929, worked havoc with the forests, uprooting or breaking off many of the trees. This also greatly increased the fire hazard.

Much information on crops, fertilizers, crop rotations, and crop varieties can be obtained from bulletins published by the Rhode Island Agricultural Experiment Station. These bulletins are mailed free on request.

MORPHOLOGY AND GENESIS OF SOILS

Newport and Bristol Counties lie within the Brown Podzolic soils region. The physical aspects of the area are characterized by fairly smooth rounded hills with gentle slopes and nearly level to gently undulating glacial plains. The elevation ranges from sea level to a maximum of 100 feet above, but in only one place does the elevation rise above 200 feet. The average annual rainfall is about 46 inches. Drainage ranges from good to poor. The Brown Podzolic soils region occurs in the northeastern United States south and east of the true Podzol area of New England. Essentially, the Brown Podzolic soils are imperfectly developed podzols. A normal profile in this region, under forest cover, has an organic mant over the surface from 1½ to 2 inches thick, and a very thin leached layer just beneath it. This leached layer varies from a mere film to about one-half inch in thickness. In places it is not noticeable; elsewhere it is well developed generally in the light-colored soils. The B horizon may be yellow, yellowish-brown, or brown, and it becomes lighter in color and texture with depth. In places there are the beginnings of a dark-brown earth just beneath the leached layer or the surface mant. The depth of the solon range from 24 to 30 inches in most places. Practically all of the soils developed from shales, slates, conglomerates, and sandstones have been disturbed, and it is hard to tell just how much podzolization has taken place. These soils are not so susceptible to podzolization as are those developed from granitic materials, however, because of the lower content of siliceous materials. There is some question as to whether

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Most of the soil-developed, well-developed soils of southern New England differ in main aspects from the Mid-Atlantic Podzolic soils of the Middle Atlantic and New England regions and from the Podzolic soils of the higher parts of the Piedmont Region. The present report of field survey, though it must be recognized that differences in making a thorough field survey, the Brown Podzolic soils. As a consequence, most of the soils of these two high

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April 1930.
these soils belong with the Brown Podzolic soils or the Gray-Brown Podzolic soils.

The soils have developed under a forest cover of mixed hardwoods and conifers. All the original forest cover has been cut, and the present forest consists of second- and third-growth trees of the species named. The distribution of the trees is correlated with drainage, texture, and depth of the soil. Both the climate and the soils over most of the area favor rapid growth of vegetation, and raw humus has accumulated on the surface of virgin land or even on land once cultivated but now abandoned and reverting to forest. The amount of organic matter accumulated on the surface is correlated in a general way, with the degree of drainage. On the poorly drained or imperfectly drained soils conditions are most favorable for a rapid growth of dense vegetation, and in such places the most organic matter has accumulated. On the light sandy soils, which are inextensive, the accumulation of organic matter is small because of the low fertility, droughtiness, and the consequent sparse or stunted vegetation.

The climatic conditions are such that the ground is frozen or covered with snow several months during the year, thereby preventing leaching, but having sufficient rainfall during the rest of the year to cause some leaching. The summers are sufficiently warm to allow some disintegration of the organic matter on the surface. Disintegration and leaching of the organic matter are more rapid on the light sandy soils than on the heavier textured soils. Most of the cultivated soils are deficient in organic matter and could be improved both physically and chemically by the addition of organic matter in the form of barnyard manure, seaweed, and green-manure crops. Newport and Bristol Counties lie within the glaciated region of North America, where the materials from which the soils have developed have accumulated largely through glacial action and have been deposited as till by the receding glacier or as outwash material from the melting glacier. The glacial covering from which the till soils have developed ranges in depth from very shallow to 10 feet or more. In small local areas bedrock lies at a slight depth or outcrops on the surface, on which little or no glacial debris was deposited. In such places the soils have developed partly from residual materials. The outwash materials from which the soils on the glacial plains have developed consist of rather coarse assorted materials. At the time of deposition, the till was little altered mineralogically, whereas, the outwash material was altered considerably by the loss of fine materials and minerals. Soils developed from recent alluvial materials are of very small extent in this area.

As much of the glacial material has been transported only a short distance, the underlying rock formations play an important part in the distribution of the parent material from which the soils have developed. The Gloucester and Narragansett soils have developed largely from granitic materials, and the underlying bedrock consists of granite, granitic gneiss, and a small quantity of other rocks in places. The Newport, Bernardston, and Compton soils have developed from till composed of shale, slate, conglomerate, sandstone, and schist, and the underlying rocks consist of the same materials. The soils developed chiefly from conglomerate and sandstone, with
A small quantity of granite material, as classified as Tiverton soils. The Merivale and Warren soils have developed on glacial plains from reworked outwash materials consisting mainly of shales, slates, schists, and sandstone. All the soils vary in acidity and are the same. The Quioset soils have developed on the kames from reworked outwash materials consisting largely of shales, slates, and sandstone. There are several soils from Newport and Bristol Counties. Table 10 gives the pH values of several soils from Newport and Bristol Counties.

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<th>Soil type and sample No.</th>
<th>Depth</th>
<th>pH</th>
<th>Soil type and sample No.</th>
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The mechanical analysis of a sample of Gloucester sandy loam from Middlesex, Mass., indicates that there has been little transfer of material within the profile. No significant variations in color or texture were observed. However, the chemical analysis of the same sample indicates that the iron and aluminum have been marked. The silica-silicic acid ratio of the B horizon is 0.04, and the silica-alumina ratio 0.70. The Gloucester soils from Rhode Island and Mass., are very similar, and it is assumed that the analysis of a sample of Gloucester soil from Rhode Island should give the same results.

All the soils are comparatively young. The light-textured soils in general are derived from light-textured material. There is a close correlation between the texture of the parent material and the soil. In poorly drained areas little development of a profile has taken place; whereas in the well-drained uplands the soils have reached a fair stage of maturity. Gloucester sandy loam is representative of the normal nature profile of the area. Following is a description of a profile of Gloucester sandy loam, as observed in a wooded area about 1½ miles south of Blue Corners, Newport County.
1. A thin layer of dark-brown organic matter.
2. 0 to 1 inch, grayish-brown, loose, fine sandy loam containing a small quantity of organic matter.
3. 1 to 1.5 inches, light-gray, highly leached, fine sandy loam. This layer has a very soft crumb structure and contains some roots and worm casts. The upper part is more brown than the lower part.
4. 1.5 to 2 inches, grayish-yellow loose, fine sandy loam containing a small quantity of gravel fragments and small rock fragments. This layer has a very soft crumb structure and contains some roots and worm casts. The upper part is more brown than the lower part.
5. 2 to 2.5 inches, grayish-yellow fine sandy loam containing more gravel fragments and small rock fragments than the layer above. This layer becomes darker in color and texture with depth.
6. 2.5 to 3 inches, dark-grayish or yellowish-gray fine sandy loam with a gravel and sandy clay loam horizon at a depth of 1 foot. The upper part is composed of gravel fragments and some water-rolled stones, and the lower part is composed of gravel, stones, and rock fragments. The depth to bedrock varies. It is more than 10 feet in places.

Many granule boulders are scattered over the surface and throughout the soil mass.

Gloucester fine sandy loam differs from Gloucester stony fine sandy loam only in stone content.

The Narragansett soils also have been developed from granite till and have profiles somewhat similar to those of the Gloucester soils. They differ from the Gloucester soils in having more of the finer materials throughout, in being slightly darker, and in having a compact C horizon. The content of organic matter is slightly higher in the surface layer, owing to better drainage. The upper part of the B horizon is pale yellow or more yellowish brown than the corresponding horizon in the Gloucester soils, and the lower part is darker grayish yellow. The greatest difference between the soils of these two series is in the C horizon. The C horizon of the Narragansett soils, beginning at a depth ranging from 34 to 39 inches, consists of gray or dark-gray fairly compact till that is easily broken down when crushed between the fingers. In places this compact layer is only from 1 to 2 feet thick over loose till whereas, in other places it continues to a depth of many feet. In all places it is sufficiently compact to restrict percolating water. Locally, it is called a hardpan; but it is not injurious to water and lacks the hardness and chemical characteristics of a true hardpan. Just above this compact till there are, in most places, gray, yellow, and graybrown mottlings, which are not characteristic of the Gloucester soils.

Associated with the Gloucester and Narragansett soils are small areas of poorly drained Whitman soils, which occur in small depressions along streams and around springs. Because of poor drainage these soils have not been used on the soil-forming processes to an appreciable extent and they are considered young or immature.

The Whitman soils have dark-brown or nearly black surface soils over mottled subsoils in most areas they are stony and are covered with water plant life all the time.

The Tiverton soils have developed from conglomerate, sandstone, and a smaller quantity of gravel material; and the surface soils are gravely. The characteristics of the profile are somewhat similar to those of the Narragansett soils, but as these soils are influenced more by darker materials they are slightly darker throughout and have a somewhat green cast in places. The till from which these soils have developed is fairly dark gray or bluish gray. It is fairly compact but breaks down easily when crushed. These soils may be
considered intermediate in character and composition of the parent material and in the color of the different horizons between the Gloucester and Narragansett soils on the one hand and the Newport and Narragansett soils on the other.

The Newport, Narragansett, and Compton soils have somewhat different characteristics from the soils previously described, due to the material from which they have developed. These soils have developed from glacial till composed largely of shales, slate, conglomerate, sandstone, and silt in varying proportions, and they occur for the most part in nearly level to sloping areas. These soils are not quite so acid as the soils developed from granite material.

Following is a description of a profile of Newport loam as observed four-fifths of a mile southeast of Coggeshall Point, Newport County, in a pasture that has been in soil for several years.

1. 0 to 7 inches, brown or gray-brown moisture friable loam that is well mixed with small rocks and containing some worm holes. When dry the material in this layer is yellowish brown with a smutty or olive tint, and when moderately moist it is brown. This layer has a soft organic structure when broken down, and the lower part has a weak clayey structure in places. On a freely drained surface or when the soil material is pressed between the fingers the brown color is intensified. A few small and large rock fragments of shale, sandstone, and slate are present in this layer. This layer contains worm holes in the surface when broken down. This layer is friable and has a worm-like structure.

2. 7 to 13 inches, pale yellow-brown or olive-brown moisture friable open pene planed horizon containing a few rocks, mostly rock fragments of shale, sandstone, and slate. When dry this layer is pale yellowish brown with an olive tint, and when wet the color is olive-brown to olive-dark. When the soil material is pressed between the fingers or is freshly cut surface the yellowish brown color is intensified. This layer has a weak clayey structure in place but breaks down to a soft clayey structure. Angular and flat shales and slate fragments are scattered throughout.

3. 13 to 19 inches, olive-gray friable open pene planed gravely and gravelly loam. When moist the color is dark olive gray with a somewhat brown cast. The brown color shown up more when the material is crushed between the fingers. This layer is less in place, has a soft clayey structure when broken down, and contains only a few rocks but many small worm holes.

4. 19 to 25 inches, bluish-gray or bluish-brown silt, silt-loam, and gravelly fine-grained and gravelly till composed chiefly of shale, slate, and sandstone fragments and becoming coarser with depth. When moist this till has a definite structure and the fingers are discernible and feel when rubbed between the fingers.

The pH values of the surface layer and the till determined by field tests indicate that the soil is acid.

The Narragansett and Compton soils differ somewhat from the Newport soil. Compton loam has developed from material having a higher percentage of dark-colored shale and slate and is characterized by a darker surface soil and subsoil containing more gravel and rock fragments than the Newport soils. The Compton soils are not as well developed as the Newport soils, but in places there is little gradation between the surface soil and subsoil, and in other places the depth of the soil is only 16 to 18 inches. Newport loam differs from the Newport soils in having a 2- to 8-inch yellowish-brown or light yellowish-brown layer just beneath the surface layers. This is probably due to slight pyritic conditions or to the fact that the till from which this soil has developed contains a lower percentage of dark-colored shales and slates.
Following is a description of a profile of Bernardston loam, as observed in a wooded area 1/2 miles northwest of Sandpoint, Newport County.

1. A loose and stony argil layer about 2 inches thick.

2. 0 to 2 inches, light brown, strungy tarwi loam well mantled with small roots and having a soft crumb structure.

3. 2 to 10 inches, yellow-brown brown plow pan in place but yellow and friable loam containing a few roots and some root holes and worm holes. The top of the layer is slightly tilled with organic matter. This layer also has a soft crumb structure.

4. 10 to 20 inches, grayish-brown, with a slight tinge, yellow, and friable loam with very few roots but some root holes and worm holes. When the material is pressed between the fingers the color changes to yellowish brown.

5. 20 to 30 inches, light yellowish, with a yellow ring, friable loam. The yellow color becomes more noticeable when the material is crushed between the fingers of a clean wet surface.

6. 28 to 40 inches, motiled yellow, very, and brown, thin in place but friable, coarse and gritty loam 865.

7. 7.0 to 90 inches, gray or light gray clay fairly compact but friable very gravelly and gritty till composed largely of sand, siltstone, and shale fragments.

The surface soil and subsoil layers carry a small quantity of small angular and flat rock fragments consisting mainly of blue shale and sandstone.

The poorly drained soils associated with the Newport, Bernardston, and Tripton soils belong to the Mansfield series. Take the Whitman soils; they have dark-brown or black massive surface soils over motiled subsoils and occur in depressions, along streams, or around swampy springs. The Mansfield soils are not so well as the Whitman soils.

The soils developed on the outwash plains are variable in texture, but all the well-drained soils have fairly well-developed profiles. The members of the Warwick series have developed from outwash material composed largely of shale, slate, schists, and sandstone. Following is a description of Warwick very fine sandy loam as observed in an idle field a quarter of a mile east of Sapowet Point, Newport County.

0 to 2 inches, light brown, eelworm matted and friable very fine sandy loam well mantled with grass roots and containing a small quantity of flat slate shale.

2 to 7 inches, yellow-brown brown matted and friable very fine sandy loam or humus, which is fairing well mantled with grass roots and breaks down into a soft crumb structure. This layer contains many worm holes, some organic remains, and a small quantity of gravel.

7 to 11 inches, yellow-brown matted and friable very fine sandy loam, which is higher in the material in the layer, contains a small quantity of grass roots, worm holes, and gravel.

11 to 20 inches, light grayish matted and friable very fine sandy loam, which is higher than the material in the layer, contains a small quantity of grass roots, worm holes, and gravel.

20 to 29 inches, light grayish humus of eroded stratified sand and gravel. The gravel is composed largely of flat and rounded shale, slate, sandstone, and eelworm, together with a small quantity of gravel material.

The lighter textured Warwick soils are somewhat similar to Warwick very fine sandy loam in profile characteristics. Drainage is better in the lighter textured soils, and no motting occurs in the lower part of the B horizon. The depth to sand and gravel in these lighter soils ranges from 18 to 30 inches.

The Quabbin soils have developed on the homoe from the same material as the Warwick soils. These soils are shallow and gravelly.
The soils of the Marmion series develop from weathered material containing a high percentage of gravelly material, and it is in this respect that they differ most from the Warwick soils. The profile characteristics of the two soils are very similar. The Warwick soils are slightly darker and probably a little less acid than the Marmion soils.

The organic layers vary in degree of decomposition and in thickness. They" are black in color and peat; mud and peat, shallow phase, and peat, salt-marsh phase. Soils developed from recent alluvium are of very small extent. They are poorly drained, and little or no development of a profile has taken place.

Miscellaneous loam types, such as rough stony land, dust sand, coastal sands, tidal marsh, made land, and unclassified city land have no true soil characteristics.

Table 11 gives the results of mechanical analysis of several soil profiles from Newport and Bristol Counties, R. I.

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Note: The values in parentheses indicate the percentage of the total length of the profile that is occupied by each component.
SUMMARY

Newport and Bristol Counties, comprising a total area of 138 square miles, are in the southeastern part of Rhode Island. About one-half of the total area of Newport County is made up of islands. In general the relief is characterized by fairly smooth rounded hills, the slopes of which range from nearly level to sloping, and nearly level to gently undulating glacial plains. The elevation ranges from sea level to a maximum of about 246 feet.

The climate is humid. The winters are medium cold and the summers short and warm. The mean annual temperature is about 49°F, and the average annual precipitation is about 40 inches which is well distributed over the seasons.

Originally, both counties supported a dense forest growth consisting of mixed deciduous and coniferous trees with variations in dominant species corresponding to differences in soil texture and conditions of drainage. The present forest consists of second-growth trees which are the original species.

Agriculture was the chief pursuit of the early settlers, and it advanced rapidly until around 1820, when the development of manufacturing in New England became important, and the area became productive of a wide variety of different kinds of crops. The area of the land area of Newport County and about 65 percent of the area of Bristol County was in farmed land, which included cultivated land and pasture. In general, the present agriculture of the two counties consists primarily of dairy farming, market gardening, poultry raising, and potato growing. Other enterprises of less importance are the growing of nursery stock, orcharding, the culture of small fruits and flowers, and cattle raising. Hay and forage crops occupy the largest area, followed closely by corn, market-garden crops, and potatoes. Hay and orange crops are produced mainly in connection with dairying whereas, other crops are produced for subsistence and cash.

Transportation facilities are good in both counties, and Providence, Fall River, and Boston are good markets for these agricultural products not consumed locally.

Newport and Bristol Counties lie within the glaciated region of North America, and the materials from which the soils have developed have been reworked largely through glacial action and deposited as till by the retreating glaciers or as outwash material from the melting glaciers. The soils are grouped in six broad groups based on such factors as mineral content, relief, physiography, drainage, agricultural use, and adaptations, as follows: (1) Momonty well-drained till soils, (2) very well-drained till soils, (3) soils of the outwash plain, (4) soils of the kame, (5) imperfectly drained and poorly drained soils, and (6) miscellaneous and types.

The well-drained soils include the members of the Newport, Middletown, Tiverton, Newport, Narragansett, and Westerly series that are free or practically free of surface stones. The soils of this group are by far the most important in the area from an agricultural point of view, and a large proportion of them is under cultivation. In general the relief ranges from nearly level to sloping.
Drainage is good but not excessive, and these soils are capable of being built up to and maintained in a fair to good state of productivity. The Newport and Bernardston soils are the most extensive of the group and the most productive for the general crops of the area. The Gloucester, Narragansett, and Tiverton soils occupy comparatively small areas.

The stony well-drained till soils include the stony members of the different soils in the first group. Of these, the stony Gloucester soils are the most extensive and the Bernardston soils the least extensive. Most of this land is in forests, and a small proportion is cleared of trees and is used for pasture or is lying idle. The cost of clearing this land of stones and trees largely prohibits its present use for agriculture other than forestry or grazing.

Soils developed on the coastal plains are represented by the Merrimack and Waming series. The land is level to gently undulating, and drainage is good to excessive, depending on the texture and structure of the soils. These soils are stone free, easily tilled, and responsive to fertilization. The heavier textured members are productive for general crops, especially vegetables; whereas the lighter textured members are productive for certain crops, if heavily fertilized and if the moisture supply is sufficient.

The soils of the bays have developed on hummocky and uneven relief, and they are shallow and droughty. These soils are represented by the Queenen series and their best use is for grazing and forestry.

The imperfectly drained soils are limited largely to the production of hay and for use as pasture soils; artificially drained; whereas the best use for the poorly drained soils unless drained is for forests or for pasture.

Miscellaneous land types include scattered areas of marsh and peat; muck and peat, shallow phase; peat, salt-marsh phase; tidal marsh; alluvial soils, undifferentiated; dune sand; coastal brush; rough rocky land; made land; and unclassified clay land. None of these land types is of any agricultural importance for cultivated crops, and the best use is for forestry, grazing, building sites, and recreational purposes.
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