Series 1940, No. 5 Issued January 1949

Soil Survey

Strafford County New Hampshire

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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Plant Industry, Soils, and Agricultural Engineering
and
Soil Conservation Service
In cooperation with the
UNIVERSITY OF NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

SOIL SURVEYS provide a foundation for all land use programs. This report and the accompanying map present information both general and specific about the soils, the crops, and the agriculture of the area surveyed. The individual reader may be interested in the whole report or only in some particular part. Ordinarily he will be able to obtain the information he needs without reading the whole. Prepared for both general and detailed use, the report is designed to meet the needs of a wide variety of readers of three general groups: (1) Those interested in the county as a whole; (2) those interested in specific parts of it; and (3) students and teachers of soil science and related agricultural subjects. Attempt has been made to meet the needs of all three groups by making the report comprehensive for purposes of reference.

Readers interested in the area as a whole include those concerned with general land use planning—the placement and development of highways, power lines, urban sites, industries, community cooperatives, resettlement projects, and areas for forest and wildlife management and for recreation. The following sections are intended for such users: (1) General Nature of the Area, in which location and extent, physiography, relief, and drainage, climate, water supply, vegetation, industries, organization and population, transportation and markets, and cultural development and improvement are discussed; (2) Agriculture, in which a brief history and the present status of the agriculture are described; (3) Estimated Yields, Productivity Ratings, and Land Classification, in which the soils are grouped according to their relative physical suitability for agricultural use and their productivity discussed; (4) Land Use and Management, in which the uses and management requirements of the soils are discussed; and (5) Water Control on the Land, in which problems pertaining to drainage and control of runoff are treated.

Readers interested chiefly in specific areas—as some particular locality, farm, or field—include farmers, agricultural technicians interested in planning operations in communities or on individual farms, and real estate agents, land appraisers, prospective purchasers and tenants, and farm agencies. These readers should (1) locate on the map the tract with which concerned; (2) identify the soils on the tract by locating in the legend on the margin of the map the symbols and colors that represent them; and (3) locate in the table of contents in the section on Soils the page where each soil type is described in detail and information given as to its suitability for use and its relations to crops and agriculture. They will also find useful specific information relating to the soils in the sections on Estimated Yields, Productivity Ratings, and Land Classification, on Land Use and Management, and on Water Control on the Land.

Students and teachers of soil science and allied subjects—including crop production, forestry, animal husbandry, economics, rural sociology, geography, and geology—will find their special interest in the section on Morphology and Genesis of Soils. They will also find useful information in the section on Soils, in which are presented the general scheme of classification of the soils of the area and a detailed discussion of each type. For those not already familiar with the classification and mapping of soils, these subjects are discussed under Soil Survey Methods and Definitions. Teachers of other subjects will find the sections on General Nature of the Area, Agriculture, Estimated Yields, Productivity Ratings, and Land Classification, and the first part of the section on Soils of particular value in determining the relation between their special subjects and the soils of the area.

This publication on the soil survey of Strafford County, N. H., is a cooperative contribution from the—

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CONTENTS

STRAFFORD COUNTY, which lies within the Seaboard Lowland and the New England Upland sections of the New England province, has an oceanic and modified continental climate. Its present-day agriculture, based largely on dairy farming, includes the production of hay and forage crops. Raising poultry, second to dairying in importance, is the chief source of income on many farms and supplements cash income on others. Potatoes, truck crops, and fruits also are important in the agriculture. Much of the county is forested, and local sawmills and wood-using industries furnish outlets for lumber products. A large part of the population is dependent on industry, including the manufacture of textiles, shoes, wood products, brick, press machines, and fiber. To provide a basis for the best agricultural uses of the land a cooperative soil survey was begun in 1940 by the United States Department of Agriculture and the University of New Hampshire Agricultural Experiment Station. The essential findings in this survey may be summarized as follows.

SUMMARY

Strafford County lies within the glaciated region of North America, and a large proportion of the soils has developed from material accumulated through glacial action and deposited as till or outwash by the receding and melting glacier. Rather extensive areas in the southeastern part have developed from marine or lacustrine deposits, and small areas have developed from recent alluvial deposits along the main drainageways throughout the county. Underlying the soils is a wide variety of highly metamorphosed sedimentary rock. The relatively complex geologic pattern with further mixing of these materials by overdrag from glacier movement gives an even more complex pattern of parent-soil material. This, together with the fact that the county lies within the Brown Podzolic and Podzol great soil groups of the United States, has given rise to a relatively large number of soil series, types, phases, and land types.

The upland soils, which cover 58.5 percent of the area, include the well-drained Charlton, Paxton, Hollis, Brookfield, Brimfield, Colrain, Gloucester, Hermon, Essex, Becket, Newmarket, Canaan, and Rockingham series, the imperfectly drained Sutton and Peru soils, and the poorly drained Whitman soils. A large proportion of these soils carry enough stone on the surface in the form of boulders or rock outcrop to interfere seriously with cultivation. On such areas the degree of stoniness varies from moderately stony to very stony. The relief ranges from smoothly sloping or undulating to hilly, and drainage is good. This group is characterized by scattered areas of improved land where some or all surface stones have been removed. Extensive stony areas are largely in forest. The Paxton, Charlton, Essex, and Becket soils are the most desirable for agricultural purposes, while the others are largely in forest, with small areas cleared and cultivated or in pasture.

The soils developed on the glacial outwash terraces are generally stone-free, have smooth surfaces, and are easy to till. Drainage conditions range from excessive on the lighter textured members to poor on the low-lying or depressed areas. Soils developed on marine and lacustrine deposits, as the Suffield, Buxton, Hartland, and Biddeford, are inherently the more productive of the group. The Suffield and Buxton are especially adapted to hay, forage crops, and pasture; the Hartland are limited largely to grazing, owing to unfavorable relief and eroded conditions; while the use of the poorly drained Biddeford is limited to grazing and forestry. The Melrose soils and the Merrimac, Barnstead, and Adams fine sandy loams are adapted to a wide variety of crops. The lighter textured Merrimac, Barnstead, and Adams soils are droughty and generally highly leached of plant nutrients. The imperfectly drained Sudbury and Scarboro soils are largely in forest with scattered areas used for pasture.

Soils of the kames, the Hinckley and Jaffrey series, occur on hummocky or uneven relief. They are droughty and best adapted to forestry or grazing.

The soils of the bottom lands include members of the Ondawa, Podunk, Rumney, and Saco series. These soils are subject to occasional flooding, which tends to replenish and maintain fertility. The Ondawa soils are inherently fertile and are adapted to a variety of crops; the Podunk is adapted to hay, silage corn, and pasture; and the poorly drained Rumney and Saco are largely in forest.

Miscellaneous soils and land types include Alluvial soils, undifferentiated, Muck, Peat, Tidal marsh, Gravel pits, and rolling stony land and rough stony land of various soil materials. The stony lands and Alluvial soils, undifferentiated, are largely in forest with scattered areas used for pasture; Muck and Peat areas are in forest or marsh grasses, while Tidal marsh and Gravel pits have no agricultural value.

The estimated acre yields of the principal crops are given in alphabetical order for each soil under both prevailing common farming practices and more intensive practices of management. The productivity rating of each soil is also tabulated.

The form of crop rotation varies widely. The general rule on dairy farms is a 5- or 6-year rotation of corn, potatoes, or sweet corn 1 year and hay the remaining years. On commercial potato farms a 3- to 5-year rotation of potatoes 1 to 3 years and grass or legumes the rest of the time is the common practice. In addition to manure, commercial fertilizer and lime are used on practically all farms.

In former years, when a larger percentage of the land was planted to clean-tilled crops, sheet erosion was severe on some soils. Under the present system of dairy farming, however, active erosion is confined to relatively small and widely scattered areas. On a large percentage of the cultivated soils simple conservation practices are adequate for effectively controlling erosion.

Drainage is not a problem in the area. Although there are extensive areas of poorly and imperfectly drained soils, there is no present need for extensive artificial drainage because these soils usually occur in association with well-drained soils and can be used to good advantage for pasture or forest. As there are no large streams in the county, overflow problems are negligible.

About three-fourths of the area of the county, in the southern and central parts, is in the Brown Podzolic region, and the true Podzols are found at higher elevations in the northern part. The Brown Podzolic soils develop under conditions of slightly higher temperature, more rapid evaporation, less leaching, and less accumulation of organic matter on the surface than do the Podzols. The Brown Podzolic soils lack the characteristic gray layer of the Podzols and are unlike them also in that there is no textural differentiation between the A and the B horizons.

GENERAL NATURE OF THE AREA

LOCATION AND EXTENT

Strafford County, in the southeastern part of New Hampshire (fig. 1), is roughly rectangular in outline, extending 34 miles from north to south and averaging about 15 miles from east to west, and has an area of 369 square miles, or 236,160 acres. The eastern boundary is formed by the Salmon Falls and Piscataqua Rivers and Little Bay. Dover, the county seat, located in the southeastern part, is 35 miles east of Concord, 35 miles northeast of Manchester, and 10 miles northwest of Portsmouth.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

The county lies within two physiographic sections of the New England province—the Seaboard Lowland and the New England Upland.

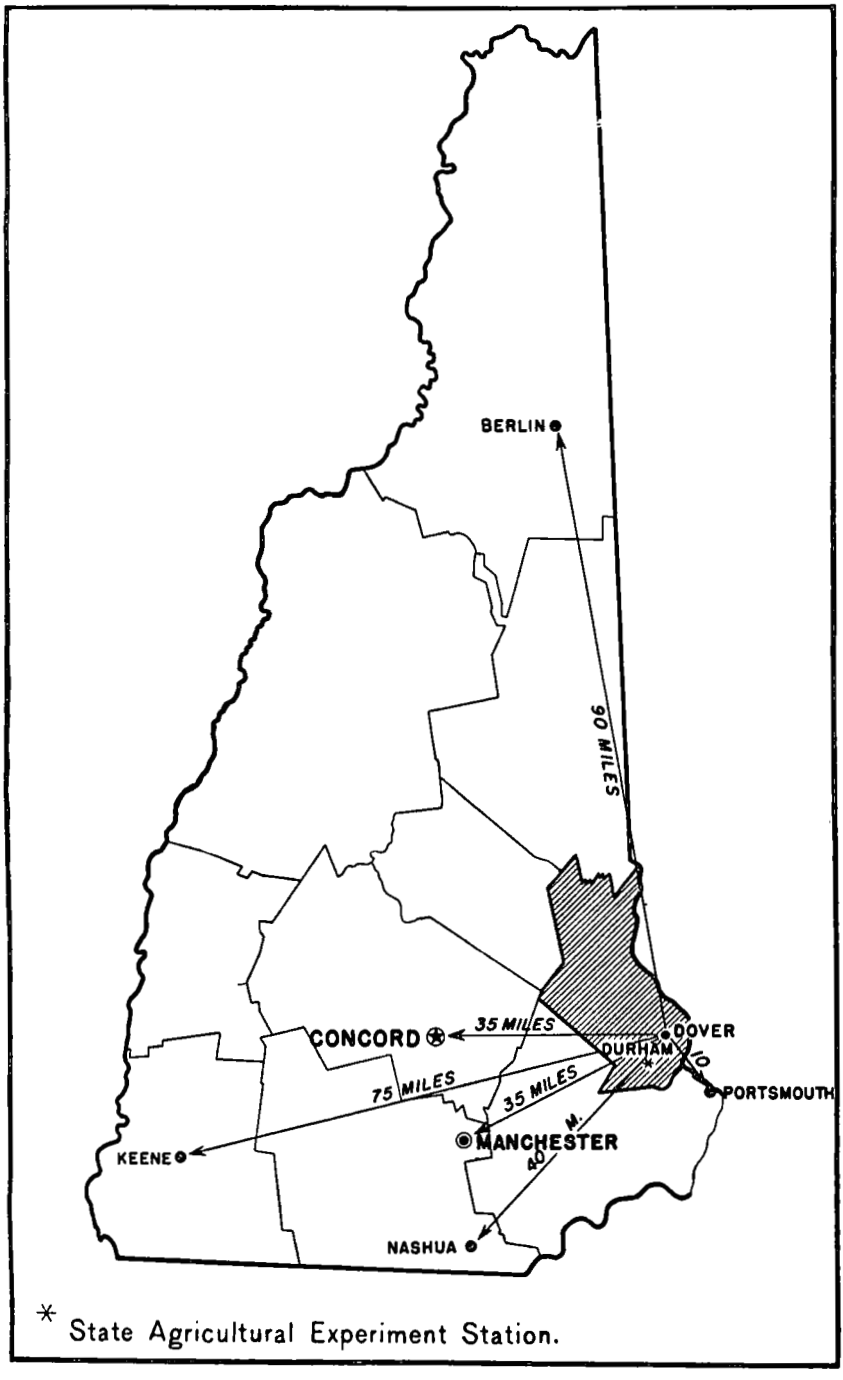

FIGURE 1.—Location of Strafford County in New Hampshire.

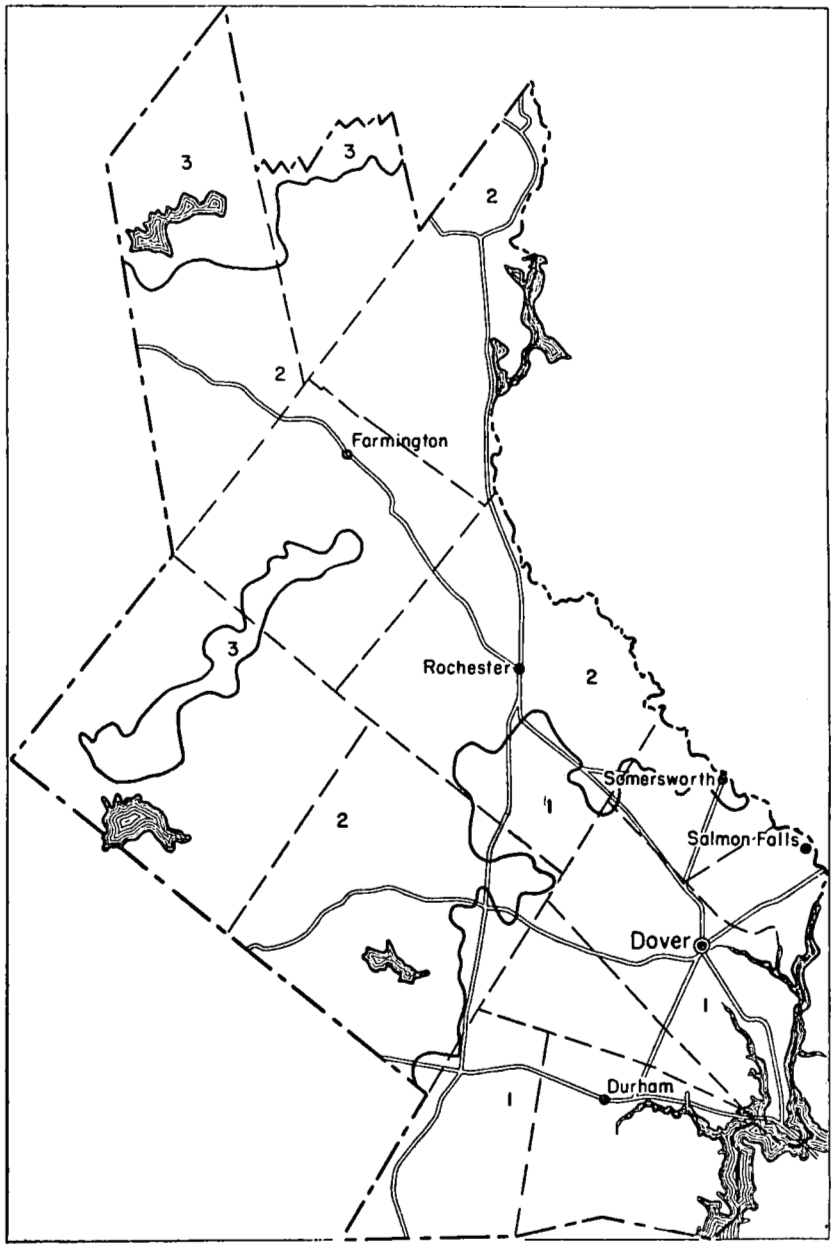

FIGURE 2.—Physiographic divisions of Strafford County, N. H.: 1, Seaboard Lowland (elevations up to 200 feet); 2, hills of the New England Upland (200 to 1,000 feet); 3, low mountains of the New England Upland (1,000 to 1,400 feet).

There is no distinct or well-defined dividing line between the two sections (fig. 2). Elevations range from sea level to about 1,700 feet on the highest peak of a low range of mountains in the northwestern part.

About a fourth of the Seaboard Lowland in the southern and southeastern parts is an old sea floor. When the ice edge withdrew from this part of New Hampshire, the land stood so low that the sea overspread it. Its upper limits follow closely the 200-foot contour line (*4*).[1] This region consists of nearly level to gently rolling outwash sand plains and marine or lacustrine deposits, interspersed with fairly smooth rounded glacial hills of gentle slope. The average elevation of the county is approximately 100 feet, the general range being from sea level to 200 feet with a few scattered hills rising slightly higher. Dissection has not been so thorough as in the upland part of the county, but drainage is well established, and physiographically this section presents features of an undulating to rolling plain. This physiographic division is crossed by all the larger streams of the county, which flow rather slowly, owing in part to the smooth relief, whereas, the smaller streams flow more rapidly. In many places the streams have cut through to bedrock, and the average level of the stream beds is 75 to 100 feet below the general level of the region. Several small lakes and ponds are scattered throughout this part.

The New England Upland section presents features of a thoroughly dissected plateau that slopes gently southeastward, the direction of the glacial ice movement. Elevations range from 200 feet in the southeastern part to 1,000 to 1,400 feet on the crest of a low range of mountains south and southwest of Farmington and 1,000 to 1,700 feet on another low range in the northwestern corner. Except for these low mountain ranges and a few other places, the elevation does not exceed 800 feet. This part of the county consists largely of medium stony to very stony smooth to steep hills and of narrow relatively smooth valleys along the larger streams. Throughout this region small scattered areas have been cleared or partly cleared of stone. The valley along the Cocheco River, southeast and west of Farmington, is more than a mile wide in places and is the most prominent of the valleys filled with glacial outwash when the glacier receded.

The dominant relief on the uplands is gently rolling or sloping to hilly. With the exception of small scattered areas, most of the steep land is associated with the two low mountain ranges mentioned. The tops of the hills or ridges are characterized by smoothly sloping or rolling relief rather than sharp crests. The streams have carved out narrow valleys and range from 100 to 400 feet below the general level of the plateau. Stream flow is fairly rapid except in swampy areas. Practically all the streams in this part rise within the county boundaries.

The receding glacier left many valleys blocked with rock debris and soil material. Lakes and ponds were formed, and those that were shallow enough supported plant life and became filled with peat deposits. This explains the rather large swampy areas in the western and northwestern parts.

Following is a list of some of the main topographic features and towns with approximate elevations:[2] Dover, 73 feet; Durham, 83 feet; Rochester, 280 feet; Bow Lake Village, 512 feet; Blue Job Mountain, 1,356 feet; and Copple Crown Mountain on the county line, 1,720 feet.

[1] Italic numbers in parentheses refer to Literature Cited, page 141.
[2] Elevations taken from U. S. Geological Survey topographic sheets.

CLIMATE

The climate is oceanic and modified continental. Because of proximity to the Atlantic Ocean the climate of the southern part is modified and tempered in winter and correspondingly is cooled in summer; but the ocean has little or no effect on the climate in the northwestern and northern parts. There are minor differences in climate over the county, caused mainly by differences in relief. In general, it is marked by long cold winters and short cool summers. The summers are pleasant, with very few excessively hot days.

The records of the United States Weather Bureau station at Durham, 83 feet above sea level, may be considered fairly representative of the southern and southeastern parts. No records are available for the northern part, but the Weather Bureau at Wolfeboro Falls, Carroll County, has precipitation records for the 11 years 1931–41, and these are probably fairly representative of the northern part of Strafford County. The normal monthly, seasonal, and annual temperature and precipitation at Durham, and the precipitation at Wolfeboro Falls, Carroll County, about 2 miles from the northwestern corner of Strafford County, are given in table 1.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Durham (elevation, 83 feet), Strafford County; and precipitation at Wolfeboro Falls (elevatiton, 524 feet), Carroll County, N. H.*

Month	Temperature [1]			Precipitation [1]				Precipitation [2]		
	Mean	Absolute maximum	Absolute minimum	Mean	Total for driest year	Total for wettest year	Average snowfall	Mean	Total for driest year	Total for wettest year
	°F.	°F.	°F.	Inches	Inches	Inches	Inches	Inches	Inches	Inches
December	26.5	71	−26	3.37	2.39	3.91	10.3	3.72	2.60	7.63
January	23.2	66	−35	3.24	1.34	4.07	14.6	3.96	1.72	7.15
February	23.3	65	−21	2.83	2.96	2.86	15.2	3.18	2.96	2.47
Winter	24.3	71	−35	9.44	6.69	10.84	40.1	10.86	7.28	17.25
March	33.5	80	−9	2.98	1.95	2.95	9.1	4.02	2.14	9.15
April	43.7	89	3	3.33	.40	2.79	3.1	4.01	.36	3.99
May	54.4	95	22	2.86	3.42	3.89	0	2.88	2.93	3.41
Spring	43.9	95	−9	9.17	5.77	9.63	12.2	10.91	5.43	16.55
June	63.3	102	30	3.35	1.00	4.54	0	3.21	1.87	1.69
July	69.4	103	40	3.17	2.47	11.82	0	3.59	3.19	3.43
August	66.9	98	35	3.31	1.33	2.11	0	2.81	1.23	3.22
Summer	66.5	103	30	9.83	4.80	18.47	0	9.61	6.29	8.34
September	60.0	96	21	3.52	.97	8.44	0	4.18	2.06	2.05
October	50.0	91	17	3.10	2.50	3.56	[3]	2.86	2.73	4.53
November	38.4	76	4	2.95	3.22	2.61	3.2	3.65	3.34	2.26
Fall	49.5	96	4	9.57	6.69	14.61	3.2	10.69	8.13	8.84
Year	46.1	[4] 103	[5] −35	38.01	[6] 23.95	[7] 53.55	55.5	42.07	[6] 27.13	[8] 50.98

[1] At Durham; record of 47 years.
[2] At Wolfeboro Falls; record of 11 years; no snowfall data available.
[3] Trace.
[4] July 1911.
[5] January 1935.
[6] In 1941.
[7] In 1938.
[8] In 1936.

The mean annual temperature at Durham is 46.1° F.; the absolute minimum, −35°; and the absolute maximum, 103°. The average date of the last killing frost in spring is May 22 and of the earliest in fall, September 27, giving an annual growing season of 128 days.

Killing frosts have been recorded as late as June 27 and as early as September 7. The growing season is ample for the maturing of a wide variety of crops.

The average annual precipitation at Durham is 38.01 inches, which is well distributed over the seasons, the heaviest rainfall occurring during the summer months. At Wolfeboro Falls, Carroll County, the average annual precipitation from 1931 to 1941, was 42.07 inches, or 4.06 inches greater than at Durham. During the fall, winter, and spring months precipitation is usually slow and steady, but occasional heavy downpours may be expected during the summer months, when thunderstorms accompanied by heavy rains are common and cause considerable damage locally. Destructive hailstorms and windstorms are infrequent.

The moisture is usually sufficient and uniformly distributed for crop needs, although occasional droughts or rainy spells damage growing crops. Climatic conditions are generally favorable for general farming, dairying, and market gardening and for poultry and livestock raising.

WATER SUPPLY

Bow Lake, in Strafford,[3] Merrymeeting Lake, in New Durham, and Union Lake, in Barrington, are the largest lakes in the area. Smaller lakes, reservoirs, and ponds are well distributed. Water supplies for the cities and villages are obtained from rivers, lakes, and reservoirs. Water for farm homes comes largely from wells and springs, but many have electric or gas pumps, and others obtain water from open wells. Bow, Merrymeeting, and Union Lakes, North River Pond, and Town House Pond, in Milton, are popular summer resorts.

Drainage is effected largely through the Salmon Falls, Piscataqua, Cocheco, Bellamy, Isinglass, Oyster, and Lamprey Rivers (fig. 2). The first two form the eastern boundary of the county and flow in a southerly or southeasterly direction. The others, with the exception of the Lamprey, rise within the county and flow in an easterly or southeasterly direction. Power for the operation of cotton and woolen mills and other industrial plants is supplied, in part at least, by these rivers. In small areas in the western and northwestern parts along the county line drainage is to the west, southwest, or south. A few cataracts and falls occur along streams coming from the higher elevations in the northwestern part.

VEGETATION

Strafford County lies largely in the so-called white pine region of New England—a belt along the Atlantic seaboard comprising southwestern Maine, southern New Hampshire, southeastern Vermont, eastern and central Massachusetts, and the northeastern corner of Connecticut (*15*). It may also be said that the area lies in the transition zone between the central hardwood forest, typified by oak, chestnut, and pine, and the beech, birch, hard maple, and hemlock forest of the north. The original forest cover was mixed hardwoods

[3] "Town" in New England is comparable to "township" in other States. In this report, in order to avoid repetition, the terms "town" and "township" are generally omitted in designating soil areas. The town of Farmington, for example, is referred to as Farmington.

and softwoods, consisting chiefly of red, scarlet, and white oaks, hickory, red and sugar maples, white and pitch pines, beech, yellow birch, white ash, basswood, hemlock, and spruce. The distribution and dominance of the various species was governed somewhat by soil type, drainage, and climatic conditions. There was an unusually large number of species, owing to the fact that the area lies in a transitional belt (*5*). Sites in the northern part of the county were favorable to the growth of a number of northern species, including hard maple, yellow and paper birches, spruce, and balsam fir; while the more exposed sites in the southern part were favorable for such central species as red, white, and scarlet oaks, hickory, chestnut, and pitch pine. Intermediate locations were characterized by a mixing of these species with several others that have a fairly wide north-south range and cannot be classed either as typically northern or central species, among them being white pine, hemlock, white ash, black cherry, and red maple. For the most part white pine occurred singly or in groups among the hemlocks and hardwoods, and pure stands, including more or less pitch pine, formed a permanent type only on the sand plains.

Practically all the virgin timber has been cut, and most of the present forest vegetation is second growth. The cover varies somewhat with differences in soil type, drainage conditions, and elevation. In general the predominant species associated with white pine on the lighter soils are pitch pine, gray birch, aspen, white oak, pin cherry, and red maple. On the heavier soils red and black oaks, yellow, black, and paper birches, red and sugar maples, basswood, white ash, and hemlock are the chief associates. Black and white oaks, hickory, and redcedar, species common in the southern part of the county, are not common on the higher elevations in the northern part. In the poorly drained and swampy positions in the southern part red maple, alder, and gray birch predominate. Black ash, spruce, balsam fir, and red maple are common in poorly and imperfectly drained positions in the northern section, while redcedar and black spruce are found in some of the peat bogs.

On abandoned farm land white pine predominates and often occurs as a pure stand, while those areas that have always supported forest growth are most likely to be characterized by mixtures of pine and hardwoods.

The most common shrubs in forested areas are barberry, hornbeam, witch-hazel, mountain-holly, high and lowbush blueberries, hazel, true hazelnut, dogwood, poison-ivy, low juniper, bracken fern, sweetfern, groundpine, moss, and wintergreen. Most of the open pastures and old idle fields contain much hardhack, sumac, low juniper, aspen sprouts, gray birch, sweetfern, hairy-cap moss, sheep laurel, bull thistle, and mullein. Along the fence rows around cleared areas chokeberry, poison-ivy, low juniper, shadbush, meadowsweet, hardhack, sumac, aster, and goldenrod abound. Raspberries and blackberries are common in all clearings and along old trails.

The most common pasture grasses are Kentucky bluegrass, redtop, broomsedge, red fescue, poverty oatgrass, Rhode Island (Colonial) bentgrass, Canada bluegrass, and white or Dutch clover. Sedges, rushes, and creeping bentgrass usually cover the swales and low wet places. Hawkweed, buttercup, hairy-cap moss, cinquefoil, sorrel, mullein, thistle, primrose, devils-paintbrush, wild carrot, oxeye daisy,

wild mustard, wild strawberry, goldenrod, quackgrass (witchgrass), and plantain are common weeds in pastures and hayfields.

Following is a list of the more common trees, shrubs, and other vegetation native to Strafford County.

TREES

Abies balsamea (L.) Mill	Balsam fir
Acer rubrum L	Red maple
A. saccharum Marsh	Sugar maple
Alnus incana (L.) Moench	Speckled alder
A. rugosa (Du Roi) Spreng	Smooth alder
Betula lenta L	Black birch
B. lutea Michx	Yellow birch
B. populifolia Marsh	Gray birch
Carya glabra (Mill.) Sweet	Pignut hickory
C. ovata (Mill.) Koch	Shagbark hickory
Castanea dentata Borkh	Chestnut
Fagus grandifolia Ehrh	American beech
Fraxinus americana L	White ash
Picea mariana (Mill.) B. S. P	Black spruce
P. rubens Sarg	Red spruce
Pinus rigida Mill	Pitch pine
P. strobus L	Eastern white pine
Populus grandidentata Michx	Largetooth aspen
P. tremuloides Michx	Quaking aspen
Prunus pensylvanica L	Pin cherry
P. serotina Ehrh	Black cherry
Quercus alba L	White oak
Q. borealis Michx. f	Northern red oak
Q. velutina Lam	Black oak
Thuja occidentalis L	White-cedar
Tsuga canadensis (L.) Carr	Hemlock
Ulmus americana L	American elm

SHRUBS

Amelanchier laevis Wieg	Shadblow; shadbush
Aronia sp	Chokeberry
Berberis sp	Barberry
Carpinus sp	Hornbeam
Comptonia peregrina (L.) Coult	Sweetfern
Cornus sp	Dogwood
Corylus americana Walt	Hazelnut
Filipendula sp	Meadowsweet
Gaylussacia baccata (Wangh.) Koch	Huckleberry
Hamamelis virginiana L	Witch-hazel
Juniperus communis L	Low juniper
Kalmia angustifolia L	Sheep laurel
Nemopanthus mucronatus (L.) Trel	Mountain-holly
Prunus virginiana L	Chokecherry
Rhus glabra L	Smooth sumac
R. toxicodendron L	Poison-ivy
Rubus alleghenicnsis Porter	Blackberry
R. flagellaris Willd	Dewberry
Spiraea tomentosa L	Hardhack

OTHER VEGETATION

Agropyron repens (L.) Beauv	Quackgrass (witchgrass)
Agrostis alba L	Redtop
A. tenuis Sibth	Rhode Island (Colonial) bentgrass
Ambrosia artemisiifolia L	Ragweed
Andropogon scoparius Michx	Broomsedge
Aster sp	Wild aster
Brassica japonica Sieb	Wild mustard

Chrysanthemum leucanthemum L.	Oxeye daisy
Cirsium lanceolatum (L.) Hill	Bull thistle
Danthonia spicata (L.) Beauv.	Poverty oatgrass
Daucus carota L.	Wild carrot
Festuca elatior L.	Meadow fescue
F. rubra L.	Red fescue
Fragaria virginiana Duchesne	Strawberry
Gaultheria procumbens L.	Wintergreen
Hieracium aurantiacum L.	Orange hawkweed; devils-paintbrush
Lycopodium obscurum L.	Clubmoss; groundpine
Onoclea sensibilis L.	Sensitive fern
Phleum pratense L.	Timothy
Plantago lanceolata L.	Narrowleaf-plaintain
Poa compressa L.	Canada bluegrass
P. pratensis L.	Kentucky bluegrass
Polytrichum commune	Hairy-cap moss
Potentilla canadensis L.	Common cinquefoil
Primula sp.	Primrose
Pteris aquilina L.	Bracken fern
Ranunculus septentrionalis Poir.	Buttercup
Rumex acetosella L.	Sheep sorrel
Solidago sp.	Goldenrod
Stellaria media (L.) Cyrill	Common chickweed
Taraxicum officinale Weber	Dandelion
Trifolium hybridum L.	Alsike clover
T. pratense L.	Red clover
T. repens L.	White clover
Typha latifolia L.	Cattail
Verbascum thapsus L.	Mullein

INDUSTRIES

Important industries in the county are concerned with textiles, shoe manufacturing, and the manufacture of wood products, brick, press machines, and fiber. The textile industry, which includes the weaving of woolens, worsteds, and cotton goods is the most important. Dover, Rochester, Somersworth, and Farmington are the principal industrial centers. Probably half the total population is dependent directly or indirectly on the industries for a livelihood, and any unemployment from the closing of mills seriously affects the agriculture.

ORGANIZATION AND POPULATION

Strafford County shares with Rockingham County the distinction of having the first permanent settlements in the State in 1623 (*11*). The first settlement in Strafford County was at Dover Point, formerly known as Hilton's Point, by Edward Hilton, an Englishman (*12*) whose descendants are now residents on Dover Neck about 1 mile north of the point. Settlements were made in Rochester in 1728 and in Barrington in 1732.

By an act of the Colonial Legislature of March 18, 1771, Strafford County was established as one of the original five counties of the State. At that time it included also Belknap and Carroll Counties, which were separated on December 22, 1840.

Although one of the smallest counties in the State, Strafford has 13 towns and 3 cities within its boundaries. The census of 1940 lists the total population at 43,553—33,138 urban and 10,415 rural—an average of 115.5 to the square mile, classed as follows: 38,124 as native-born white, 5,420 as foreign-born white, principally French Canadians;

and 9 as Negro and other races. The total population was 38,442 in 1890 and has remained at nearly that level up to this time. The present inhabitants are largely descendants of the original settlers.

The rural population is well distributed over the southern and east-central parts of the county, but the west-central and northern parts are sparsely settled. In summer the population is somewhat higher.

Dover, the county seat and largest city, had a population of 14,990 in 1940. Rochester and Somersworth, populations 12,012 and 6,136, respectively, are other important manufacturing and trading centers and with the town of Farmington furnish the principal markets for agricultural and forest products. Salmon Falls, Gonic, Milton, and Milton Mills are less important manufacturing and trading centers.

TRANSPORTATION AND MARKETS

The main line of the western division of the Boston & Maine Railroad passes through the southern and southeastern parts of the county, and branch lines serve other population and trading centers. A system of surfaced highways maintained by the State reaches every city and town, and each has a number of surfaced or graveled roads. Secondary roads are in fair to good condition during summer but are not very good in spring and late in fall. All main roads are kept open during winter with snow plows. The central location and excellent railroad facilities and highways give the cities and towns great advantages as points from which the mountains, lakes, and seashore are easily accessible.

Cities and other trading centers within the county furnish markets for most of the agricultural products with the exception of poultry and eggs. Some milk from the northeastern part goes to Boston and some from the western part to the Manchester dairy system. Poultry products are shipped to Boston and New York markets and surplus apples and potatoes to Boston. Most of this farm produce is handled by trucks. Considerable farm produce is sold at roadside stands along the main roads during summer and fall.

CULTURAL DEVELOPMENT AND IMPROVEMENT

Schools and churches are well distributed and accessible to all residents. Many children in the rural sections are transported to school. Rural-delivery mail routes reach all sections.

In general farm homes and outbuildings are well built and well kept. Most barns are large enough to house farm animals and to store feed and farm machinery. The 1940 census reports 852 farm homes with electricity, 603 with telephones, and 345 rural-farm dwelling units and 1,844 rural-nonfarm units with running water. Recently rural electrification projects of the Rural Electrification Administration have been initiated or completed in the towns of Strafford, Barrington, and Lee. Many rural homes around Dover and Rochester are connected with the city water systems and are provided with running water and fire protection. In the southern and southeastern parts most farm homes have either gas-engine or electric water pumps, while in the western and northern sections open wells with hand pumps or buckets are the general rule.

AGRICULTURE

When the white man first came to this county, it supported a dense forest cover, except for small plats that had been cleared by the Indians for growing Indian corn, beans, and vegetables. Fish and game were plentiful. The early agriculture was of necessity largely subsistence farming, wherein the primary needs of the family were satisfied by cultivating small plats of corn, wheat, oats, flax, vegetables, and keeping some livestock. Very little produce was exchanged between communities, as transportation facilities were meager and travel difficult. Commercial activities even in the early days overshadowed agricultural pursuits in that part of the county near the coast, and furs, fish, and timber soon became exportable commodities (*3*). Clearing the land of stone and trees was a slow process, but despite this task agriculture developed rapidly in the southeastern part. By 1800, 80 to 90 percent of the land around Durham was in tillage or pasture (*16*).

As agriculture gradually expanded, still on a subsistence basis, cattle and sheep became the leading farm interest and source of cash income. This system continued until the latter part of the nineteenth century, when, with the opening up of the grain and grasslands of the West, the raising of cattle and sheep gave way to dairying. At first dairy products were marketed as cheese and butter and later as fluid milk.

The present-day agriculture is based largely on dairying, and lesser agricultural pursuits are poultry raising, potato growing, market gardening, and fruit growing. Timothy alone, timothy and clover mixed, and corn for silage or cutting green are the principal hay and forage crops, grown largely in support of dairy farming. Small acreages are planted to clover alone, alfalfa, and oats cut and fed green or cured for hay. Other small acreages are planted to soybeans, usually mixed with Hungarian millet for grass silage. Potatoes are grown as a cash crop, and vegetables and fruits for home use and as cash crops. Poultry raising is second to dairying in importance and the principal source of income on many farms; on many others poultry is raised for home use and as a supplementary cash income. Some small farms also run largely on a subsistence basis, with possibly potatoes, vegetables, or poultry as a cash crop, and the owners depend on part-time work in the forest or on odd jobs for part of their livelihood.

CROPS

The area of land farmed has decreased markedly since the peak of agricultural development. Total production has declined with the drop in acreage farmed, but the acre yields have remained at about the same general level. According to the census of 1880 the number of farms was 3,018, which included 76.1 percent of the total area of the county; 67.8 percent of this acreage was classed as improved. In 1940 the number of farms had dwindled to 1,226, with an acreage of 110,136, and included 45.6 percent of the county; 39.5 percent, or 43,520 acres, of the farm land was classed as improved. The average size of the farms was 89.8 acres, a level that has been approximately maintained since 1900.

During the change from subsistence to mainly dairy farming, the acreage of subsistence crops was reduced, that in pasture increased, and some cleared land was left idle. The forests encroached upon the pasture lands and idle areas. This accounts for many of the old fields now supporting young forests.

The 1940 census lists the land in farms as follows:

	Acres		Acres
Cropland	31,561	Plowable pasture	11,959
Cropland harvested	27,720	Woodland	51,608
Crop failure	492	All other land	15,008
Cropland idle or fallow	3,349		
		All land in farms	110,136

The figures for cropland plus pasture land show that approximately 39.5 percent of all land in farms is used wholly or in part for crop production and grazing.

The trend of agriculture is indicated by the acreage planted to the principal crops and the number of orchard trees as given in table 2.

TABLE 2.—*Acreage of the principal crops and the number of apple and peach trees*[1] *in Strafford County, N. H., in stated years*

Crop	1879	1889	1899	1909	1919	1929	1939
Corn:	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
For grain	2,285	1,046	1,281	1,095	727	134	144
Cut for silage					[2] 326	413	547
Hogged or grazed, or cut for fodder					252	125	146
Oats:							
Threshed	520	257	38	88	372	49	29
Cut and fed unthreshed						72	137
Wheat	380	75	4	1	27		[3]
Rye	128	67	28	23	27	5	[3]
Barley	311	268	54	42	30	18	[3]
Buckwheat	18	13	7	5	14	9	[3]
Dry field beans			348	338	314	[4] 352	17
Hay, total	40,288	40,317	41,441	33,204	30,930	19,712	24,422
Clover or timothy hay, alone or mixed				21,180	15,525	9,232	10,525
Clover alone			18	153	133	295	[5] 19
Annual legumes for hay					41	279	13
Alfalfa			1	1	23	167	110
Small grain hay			904	843	601	179	268
Other tame hay			38,896	10,060	14,041	9,344	12,736
Wild hay			1,622	967	566	216	751
Potatoes	1,983	1,515	1,647	1,377	916	443	448
Market vegetables					167	366	244
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Apples—trees		104,084	165,986	86,578	36,426	28,447	19,671
Peaches—do		1,522	5,265	2,912	3,030	2,372	4,383

[1] Trees of bearing age as of years of census 1880-1910.
[2] Silage crops in 1919.
[3] Not reported.
[4] Partly duplicated in annual legumes for hay.
[5] Sweetclover only.

From table 2 it will be seen that the acreage in corn for grain and other cereals steadily declined from 1879 to 1939. Although there was a slight increase in the acreage in 1939 over 1929, the lowest level, the other cereals, with the exception of oats, have practically ceased to be grown. The acreage in hay showed a downward trend from 1899 to 1929, but there was a sharp increase from 1929 to 1939. A general downward trend also applies to potatoes. It is interesting, however, to note the increasing number of acres planted for corn silage in 1919, 1929, and 1939. The changes from 1889 to 1939 can be accounted for in part by the complete abandonment of many farms and curtailment of acreage on others, following the opening up of the West and the shift of rural population to industrial centers.

Of the orchard fruits apples are the most important. Several commercial apple orchards are scattered over the county, and nearly every farm has a small orchard, mainly for apples for home use. Of the small fruits, strawberries, blueberries, and raspberries are of considerable importance for home use and for sale locally. Several commercial blueberry farms are maintained in the western and northern parts. Vegetables and sweet corn are grown for home use. Almost every farm in the vicinity of Dover, Somersworth, and Rochester contains a considerable acreage of sweet corn for commercial harvesting. Several market-garden farms, most of the produce of which is sold locally, are scattered over the southeastern part. In the last few years a considerable acreage has been planted to winter squash for commercial purposes.

Tillage operations may be carried on from about May 1 to November 1 to 15, depending on the seasons and soil types. Hay mixtures are seeded either in spring or in fall. A large part of the alfalfa and clover is seeded in spring or summer, usually in May; that seeded in fall is subject to heaving, especially on the heavier soil types. Oats is the most common nurse crop seeded with hay mixtures and legumes in spring, although barley and wheat are used to some extent. The most common hay mixture includes timothy, redtop, and red and alsike clovers. Vegetable crops are planted or transplanted as early as soil and weather conditions permit.

Early potatoes are planted as soon as possible in spring, after the ground is warm (*14*). This will usually be from May 10 to 20 and may be as early as May 1 in favorable situations in the southern part. For late potatoes there is a wider range of choice, but the general practice is to plant from May 10 to 30.

ROTATIONS AND FERTILIZERS

Very few dairy farmers practice any definite rotation system, but for most dairy farms the county agent recommends a 6- to 7-year rotation of potatoes, corn, or sweet corn 1 year and hay 5 or 6 years. Some potato farmers practice a 3-year rotation of potatoes 1 year and grass or grass and clover 2 years; others grow potatoes 2 years out of 4 or 3 years out of 5. It is a general practice on the better dairy farms to rotate, top-dress, or reseed hayfields just often enough to keep the soil built up and in good condition. Some soils may need reseeding every 2 or 3 years, while others can run 6 to 7 years without attention. Many fields are mowed and pastured until the desirable grasses completely run out. On some farms hay fields are pastured after the hay begins to fail or after the first cutting. Very often the sod is turned under and the land reseeded to grass without other crops intervening.

Silage corn usually receives most of the barnyard manure available on the dairy farms and is usually supplemented with 300 to 500 pounds of 4–8–4 [4] or 4–12–4 fertilizer or 200 to 500 pounds of superphosphate an acre. Hayfields usually receive 1 to 1½ tons of lime and may or may not receive fertilizer when reseeded. Alfalfa and clovers usually receive 1½ to 2 tons of lime and 300 to 500 pounds of a complete fer-

[4] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

tilizer when seeded. Available manure is used for silage corn as top dressing for hayfields. A few farmers top-dress with 300 to 600 pounds of 7–6–6 or 7–7–7. During the last few years lime and superphosphate have been available for top dressing hayfields and pastures under the agricultural conservation program. Lime is usually applied at the rate of about 1 ton an acre, and superphosphate at 100 to 200 pounds. Potatoes commonly receive about half a ton of 8–16–16 and vegetables and sweet corn 1,000 to 1,500 pounds of 5–8–7 or 4–8–8. Commercial apple trees are fertilized with 5 to 8 pounds of nitrogen a tree in the form of nitrate of soda or cyanamide.

The use of fertilizer and lime is general. They are used more extensively in the southern and eastern parts than in the more remote sections of the west and the north. The Federal census reports that in 1939, 475 farms, or 38.7 percent reported the use of fertilizer, with a total expenditure of $17,376, or $36.58 per farm reporting. At present practically all farms use either lime or fertilizer or both. The agricultural conservation program has stimulated the use of lime and superphosphate, and the farmers are recognizing the value of these amendments in growing legumes and grasses and as an economical method of improving pastures and cropland.

Practically all the fertilizer purchased in the county is factory-mixed. About 20 percent is purchased cooperatively and the rest individually.

PERMANENT PASTURES

Permanent pastures are well distributed, as dairying is the chief agricultural enterprise in all sections. For several years under the agricultural conservation program lime, superphosphate, and potash have been available to farmers, but despite this there is much to be desired in pasture improvement. In general, the carrying capacity is low, owing to the exhaustion of available plant food through years of pasturing. Pastures are frequently left to grow without any attention (*1*).

A large percentage of the permanent pastures is on poorly and imperfectly drained soils, stony upland soils, or old worn-out fields. Very little effort has been made to keep weeds and brush out, consequently ground juniper, gray birch, broomsedge, and hardhack and other pests have nearly or completely taken over many of the upland pastures, and on the poorly drained and imperfectly drained soils, alder, hardhack, swale grass, hairy-cap moss, and gray birch are serious pests.

Grasses and legumes most commonly found in pastures are Kentucky bluegrass, redtop, poverty oatgrass, broomsedge, Canada bluegrass, Rhode Island (Colonial) bentgrass, timothy, and white and red clovers. Rushes, sedges, and meadow fescue are abundant in swales and low wet areas.

Nearly all farms have stock on pasture both day and night, but as a rule cows are not pastured at night. Alternate grazing is practiced on a few farms, and the use of rotated pastures, where crop fields are pastured 1 or 2 years in the rotation, is also followed on a few farms. On many farms the acreage of open pasture land is very small and the cows are allowed to roam over large woodland pastures, which afford very scant grazing. In general, open pastures receive very little at-

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tention, and fertilization, seeding, and brush removal are the exception rather than the rule. Overgrazing is also common.

LIVESTOCK AND PRODUCTS

The number and value of livestock on farms in census years since 1880 are given in table 3.

TABLE 3.—*Number and value of livestock on farms in Strafford County, N. H., in stated years*

Livestock [1]	1880 [2] (June 1)	1890 [2] (June 1)	1900 [2] (June 1)	1910 (Apr. 15)		1920 (Jan. 1)		1930 (Apr. 1)		1940 (Apr. 1)	
	Number	*Number*	*Number*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Horses	2,574	2,788	3,382	2,592	$283,532	2,121	$283,017	999	$99,025	[3] 801	$110,422
Mules	1	9	6	8	885	6	575	3	279	[4]	
Cattle	11,779	10,742	10,881	9,660	313,351	8,602	630,605	7,032	492,704	[3] 6,207	321,603
Swine	3,185	3,260	2,546	2,184	23,705	2,140	52,377	768	10,648	[5] 627	7,924
Sheep	4,143	2,717	2,397	2,075	9,950	951	10,820	1,776	14,074	[6] 864	4,802
Goats			1	50	435	35	585	13	91	[5] 50	400
All poultry	[3] 34,663	61,180	[3] 59,868	[3] 61,709	42,564	51,364	96,122	[4]		[6] 77,867	74,264
Chickens	[3] 33,142	58,965	[3] 59,432	[4]		50,723	[2]	[3] 60,601	78,781	[5] 77,490	73,616
Bees—hives			346	370	2,050	261	1,835	136	1,088	124	645

[1] Animals of all ages as of census dates, except 1940.
[2] Values not reported.
[3] Over 3 months old.
[4] Not available.
[5] Over 4 months old.
[6] Over 6 months old.

There has been a steady decline in the number of cattle, horses, sheep, and swine since 1900, and a sharp decrease in the number of horses in the decades 1920–40. The decrease in the number of farms in a measure accounts for the decline in livestock. The reduced number of horses is a result of the development of motorized transportation and increased use of power machinery on farms.

The dairy cattle are good grades of Holstein-Friesian, Guernsey, and Jersey breeds, the first being the most common. Some farms have purebred bulls. Very few beef cattle were noted during the survey. The scattered flocks of sheep are dual-purpose breeds, mainly grades of Southdown and Hampshire. The swine are mainly Chester White Berkshire or grades of these breeds. New Hampshire Red, Barred Plymouth Rock, and White Leghorn are the most common breeds of chickens; the first two are kept as dual-purpose breeds and the latter for egg production. Milk and milk products are consumed largely in the county, but a small percentage of milk is shipped to Boston and Manchester. Poultry and poultry products not consumed locally are sold on New York and Boston markets.

Farm horses are of a semidraft type, which is well suited to farm conditions in this section. Practically no replacements are raised in the county. Most large dairy farms have at least two work horses. Some of the smaller farms have only one horse, and many small farms have none, the heavy work being done with tractors and trucks.

In 1939, 791 farms, or 64.5 percent, purchased feed, at a total expenditure of $459,659, or $581.11 per farm. This consisted mainly of concentrated feeds for the cows and poultry.

The value of agricultural and livestock products by classes in stated years is given in table 4. It can readily be seen that dairy products, poultry, and eggs represent the bulk of the farm products sold.

TABLE 4.—*Value of agricultural products, by classes, in Strafford County, N. H., in stated years*

Crops	1909	1919	1929	1939
All cereals	$37,750	$49,690	$8,051	$5,507
Corn harvested for grain	(1)	(1)	6,272	4,600
Other cereals	(1)	(1)	1,779	907
Other grains and seeds	6,573	13,579	5,379	1,850
Hay and forage	525,266	836,519	267,503	293,242
All vegetables	143,274	313,639	195,236	162,207
For sale [2]	(1)	(1)	50,524	22,072
For farm household's use [2]	(1)	(1)	49,926	88,020
Potatoes	(1)	(1)	94,786	52,115
Fruits and nuts	36,111	104,335	84,608	50,621
Horticultural specialties sold	(1)	(1)	98,926	211,687
All other crops	274,735	1,877	697	725
Forest products sold	(1)	(1)	79,553	51,076

Livestock products	1909	1919	1929	1939
Dairy products sold	$344,112	$606,850	$452,164	$463,131
Whole milk	(1)	(1)	373,871	439,444
Cream [3]	(1)	(1)	25,578	10,222
Butter	(1)	(1)	52,715	13,465
Poultry and eggs produced	173,425	[4] 266,816	557,471	446,735
Poultry	(1)	(1)	308,223	245,036
Chicken eggs	(1)	(1)	249,248	201,699
Livestock sold or slaughtered	100,133	(1)	(1)	75,282
Cattle and calves	(1)	(1)	(1)	60,773
Hogs and pigs	(1)	(1)	(1)	11,864
Sheep and lambs	(1)	(1)	(1)	2,645
Honey produced	[5] 1,157	[5] 927	578	236
Wool shorn	[6] 1,487	2,003	1,985	972

[1] Not available.
[2] Excludes potatoes.
[3] Includes both sweet cream and sour cream (butterfat).
[4] Excludes value of poultry other than chickens.
[5] Includes value of wax.
[6] Includes value of mohair.

TYPES OF FARMS AND LAND USE

The number of farms by size in 1940 was as follows:

Number:	*Acres*	Number:	*Acres*
118	Under 10	51	180–219
225	10–29	24	220–259
181	30–49	38	260–379
183	50–69	12	380–499
141	70–99	10	500–699
140	100–139	2	700–999
99	140–179	2	Over 1,000

Table 5 classifies the farms according to the major source of income and gives the value of the products. Dairy, poultry, and field-crop farms constitute the main type. Strictly dairy and poultry farms make up approximately 28.1 percent of the total.

TABLE 5.—*Classification of farms by major source of income and value of products sold, traded, or used by farm households*

Major source of income	Farms reporting	Value of products	Major source of income	Farms reporting	Value of products
	Number	*Dollars*		*Number*	*Dollars*
Livestock	21	27,412	Vegetables harvested for sale	17	21,294
Dairy products	204	547,602	Fruits and nuts	19	22,990
Poultry and poultry products	134	361,524	Horticultural specialties	8	210,448
Other livestock products	1	(1)	Forest products	40	38,096
Field crops	123	62,282	Farm products used by farm households	636	193,261

[1] Not reported.

FARM TENURE

Of all farms, 94.5 percent were operated by owners and part owners, 5.1 percent by tenants, and 0.4 percent by managers, according to the 1940 census. Farm tenancy has remained about the same for the last 60 years. The few farms rented are rented for cash, and the rental varies according to locatiton, improvements, soil conditions, and other factors.

FARM INVESTMENTS AND EXPENDITURES

In 1939, 300 farms, or 24.5 percent of the total, reported the hire of labor, at an expenditure of $203,307, or $677.69 per farm reporting. In the northern and western parts of the county the farmers and members of the family do most of the farm work, whereas in the southern and eastern parts farm labor is performed by the farm family and helpers. The large dairy and poultry farms employ permanent help. On the smaller dairy and potato farms help is required only during the rush season of haying or potato harvesting. The average wage paid for farm labor is $25 to $50 per month with room and board, or $2.50 to $3.50 a day without room or board.[5] Experienced and reliable farm labor is very scarce.

The per acre land value, including buildings on farms, is given as $37.86 by the 1940 census. This is an increase over the figures given in 1910 and 1920. The value of all farm property in 1940 averaged $5,210, the land and buildings represented $4,210, or 80.8 percent, implements and machinery 9.1 percent, and domestic animals, poultry, and bees 10.1 percent.

There were 978 automobiles on 822 farms reporting, 414 motortrucks on 354 farms, and 259 tractors on 231 farms. Machinery and equipment found on the average farm consists of a truck, tractor, mowing machines, hay rakes, manure spreader, plows and cultivators, grain drills, gang plows, disk harrows, spring-toothed harrows, smoothing harrows, scythes, hoes, and other implements.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field and the recording of their characteristics, particularly in regard to the growth of various crops, grasses, and trees.

The soils and the underlying formations are examined systematically in many locations. Test pits are dug, borings made, and highway or railroad cuts and other exposures studied. Each exposes a series of distinct soil layers, or horizons, termed collectively the soil profile. Each horizon, as well as the underlying parent material, is studied in detail, and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. The chemical reaction of the soil and its content of lime and salts are determined by simple tests.[6] Other features taken into consideration are the drainage, both internal and external, the relief, or lay of the land, and the interrelations of soil and vegetation.

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[5] County agricultural agent's estimate.

[6] The reaction of the soil is its degree of acidity or alkalinity expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality; higher values, alkalinity; and lower values; acidity. Indicator solutions are used to determine the chemical reaction. The presence of lime is detected by the use of a dilute solution of hydrochloric acid.

The soils are classified according to their characteristics, both internal and external, with special emphasis upon the features that influence the adaptation of the land for the production of crop plants, grasses, and trees. On the basis of these characteristics the soils are grouped into classification units, the principal three of which are (1) series, (2) type, and (3) phase. Some areas that have no true soil—such as rolling stony land and rough stony land—are termed (4) miscellaneous land types.

The series is a group of soils having the same genetic horizons, similar in their important characteristics and arrangement in the profile and having similar parent material. Thus, the series comprises soils having essentially the same color, structure, natural drainage, and other important internal characteristics and the same range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The series are given geographic names taken from localities near which they were first identified. Charlton, Canaan, Suffield, Merrimac, Hinckley, and Ondawa are names of important soil series in Strafford County.

Within a soil series are one or more types, defined according to the texture of the upper part of the soil. Thus, the class name of this texture—sand, loamy sand, sandy loam, silt loam, clay loam, silty clay loam, or clay—is added to the series designation to give a complete name to the soil type. Canaan fine sandy loam and Canaan stony fine sandy loam are soil types within the Canaan series. Except for the texture of the surface soil, these 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 unit to which agronomic data are definitely related. In comparisons of the type and phases of that type, to avoid the repetition of their complete names, the type is sometimes referred to by abbreviation either as the type, the normal soil, the normal type, or the typical soil.

A soil phase is a variation within the type, differing from it in some minor feature, generally external, that may be of special practical significance. For example, within the normal range of relief for a soil type some areas may be adapted to the use of machinery and the growth of cultivated crops and others may not. Differences in relief, stoniness, and degree of accelerated erosion may be shown as phases. Even though no important differences may be apparent in the soil itself or in its capability for the growth of native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. In such instances the more sloping parts of the soil type may be segregated on the map as a sloping or a hilly phase. Similarly, some soils having differences in stoniness 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, town lines, and other cultural and natural features of the landscape.

SOIL SERIES AND THEIR RELATIONS

Strafford County lies in the glaciated region of the northeastern United States. The soils have developed under a forest cover of mixed

hardwoods and softwoods in varying proportions. Higher positions in the northern part of the county favored the growth of so-called "northern" species, while so-called "central belt" species were dominant throughout the rest of the county. The soils have characteristics common to those of the other northeastern States under similar conditions of climate and physiography. The distinguishing feature between the well-drained soils on the higher positions in the northern part and those in other parts of the county in undisturbed forest conditions is the development of the gray layer just beneath the forest duff. In the former the gray layer is very noticeable and varies from about 1 to 3 inches, whereas in the latter it varies from a mere film to generally less than 1 inch.

Rock of the area shows a wide variety, as granite, gneiss, granodiorite, coarse crystalline gneisses and schists, and slaty, weak mica, and calciferous and pyritiferous schists. The relatively complex geologic pattern was further complicated in the mixing of these materials by overdrag from glacier movements, giving an even more complex parent soil material.

A large percentage of the soils have developed from materials deposited by glacial action as till or as outwash by the melting glacier. Soils developed from marine and lacustrine sediments are rather extensive in the southeastern part of the county, and small areas have developed from recent alluvial materials and 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 control of their distribution.

The upland soils range in relief from mostly level to rolling or sloping and steep. The dominant relief, however, is gently rolling or gently sloping to rolling or sloping. All these soils originally varied from moderately to very stony, and the cleared fields represent areas where part or all of the surface stone has been picked off. As the fields were cleared the stone was placed in boundary walls or fences. Remnants of old stone walls are now common in young forested areas that were at one time cleared and cultivated.

The soils developed from till derived largely from schist are of heavier texture throughout than those developed from till derived largely from granitic materials. Perhaps the texture and structure of the till from which the upland soils have developed are more important from an agricultural point of view than any other characteristics. Those developed on compact or firm till have a higher water-holding capacity and their plant nutrients do not leach out so readily as on those developed on loose and friable till. A larger percentage of the soils with compact substrata is used for agriculture than any other upland soil. Because of the slower absorptive capacity, however, erosion is more active in cultivated fields, and more care must be exercised in its control on the steeper slopes.

Soils generally shallow over bedrock make up a fairly large percentage of the upland soils. Except for scattered areas these are largely in forest or are used for pasture. Erosion is not a serious problem on these soils, except on a few farms or in scattered fields. On some of the steeper slopes sheet erosion has been rather active in the past. Under the present system of agriculture, however, which consists mainly of growing hay and forage crops in support of dairying, there is very little active erosion except on small scattered fields.

The soils of the terraces and bottom lands are characterized by fairly smooth surfaces and are generally stone-free and easy to till. Drainage ranges from excessive on some of the lighter textured members to poor on some of the low-lying or depressed areas. The light-textured terrace soils are light-colored, highly leached, and less fertile than the medium-textured members, especially those developed from lacustrine silt and clay.

Except for the well-drained soils developed from lacustrine silt and clay deposits, the soils of terraces and bottom lands are not subject to serious erosion. The lacustrine soils are the most erodible in the county and are subject to serious erosion on the steeper slopes if not properly handled. It is on these soils, first in the county to be cleared and cultivated, that erosion has been most active down through the years. Yet, as on the upland soils, a large percentage is used at present for the production of hay and forage crops, and active erosion is not serious except on relatively small scattered areas.

The soils developed on the kames are light-textured, excessively drained, highly leached, and subject to serious erosion if planted to cultivated crops. They are largely in forest, pasture, or idle land.

The texture of the soils of the area varies from loamy sand to silt loam with a large percentage falling in the loam and fine sandy loam classes. All the soils are acid, varying from very strongly to medium acid in the surface layer. The Suffield soils are the least acid of the group, and the lower subsoil layers may be neutral in places. The Colrain soils, though developed from calcareous schist, are very acid to medium acid in the surface layer.

In general, erosion is not a serious problem, except in small scattered areas. In an earlier cycle sheet erosion was rather active on some of the cultivated soils, but under the present system of agriculture there is very little active erosion. Most of the cultivated land is on slopes of less than 15 percent.

Inherently, the soils of the county are not so productive as those in some other parts of the United States. Because of favorable texture, good structure, good but not excessive drainage, and absence of severe leaching, however, a large percentage of the cultivated soils lend themselves readily to soil management and improvement practices and are well suited to the growth of hay and forage crops, vegetables, small fruits, and potatoes. The light-textured terrace soils with heavy fertilization could be used for the production of certain vegetable crops if the market demand warranted.

Little or no correlation exists between soil series or soil type and the crops grown in the county, because dairy farming or subsistence farming with dairying the chief interest is the main type of farming in all sections. Poultry farms are well distributed over the central and eastern parts, and the strictly market-garden farms are located near the centers of population. Nevertheless, the better farms are generally located on better soils. Many homes are maintained on the less desirable soils by summer residents or by farmers who obtain part of their livelihood by part-time work away from the farm.

The soils of the county are classified according to their characteristics, both internal and external, special emphasis being given to such features as relief, stoniness, drainage, texture, structure, depth, reaction, and type of parent material, which influence the adaptation of the land for growing crop plants, grasses, and trees. A key for identifying the soil series is given in table 6.

TABLE 6.—*Key to the soil series of Strafford County, N. H.*

SOILS DEVELOPED ON GLACIAL TILL

Soil series	Great soil group	Parent material		Relief	Drainage
		Parent rock	Character of derived soil material		
Hermon	Podzol	Mainly granite	Loose and gritty	Rolling to hilly	Good to excessive.
Gloucester	Brown Podzolic	do	do	do	Do.
Becket	Podzol	do	Compact and platy	do	Good.
Essex	Brown Podzolic	do	do	do	Do.
Peru	Podzol	do	Compact, mottled	do	Imperfect.
Whitman	Half Bog	do	Loose or compact	do	Poor.
Canaan	Podzol	do	Shallow over bedrock	do	Good to excessive.
Newmarket	Brown Podzolic	Mainly granodiorite	Firm to loose	do	Good.
Rockingham	do	do	Shallow over bedrock	do	Do.
Paxton	do	Mixed granite and pyritiferous mica schist.	Compact and platy; greenish tinge	do	Do.
Charlton	do	Mainly schist	Firm in place; greenish tinge	do	Do.
Sutton	do	do	do	do	Imperfect.
Hollis	do	do	Shallow over bedrock	do	Good.
Brookfield	do	Mainly pyritiferous mica schist.	Loose and friable, high in mica; yellowish brown.	do	Do.
Brimfield	do	do	Shallow over bedrock	do	Do.
Colrain	do	Mainly interbedded phyllites and siliceous limestone.	do	do	Do.

SOILS DEVELOPED ON WATER-ASSORTED MATERIALS

Hinckley	Brown Podzolic	Mainly of granitic origin but includes some schist other than pyritiferous mica schist.	Coarse cross-bedded grayish materials.	Rolling or hummocky kames.	Excessive.
Merrimac	do	do	Mainly horizontal-bedded grayish gravel and sand.	Level terraces	Good to excessive.
Sudbury	do	do	do	do	Imperfect.
Scarboro	Half Bog	do	do	do	Poor.
Ondawa	Alluvial	do	Mainly horizontal-bedded grayish sand.	Level bottom lands	Good.
Podunk	do	do	do	do	Imperfect.
Rumney	do	do	do	do	Poor.
Alluvial soils, undifferentiated.	do	do	do	do	Complex of good, imperfect, and poor.
Jaffrey	Brown Podzolic	Mainly of granitic origin but contains high proportion of pyritiferous mica schist.	Coarse cross-bedded yellowish-brown materials.	Rolling or hummocky kames.	Excessive.
Barnstead	do	do	Mainly horizontal-bedded yellowish-brown gravel and sand.	Level terraces	Good to excessive.
Adams	do	Mixture of fine material derived from all rocks of the county.	Deep sandy outwash over marine or lacustrine clays.	do	Excessive.
Melrose	do	do	Shallow sandy outwash over marine or lacustrine clays.	do	Good.
Hartland	do	do	Silt or clay marine or lacustrine deposits.	Rolling to steep eroded terraces.	Do.
Suffield	do	do	do	Level terraces	Do.
Buxton	do	do	do	do	Imperfect.
Biddeford	Half Bog	do	do	do	Poor.
Saco	Alluvial	do	do	Level bottom lands	Do.

SOILS DEVELOPED ON ORGANIC MATERIALS

Peat	Bog	Acid organic remains	Slightly to partly decomposed with little or no mineral matter.	Level swamp	Poor.
Muck	do	do	Well decomposed with considerable mineral matter.	do	Do.

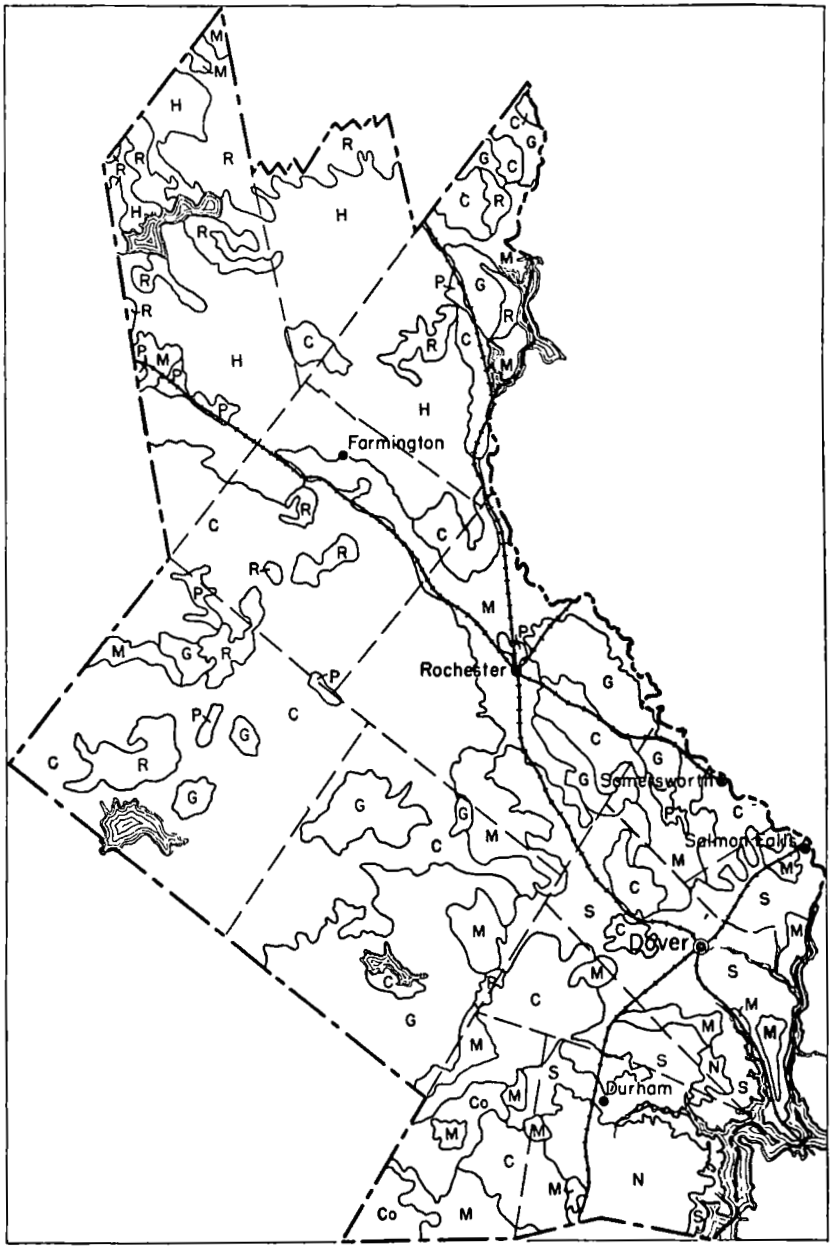


FIGURE 3.—Generalized map of Strafford County, N. H., showing soil associations.

C. Charlton, Paxton, Hollis, Brookfield, Brimfield, Sutton.
Co. Colrain, Whitman.
G. Gloucester, Essex, Whitman.
H. Hermon, Becket, Canaan, Whitman.
M. Merrimac, Barnstead, Adams, Hinckley, Jaffrey.
N. Newmarket, Rockingham.
P. Peat and Muck.
R. Rough stony land (Gloucester or Hermon soil material).
S. Suffield, Hartland, Buxton, Melrose, Biddeford.

The locations of the more extensive and important soils in the county are shown in figure 3. Following is a brief description giving some general information regarding the origin and use of the soils in the various association.

CHARLTON, PAXTON, HOLLIS, BROOKFIELD, BRIMFIELD, SUTTON ASSOCIATION

The association of the Charlton, Paxton, Hollis, Brookfield, Brimfield, and Sutton is characterized by scattered farms or cultivated areas and rather extensive forested areas. The soils are developed from till derived largely from schist. The relief is dominantly rolling to hilly and drainage is good, except in the Sutton and included Whitman soils. All the soils were originally stony and the land under cultivation represents areas from which part or all the stones have been removed. The Charlton and Paxton are the most desirable agricultural soils, and a higher percentage of them is cultivated than in other members of the group. Some of the best farms in the county and the most stable agriculture are located on these soils, which are adapted to a wide variety of crops. The moderately to very stony Hollis, Brookfield, and Brimfield are largely in forest, although scattered areas are tilled or in pasture. The Sutton and associated Whitman soils are generally stony and, except for scattered areas in pasture, are largely in forest.

COLRAIN, WHITMAN ASSOCIATION

The Colrain soils of the Colrain, Whitman association are developed from till derived mainly from calciferous schist and siliceous limestone. They are generally shallow, and bedrock outcrops are numerous. The relief ranges from gently rolling to hilly, and drainage is good. A small percentage is cleared of trees and stone and is cultivated or in pasture. The rest is largely in forest and ranges from moderately to very stony. Small areas of other soils are included.

GLOUCESTER, ESSEX, WHITMAN ASSOCIATION

Soils of the Gloucester, Essex, Whitman association are developed from glacial till derived largely from granite and gneiss. The Gloucester and Essex soils generally occur on sloping to hilly relief and have good drainage. The Whitman occupy poorly drained positions. The Essex differ from the Gloucester in having a compact substratum, occurring on smoother relief, having a higher moisture supply, and in being more productive. A high percentage of the Essex is tilled or in pasture, whereas the Gloucester are largely in forest and generally stony. Scattered areas of Gloucester are cultivated or in pasture; the Whitman are largely in forest.

HERMON, BECKET, CANAAN, WHITMAN ASSOCIATION

The Hermon and Becket soils of the Hermon, Becket, Canaan, Whitman association are somewhat similar to the Gloucester and Essex soils, respectively, except that they have developed in forested areas at higher elevations and are characterized by a light-gray layer just beneath the forest duff. The Canaan have developed on shallow till where granite and gneiss outcrops are numerous. The Becket have a compact substratum and are good agricultural soils, whereas the Hermon and Canaan are underlain by loose till, and drainage is inclined to be excessive. The relief ranges from gently rolling to

hilly. The Becket soils are not extensive, but a large percentage is cleared of trees and stone and is cultivated or in pasture. Scattered areas of the Hermon and Canaan are cultivated or in pasture, but a large percentage is in forest, and the range is from moderately to very stony. Whitman soils occupy the low poorly drained areas and are largely in forest, with small areas in pasture.

MERRIMAC, BARNSTEAD, ADAMS, HINCKLEY, JAFFREY ASSOCIATION

Soils of the Merrimac, Barnstead, Adams, Hinckley, Jaffrey association occupy the broad sandy terraces. The Merrimac, Barnstead, and Adams occur on smooth relief and the Hinckley and Jaffrey on hummocky and uneven relief. Drainage is good to excessive. These soils are generally stone-free and easy to handle but are inherently low in fertility. The moisture supply is usually the limiting factor in crop production even when crops are heavily fertilized. The fine sandy loams are naturally more productive than the lighter textured ones. A small percentage of the Merrimac, Barnstead, and Adams soils is cultivated or in pasture, and the rest is lying idle or in forest. The Hinckley and Jaffrey are largely in forest or lying idle. Small areas of Scarboro, Sudbury, and other soils are included.

NEWMARKET, ROCKINGHAM ASSOCIATION

The soils of the Newmarket, Rockingham association are developed from till derived largely from granodiorite. They occur on smooth to hilly relief and have good drainage. The Newmarket are not extensive, but cultivated areas are similar to the Charlton in productiveness; the Rockingham are generally shallow, with numerous outcrops, and are largely in forest or in pasture. The Biddeford and small areas of Whitman occupy the level poorly drained positions associated with these soils.

PEAT AND MUCK ASSOCIATION

The peat and muck association includes areas of organic soils varying in degrees of decomposition. They are not cultivated and are largely in forest.

ROUGH STONY LAND (GLOUCESTER OR HERMON SOIL MATERIAL)

Rough stony land (Gloucester or Hermon soil material) includes widely scattered areas of hilly to steep stony land of the various soil materials. Areas of this land are in forest to which they are best adapted.

SUFFIELD, HARTLAND, BUXTON, MELROSE, BIDDEFORD ASSOCIATION

The Suffield, Hartland, Buxton, Melrose, Biddeford association occupies an old sea floor that has been thoroughly dissected by drainage, thereby altering the original surface configuration considerably. The relief is dominantly smooth to rolling, and drainage conditions range from good to poor. This group comprises the most intensively cultivated soils of the area. They are stone-free, productive, and owing to relief are generally favorable for farming operations. The Suffield, Buxton, and Biddeford are inherently the most productive soils in the county. The Suffield and Buxton are especially adapted to hay, corn, and pasture grasses, while poor drainage limits the use

of the Biddeford soil mainly to pasture and forestry. Soils of the Hartland series occupy the hilly and steep eroded and broken areas associated with the Suffield. Developed from shallow sandy deposits over silt and clay, the Melrose occupy smooth to sloping relief, and have good drainage. These soils are stone-free, easy to handle, and are adapted to a wide variety of crops. Small areas of other soils, as Sudbury, Scarboro, Newmarket, Rockingham, and Charlton, are included.

For convenient discussion the soils of the county are placed in five broad groups, based on their agricultural relations and their external and internal characteristics, as follows: (1) Soils of the uplands, which are divided into (*a*) soils developed on compact till, (*b*) soils developed on firm to loose till, (*c*) soils developed on shallow till, and (*d*) imperfectly and poorly drained soils; (2) soils of the terraces, which are divided into (*a*) soils developed on marine or lacustrine silt and clay deposits, (*b*) soils developed on medium- to light-textured materials over silt and clay deposits, and (*c*) soils developed on sand and gravel outwash deposits; (3) soils of the kames; (4) soils of the bottom lands; and (5) miscellaneous soils and land types.

SOILS OF THE UPLANDS

The soils of the uplands cover 58.5 percent of the total area of the county and have a fairly wide range in elevation, in relief, and in character of the parent material from which developed. In general, these comparatively stone-free to moderately stony and very stony soils are well drained, friable, and easy to handle. A large percentage of the cleared land is on the smoother areas; the steeper slopes, which have been cleared of stones, and the stony to very stony areas are used for pasture or are in forest.

SOILS DEVELOPED ON COMPACT TILL

The soils developed on compact glacial till are not so extensive but agriculturally are the most important of the upland soils. This group includes the Paxton, Essex, and Becket series. The Paxton soils are developed from compact greenish-gray till derived mainly from schist, whereas the Essex and Becket are developed from compact and platy granitic till, grayish in color. As typically developed, these soils are uniformly gently sloping to sloping. Surface drainage is good, but internal drainage is not rapid, and the water-holding capacity is comparatively high. The soils are especially adapted to hay and forage crops and pasture.

PAXTON SERIES

The Paxton soils usually occur on smoothly rounded drumlinlike hills (pl. 1, *A*) and are associated with the Charlton, Hollis, and Brookfield. The surface relief ranges from nearly level to steep, but the dominant relief is gently sloping to sloping. Surface drainage is good, but internal drainage is rather slow because of the compact substrata at a depth of 18 to 24 inches. Water may seep out along the slopes early in spring or during wet seasons. The vegetation in forested areas consists chiefly of white pine, hemlock, red and black oaks, red maple, basswood, and gray and yellow birches.

In cultivated fields the surface soil is brown to grayish-brown mellow loam 6 to 7 inches deep over a yellowish-brown friable loam upper subsoil. At 10 to 12 inches it grades into olive-yellow gritty and friable loam, which rests on a greenish-gray heavy compact and platy till at 18 to 24 inches. The till is derived mainly from schist and is of a loam texture.

These soils are most extensive in Strafford, Rochester, and the northern part of Barrington. Scattered areas are mapped in Farmington, Dover, Madbury, Durham, and Lee. Probably 70 percent of this soil is under cultivation [7] or lying idle. The stony types and phases are largely in forest or pasture. Hay and forage crops occupy a large part of the total acreage. Some small areas are in open pasture, while others are planted to vegetables for home use, potatoes, and orchard fruits. Erosion conditions on cultivated land vary from slight to severe, but most of the severe erosion is on the steeper slopes and has occurred in the form of sheet erosion. Practically all the cultivated land is fairly stone-free, and the stony types and phases are not excessively stony.

These soils are considered among the best in the county for grasses and forage crops, potatoes, vegetables, and small fruits, and they are also good for apples. They lend themselves well to conservation and management practices and can be easily kept productive.

Paxton loam, with five phases and Paxton stony loam, with three phases are mapped.

ESSEX SERIES

The Essex soils are associated with soils of the Gloucester series and have developed on smoothly rounded hills where apparently the glacier exerted great pressure to form the hard or compact till over which they are developed. The dominant surface relief is gently sloping to sloping, with an occasional level or steep slope (pl. 1, *B*).

In cultivated fields the 6- or 7-inch surface soil is dark-brown or grayish-brown mellow loam. A thin layer of leaf litter, which has developed in wooded areas, is underlain by brown to grayish-brown mellow loam about 2 inches thick. The upper subsoil is yellowish-brown friable loam, grading into pale-yellow gritty loam at about 12 inches below the surface. This layer rests on gray to yellowish-gray compact and gritty till at 20 to 24 inches. The till is derived largely from granitic material and has a platy structure.

Surface drainage is good, but internal drainage is slow, owing to the compact substratum. Drainage is adequate and because of the high water-holding capacity of this soil, plants seldom suffer from lack of moisture.

Although not very extensive, these are important agricultural soils in the sections in which they occur and rate with the best for hay, corn, other forage crops, and pasture (pl. 1, *B*). About 65 percent of the total acreage is cleared and cultivated, in pasture, or idle; the rest is in forest. Dairy farming is the principal enterprise, and therefore hay and forage crops occupy the largest acreage. Yields are about the same as on the Paxton and Becket soils.

Owing to the compact substratum, the infiltration capacity of these soils is comparatively low and the steeper slopes are susceptible to

[7] Land in mowing is considered under cultivation.

erosion under poor management if clean-tilled crops are grown. Most of the slopes are moderate, so that erosion control is not a problem under simple management and conservation practices.

The stony types and phases are largely in forest. The vegetation consists chiefly of red maple, gray and yellow birches, white pine, hemlock, and white and red oaks.

Five types and phases are mapped, including Essex loam and its eroded and gently sloping phases and Essex stony loam and its gently sloping phase.

BECKET SERIES

The Becket soils are somewhat similar to the Essex, but have developed at higher elevations under slightly different climatic conditions and have a noticeable gray layer just below the forest duff in undisturbed forested areas. They are closely associated with the Hermon soils in the northern part, usually on smoothly rounded hills (pl. 2, *A*) where apparently the glacier exerted great pressure to form the compact till over which they are developed. The soil profiles of the Becket and Hermon soils are very similar, except that the former is developed on compact granitic till and the latter on loose till.

In undisturbed forested areas there is a layer of forest litter 2½ to 4 inches thick on the surface, and the lower part is partly decomposed. This is underlain by a 1- to 2½-inch light- or ashy-gray light loam, which rests on a rusty-brown friable loam about 4 inches thick. This layer grades into yellowish-brown friable loam that gradually changes to a pale- or grayish-yellow gritty fine sandy loam at 13 to 15 inches below the surface. At 20 to 22 inches in depth this lower subsoil layer rests on gray compact gritty till, which is derived mainly from granitic materials.

Surface drainage is good, but internal drainage is rather slow because of the compact substratum. Internal drainage, however, is sufficient for most crops. Owing to the high water-holding capacity crops, grasses, and trees seldom suffer from lack of moisture.

These soils occur in scattered areas in Farmington, Milton, and Middleton. About half the acreage is cleared of stone and trees and is under cultivation, in pasture, or lying idle, while the rest is stony and in forests. Most of the cultivated land is used for growing hay and forage crops in support of dairying. Small areas are used for potatoes, field corn, oats, and vegetables for home use. Yields are about the same as on Essex soils. On the steeper slopes some care must be exercised to control erosion if planted to clean-tilled crops.

Becket loam and three of its phases and Becket stony loam and two of its phases are mapped.

SOILS DEVELOPED ON FIRM TO LOOSE TILL

The soils developed on firm to loose till are in the Charlton, Brookfield, Newmarket, Gloucester, and Hermon series. They are rather extensive and except for the Charlton and Newmarket are not very important agriculturally. The relief ranges from smoothly rolling to hilly and steep. Drainage is good, both external and internal.

The Charlton soils, developed from schist accumulated under glacial action and deposited as till, are characterized by brown loam surface soil and friable subsoil; the Brookfield are developed from schistose till derived largely from mica schist and are characteristically reddish

brown or rusty brown. These soils are not used extensively for agriculture. The Newmarket soils, developed from glacial till derived mainly from granodiorite, have brown mellow surface soil and friable subsoil; the Gloucester and Hermon, developed from loose and gritty granitic till, have fine sandy loam surface soil and open friable subsoil. The Hermon are extensive in the northern part of the county and are similar to the Gloucester, but are found at higher elevations and have developed a noticeable gray layer just beneath the forest litter in undisturbed forest areas.

CHARLTON SERIES

The Charlton soils are developed from schistose till. All were originally stony, and the loam types and phases represent areas where most of the stone has been removed. The stony soils are largely in forest or used for pasture. The dominant relief is gently rolling to rolling, with an occasional smooth or steep area. Both surface and internal drainage are good, but the favorable texture is conducive to a good moisture-holding capacity.

In cultivated fields the 6- to 7-inch surface soil is brown to rich-brown mellow loam; in forested areas there is a layer of leaf litter on the surface underlain by a dark-brown loam surface 1½ to 2 inches thick. The upper subsoil is yellowish-brown loam grading into pale-yellow or grayish-yellow gritty loam, which rests on greenish-gray schistose till at about 24 inches below the surface. The till is firm in place to slightly compact and has a weak platy structure in places.

These soils are found in small to fairly large areas over the central and southern parts of the county in a fairly large total acreage. Areas under cultivation are used largely for hay and silage corn, with small acreages planted to clover, alfalfa, potatoes, oats, vegetables, sweet corn, field corn, and fruits. Considerable cleared land is idle or in pasture. These soils are easily handled and responsive to fertilization and care, and crop yields are fair to good. Forested areas support a mixed vegetation consisting of white pine, red and white oaks, hickory, gray birch, and red maple.

Seven types and phases are mapped as follows: Charlton loam and three of its phases and Charlton stony loam with two phases.

BROOKFIELD SERIES

The Brookfield soils are closely associated with the Charlton, Hollis, and Brimfield soils and have developed from loose glacial till. The dominant relief is gently rolling to hilly, with a few smooth areas. Drainage is good to excessive. Most of the soil is moderately to very stony. Scattered areas have been cleared of stone and are used for general crops and pasture or lie idle. The forest vegetation consists of mixed hardwoods and conifers with an undergrowth of shrubs and herbs.

In forested areas there is a layer of leaf litter 2 to 3 inches thick on the surface. The grayish-brown to brown light loam surface soil, 1 to 1½ inches thick, is underlain by a rusty-brown loam, which with depth becomes lighter and grades into a light-yellow to brownish-yellow gritty to sandy loam. The subsoil rests on yellow to grayish-yellow, loose, and gritty highly micaceous till at 24 to 26 inches. The

A, Paxton loam on smoothly rounded drumlinlike hill. Pasture in foreground with cultivated field in background. *B*, Timothy and clover hayfield on Essex loam, gently sloping phase, in foreground; silage corn in background.

A, Silage corn and hayfield on Becket loam. *B*, Silage corn on Sutton loam.

till is derived largely from reddish-brown micaceous rocks that contain iron pyrites in places. All layers are acid, and the surface is usually extremely acid.

These soils are rather extensive in the central part of the county, the largest areas occurring in Strafford, Farmington, and Barrington. They are largely in forest and are easy to handle where the stones have been removed, but crop yields are generally low unless heavily limed and fertilized. The carrying capacity of the pasture is also generally low.

Brookfield loam, together with its eroded phase, gently undulating phase, and hilly phase; Brookfield stony loam and its gently undulating phase and hilly phase; and Brookfield very stony loam and its hilly phase are mapped.

NEWMARKET SERIES

The Newmarket soils have developed from glacial till derived largely from dark-colored granitelike granodiorite rock. They are closely associated with soils of the Rockingham series, which are developed from the same kind of material but are generally shallow over bedrock. Surface relief is nearly level to rolling, and drainage is good. Small areas have been cleared of trees and stone and are cultivated. The stony areas are largely in forest consisting of mixed white pine and hardwoods.

These soils are characterized by brown to rich-brown mellow and friable loam surface soil, underlain by brown to yellowish-brown upper subsoil. This material grades into an olive or pale-yellow loose and gritty loam at 12 to 14 inches and rests on greenish-gray gritty till of a loam texture at about 24 inches. The till contains many disintegrated or partly weathered granodiorite rock fragments, which are common throughout the profile. On stony areas the surface stone is largely granodiorite. All layers are acid.

Cultivated areas are used largely for hay and forage crops. Erosion has not been significant except on a few small areas, and with simple conservation practices the soil may be easily conserved. These soils are easy to handle and are responsive to management and fertilization.

The total acreage is not large. The soils are found in a small belt in the extreme southeastern corner of the county and occur in scattered areas in Durham, Madbury, Dover, and Rollinsford. Newmarket loam with its gently undulating phase and Newmarket stony loam are mapped.

GLOUCESTER SERIES

The Gloucester soils have developed in the glaciated uplands from till derived largely from granite and gneiss. A large percentage vary from moderately to very stony, and these areas are in forest or pasture. Small comparatively stone-free areas are either under cultivation, in pasture, or lying idle. Both surface and internal drainage are good to excessive, and the soils are inclined to be droughty. The forest vegetation consists of mixed hardwoods and conifers.

Under forest conditions there is a 2- to 3-inch brown to dark-brown partly decomposed leaf litter. The 1½ to 2 inches of surface soil is grayish-brown or brownish-gray friable fine sandy loam, well matted with small roots. The yellowish-brown friable fine sandy loam upper

subsoil changes to pale-yellow or grayish-yellow loose and gritty fine sandy loam or sandy loam at 10 to 12 inches. This lower subsoil becomes lighter in color and texture with depth and rests on gray to yellowish-gray loose and gritty till at 24 to 26 inches. The till is fairly firm in place but exhibits little or no compaction. Granite or gneiss boulders are scattered over the surface and throughout the profile.

The Gloucester soils are found in small to fairly large areas in the central and southern parts of the county, being most extensive in Barrington and Rochester. The dominant relief is gently rolling to rolling, with some nearly level and some hilly areas. Because of the open and porous nature of these soils they are not particularly susceptible to erosion. Most of the cleared land is used for hay, with small areas in corn, potatoes, vegetables, and other general crops.

Owing to the relatively low inherent fertility and droughty nature of these soils, crop yields are generally lower than on Essex, Paxton, or Charlton. They are very responsive to fertilization, however, and are capable of producing fair to good yields of general crops. They warm up early in spring and are well adapted to early vegetables if heavily fertilized.

Three types and five phases are mapped as follows: Gloucester fine sandy loam and its eroded and gently undulating phases; Gloucester stony fine sandy loam, with its gently undulating and hilly phases; and Gloucester very stony fine sandy loam and its hilly phase.

HERMON SERIES

The Hermon soils are formed from loose granitic till and are somewhat similar to the Gloucester. They usually occur, however, at higher elevations (700 to about 1,000 feet) and under different climatic conditions, and have devcloped a well-defined gray layer just beneath the forest duff. Natural drainage is good. A large percentage is in forest, and white pine, hemlock, paper and yellow birches, red and sugar maples, red oak, and beech are the most common species.

Under undisturbed forest conditions there is a 3- to 4-inch mat of organic material, or forest duff, over a very thin layer of dark-brown fine sandy loam resting on a 1- to 3-inch layer of light-gray or light brownish-gray fine sandy loam. This is underlain by a rusty-brown or dark-brown friable fine sandy loam, firm in place and slightly indurated in places, which grades into a yellowish-brown loose and friable light fine sandy loam at a depth of 7 to 8 inches. At about 15 to 18 inches this layer changes to a pale-yellow loose and gritty sandy loam, resting on a gray gritty and loose till at 22 to 26 inches. The till is firm to loose in place and when dug out breaks down into a structureless mass. Granite and gneiss stone and boulders are scattered over the surface and embedded throughout the profile. All layers are acid.

These soils are extensive in the northern part of the county. The dominant relief is rolling to hilly, with some smooth and some steep slopes. These soils are generally stony, varying from moderately stony to very stony. Part or most of the stone has been picked off small scattered areas that are under cultivation, lying idle, or used for pasture. The rest supports some type of forest cover, largely second growth. Crops grown on these soils are mainly subsistence crops.

Three types and five phases are mapped as follows: Hermon fine sandy loam and Hermon stony fine sandy loam with their gently undulating and hilly phases, and Hermon very stony fine sandy loam and its hilly phase.

SOILS DEVELOPED ON SHALLOW TILL

In this group of shallow upland soils are the Colrain, Hollis, Brimfield, Rockingham, and Canaan series. These are generally shallow over bedrock, and surface outcrops are common. Relief ranges from gently rolling to hilly and steep, and drainage is good. The Colrain soils have developed from till derived mainly from calciferous phyllite schist and to some extent from the underlying bedrock of the same material; the Hollis from till derived from slaty schists; the Brimfield from weak mica schist till; the Rockingham from granodiorite and to a less extent from underlying rock; and the Canaan on thin glacial till derived largely from granite and gneiss. The Colrain and Hollis have a rich-brown surface soil and rusty-brown to yellowish-brown subsoil; the Brimfield reddish-brown to rusty-brown surface and subsurface layers high in mica; the Rockingham brown to dark-brown surface soil and rich yellow-brown to yellowish-brown subsoil; and the Canaan light-gray or ashy-gray surface layer and rusty or rich-brown subsoil. Granite, gneiss, and granodiorite bedrock outcrops are common, and these soils have developed mainly from a thin mantle of till derived from these rocks and to a less extent from the underlying bedrock.

COLRAIN SERIES

The Colrain soils in this area are generally shallow. Surface outcrops are common, and depth to bedrock or disintegrated and partly weathered schist varies from a few inches to less than 2 feet in most places. In this respect and also in color they are similar to the Hollis soils, except that the brown is usually more intense in the Colrain. They are developed largely from a thin mantle of till derived mainly from calciferous phyllite schist and siliceous limestone and to a less extent from the underlying bedrock. Leaching has been rather thorough, and the reaction of the surface and subsoil layers is very strongly to medium acid. The unaltered till is usually almost neutral. The native vegetation consisted chiefly of white pine, red and white oaks, hickory, beech, hemlock, white ash, red maple and various shrubs.

Most of this soil was cleared at one time. The 6-inch surface soil is dark-brown to brown mellow loam, with some schist fragments, underlain by a rusty- or reddish-brown gritty and friable loam to silt loam 5 to 6 inches in depth, where it changes to a pale yellowish-brown light loam. Partly disintegrated calciferous schist fragments are common throughout these layers. Depth to till or bedrock varies but is usually less than 2 feet. The olive to greenish-yellow coarse and gritty schistose till is mixed with disintegrated schist fragments. Limestone rocks are common in stone walls, on the surface, and throughout the profile.

These soils are not very extensive but are well distributed over Lee and in the eastern part of Durham. Surface relief is dominantly gently rolling to rolling, with a few smooth and a few hilly areas. Natural drainage is good. About half this soil is comparatively stone-free

except for surface outcrops; the rest is moderately stony. A small percentage is under cultivation; the rest is in forest, lying idle, or in pasture. Two types and three phases are mapped as follows: Colrain loam and its gently undulating and hilly phases; and Colrain stony loam and its hilly phase.

HOLLIS SERIES

Soils of the Hollis series are closely associated with those of the Charlton. They are generally shallow over schist bedrock, outcrops of which are numerous. Between the outcrops the depth to bedrock or disintegrated schist varies from a few inches to 2 or 3 feet in most places. These soils are developed from a thin mantle of glacial till, similar in origin to that from which the Charlton are developed and to a less extent from the underlying bedrock. The surface and subsoil layers also are similar in color, texture, and structure to those of the Charlton, but the profile is generally much shallower, and schist fragments are more common throughout.

In forested areas under an organic layer of leaves and branches the surface soil is dark- to rich-brown mellow and friable loam 1½ to 2 inches thick. The upper subsoil is rich yellowish-brown to yellowish-brown friable loam and grades into pale-yellow gritty light loam at 12 to 14 inches below the surface. The depth to greenish-gray or greenish-yellow till or bedrock is variable but in most places less than 2 feet. Depth to bedrock is less than 2 feet for about half the areas. The till is derived largely from mica schist, and slabs of schist and smaller fragments are numerous throughout the profile. All layers are acid.

These fairly extensive soils occur in small to fairly large bodies throughout the central and southern parts of the county. A small percentage has been cleared of trees and stone and is under cultivation, used for pasture, or lies idle; the rest is in forest or pasture. The degree of stoniness varies from moderately to very stony. On a large percentage of these soils the relief is gently rolling to rolling. Both external and internal drainage are good. Three types and six phases are mapped: Hollis loam and its eroded, eroded hilly, and gently undulating phases; Hollis stony loam and its gently undulating and hilly phases; and Hollis very stony loam and its hilly phase.

BRIMFIELD SERIES

The Brimfield series consists of essentially shallow Brookfield soils. All are closely associated with the Brookfield and are developed from a thin mantle of glacial till of similar origin and to a less extent from the bedrock. Reddish-brown micaceous schist outcrops are common. Bedrock is of extremely variable depth—in many places it lies near the surface and is probably less than 2 feet below the surface on 50 to 60 percent of the delineated areas. Micaceous schist fragments are common on the surface and throughout the profile.

In forested areas a thin layer of organic debris is underlain by a brown to dark-brown loam surface soil 1 to 2 inches thick. The upper subsoil of rich yellow-brown mellow loam grades into a yellowish-brown friable loam that changes to a yellow or brownish-yellow gritty loam at 12 to 14 inches. The depth to till or bedrock is variable. The till is derived largely from micaceous schist and is yellow to grayish-

yellow gritty and friable loam to sandy loam. Finely divided mica flakes are numerous throughout this soil and impart a greasy feel when pressed between the fingers. All layers are acid, varying from extremely acid in the surface layer to slightly less acid in the subsoil.

These soils are fairly extensive in Farmington and occur in scattered areas in other towns of the central and northern parts of the county. Small bodies have been cleared and are lying idle, used for pasture, or in mowing; the rest is in forest. Stones have been partly picked off small areas, but they are still present in sufficient quantity to interfere seriously with or to prevent the use of modern cultural implements. The degree of stoniness varies from moderately to very stony. The dominant relief is gently rolling to hilly, with an occasional smooth or hilly area. Natural drainage is good. Two types and two phases are mapped: Brimfield stony loam and Brimfield very stony loam and their hilly phases.

ROCKINGHAM SERIES

Soils of the Rockingham series are generally shallow over granodiorite bedrock. They are developed from till derived largely from granodiorite and to a less degree from the underlying rock. These soils are essentially shallow Newmarket soils and are closely associated with them. Granodiorite outcrops are numerous, and elsewhere the depth to bedrock is extremely variable. In many places it is within a few inches of the surface and is probably less than 2 feet on more than half the area.

Where there is any marked degree of development, the color, texture, and other characteristics of the different layers are similar to the corresponding ones in the Newmarket soils. In forested areas under a layer of organic debris the 1- to 2-inch surface soil is brown to dark-brown loam. The upper subsoil of rich yellow-brown friable loam grades into a yellowish-brown loam, which at 12 to 14 inches grades into a pale-yellow or olive loose and gritty loam. Depth to till or bedrock is variable. The till is derived largely from granodiorite and contains many disintegrated and partly weathered fragments of this rock, and soft fragments are also numerous throughout the profile. All layers are acid, varying from very strongly acid in the surface soil to slightly less acid in the subsoil.

The Rockingham soils occur in the extreme southeastern part of the county in Durham, Dover, Madbury, and Rollinsford. About 25 percent of the total acreage is cleared of trees and of most of the loose surface stone. These areas are under cultivation, in pasture, or lying idle; the rest is in forest. On the cleared areas the surface outcrops interfere with cultivation. In forested areas the degree of stoniness varies from moderately to very stony. The dominant relief is gently rolling to rolling with an occasional smooth or hilly area. Natural drainage is good, and the water-holding capacity is fair except on the shallower spots. On only a few areas has erosion been significant, and simple conservation practices are generally adequate for conserving the soil.

Three types and one phase are mapped: Rockingham loam; Rockingham stony loam and its hilly phase; and Rockingham very stony loam.

CANAAN SERIES

Canaan soils are developed on thin glacial till derived largely from granite and gneiss. As typically developed, they are essentially shallow Hermon or Becket soils and are usually associated with them. Bedrock outcrops of granite and gneiss are numerous. Between the outcrops depth to bedrock varies from a few inches to 2 or 3 feet in most places.

Under forest conditions where bedrock is deep enough for a normal profile to develop it is similar to the Hermon soil. A raw humus layer 2 to 4 inches thick is underlain by a light-gray or ashy-gray layer ½ to 2 inches thick, which rests on a rusty- or rich-brown 2- to 4-inch layer. Below this the material is yellowish-brown friable fine sandy loam, fairly firm in place but when disturbed breaks into soft irregular fragments. The lower subsoil is pale-yellow friable and gritty sandy loam, resting on gray loose gritty till at 18 to 24 inches in depth. All layers are acid, varying from very strongly acid in the surface soil to slightly less acid in the subsoil.

These soils occur in scattered areas mainly in the northern and west-central parts of the county. Surface relief is dominantly gently rolling to rolling, with a few smooth and a few hilly areas. Owing to shallowness, stoniness, and low moisture-holding capacity, these soils are largely in forest. A small part is cleared and used for cultivated crops or pasture. The degree of stoniness varies from moderately to very stony. Six types and phases are mapped: Canaan fine sandy loam, Canaan stony fine sandy loam, and Canaan very stony fine sandy loam, with their hilly phases.

Scattered areas of Shapleigh soils associated with Gloucester soils in the southern part are included because of their small extent. They differ from the Canaan soils mainly in having only a weakly developed gray layer just beneath the forest organic layer.

IMPERFECTLY AND POORLY DRAINED SOILS

In the imperfectly drained upland soils two series are represented, the Sutton and the Peru. Surface relief is level to gently sloping and stoniness varies from comparatively stone-free to very stony. Only a small part is used for cultivated crops, much of the total acreage being in open and woodland pasture, the rest in forest. The Sutton soils are mapped in association with the Charlton, Hollis, Brookfield, Paxton, Essex, and Gloucester, and the Peru with the Hermon and Canaan in the northern part of the county. These soils have rather dark surface soils over mottled subsoils. The Whitman occupy poorly drained positions associated with the glaciated uplands.

SUTTON SERIES

The soils of the Sutton series occupy nearly level to smoothly sloping positions associated with the Charlton, Hollis, and Brookfield. They are intermediate in drainage, being between the well-drained soils of the uplands and the poorly drained Whitman soils.

In forested areas there is a 2- to 4-inch layer of partly decomposed organic debris well matted with roots. The surface soil is dark grayish-brown friable loam also well matted with roots. Below this the upper subsoil is yellowish-brown heavy loam with some rust-brown and gray mottlings. This layer is firm in place but when disturbed breaks into

soft irregular fragments. The upper subsoil grades into pale-yellow mottled with rust-brown and gray gritty loam at 10 to 12 inches below the surface. This rests on greenish-gray or olive-gray mottled and streaked with rust-brown yellow and gray compact till at 18 to 22 inches. The till is derived largely from schist, with an admixture of granitic materials in places. When dug out with a pick the till breaks into irregular fragments with a platy structure.

These soils occur in small to fairly large areas in the central and southern parts of the county. Only a small percentage is under cultivation, and the rest is used for pasture, is idle, or is in forest. Most of them are only moderately stony. Imperfect drainage limits use for certain crops, but the soils are well adapted to hay, corn, and pasture. Plate 2, *B*, shows good silage corn on Sutton loam. Two types are mapped: Sutton loam and Sutton stony loam.

PERU SERIES

The soils of the Peru series occupy imperfectly drained areas associated with the Hermon and Canaan soils. They are intermediate in drainage between these and the poorly drained Whitman. Some areas occupy nearly level or gentle slopes and receive considerable water from higher positions.

As typically developed the surface soil is dark-brown or nearly black highly organic loam 1½ to 2 inches thick underlain by light-brown or grayish-brown mellow loam. At 4 to 6 inches in depth the material is brown to yellowish-brown loam mottled with rusty brown and gray. At 12 to 14 inches this grades into a mottled yellow rust-brown and gray gritty loam that rests on a yellowish-gray or greenish-gray compact till at 20 to 22 inches. The till is highly mottled with rust-brown, yellow, and gray and is waterlogged most of the time.

These soils occur in scattered areas in the northern part of the county in Farmington, Milton, and Middleton. Owing to stoniness and imperfect drainage only small areas have been cleared of stone and trees and are used for hay or cultivated crops. They are largely in forest and vary from moderately to very stony. Three types—Peru loam, Peru stony loam, and Peru very stony loam—are mapped.

WHITMAN SERIES

The Whitman soils occupy poorly drained positions in the glaciated uplands and vary from moderately to very stony. They are characterized by dark-brown or nearly black surface soils over highly mottled subsoils. The reaction is acid throughout. These soils are rather extensive and occur in small to large bodies throughout the county. Because of stoniness and poor drainage they are not used for agricultural purposes other than grazing. Small areas are cleared and used for pasture or are idle; the rest is in forest. Whitman stony loam and Whitman very stony loam are mapped.

SOILS OF THE TERRACES

The soils of the terraces are most extensive in the southern and the east-central parts of the county. Surface relief is generally smooth except along some of the main drainageways and on the broken edges of the terraces. Drainage ranges from excessive to poor. The heav-

ier textured well-drained members are practically all used for agriculture, whereas the lighter textured ones are largely in forest or pasture or lie idle.

SOILS DEVELOPED ON MARINE OR LACUSTRINE SILT AND CLAY DEPOSITS

The group of terrace soils developed from marine or lacustrine silt and clay deposits is represented by the Suffield, Hartland, Buxton, and Biddeford series. The Suffield occupy smooth to gently rolling and rolling topographic positions and the Hartland the steeper slopes usually adjacent to drainageways or on the broken edges of old terraces. Surface drainage is good on the Suffield and rapid on the Hartland, but internal drainage in both soils is slow, because of the heavy texture of the subsoils. The imperfectly drained Buxton soils occupy level to gently sloping positions. The Biddeford soil is poorly drained.

SUFFIELD SERIES

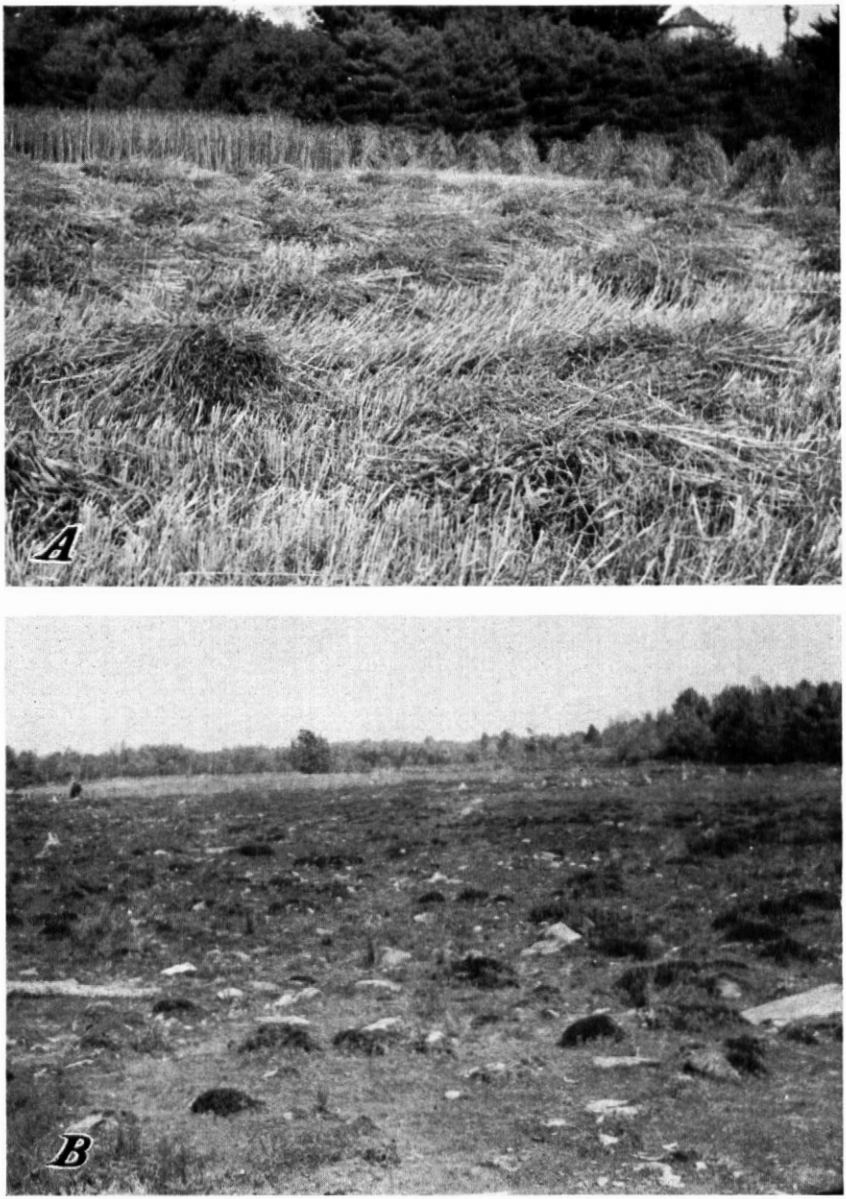
The Suffield soils, developed from marine and lacustrine silt and clay deposits, occur only in the southeastern part of the county and at elevations below 200 feet. Except for an occasional preglacial rock outcrop or glacial erratic, they are stone-free and are the most intensively cultivated soils of the county. Drainage is well established, and stream dissection has been so thorough that the surface configuration has been considerably altered. The areas now present features of an undulating to rolling plain.

In cultivated fields the 5- to 7-inch surface soil is brown to dark grayish-brown mellow silt loam with a soft granular structure. This is underlain by a yellowish-brown mellow and friable silt loam that grades into an olive-yellow silt loam at 10 to 12 inches in depth. Both layers are firm in place and break into irregular clods or fragments that are easily crushed into a soft granular mass. At a depth of 16 to 18 inches the material is olive to greenish-gray silt loam or silty clay loam and grades into greenish-gray heavy clay interbedded with silt at about 24 inches. This material is very compact in place and breaks into hard angular blocks that are hard to crush when dry. It is plastic when wet. The surface and subsoil layers are acid, but the unaltered silts and clays are slightly acid or neutral.

The relief is nearly level to rolling, but dominantly undulating to gently rolling. Drainage is good, but internal drainage is retarded to some extent by the heavy subsoil. A large percentage of these soils is cleared and under cultivation or in pasture (pl. 3, *A*). They are the best soils in the area for hay and forage crops. Owing to the silty subsoil layer and heavy parent material they do not absorb water so readily and, therefore, are very susceptible to erosion if planted to clean-tilled crops. They cannot be worked so early in spring or so soon after rains as the lighter textured soils and require more power for cultural operations.

Clay deposits have been used extensively for making brick in the vicinity of Gonic in Rochester. The surface soil has been disturbed on a few rather large areas, which are indicated as undifferentiated erosion areas on the soil map.

Erosion does not seem to affect productivity so much as on other soils of the county. Excellent stands of clover were noticed in several



A, Millet on Adams loamy sand. *B*, Pasture on Whitman stony loam.

old clay pits where all the surface and part of the subsoil had been removed. Suffield silt loam, together with its eroded, eroded rolling, level, and severely eroded rolling phases are mapped.

HARTLAND SERIES

The Hartland soils are developed on hilly to broken topography, largely the result of severe geologic erosion of marine or lacustrine silt and clay deposits. They are closely associated with the Suffield soils and generally occur on the broken edges of terraces or bordering drainageways. The areas are thoroughly dissected, and the slopes are generally short and broken.

These soils have developed from the same kind of material as the Suffield, but as a result of geologic and accelerated erosion there is little uniformity in profile development. In protected areas the profile is similar to that of the typical Suffield, except that the surface layer is usually shallower and the total thickness of the soil over unaltered silt and clay deposits is less. The brown or grayish-brown surface soil is generally very shallow or, in many places, is entirely lacking. In places there is a shallow dark grayish-brown silt loam surface soil underlain by a brownish-gray or greenish-gray slightly altered silty clay that breaks into irregular angular fragments. Surface drainage is good, but the heavy character of the soil slows up internal drainage. The moisture supply is usually adequate for grasses even in dry seasons.

These soils occur in small bodies in the southeastern part of the county, and the total acreage is not large. A small part is in forest; the rest largely in pasture or hay. Mowing areas generally occupy the smoother slopes. Because of the susceptibility to erosion if cleared, these soils are best adapted for grazing or hay. Control of erosion is difficult except by using sod or close-growing crops over the entire area. Owing to the character of the parent material, removal of the surface soil does not affect the productivity for hay the same as it does the lighter soils of the county. One type and its two phases are mapped: Hartland silt loam and its severely eroded and steep phases.

BUXTON SERIES

The soils of the Buxton series—the silt loam and its gently sloping phase—occupy nearly level to gently sloping positions and are intermediate in drainage between the well-drained Suffield and the poorly drained Biddeford, with which they are associated. Surface drainage is only fair, and internal drainage is imperfect. On the smoother areas water stands on the surface after heavy rains.

The 4- to 6-inch surface soil is brown to dark grayish-brown silt loam with a granular structure. This is underlain by a yellowish-brown silt loam, with faint mottlings in places, which grades into a yellowish-gray silt loam to silty clay loam mottled with rust brown and yellow at 9 or 10 inches in depth. The lower subsoil becomes more highly mottled with depth and rests on greenish-gray heavy clay or silty clay highly mottled with rust brown at 15 inches below the surface.

These soils occur in scattered bodies in the southeastern part of the county. About 85 percent of this land is cleared and utilized for hay

or pasture; the rest is in forest. Imperfect drainage limits its use for cultivated crops, but it is one of the best hay and pasture soils in the county (pl. 3, *A*).

BIDDEFORD SERIES

The single soil of the Biddeford series—the silty clay loam—occupies poorly drained areas associated with the Suffield and Buxton soils. It occurs on nearly level or flat relief, and natural drainage is poor. Water stands on the surface early in spring and late in fall.

The 6- to 8-inch surface layer is a dark grayish-brown to nearly black silty clay loam to silt loam, which is plastic when wet. This is underlain by a gray to light-gray silty clay loam mottled with rust brown and yellow to a depth of 12 to 14 inches. Below this layer the material is bluish-gray heavy clay, which breaks into irregular blocky fragments when moderately dry, but is very plastic and sticky when wet.

This soil is found in small to fairly large bodies in the southeastern part of the county. Poor drainage largely limits its use for purposes other than grazing or forestry.

SOILS DEVELOPED ON MEDIUM- TO LIGHT-TEXTURED MATERIALS OVER SILT AND CLAY DEPOSITS

The group of terrace soils developed on medium- to light-textured materials over silt and clay deposits is represented by the Melrose and Adams series. Surface relief is smooth to sloping, and drainage conditions range from excessive to poor. The Melrose soils are characterized by gravel-free sandy outwash deposits over silt and clay at shallow depths, usually 2½ to 4 feet. The Adams are also derived from sandy outwash deposits, with little or no gravel, which may be underlain by lacustrine silt and clay at a depth of 6 to 20 feet.

MELROSE SERIES

The Melrose soils are developed from medium- to light-textured outwash materials over silt and clay deposits. They are stone-free, easy to handle, hold moisture well, and are very responsive to fertilization and management. The fine sandy loam type and its sloping phases are among the best general-purpose soils of the county.

In cultivated fields the 6- to 8-inch surface soil is brown to light-brown mellow fine sandy loam, underlain by a yellow-brown mellow fine sandy loam that grades into a pale-yellow fine sandy loam at a depth of 12 to 14 inches. Below a depth of 20 to 24 inches the material is gray to yellowish-gray light fine sandy loam or loamy fine sand mottled and streaked with rust brown and yellow and resting on olive-gray heavy clay at 30 to 36 inches. Natural drainage is good, but drainage in the lower part of the subsoil is retarded to some extent by the clay strata.

These soils occur in the southeastern part of the county in association with the Suffield and associated soils. A large percentage is cleared and used for general crops and pasture or is lying idle. The relief is nearly level to gently sloping, and erosion control is not a serious problem.

Melrose fine sandy loam and Melrose loamy sand and their sloping phases are mapped.

ADAMS SERIES

The Adams soils have developed on relatively smooth low-lying terraces from sandy material over marine or lacustrine silt and clay deposits. These deposits are generally 8 to 10 feet or more in depth. They differ from soils of the Merrimac series in that there is practically no gravel in the profile.

These soils are characterized by grayish-brown fine sandy loam or loamy sand surface layer. This material is underlain by brownish-yellow fine sandy loam or loamy sand, which grades into pale-yellow material of the same texture at 14 to 20 inches in depth. At a depth of 26 to 40 inches the material changes to gray or slightly yellowish-gray loamy sand or loamy fine sand, containing a few mottlings or streaks of yellow at 4 feet or more. All layers are loose and friable when disturbed. Drainage is good to excessive, but the water table is higher than under the Merrimac or Barnstead soils.

Except for a few areas these soils occur in the southeastern part of the county. The relief is nearly level to sloping, the dominant range of slope being less than 5 percent. There is some evidence of slight wind erosion on unprotected areas, but there is little water erosion. These soils are largely in forest, with scattered areas cleared of trees and under cultivation, in pasture, or lying idle. Adams fine sandy loam and Adams loamy sand with its sloping phase are mapped.

SOILS DEVELOPED ON SAND AND GRAVEL OUTWASH DEPOSITS

The soils developed on sand and gravel outwash deposits are represented by the Merrimac, Barnstead, Sudbury, and Scarboro series. Gravel is common throughout the profiles. The Merrimac soils are light in color, and the stratified sand and gravel deposits from which they have developed are largely granitic. The deposits from which the Barnstead soils are developed contain sufficient pyritiferous schist material to give the soils a rusty- or reddish-brown color throughout. The imperfectly drained Sudbury soil occupies level to very gently sloping areas, and the poorly drained Scarboro soils level to depressed areas.

MERRIMAC SERIES

The Merrimac soils have developed on glacial outwash plains from deposits of coarse sand and gravel derived largely from granite and gneiss. They are comparatively stone-free and are easy to till but are generally excessively drained, which is often the limiting factor in crop production. The brown surface soil is underlain by a yellowish-brown upper subsoil that grades into pale-yellow or yellow incoherent fine sandy loam or loamy sand at a depth of 14 to 16 inches. At an average depth of 24 inches the material is gray or yellowish-gray stratified coarse sand and gravel of granitic origin. All layers are acid.

These soils occur in small to fairly large bodies well distributed over the county. The dominant relief is nearly level to gently sloping or undulating, a few areas occupying slopes of more than 5 percent. In general the inherent productivity is closely related to texture. The lighter members, especially, are highly leached of organic matter and plant nutrients.

Two types and two phases are mapped: Merrimac fine sandy loam and Merrimac loamy sand and their sloping phases.

BARNSTEAD SERIES

The Barnstead soils are developed on outwash glacial terraces on material derived in part from schist high in iron pyrite and mica. These soils have gravelly substrata similar in texture, structure, and consistence to the Merrimac soils from which they have been separated because of differences in parent material. Drainage is good to excessive.

In forested areas there is a thin top layer of partly decomposed organic debris. The 1- to 3-inch surface soil is rich-brown mellow fine sandy loam, containing a noticeable quantity of organic matter. This material is underlain by a rusty yellowish-brown fine sandy loam that breaks down into soft fragments when disturbed. The color becomes lighter with depth and at about 14 inches there is a rusty-yellow or yellow light fine sandy loam. The lower subsoil contains considerable gravel and gritty material and rests on rusty-brown and yellowish-gray coarse sand and gravel deposits at about 24 inches. Sand and gravel deposits are derived from schist and granitic materials in varying proportions, but usually about 50 percent is made up of schist. The material is slightly cemented in places where there are considerable pyritiferous schist fragments. Variations are mainly in intensity of rusty-brown coloring. All layers are acid.

These soils occur in fairly large areas in Rochester and Somersworth and in small scattered bodies in Barrington and Strafford. They are largely in forest or lying idle. The dominant relief is nearly level to gently sloping, a few areas having a gradient of more than 5 percent.

Barnstead fine sandy loam and Barnstead loamy sand with their sloping phases are mapped.

SUDBURY SERIES

The Sudbury soil occupies widely separated flats or low imperfectly drained areas on the terraces in association with the Merrimac, Barnstead, and Adams soils in the central and southern parts of the county.

In cultivated fields the surface soil is dark grayish-brown mellow fine sandy loam to a depth of 6 or 7 inches. This is underlain to a depth of 16 to 18 inches by a yellowish-brown fine sandy loam with some rust-brown and gray mottlings. Below this is a layer of strongly mottled gray or yellowish-gray loamy fine sand or sand. Below 24 inches the material is generally gray or light-gray loamy sand mottled and streaked with rust brown and yellow. In places the lower part contains considerable gravel.

Imperfect drainage limits the range of crops that may be grown successfully. Timothy hay, silage corn, and vegetables for home use are the principal crops.

Sudbury fine sandy loam is the only type mapped. Probably more than 90 percent of its area is in forest.

SCARBORO SERIES

The Scarboro soils occupy poorly drained positions on the terraces. They are characterized by a dark-brown or black surface soil underlain by a mottled subsoil, which is waterlogged most of the time.

Scarboro fine sandy loam and Scarboro loam are mapped.

SOILS OF THE KAMES

The group of soils developed on the kames is represented by the Hinckley and Jaffrey series. They occupy a very small percentage of the total area of the county and are little used for agricultural purposes. Drainage is rapid to excessive. The Hinckley soils are developed mainly from granitic deposits and are light in color, whereas the Jaffrey soil has developed from kame deposits containing considerable schist and has a rusty yellowish-brown or ocherous-yellow color throughout.

HINCKLEY SERIES

The Hinckley soils are developed on hummocky uneven or strongly sloping relief associated with the Merrimac from bedded sand and gravel deposits derived largely from granite, gneiss, and other crystalline rock material. Their open structure, together with hummocky and uneven relief, is conducive to excessive drainage. They are characterized by a grayish-brown to brown surface soil underlain by a yellowish-brown gravelly and gritty subsoil resting on stratified coarse sand and gravel at varying depths. The quantity of gravel on the surface and throughout the soil is variable, and there are also variations in texture. All layers are acid.

These soils occur in widely separated bodies throughout the county. Surface relief ranges from rolling to steep, but is dominantly hilly. Except for a few scattered areas the soils are generally stone-free. If cleared and improperly handled, they are subject to some wind and also sheet erosion. Owing to their unfavorable relief and excessive drainage, their principal use is for forest or grazing.

Hinckley loamy sand and its eroded phase are mapped.

JAFFREY SERIES

The single soil of the Jaffrey series—the loamy sand—occurs on hummocky, uneven, and strongly sloping relief associated with the Barnstead soils. It has developed from coarse sand and gravel deposits derived in part from schist high in iron pyrites and mica that give it a rusty yellowish-brown or ocherous-yellow color throughout. It is similar in texture, structure, and consistence to the Hinckley soils, from which it has been separated because of differences in parent material and in color.

The soil is characterized by a dark-brown or rich-brown surface soil underlain by a rusty yellowish-brown upper subsoil that grades into a yellow or ocherous-yellow lower subsoil. Depth to rusty-brown and grayish-brown sand and gravel deposits varies but is usually from 14 to 20 inches. The quantity of gravel on the surface and throughout the soil also varies. All layers are acid, varying from extremely acid in the surface soil to slightly less in the subsoil.

The inextensive Jaffrey loamy sand occurs in widely separated areas, mainly in the central and southeastern parts of the county. The relief is dominantly rolling to hilly, a few areas steep. If cleared and improperly handled, this soil is subject to some wind erosion and also sheet erosion. It is largely in forest, and owing to unfavorable relief and excessive drainage, its use for agriculture is limited.

SOILS OF THE BOTTOM LANDS

The following series are represented in the group of bottom lands: Ondawa, Podunk, Rumney, and Saco. Of the combined small acreage, scattered areas are cultivated, and the rest is used for pasture or is in forest. Drainage conditions range from good to poor, and the soils are subject to occasional flooding. With the exception of the Saco series all the soils of this group are light-textured.

ONDAWA SERIES

The Ondawa soils—the fine sandy loam and its high-bottom phase—are located on well-drained first bottom positions and are developed from fairly recent alluvial deposits. They are subject to occasional flooding. The sediments are largely of granitic origin, and the soil is acid throughout. Both are characterized by a brown mellow surface soil over a yellowish-brown or brownish-yellow upper subsoil, becoming lighter in color and texture with depth. They occur in a small total acreage along the Lamprey, Cocheco, Salmon Falls, and Isinglass Rivers and are free of stone and gravel, easy to cultivate, and are adapted to a wide variety of crops common to the area.

PODUNK SERIES

Podunk fine sandy loam, the only representative of its series, occupies imperfectly drained positions on the first bottoms in association with the Ondawa and Rumney soils. It is highly acid throughout. The 8- to 10-inch dark-brown or grayish-brown mellow fine sandy loam surface layer is underlain by yellow-brown fine sandy loam mottled with rusty brown and gray. The lower subsoil is dominantly gray mottled with brown, rust brown, and yellow and is saturated with water early in spring and late in fall. Surface drainage is fair, but imperfect subsoil drainage limits the use of the soil for many crops.

RUMNEY SERIES

The inextensive Rumney fine sandy loam, the only type mapped, occupies poorly drained positions associated with the Ondawa and Podunk soils. The 8- to 10-inch dark-brown or dark grayish-brown mellow fine sandy loam surface soil is underlain by a pale yellowish-brown fine sandy loam mottled with rust brown and light gray. Below 18 to 20 inches the material is gray to yellowish-gray loamy sand or coarse sand mottled with rust brown. The reaction is very acid throughout. The soil is not important agriculturally. Poor drainage limits the use of the cleared areas to hay, and about 75 percent of the total acreage is in forest.

SACO SERIES

The silt loam, only type of the Saco series mapped, occupies low positions on first bottoms, associated with and receiving wash from the Suffield, Buxton, and Biddeford soils. Both surface and subsurface drainage are poor. The 10- to 12-inch dark grayish-brown to nearly black friable silt loam surface soil is high in organic matter and is underlain by a bluish-gray heavy silt loam or silty clay loam mottled and streaked with rust brown and yellow. Below 18 to 20 inches the material is bluish-gray heavy silty clay or clay mottled and streaked

with rust brown. Occurrence is for the most part in small strips along drainageways in the southeastern part of the county. Small areas are cleared and in mowing or in pasture or lying idle; the rest is in forest, consisting mainly of willow, alder, red maple, gray birch, and elm.

MISCELLANEOUS SOILS AND LAND TYPES

The miscellaneous soils and land types include Alluvial soils, undifferentiated; Muck and Peat and their shallow phases; Tidal marsh; rolling stony land of Brimfield, Hollis, and Rockingham soil materials; rough stony land of Brimfield, Canaan, Colrain, Gloucester, Hermon, Hollis, and Rockingham soil materials; Gravel pits; and Rock outcrop. The stony lands and Muck and Peat are largely in forest. The organic soils, or deposits of Muck and Peat, occur in forested swamps, marshes, and heath bogs. These deposits are the remains of plants that have accumulated in former ponds, in depressions, and in other permanently wet situations. They vary in composition, in degree of decomposition, and in depth. Areas of Muck are more highly decomposed than Peat areas and generally contain a higher percentage of mineral soil.

DESCRIPTIONS OF SOIL UNITS

In the following pages the soil series, types, and phases are described in detail and their relation to agriculture is discussed. Their location and distribution are shown on the accompanying soil map, and their acreage and proportionate extent are given in table 7.

TABLE 7.—*Acreage and proportionate extent of the soils mapped in Strafford County, N. H.*

Soil type	Acres	Percent	Soil type	Acres	Percent
Adams fine sandy loam	320	0.1	Canaan very stony fine sandy loam	1,920	0.8
Adams loamy sand	1,664	.7	Hilly phase	512	.2
Sloping phase	704	.3	Charlton loam	3,392	1.4
Alluvial soils, undifferentiated	1,792	.8	Eroded phase	1,280	.5
Barnstead fine sandy loam	1,664	.7	Eroded hilly phase	192	.1
Sloping phase	512	.2	Gently undulating phase	1,344	.6
Barnstead loamy sand	4,160	1.8	Charlton stony loam	5,952	2.5
Sloping phase	1,152	.5	Gently undulating phase	832	.4
Becket loam	768	.3	Hilly phase	576	.2
Eroded phase	128	.1	Colrain loam	960	.4
Eroded hill phase	192	.1	Gently undulating phase	832	.4
Gently sloping phase	448	.2	Hilly phase	384	.2
Becket stony loam	1,280	.5	Colrain stony loam	384	.2
Gently sloping phase	192	.1	Hilly phase	256	.1
Hill phase	192	.1	Essex loam	512	.2
Biddeford silty clay loam	8,832	3.7	Eroded phase	512	.2
Brimfield stony loam	3,712	1.6	Gently sloping phase	448	.2
Hilly phase	768	.3	Essex stony loam	1,024	.4
Brimfield very stony loam	1,536	.7	Gently sloping phase	256	.1
Hilly phase	320	.1	Gloucester fine sandy loam	1,408	.6
Brookfield loam	512	.2	Eroded phase	448	.2
Eroded phase	320	.1	Gently undulating phase	640	.3
Gently undulating phase	128	.1	Gloucester stony fine sandy loam	8,320	3.5
Hilly phase	64	(1)	Gently undulating phase	1,600	.7
Brookfield stony loam	6,400	2.7	Hilly phase	576	.2
Gently undulating phase	448	.2	Gloucester very stony fine sandy loam	2,240	.9
Hilly phase	768	.3	Hilly phase	320	.1
Brookfield very stony loam	4,160	1.8	Gravel pits	64	(1)
Hilly phase	704	.3	Hartland silt loam	640	.3
Buxton silt loam	1,920	.8	Severely eroded phase	192	.1
Gently sloping phase	512	.2	Steep phase	320	.1
Canaan fine sandy loam	256	.1	Hermon fine sandy loam	640	.3
Hilly phase	64	(1)	Gently undulating phase	448	.2
Canaan stony fine sandy loam	1,984	.8	Hilly phase	64	(1)
Hilly phase	448	.2			

[1] Less than 0.1 percent.

TABLE 7.—*Acreage and proportionate extent of the soils mapped in Strafford County, N. H.*—Continued

Soil type	Acres	Per-cent	Soil type	Acres	Per-cent
Hermon stony fine sandy loam	4,032	1.7	Peat	4,160	1.8
Gently undulating phase	2,432	1.0	Shallow phase	320	.1
Hilly phase	704	.3	Peru loam	192	.1
Hermon very stony fine sandy loam	10,752	4.6	Peru stony loam	896	.4
Hilly phase	2,880	1.2	Peru very stony loam	1,280	.5
Hinckley loamy sand	4,480	1.9	Podunk fine sandy loam	448	.2
Eroded phase	960	.4	Rockingham loam	704	.3
Hollis loam	2,112	.9	Rockingham stony loam	1,664	.1
Eroded phase	128	.1	Hilly phase	192	.7
Eroded hilly phase	128	.1	Rockingham very stony loam	704	.3
Gently undulating phase	192	.1	Rock outcrop	128	.1
Hollis stony loam	6,016	2.6	Rolling stony land:		
Gently undulating phase	256	.1	Brimfield soil material	1,280	.5
Hilly phase	1,408	.6	Hollis soil material	320	.1
Hollis very stony loam	1,728	.7	Rockingham soil material	1,856	.8
Hilly phase	768	.3	Rough stony land:		
Jaffrey loamy sand	1,792	.8	Brimfield soil material	3,648	1.5
Melrose fine sandy loam	3,136	1.3	Canaan soil material	5,376	2.3
Sloping phase	1,664	.7	Colrain soil material	192	.1
Melrose loamy sand	384	.2	Gloucester soil material	256	.1
Sloping phase	128	.1	Hermon soil material	4,672	2.0
Merrimac fine sandy loam	1,600	.7	Hollis soil material	2,432	1.0
Sloping phase	640	.3	Rockingham soil material	320	.1
Merrimac loamy sand	6,528	2.8	Rumney fine sandy loam	1,536	.7
Sloping phase	2,560	1.1	Saco silt loam	1,216	.5
Muck	2,624	1.1	Scarboro fine sandy loam	3,328	1.4
Shallow phase	1,216	.5	Scarboro loam	1,728	.7
Newmarket loam	384	.2	Sudbury fine sandy loam	3,008	1.3
Gently undulating phase	128	.1	Suffield silt loam	4,352	1.8
Newmarket stony loam	576	.2	Eroded phase	1,856	.8
Ondawa fine sandy loam	384	.2	Eroded rolling phase	1,472	.6
High-bottom phase	512	.2	Level phase	384	.2
Paxton loam	1,664	.7	Severely eroded rolling phase	512	.2
Eroded phase	1,472	.6	Sutton loam	1,024	.4
Eroded hill phase	320	.1	Sutton stony loam	4,288	1.8
Gently sloping phase	512	.2	Tidal marsh	192	.1
Hill phase	64	(1)	Whitman stony loam	17,472	7.4
Severely eroded phase	192	.1	Whitman very stony loam	3,456	1.5
Paxton stony loam	2,176	.9			
Gently sloping phase	192	.1	Total	236,160	100.0
Hill phase	768	.3			
Steep phase	192	.1			

[1] Less than 0.1 percent.

Adams fine sandy loam.—Occupying a small total acreage, this soil occurs in small widely scattered areas largely in Rochester, Somersworth, Dover, and Barrington. It is not important in the agriculture of the county. A few areas are included with sloping relief, but the gradient does not exceed 5 percent on most of this soil. Drainage is good and inclined to be excessive in the surface soil and upper subsoil. The water table is comparatively high, but crops suffer for lack of moisture in dry seasons.

In forested areas a thin layer of leaf litter has developed on the surface. The 8-inch surface soil is grayish-brown light fine sandy loam underlain by a brownish-yellow fine sandy loam, slightly heavier than the surface, which grades into a pale-yellow loamy fine sand at 14 to 20 inches. This material changes to gray or slightly yellowish gray loamy fine sand with faint mottlings and streaks at 30 to 40 inches and continues to more than 5 feet in depth. Beds of silt and clay underlie this soil in places at a depth of 8 to 10 feet. Considerable finely divided mica flakes are present in the lower subsoil in most places. All layers break down into a loose incoherent mass when disturbed. The reaction varies from strongly acid in the surface layer to slightly less acid in the subsurface layer. Roots, air, and water easily penetrate this

soil to great depths. Where areas occur in association with the Barnstead soils, they are browner than typical throughout. Otherwise, they are fairly uniform in texture, color, and other characteristics.

This soil is largely in second- or third-growth forest cover, consisting mainly of white pine with a scattering of gray birch and red maple. Scattered cleared areas are either under cultivation, lying idle, or in pasture. This soil is very easy to handle, warms up early in spring, and is responsive to fertilization. Heavy applications of manure and fertilizers may produce good yields of potatoes, vegetables, sweet corn, alfalfa, hay, and other general crops. Yields compare favorably with those obtained on Merrimac fine sandy loam. Hay yields 1 to 1½ tons an acre and potatoes 100 to 175 bushels.

Pastures and idle areas generally contain much broomsedge, poverty grass, sweetfern, gray birch sprouts, cinquefoil, goldenrod, hairy-cap moss, and blueberries, with some Kentucky bluegrass and redtop.

Adams loamy sand.—Except for texture this type is similar in profile characteristics to Adams fine sandy loam. It varies from loamy sand to loamy fine sand and is loose and incoherent throughout when disturbed. A few areas associated with the Barnstead soils or influenced by pyritiferous schist are browner throughout than is typical.

This type is most common in the town of Rollinsford and occurs in small bodies in Somersworth, Rochester, Milton, Barrington, Dover, Madbury, Durham, and Lee. The relief is level to gently sloping, the gradient not exceeding 5 percent. A few swales have developed in favorable locations; otherwise, there is little evidence of either wind or water erosion.

Owing to the loose and porous nature of both the surface and subsoil layers, water passes rapidly through to lower depths and drainage is excessive. The soil is highly leached of plant nutrients and organic matter, and applied nutrients in the form of commercial fertilizer, lime, or manure are rapidly leached. Although the water table is higher than in the Merrimac or Barnstead soils, it is generally too low to furnish an adequate moisture supply for good growth of crops and grasses during dry periods.

This soil is largely in forest consisting mainly of white pine, with a scattering of gray birch and red maple. Small bodies are under cultivation, lying idle, or in pasture. Heavy applications of manure, fertilizer, and lime may produce fair to good yields of certain crops. Millet, silage corn, and sweet corn are the main crops. Millet yields about 15 tons of silage an acre (pl. 3, *B*), if 10 to 12 loads of manure and 200 pounds of a 4–16–20 mixture are applied. Yields of silage corn and other crops vary, depending on fertilization and moisture supply.

The carrying capacity of pastures is generally low unless fertilized. Most pastures and idle areas contain much broomsedge, poverty grass, gray birch sprouts, cinquefoil, sweetfern, hairy-cap moss, and common juniper.

Adams loamy sand, sloping phase.—Occurring in small bodies associated with the loamy sand, this phase is similar to it except in relief. Most of it occupies slopes of 5 to 10 percent, but a few areas have gradients of 15 percent or more. There has been slight wind erosion on some exposed areas and some water erosion on the steeper

exposed slopes. The occurrence is principally on terrace breaks bordering drainageways. This soil is largely in forest, mainly of white pine and a scattering of gray birch. Scattered areas are lying idle or used for pasture, and the predominating vegetation is broomsedge, poverty oatgrass, sweetfern, cinquefoil, moss, and blueberries.

Alluvial soils, undifferentiated.—Generally occurring in narrow strips along drainageways subject to frequent flooding, these areas represent overflow land that is variable in texture, color, and stoniness and is usually poorly drained. This soil is inextensive and is not important agriculturally. It occurs in narrow strips along drainageways in widely separated bodies over the county. None of the poorly drained areas is artificially drained.

The 6- to 8-inch surface soil is dark-brown to nearly black fine sandy loam, loamy sand, or loam and the subsoil pale yellowish-brown highly mottled with rust-brown and gray fine sandy loam or loam becoming lighter in color with depth. Below 20 to 24 inches the material is gray to dark-gray loamy sand or sand. Gravel is present in places, and in others cobblestones or boulders are strewn over the surface.

Because of poor drainage and frequent overflows, practically none of this soil is used for cultivated crops. A few small areas have been cleared of trees and used for pasture. The others support a forest cover consisting mainly of gray birch, red maple, willow, alder, elm, and hemlock. Pastured areas afford good grazing if weeds and brush do not crowd out the desirable grasses and legumes, as Kentucky bluegrass, bentgrasses, and white clover.

In small widely separated bodies areas of Ondawa loamy fine sand are included with this soil. The total acreage is small, and it is not an important agricultural soil. Its profile resembles that of Ondawa fine sandy loam except for the lighter texture throughout. It generally occupies positions bordering the streams and in many places the surface soil is of very recent deposition. Drainage is more thorough and the moisture supply is not so high as in the fine sandy loam type.

Barnstead fine sandy loam.—Developed on glacial outwash terraces, this soil is similar in texture, structure, and consistence to Merrimac fine sandy loam. The sand and gravel deposits from which the soil has developed is derived in part from schist high in iron pyrites and mica which gives the soil a rusty yellowish-brown or ocherous-yellow color throughout.

This type occurs in small scattered bodies in Rochester, Somersworth, and Dover. The relief is dominantly nearly level with some areas on gentle slopes not exceeding 5 percent. Natural drainage is good to excessive, and crops often suffer for lack of moisture in dry seasons.

In areas under cultivation or ones that have been at one time, the surface is rich-brown mellow fine sandy loam 6 to 8 inches thick with a soft granular structure in places. This is underlain by a rusty yellowish-brown mellow fine sandy loam, firm in place but when disturbed breaks into soft irregular fragments. At 14 to 16 inches in depth this layer grades into a rusty-yellow or light-yellow gritty and gravelly fine sandy loam. The lower subsoil contains more gravel and gritty material with depth and rests on rusty-brown and yellowish-gray coarse sand and gravel deposits at about 24 inches. Sand and

gravel deposits are derived from schist and granitic materials in varying proportions, but usually about 50 percent is of schist origin. The material is slightly cemented in places where there are considerable pyritiferous schist fragments. All layers are acid in reaction, varying from very strongly acid in the surface to slightly less acid in the subsoil layers. Roots, air, and water easily penetrate this soil. Variations are mainly in intensity of the rusty-brown coloring where it grades toward the Merrimac soils.

Like Merrimac fine sandy loam this soil is stone-free, easy to cultivate, warms up early in spring, and works up into a mellow friable tilth. Its relief is favorable for farming operations, and tillage operations are possible soon after rains, owing to the open and friable nature of the surface and subsoil layers. It is responsive to fertilization, and, with heavy applications of manure, fertilizers, and lime, good yields of general crops may be expected. The moisture supply is generally the limiting factor in crop production.

Only a very small percentage of this soil is cultivated, the principal crops being hay, silage corn, sweet corn, and vegetables. Fertilizer treatments and management practices are similar to those on Merrimac fine sandy loam, and crop yields are essentially the same. Considerable acreage is lying idle or in pasture, and the rest is in forest, consisting chiefly of white pine. The dominant vegetation on idle areas and pastures is broomsedge, poverty oatgrass, sweetfern, common juniper, cinquefoil, blueberries, and gray birch sprouts.

Barnstead fine sandy loam, sloping phase.—Although similar to the fine sandy loam, this sloping phase differs in relief. It generally occupies positions on the edge of terraces on gradients of 5 to about 15 percent. This soil occurs in small widely scattered bodies associated with the typical soil, and is not important agriculturally. Practically the entire acreage is in forest or lying idle, and the vegetation is the same as on similar areas of the typical soil. Owing to the relief it is more susceptible to erosion than the typical soil. However, erosion has not been significant except on two or three small bodies. Simple conservation practices are adequate for controlling erosion if used for clean-tilled crops.

Barnstead loamy sand.—This soil is similar to Barnstead fine sandy loam except in texture; it is coarser, loose, and incoherent throughout. Drainage is excessive owning to the open and porous surface, subsoil, and substratum. It is highly leached of plant nutrients, and applied nutrients in the form of manure, fertilizers, and lime are rapidly leached out. In places, indicated by stone symbols on the map, a few stones are scattered over the surface. These areas are not extensive and are of little agricultural importance. The relief is nearly level with scattered areas occupying gentle slopes with a gradient of less than 5 percent. This type occurs in rather extensive areas in the vicinity of the city of Rochester, south and southwest of Gonic, northwest of the city of Dover, in the vicinity of East Barrington in Barrington, and in small scattered areas throughout the central part of the county.

Most of this soil has been under cultivation at one time and virgin profiles are not common. The 4- to 6-inch surface soil is dark-brown or brown loose and friable loamy sand. In forested areas there is a very thin layer of organic debris on the surface. The upper sub-

soil is rusty yellowish-brown loamy sand that grades into a light-yellow loamy sand at a depth of about 12 inches. Both layers are loose and incoherent when disturbed, and the lower part contains considerable gravel in places. At a depth of 20 to 24 inches the lower subsoil rests on rusty-brown and grayish-yellow stratified coarse sand and gravel. Sand and gravel deposits are derived in part from schist high in iron pyrites and mica, but generally about 50 percent is of granitic origin. All layers are acid in reaction. Variations are mainly in texture and intensity of the rusty-brown coloring. The texture is largely loamy sand with small areas of loamy fine sand included. Where the soil grades toward Merrimac loamy sand it is lighter colored throughout.

This soil is largely in forest, consisting mainly of white pine, with some pitch pine, gray birch, aspen, red maple, and white oak. In places there is almost a pure stand of young white pine. Small areas are in pasture or lying idle, and a few bodies are under cultivation, mainly to hay and vegetables for home use. Crop yields are generally low unless heavily fertilized, and the carrying capacity of the pastures is also low. Vegetation on the pastures and idle areas consists mainly of broomsedge, poverty oatgrass, sweetfern, moss, and gray birch sprouts.

Barnstead loamy sand, sloping phase.—Closely associated with the loamy sand in small scattered bodies, this soil is similar to it, except in relief. It occurs on the more sloping areas with gradients of 5 to 15 percent. Owing to the sloping relief this soil is subject to some erosion if exposed or improperly handled. A few areas have been moderately eroded; that is, 25 to 75 percent of the surface has been lost. Also a few short gullies have developed on some of the short slopes. These eroded areas should be allowed to revert to forest. Practically the entire acreage is in forest or lying idle, with the same vegetation as found on forested and idle areas of the loamy sand.

Becket loam.—Associated with the Hermon soils in the northern part of the county, this soil occurs for the most part on uniformly rounded hills and on slopes of 5 to 15 percent (pl. 2, *A*) in scattered areas in Farmington, Middleton, New Durham, and Milton. It is fairly uniform in texture and structure, and a large part of it is cultivated or in pasture. A few scattered areas are idle or support a young forest cover.

The 6- to 8-inch brown or dark-brown mellow loam surface soil exhibits very little structure, unless the soil has been in sod for several years The upper subsoil is rich-brown loam that grades into a yellowish-brown loam containing some small rock fragments and gritty material. This upper subsoil layer passes into pale-yellow or grayish-yellow gritty loam at 12 to 14 inches. These layers are firm in place but break down easily into soft granules when disturbed. At 20 to 22 inches below the surface the soil rests on gray to yellowish-gray rather compact granitic till. When dug out with a pick, it breaks into platy fragments. Most of the stone has been picked off the surface, but rock fragments of granite and gneiss are common throughout the soil mass. The soil is acid in all layers, varying from very strongly acid in the surface to strongly acid or medium acid in the subsoil layers.

While the compact substratum retards the downward movement of water, it does not act as a hardpan but holds a good supply for growing crops. Early in spring or wet seasons there is some lateral movement of water along the compact layer with seep spots along the lower slopes and in low places. Surface drainage is good. A few small areas of imperfectly drained soils are included in mapping.

The surface relief is favorable for all farming operations, and most of the fields are large enough to permit the use of modern farm implements. The soil is fairly easy to handle as it lends itself well to management and conservation practices. Because of the compact substratum and low water-absorbing capacity, some care must be taken to control erosion on the steeper slopes when used for clean-cultivated crops. With grasses or other close-growing crops in a long rotation, however, erosion is not likely to be serious. Although when a hayfield is plowed for corn or for reseeding, strips across the slope rather than the whole slope should be plowed.

Hay and silage corn are the main crops, as dairying is the principal farming enterprise. Small acreages are planted to potatoes, oats, field corn, and vegetables for home use. Fertilizer practices are essentially the same as on Essex loam, and crop yields are about the same. Hay yields 1½ to 3 tons an acre, silage corn 10 to 14 tons, field corn 35 to 50 bushels, and potatoes 175 to 300 bushels. Pastures have about the same carrying capacity as those on Paxton or Essex loams. Kentucky bluegrass, redtop, Canada bluegrass, poverty grass, and broomsedge are the most common grasses. Run-down pastures support a good stand of undesirable shrubs and herbs, as common juniper, gray birch, and aspen sprouts, hardhack, hawkweed, hairy-cap moss, and broomsedge.

Becket loam, eroded phase.—This eroded phase occurs in small widely scattered areas closely associated with Becket loam but differs from it in the degree of erosion—25 to 75 percent of the surface soil having been lost. One fairly large area is mapped on New Durham Ridge along the New Durham and Farmington town line. No gullies have developed, as sheet erosion is the only form that has occurred over a period of years. Crop yields have not been reduced materially by erosion except in spots where it has been most severe. A large part of this phase is under cultivation, in pasture, or idle. The same crops are grown in about the same proportion as on the type. With simple practices, as contour cultivation, strip cropping, and proper rotation of crops, the soil may be stabilized and accelerated erosion limited to a minimum. On some of the most severely eroded spots special care and fertilization will be necessary to restore them to their former fertility level.

Becket loam, eroded hill phase.—Occurs on gradients of 15 to 25 percent. Owing to the relief and the compact substratum, this soil is very erodible if used for clean-tilled crops under improper management. Two small areas are slightly eroded and several severely, and on the rest 25 to 75 percent of the surface soil has been removed. The total acreage occurs in small scattered areas. Surface drainage is rapid, and the moisture supply is usually lower than on the smoother types and phases. As typically developed, this phase does not average

so deep a surface layer as do the smoother soils. About 90 percent is in forest or is lying idle, and the rest is cultivated. Because of the unfavorable relief and susceptibility to erosion if cultivated, the best uses for which this land is adapted are probably long-term hay crops, pasture, or forestry.

Becket loam, gently sloping phase.—Similar in all respects to the loam, except in relief, this phase occurs in small scattered areas chiefly on the crest of the smoothly rounded hills on slopes from nearly level to 5 percent. Because of the smooth relief surface runoff is not so rapid, water-holding capacity is slightly higher, and it is not so easily eroded under clean cultivation as the normal loam. Internal drainage is adequate for crops commonly grown. Most of this phase is under cultivation, in pasture, or idle. A few small areas have been allowed to reforest themselves and now support a young forest cover. Hay and silage corn are the principal crops. Yields average about the same as on Becket loam or a little higher. The soil requires no special practices for its conservation if planted to row crops.

Becket stony loam.—This type represents areas where none or only a part of the surface stone has been removed. The degree of stoniness varies from moderately to very stony. It is found in small scattered areas associated with other Becket soils. Surface drainage is good, but internal drainage is rather slow because of the compact till. The compact layer does not act as a hardpan but only serves to slow up the downward movement of water and hold a good supply for plant and tree roots. The relief ranges from 5 to 15 percent and the gradients are uniformly sloping for the most part.

Under undisturbed forest conditions a layer of dark-brown leaf litter, 2½ to 4 inches thick, has developed on the surface. This is underlain by a light- or ashy-gray light loam 1 to 2½ inches thick, which rests on a rusty-brown loam about 4 inches deep. This rusty-brown layer is firm in place but when taken out it breaks into soft granules. It becomes lighter in color with depth and grades into a yellowish-brown friable loam with some gritty material and small rock fragments. At 12 to 14 inches this grades into a pale-yellow or grayish-yellow gritty loam or sandy loam. This lower subsoil layer becomes lighter in color and texture with depth and rests on gray to yellowish-gray compact, platy till at 20 to 22 inches. The till is derived mainly from granitic materials. In places some mottlings occur just above the till, and the till may be highly mottled with yellow and rust brown in places.

This type rates among the best forest soils of the uplands region, and a large part of it is in forest. Small areas have been cleared of trees and are now in pasture or mowing or lying idle. Surface stone is present in sufficient quantities to interfere with or prevent the use of farm machinery. The vegetation and forested areas consist chiefly of white pine, red and sugar maples, white ash, hemlock, spruce, paper birch, yellow birch, beech, and red oak, with such shrubs as mountain-holly, witch-hazel, dogwood, hazel, bracken fern, blueberry, and wintergreen. Pasture areas furnish good grazing, and the carrying capacity is about the same as on Becket loam under similar management and fertilization practices.

Becket stony loam, gently sloping phase.—Mapped on several small scattered areas in New Durham and Milton, the relief is nearly level to gently sloping, and in this respect differs from the stony loam. The total acreage is largely in forest, mainly of the same species as on the stony loam.

Becket stony loam, hill phase.—This soil is essentially the same as the stony loam, except in relief. Practically all the small scattered areas are in forest, for which purpose it is probably best suited because of stoniness, unfavorable surface relief, and susceptibility to erosion if cultivated. The slopes are for the most part single ones of 15 to 25 percent.

Biddeford silty clay loam.—Occurring on nearly level or flat relief, this soil occupies poorly drained areas associated with the Suffield and Buxton. Water stands on the surface the greater part of the year. This type is found in small to fairly large bodies in the southeastern part of the county, the largest areas, north and northwest of the city of Dover and southwest of the city along the Dover-Madbury town line.

The 6- to 8-inch surface layer is dark grayish-brown to nearly black silty clay loam to silt loam that is plastic when wet. In places some sandy material has washed in from the adjoining upland. The surface soil is underlain by a gray to light-gray silty clay loam mottled and streaked with rust brown and yellow to a depth of 12 to 14 inches. This breaks into irregular angular fragments when dry but is sticky and plastic when wet. Below this layer the material is bluish-gray heavy clay streaked and mottled with rust brown and yellow, which breaks into irregular blocky fragments when moderately dry but is very plastic and sticky when wet. Very few roots penetrate this soil below a depth of 12 inches.

Poor drainage largely limits this type for purposes other than grazing or forestry. A few areas have been artificially drained by means of tile or open ditches and are used mainly for hay. One tiled area on the University of New Hampshire farm is used for silage corn. About half of the remaining acreage is in forest, and the other is in pasture or lying idle.

Hay yields 1½ to 3 tons an acre, depending on the seasons and care. Pastures generally furnish good grazing except in unusually dry seasons, and 1 to 3 acres are required to support one cow for the normal grazing season of 130 days. On the better pastures the most common grasses and legumes are Kentucky bluegrass, white clover, and redtop. Sedges are common on the wetter spots, and hardhack, goldenrod, meadowsweet, common juniper, alder, gray birch sprouts, asters, ferns, and hairy-cap moss are numerous on the neglected pastures and idle areas. Red maple, alder, elm, and gray birch are the principal forest species in forested areas.

Brimfield stony loam.—Although several small areas with smooth relief are included, this soil occurs largely on smoothly rolling relief with 5 to 15 percent slopes. It is the most extensive of the Brimfield soils. Schist bedrock outcrops are numerous, and the depth of the soil over bedrock is extremely variable—from a few inches to less than 2 feet on a large percentage of this soil. It has developed largely from

a thin mantle of glacial till derived from reddish-brown micaceous schist and to a less extent from the bedrock itself.

It occurs in small to fairly large areas in northern Barrington, Strafford, Farmington, Rochester, Milton, and the southern parts of New Durham, the most extensive in Farmington and Strafford. Both surface and internal drainage are good. Although the soil is generally shallow, and its water-holding capacity is therefore limited, the moisture supply seems adequate for tree growth. Grasses and crops suffer from lack of water late in summer and fall. Roots, air, and water easily penetrate the soil to bedrock.

The profile characteristics are similar to those of the Brookfield soils, where there is any development. Under forest conditions an organic layer 1½ to 3 inches thick has developed on the surface. The surface soil is dark-brown mellow loam well-matted with small roots. The upper few inches of the subsoil is a rusty-brown friable loam that grades into a rich-brown loam. This changes to a yellow or brownish-yellow friable and gritty loam at 12 to 14 inches. The depth to till or bedrock varies but is usually less than 20 inches. The till is derived largely from micaceous schist and is a yellow gritty and friable loam to sandy loam. Finely divided mica flakes are common, and in most places are in sufficient quantities to impart a greasy feel when the soil is pressed between the fingers. Loose stone consisting of schist, granite, and gneiss are scattered over the surface and embedded in the soil, as are fragments of disintegrated mica schist. All layers are acid in reaction, varying from extremely acid in the surface to slightly less acid in the subsoil layers.

About 90 percent of the soil is forested and the rest is largely idle or in pasture. A few scattered areas are cultivated. Hay is the principal crop. Vegetables and potatoes for home use and corn are planted in small patches. Hay yields are generally low and average about three-fourths ton an acre. The carrying capacity of pastures is about the same or lower than on Hollis stony loam. Three to six acres are required to carry one cow for the normal grazing season of 130 days. The vegetation on the idle areas is chiefly broomsedge, common juniper, gray birch sprouts, sweetfern, sumac, poison-ivy, poverty oatgrass, cinquefoil, devils-paintbrush, and daisies. Some redtop, Colonial bentgrass, and Kentucky bluegrass are found on the better pasture areas. The predominating forest species are white pine, white and red oaks, pitch pine, red maple, gray birch, and scrub oak, with an undergrowth of blueberries, sheep laurel, sweetfern, witch-hazel, and wintergreen. Most of the timber is small and of little value at present except for cordwood.

In the northern part of the county a few bodies that have a well-defined gray layer just beneath the forest duff are included.

Brimfield stony loam, hilly phase.—Differing from the stony loam mainly in relief, the hilly phase occurs on slopes of 15 to 25 percent, which are generally short but not broken. This phase is of small extent, and is mapped for the most part in small bodies closely associated with the type. Several fairly large areas are found in the vicinity of Blue Job Mountain in Strafford and Farmington. Surface drainage is more rapid on the hilly phase, and if cleared and used for cultivated crops would be more susceptible to erosion. Owing to

shallowness, stoniness, and hilly relief, the best use for this soil is either for forest or for grazing. Practically the entire acreage is in forest, consisting of the same species as found on the stony loam.

Brimfield very stony loam.—This inextensive soil occurs in scattered bodies in Strafford, Farmington, the northern part of Barrington, and the western part of Rochester. It is similar to the stony loam type except that stones are more numerous, generally larger, and consequently more difficult to remove. The stone content largely prohibits the use of this land for crops, but it can be used for pasture. If cleared of trees, however, it would be less valuable than the stony loam for grazing because a larger percentage of the surface is taken up by stones and boulders. Practically the entire acreage is in forest, consisting of the same species as found on Brimfield stony loam.

Brimfield very stony loam, hilly phase.—Except in the content of stone on the surface and throughout the soil, this soil is similar to Brimfield stony loam, hilly phase. It is of small extent and is closely associated with the very stony loam in Strafford and Barrington. The stones are generally larger than on that soil and more difficult to remove. The stone content and hilly relief prohibit its use for crops, but it has some value for grazing. Probably about 50 percent of the surface is taken up by stones and boulders. The entire acreage is in forest.

Brookfield loam.—This soil occurs on undulating to smoothly rolling relief, the gradient ranging from 5 to 15 percent. Most of it is cultivated, and the rest is in pasture or lying idle. It is found in small widely scattered areas in Barrington, Somersworth, Rochester, Milton, Farmington, and the southern part of New Durham. Most of the total acreage is cultivated or in pasture. Both surface and internal drainage are good, but internal drainage is inclined to be excessive. The moisture-holding capacity is only fair, and crops sometimes suffer from lack of moisture.

The surface is brown or dark-brown mellow loam with considerable reddish-brown mica schist fragments. This material is underlain by a 4-inch strong yellowish-brown or rusty-brown friable loam, where it grades into light yellowish-brown gritty and friable light loam. This layer contains more rock fragments and gritty material with depth and grades into yellow gritty and friable micaceous till at 24 to 30 inches. The subsoil layers are fairly firm in place but break down easily into very soft irregular fragments. Considerable mica and mica schist rock fragments are present throughout the profile, and when pressed between the fingers the mica imparts a slick or greasy feel to the soil. All layers are acid in reaction. The surface layer is usually extremely acid and the subsoil slightly less acid. This type is fairly uniform in texture. Small areas are included with fine sandy loam surface textures. There are also some variations in intensity of the brown or rusty-brown coloring caused by granitic materials mixed with mica schist that form the parent material.

Hay and silage are the principal crops. Small acreages are used for field corn, vegetables, and potatoes for home use, and oats. Most of the available manure is used under silage corn or for top dressing of hayfields. Lime and commercial fertilizers are not used so ex-

tensively as on the Charlton or Paxton soils. Crop yields are generally fair to poor unless heavily fertilized and limed. Hay yields 1 to 1½ tons, silage corn 5 to 9 tons, field corn 25 to 40 bushels, and potatoes 100 to 200 bushels an acre. From 3 to 5 acres are required for each cow for the grazing season of 130 days, depending on the care and fertilization. Most pastures are given very little attention, and shrubs and weeds, as common juniper, gray birch sprouts, hardhack, sweetfern, sumac, and blueberry predominate. Redtop, Colonial bentgrass, broomsedge, and poverty oatgrass are the most common grasses.

Owing to the open and friable character of the surface and subsoil layers, loss of surface soil by erosion is not likely to be significant if simple conservation practices are employed. Applications of manure and lime and proper selection of crops may build up this soil and maintain it in a fairly productive state.

Brookfield loam, eroded phase.—Essentially the same as Brookfield loam, except in the degree of erosion. From 25 to 75 percent of the surface soil has been removed, the percentage varying considerably over the same field or areas. Where erosion has been heaviest, small schist fragments are common on the surface, and the present plow layer is very low in organic matter. A small total area is occupied, in widely scattered areas closely associated with the loam. Most of this soil is used for the same crops and in about the same proportion as on the typical soil. A few areas are in pasture or are lying idle. Erosion has not advanced to such a degree that crop yields are materially decreased. Under similar management and fertilizer practices yields probably are very little lower than on Brookfield loam. This phase is not particularly susceptible to erosion, and with simple conservation practices it may be stabilized and future erosion minimized.

Brookfield loam, gently undulating phase.—This phase occurs in small scattered areas, practically all of it cultivated to the same crops as the loam. It occurs on nearly level to gently undulating relief and in this respect mainly it differs from the loam. Surface drainage is not so rapid, due to the smooth relief, water-holding capacity is slightly higher, and it is not so susceptible to erosion. For these reasons it is more desirable for agricultural purposes. No special practices are required for its conservation if planted to clean-tilled crops. Fertilizers and management practices are the same, and yields are about the same or slightly higher.

Brookfield loam, hilly phase.—This phase is found in a few small areas in the southwestern corner of Rochester and the southern part of New Durham. About 75 percent of it is in forest; the rest is in hay or pasture. It occurs on slopes of 15 to 25 percent, and in this respect mainly it differs from Brookfield loam. Surface runoff is more rapid, and it is more susceptible to erosion if used for clean-tilled crops. Several moderately eroded areas too small to separate on the map are included.

Brookfield stony loam.—Representing areas where the stones have not been picked off, this soil is closely associated with Brookfield loam and its phases. It is largely in forest. Small scattered areas cleared of trees and in some cases of part of the surface stone are in pasture or lying idle.

This soil occurs on slopes of 5 to 15 percent. Both surface and internal drainage are good. In forested areas the species consist chiefly of white and red oaks, gray birch, white pine, pitch pine, red maple, and scrub oak with an undergrowth of blueberry, sheep laurel, sweetfern, bracken fern, witch-hazel, poison-ivy, wintergreen, and groundpine. Most of the timber is small and of little value except for cordwood at present.

Under forest conditions a layer of leaf litter, 2 to 3 inches thick, has developed on the surface. The 1- to 1½-inch surface soil is grayish-brown to dark-brown friable loam, well-matted with small roots, and is underlain by reddish-brown or rust-brown loam 4 to 6 inches thick. It is firm in place but breaks down easily into soft granules or crumbs. The upper subsoil grades into light-yellow to brownish-yellow gritty light loam that becomes lighter in color and texture and contains more gritty material with depth. At 24 to 30 inches the lower subsoil grades into a yellow loose and gritty micaceous till derived largely from reddish-brown weak mica-schist rocks. Considerable finely divided mica flakes and mica schist rock fragments are common in the surface and throughout the profile. Sufficient mica is usually present to give the material a greasy or slick feel when pressed between the fingers. Schist and granitic stone and boulders are scattered over the surface and throughout the soil mass. All layers are acid, varying from extremely acid in the surface to slightly less acid in the subsurface layers.

Areas in pasture are given little attention, and common juniper, sweetfern, hardhack, broomsedge, and poverty grass predominate. On the better pastures redtop, Kentucky bluegrass, Colonial bentgrass, and poverty grass are common. From 3 to 6 acres are required to carry one cow during the grazing season of 130 days. A few small areas are in hay or in patches of corn; yields are generally low.

Small areas are included with fine sandy loam surface textures. There are some variations in color caused by differences in composition of the till from which the soil has developed. In the northern part of the county small areas are included where a light- or ashy-gray layer has developed just beneath the leaf litter.

Brookfield stony loam, gently undulating phase.—Slightly superior as a forest soil and for agricultural purposes, if cleared the gently undulating phase is essentially the same as the stony loam except in relief. It occurs on nearly level to gently undulating relief, with gradients up to 5 percent. Because of the smooth relief surface runoff is not so rapid and the water-holding capacity is slightly higher than on the stony loam. This phase is found in small scattered areas usually on the crest of hills. Practically all the acreage mapped is supporting a forest cover of the same species as found on the stony loam.

Brookfield stony loam, hilly phase.—This hilly phase occurs in small scattered areas and is not extensive. It is mapped on slopes of 15 to 25 percent and in this respect differs from Brookfield stony loam. A large percentage of the total acreage is in forest. One or two small areas are cleared of trees and used for pasture or lying idle. Because of stoniness and hilly relief this soil is probably best adapted to forest or grazing. If cleared and used for clean-tilled crops intensive erosion-control practices will be necessary.

Brookfield very stony loam.—Differing from the stony loam mainly in the content of stone on the surface and throughout the soil mass, this type has little potential value for agricultural purposes other than grazing. It is less valuable for forest or grazing than the stony loam, because a higher percentage of the surface is taken up by stones and boulders. This soil occurs chiefly on slopes of 5 to 15 percent. A few small areas are included with nearly level to gently sloping relief. It is closely associated with the other Brookfield soils in small to fairly large bodies. The largest areas are found in New Durham, Farmington, Middleton, and Strafford. Practically the entire acreage is in forest. Small patches have been cleared of trees and are in pasture or lying idle.

Brookfield very stony loam, hilly phase.—Nearly all the scattered areas of this phase are in forest. It occurs on the same relief as Brookfield stony loam, hilly phase, and differs from that soil only in having a larger content of stone and boulders on the surface and throughout the soil mass. It is less valuable for forestry or grazing purposes because of the higher stone content. The forest vegetation is the same as on the stony soils.

Buxton silt loam.—Located on nearly level relief with the gradient not exceeding 2 percent, this soil is subject to water standing on its surface after heavy rains. Surface drainage is only fair, and internal drainage is imperfect. It is slow to warm up in spring, and moisture conditions must be right before it can be plowed. Considerable power also is necessary for cultural operations.

In cultivated fields the 5- to 6-inch surface soil is brown or dark grayish-brown silt loam with a soft granular structure that is underlain by a pale yellowish-brown silt loam with faint mottlings in places. At 9 or 10 inches this grades into a yellowish-gray silt loam or silty clay loam mottled with rust brown. These layers are firm in place, but when disturbed break into irregular fragments that break down fairly easily under pressure into soft granules. The lower subsoil rests on greenish-gray heavy clay or silty clay, highly mottled with rust brown at about 15 inches below the surface. This layer is waterlogged most of the time and roots seldom penetrate it. The surface and subsoil layers range from strongly acid to slightly acid, and the unaltered parent material may be neutral or slightly alkaline.

Associated with the Suffield and Biddeford soils this type occurs in scattered bodies in the southeastern part of the county. About 80 to 85 percent of the total acreage is cleared and used chiefly for hay and pasture. Small acreages are planted to silage corn, oats for forage, and vegetables for home use. Imperfect drainage limits its use for cultivated crops, but it is one of the best hay and pasture soils in the county. Except for some areas of this soil on the University of New Hampshire farm, practically none is artificially drained. With lime and fertilizer hay yields 2 to 3 tons an acre, silage corn 9 to 12 tons, and oats for hay 2½ to 3 tons. From 1 to 2 acres are required to carry one cow for the grazing season of 130 days, depending on fertilization and management. The dominant pasture grasses and legumes consist of Kentucky bluegrass, Canada bluegrass, redtop, white clover, Colonial bentgrass, and some poverty oatgrass. Hardhack, meadowsweet, gray birch sprouts, broomsedge, and sedges are common pests on the neglected areas.

The predominating trees on forested areas consist of red maple, beech, white ash, hemlock, basswood, gray birch, yellow birch, elm, red oak, black oak, and white pine with an undergrowth of shrubs and herbs.

Buxton silt loam, gently sloping phase.—Similar to Buxton silt loam, except in relief, this phase occurs on slopes of 2 to about 5 percent. Surface drainage is better than that of the typical soil and the surface is not so dark. It is also more susceptible to erosion, but simple conservation practices are adequate for conserving the soil under clean cultivation. In the vicinity of the village of Durham a few areas have been moderately eroded; otherwise, there has been slight or no apparent erosion. This phase is less extensive than Buxton silt loam and also occurs in small scattered areas. About the same percentage is cleared and is used for the same purposes. Fertilizer treatments and management practices are similar, and crop yields and the carrying capacity of the pastures are essentially the same on the two soils.

Canaan fine sandy loam.—Owing to the numerous surface outcrops and varied depths to bedrock, this soil is not important agriculturally. The total acreage is in widely scattered areas in Milton, Farmington, the southern part of New Durham, Rochester, Middleton, and Barrington. This soil is generally shallow over granite and gneiss bedrock and has developed from a thin layer of glacial till derived mainly from these rocks.

The relief is dominantly gently rolling to rolling (5 to 15 percent). A few areas are nearly level to gently sloping. Natural drainage is good and is inclined to be excessive. Owing to the shallowness and loose and friable nature of the substratum the water-holding capacity is comparatively low and crops and grasses suffer from lack of moisture in dry seasons.

The 4- to 6-inch surface soil is brown to light-brown fine sandy loam underlain by a yellowish-brown friable fine sandy loam that grades into a pale-yellow gritty and friable sandy loam at 14 to 16 inches. The lower subsoil becomes coarser with depth and rests on yellowish-gray to gray gritty and gravelly till at 18 to 24 inches. The subsoil layers are fairly firm in place but break down easily into a structureless mass. In most places the till is loose and friable. Roots, air, and water have no trouble penetrating this soil. All layers are acid in reaction.

Most of the loose stone has been picked off the surface, but outcrops interfere with cultivation. About half the total acreage is under cultivation; the rest is lying idle or is used for pasture. Hay is the principal crop, but a few small spots are used for corn, potatoes, or vegetables for home use. Hay averages 1 to 1½ tons an acre, and yields of potatoes and vegetables vary considerably, depending on fertilization and care. The vegetative cover on the idle areas and pastures is mainly broomsedge, poverty grass, common juniper, sweetfern, sumac, and gray birch sprouts with some redtop, bentgrass, and Kentucky bluegrass. From 3 to 6 acres are required to carry one cow for the normal grazing season of 130 days.

Canaan fine sandy loam, hilly phase.—Except for relief, this soil is similar to the fine sandy loam. It occurs on gradients of 15 to 25 percent, the slopes being rather short but uniformly sloping. Surface

runoff is more rapid than on the typical soil; therefore, it is more susceptible to erosion and more care is necessary for its control where used for cultivated crops. The small total acreage is found in several small bodies in New Durham and Milton. It is relatively unimportant agriculturally. About half the soil is in hay, the rest being idle or in forest. Yields of hay average about the same as on the typical fine sandy loam, and vegetation on the idle areas is similar to that on the idle areas of the typical soil.

Canaan stony fine sandy loam.—This more extensive soil is associated with the fine sandy loam in New Durham, Middleton, Milton, Strafford, Barrington, Farmington, and Rochester in widely scattered areas. It is also generally shallow over granite and gneiss bedrock, and surface outcrops are numerous. It has developed from a thin layer of till derived mainly from granite and gneiss and to a less degree from residual material from underlying bedrock.

Except for several nearly level areas the relief is gently rolling to rolling with a gradient of 5 to 15 percent. Drainage is well established and inclined to be excessive. Because of the friable and porous nature of the subsoil and substratum and shallowness over bedrock, the water-holding capacity is limited. Grasses and crops suffer for lack of moisture in dry seasons.

Under virgin forest conditions there is an organic layer on the surface, 2 to 4 inches thick, underlain by a light- or ashy-gray light fine sandy loam or loamy fine sand ½ to 2 inches thick. The upper 2- to 3-inch subsoil is rusty- or rich-brown friable fine sandy loam that grades into a yellowish-brown friable fine sandy loam. At 14 to 16 inches this grades into a pale-yellow gritty and friable sandy loam that becomes coarser with depth and rests on gray to yellowish-gray loose and gritty till. The subsoil layers are fairly firm in place but when disturbed break into very soft irregular-shaped fragments. Depth to bedrock is extremely variable. Loose granite and gneiss stone are scattered over the surface and throughout the soil. Roots, air, and water easily penetrate this soil to bedrock. The gray layer just beneath the forest duff is not well developed on areas associated with the Gloucester soils in the central and southern parts of the county.

Only a very small percentage of this soil is cleared of trees and is under cultivation, lying idle, or in pasture. The rest is in forest consisting chiefly of white pine, red maple, sugar maple, birch, red oak, black oak, gray birch, paper birch, and hemlock. Cultivated areas are largely in hay or vegetables for home use. Some loose stones have been picked off these areas, but they are still present in sufficient quantities to interfere seriously with modern cultural practices. The predominating vegetation on the idle areas and pastures is common juniper, hardhack, broomsedge, poverty oatgrass, sweetfern, sumac, meadowsweet, blueberries, bracken fern, with a small quantity of redtop, Colonial bentgrass, and Kentucky bluegrass.

Canaan stony fine sandy loam, hilly phase.—This phase is largely in forest, the best purpose for which it is adapted unless used for pasture. Similar to the stony fine sandy loam except in relief, this soil occurs on slopes of 15 to 25 percent. It occurs in scattered bodies in Barrington, Strafford, Farmington, Milton, Middleton, and New Durham. Surface drainage is rather rapid. If it were cleared of trees and used for crops, intensive conservation practices would be necessary to control erosion.

Canaan very stony fine sandy loam.—Associated with the other Canaan soils in New Durham, Milton, Farmington, and the northern part of Barrington, this soil is largely in forest, consisting of the same species as found on Canaan stony fine sandy loam. The relief is also the same as on that soil, but it differs in having more stone and boulders on the surface and throughout the profile. The stones are generally larger and more difficult to remove. This largely prohibits the use of the soil for cultivated crops. It may be used for pasture, but its value for this purpose is limited owing to the shallowness of the soil and the high percentage of the surface taken up by outcrops and loose surface stones.

Canaan very stony fine sandy loam, hilly phase.—Except for its location on hilly relief, this soil is essentially the same as the very stony fine sandy loam. It is mainly in forest, with very limited use as pasture.

Charlton loam.—Comparatively stone-free, 75 to 80 percent of this soil is cultivated, and the rest is idle or in pasture. It occurs on smoothly rolling relief with slopes of 5 to 15 percent.

Occurring in small to fairly large bodies in Rochester, Farmington, Strafford, Barrington, Dover, Somersworth, Rollinsford, Madbury, Durham, and Lee, this is the most extensive of the cultivated soils. Both surface and internal drainage are good, but the water-holding capacity is fairly high because of the favorable texture and structure. Roots, air, and water penetrate the subsoil layer readily. This soil is easily handled and is responsive to fertilization and management. Erosion has not been serious except on scattered areas, but the fertility level on many areas is very low owing to continuous cropping or grazing.

In cultivated fields the surface soil is brown or rich-brown mellow loam, 6 to 7 inches thick. Where the soil has been in sod for several years the surface layer exhibits a soft granular structure. The upper few inches of the subsoil is rusty yellowish-brown mellow loam grading into a yellowish-brown friable loam that grades into a pale-yellow gritty light loam at about 14 inches. The lower subsoil usually contains considerable gritty material and small rock fragments. Both the upper and lower subsoil layers are fairly firm in place but when disturbed break down into very soft granules. At about 24 inches in depth the subsoil rests on greenish-gray or greenish-yellow firm till of a gritty loam texture. The till is derived largely from schist with an admixture of granitic materials varying considerably in proportion over the county. The upper 12 inches of the till is firm to loose and has a weak platy structure in places. Below this depth it is sometimes very compact and has a platy structure. A small quantity of schist and granitic rock fragments is scattered over the surface, and small stone and rock fragments are common throughout the soil mass. All layers are acid in reaction, varying from very strongly acid in the surface to slightly less acid in the subsurface layers.

As mapped, this type includes some variations in texture, structure, and color. In the vicinity of Durham areas are included with light loam to fine sandy loam textures, and the till which is loose and gritty seems to be influenced by outwash material. In places over the county where this soil is associated with the Gloucester or Brookfield soils, the mixing of granitic and schist materials was such that the bound-

aries between Charlton and Gloucester or Charlton and Brookfield are more or less arbitrary.

Dairying is the leading farm activity and a large part of the cultivated land is used for hay and forage crops. Small acreages are planted to potatoes, sweet corn, vegetables for home use, winter squash, field corn, and orchard fruits. Mixed hay usually receives 1 to 1½ tons of lime when seeded and in some cases is supplemented with 300 to 400 pounds of a complete fertilizer. Alfalfa and clover usually receive 1½ to 2 tons of lime and 300 to 500 pounds of a complete fertilizer. Hay yields 1½ to 3 tons, clover 1 to 3 tons, and alfalfa 2 to 3 tons an acre. Most of the available manure on the dairy farms is used under silage corn. This is usually supplemented with 200 to 400 pounds of 20-percent superphosphate or 300 to 500 of a 4–12–4 mixture. Yields of silage corn range from 10 to 14 tons. Potatoes usually receive about half a ton of 8–16–16 or 1 ton of 4–8–8 an acre, and yields range from 200 to 350 bushels depending on the season and care. Sweet corn and vegetables are usually fertilized with 1,000 to 1,500 pounds of a 5–8–7 or 4–8–8 mixture. For winter squash manure is commonly applied in the hill and in some cases supplemented with commercial fertilizer around the hill. Yields average around 10 tons an acre.

The carrying capacity of the pastures varies considerably. On fertilized and rotated pastures about 2 acres will support one cow for the normal grazing season of 130 days, while on unimproved pastures about 3½ acres are required to carry one cow for the same length of time. On the better pastures Kentucky bluegrass, redtop, Colonial bentgrass, white clover, and poverty oatgrass predominate; whereas, on neglected and run-down areas common juniper, gray birch and aspen sprouts, broomsedge, hardhack, hawkweed, moss, sweetfern, sumac, and other pests have almost crowded out the desirable grasses. Small areas that have been abandoned long enough support a young forest cover of mixed white pine and hardwoods.

Charlton loam, eroded phase.—Occurs in scattered areas closely associated with Charlton loam and differs from it only in the degree of erosion. The total acreage is small and for this reason is not so important agriculturally. From 25 to 75 percent of the surface has been removed or lost through erosion, and on several small areas shallow gullies have developed. Owing to erosion, the present plow layer is lower in percentage of organic matter, and small rock fragments are more common on the surface. Also part or all of the rusty yellowish-brown upper subsoil layer has been incorporated with the plow layer and has lost its identity.

About 90 percent of the total acreage is cultivated, and the rest is idle or in pasture. The cultivated land is used for the same crops and in about the same proportion as Charlton loam. Under similar management practices and fertilizer treatments yields average 20 to 30 percent lower than on the typical soil. The degree of erosion varies considerably from one area to another and even on the same area in places. Very little active erosion exists on this land at present, as most of it is in grass, and with such simple practices as contour cultivation, strip cropping, and proper rotation of crops erosion may be easily controlled. Several small scattered areas, one in the vicinity of Durham and one or two in Rochester, are severely eroded.

With fertilization and proper selection of crops most of this soil can be built up to its former fertility level within a few years. The carrying capacity of the pastures is somewhat lower than on the typical soil under similar management practices.

Charlton loam, eroded hilly phase.—The surface relief is the same as that of Charlton loam, hilly phase, and the two soils differ only in the degree of erosion. From 25 to 75 percent of the surface soil has been lost through erosion except on one included area where more than 75 percent of the surface has been removed and on several small areas where very little erosion has taken place. Because of the unfavorable surface relief much care is required to control erosion if this soil is used for clean-tilled crops, although it is not so susceptible to erosion as the soils with compact substrata. The total acreage occurs in small scattered areas in Strafford, Barrington, Rochester, Rollinsford, Somersworth, and Lee.

This type is used largely for hay and pasture. Hay yields 1 to 2½ tons an acre, depending on fertilization and management. Such practices as strip cropping, contour cultivation, and other conservation measures should be employed where row crops are used in the rotation. The idle land and pasture areas, in general, are in a run-down condition, and the vegetation consists chiefly of common juniper, broomsedge, poverty oatgrass, redtop, and gray birch sprouts.

Charlton loam, gently undulating phase.—Since this gently undulating phase occupies nearly level to gently sloping to undulating positions, it differs from Charlton loam. The gradients range from nearly level to 5 percent. Because of the smoother relief surface drainage is slower than on the typical soil, the water-holding capacity is slightly higher, and it is not so susceptible to erosion where cultivated. For these reasons this soil is more desirable for agricultural purposes. It occurs in small scattered areas associated with the other Charlton soils.

About 75 percent of this soil is used for hay and cultivated crops, and the rest is in pasture, lying idle, or in forest. Hay and forage crops, potatoes, and vegetables are the principal crops. No special practices are required for its management and conservation where used for clean-tilled crops, but rotation of crops and replenishment of plant nutrients lost through cropping are desirable for maintaining the productivity level. Fertilizer treatments and management practices are essentially the same as on Charlton loam, and crop yields average about the same or a little higher. The carrying capacity of the pastures may be somewhat higher due to slightly better moisture conditions. Small areas that have been allowed to revert to forest support a mixed stand of white pine, oaks, gray birch, red maple, and hickory.

Charlton stony loam.—Although this soil is largely in forest, some small areas are in pasture, lying idle, or in mowing. Some stones have been picked off these areas in places, but they are still present in sufficient quantities to interfere seriously with or to prevent the use of modern farm implements.

The relief is gently rolling to rolling, the slopes ranging from 5 to 15 percent. Drainage is good, both externally and internally, but

the water-holding supply is fairly good. Roots, water, and air can readily penetrate to subsurface layers. This fairly extensive soil occurs in large to small bodies in the towns of Strafford, Farmington, Rochester, Barrington, Somersworth, Rollinsford, Dover, Madbury, Durham, and Lee. The largest areas are found in Strafford and Farmington.

In forested areas there is a layer of leaves and branches about 2 inches thick on the surface. The 2- to 3-inch surface soil is dark- to rich-brown mellow loam, well-matted with small roots, and has a soft granular structure. The upper few inches of the subsoil is rusty yellowish-brown friable loam, grading into a yellowish-brown loam. At 12 to 14 inches it becomes a pale-yellow or grayish-yellow light loam that is lighter in texture and color and contains more gritty material with depth. The subsoil layers are fairly firm in place but break down easily into very soft granules. At about 24 inches the subsoil rests on greenish-gray or greenish-yellow firm to loose gritty till of a loam texture. The till is derived largely from schist with an admixture of granite and gneiss and varies in places from firm to loose with a weak platy structure. In places the till is compact and platy at a depth of 12 to 18 inches. Stone and boulders are scattered over the surface and throughout the soil mass. Most of this soil is only moderately stony and is fairly uniform. In a few areas the texture approaches a fine sandy loam and the boundaries between this soil and the Gloucester or Brookfield soils are more or less arbitrary in places owing to the complete mixing of the schist and granitic rock materials by glacial action.

Scattered areas are cleared of trees and are in pasture, lying idle, or in mowing. The carrying capacity of pastures on the stony type may be slightly less than on the loam type, owing to the presence of stone. Vegetation on the stony areas is the same as on Charlton loam. The vegetation on many long-abandoned areas consists chiefly of common juniper, gray birch sprouts, broomsedge, and poverty grass. Areas used for hay or vegetables are usually very small. In forested areas the species are chiefly white oak, red oak, hickory, white pine, red maple, gray birch, and beech with an undergrowth of blueberries, blackberries, bracken fern, witch-hazel, sumac, and poison-ivy.

Charlton stony loam, gently undulating phase.—Differing from the stony loam mainly in slope, this soil occurs on nearly level to undulating relief with a gradient of 0 to 5 percent. Surface drainage therefore is not so rapid, and the water-holding capacity is slightly higher than on the typical stony loam. For these reasons it is slightly superior as a forest soil and, if cleared, for agricultural purposes. The total acreage occurs in small widely scattered areas. It is largely in forest, with a few areas in open pasture or in mowing. The vegetation consists of the same species as found on the typical stony loam.

Charlton stony loam, hilly phase.—Except for relief this hilly phase is essentially the same in all respects as the stony loam. It occurs in a few scattered areas in Strafford, Farmington. Rochester, and Barrington, with probably one or two areas in other towns. Practically all this hilly phase is in forest. The slopes range from 15 to 25 percent, and most of them are fairly short. Surface drainage is more rapid than on Charlton stony loam, and if cleared of trees would be more susceptible to erosion. It is not likely that any of this soil will be

cleared for agricultural purposes because of the stoniness and hilly surface relief.

Colrain loam.—The scattered areas in the town of Lee and in the eastern part of Durham are generally shallow over bedrock. The soil is developed largely from a thin mantle of glacial till derived mainly from calciferous phyllite schist and siliceous limestone and to a less degree from the underlying bedrock. Surface outcrops are common. Surface relief is gently rolling to rolling, with gradients of 5 to 15 percent. Natural drainage is good, and where bedrock is not too near the surface, the moisture supply is usually fairly high. Because of the favorable relief and friable character of the soil, it is not particularly susceptible to erosion if handled properly. Two small areas are included with moderate erosion, and on other areas there has been no apparent erosion. Simple practices, as contour cultivation and proper rotations, are adequate for conserving this soil. The fertility level on many areas seems to be rather low, owing to continuous cropping or grazing without the addition of fertilizers and lime.

The 6-inch dark-brown or brown mellow loam surface soil contains varying quantities of flat schist fragments and is underlain by a rusty-brown or rich-brown friable loam 5 to 6 inches thick that grades into a pale yellowish-brown friable light loam. These layers are fairly firm in place but when disturbed break down into very soft granules. Partly disintegrated schist fragments are common throughout these layers and in some places make up more than 50 percent of the lower part. Depth to till or bedrock is variable, but in most places it is less than 2 feet. In many places bedrock or disintegrated schist is within a few inches of the surface. The olive to greenish-yellow till is loose and friable, with a high content of partly disintegrated schist fragments. Most of the loose stone has been picked off the surface and placed in walls or fences. Limestone rock is common in these walls and throughout the soil profile. Field tests indicate that the reaction of the surface and subsoil layers ranges from strong to medium acid and the unaltered till is almost neutral.

About 40 to 50 percent of this inextensive soil is in young forest, and the rest is under cultivation, in pasture, or lying idle. Mixed hay is the principal crop, and small acreages are used for silage corn, clover, alfalfa, oats, potatoes, sweet corn, vegetables, and winter squash. Fertilizer treatments and management practices are the same on this soil as on Charlton or Newmarket loams. Hay yields 1 to 2½ tons, clover 1 to 2½ tons, silage corn 8 to 12 tons, and potatoes 150 to 300 bushels an acre.

The vegetation on pastures and idle areas consists chiefly of broomsedge, poverty grass, hawkweed, common juniper, hardhack, sorrel, cinquefoil, and hairy-cap moss. On the better pastures redtop, Kentucky bluegrass, Colonial bentgrass, Canada bluegrass, and poverty oatgrass are the principal grasses. Forest species are largely white pine, red and white oaks, gray birch, hickory, red maple, white ash, redcedar, beech, and pitch pine, with such common shrubs as blueberry, hazel, dogwood, poison-ivy, sumac, and common juniper.

Colrain loam, gently undulating phase.—Mapped on nearly level to gently sloping relief or on slopes of not more than 5 percent, this gently undulating phase is similar to the typical loam except in relief.

Owing to its smoother relief, surface runoff is less rapid and it is not so susceptible to erosion; therefore, it is more desirable for agricultural purposes. About the same proportion of this soil is in forest, crops, pasture, and lying idle. Fertilizer treatments and management practices are the same on the two soils, and crop yields average about the same.

Colrain loam, hilly phase.—Most of the small total acreage in the few scattered bodies in Lee is in forest. This phase is similar to Colrain loam, except in relief (15 to 25 percent). As surface drainage is more rapid, this hilly phase is more susceptible to erosion than Colrain loam if used for cultivated crops. Under present economic conditions it is probably best adapted to forest or grazing. Most of it was cleared at one time and is in tillage or pasture. It is comparatively stone-free, but surface outcrops are common.

Colrain stony loam.—Closely associated with the other Colrain soils, this soil is found in small bodies in Lee and the eastern part of Durham. This soil is largely on slopes of 5 to 15 percent. A few small areas are included with nearly level to gently sloping relief. Natural drainage is good, but the moisture supply seems adequate in most places for the growth of trees. The surface and subsoil layers range from strongly to medium acid, and the unaltered till is nearly neutral in reaction.

Under undisturbed forest conditions there is a dark-brown organic mat 2 to 3 inches on the surface. The surface soil is dark-brown friable loam, 1½ to 2 inches thick, underlain by a rich- to rusty-brown friable loam to silt loam 4 to 6 inches thick. This grades into a pale yellowish-brown friable loam that is variable in depth to till or bedrock. Calciferous schist fragments are common on the surface and in the subsoil layers. Surface outcrops are common, and depth to bedrock or disintegrated and partly weathered schist varies from a few inches to less than 2 feet in most places. Loose stones, consisting of slabs of schist, limestone, granite, and gneiss, are scattered over the surface and embedded in the soil.

Practically the entire acreage is in forest. The most common trees are white pine, white oak, red oak, red maple, hickory, beech, white ash, gray birch, and pitch pine, with an undergrowth of blueberry, hazel, common juniper, poison-ivy, dogwood, bracken fern, and wintergreen.

Colrain stony loam, hilly phase.—This inextensive hilly phase occurs in widely scattered areas in association with other Colrain soils. It differs mainly from Colrain stony loam in relief (15 to 25 percent). For the most part the slopes are short and choppy. Practically the entire acreage is in forest, consisting of the same species as found on Colrain stony loam.

Essex loam.—Closely associated with the Gloucester soils, this soil occurs on uniformly gently sloping or sloping hillsides and drumloid hills. The slopes range from 5 to 15 percent, but a large percentage has a gradient of less than 12 percent. Surface drainage is good, but internal drainage is slow owing to the compact or hard substratum that slows up the downward movement of water. This compact layer does not act as a hardpan but serves to hold a good supply of water for

growing crops, grasses, and trees. In wet seasons there is some lateral movement of water along the hard layer with seep spots along the lower slopes and in low places.

In cultivated fields the dark-brown or grayish-brown mellow and friable loam surface soil is 6 to 7 inches thick. Where this soil has been in sod for several years the surface soil is well-matted with small roots and has a soft granular structure. The 10- to 12-inch upper subsoil is a yellowish-brown loam that is firm in place but when taken out breaks readily into irregular fragments. It becomes lighter in texture with depth and grades into a pale-yellow friable and gritty loam, resting on gray or yellowish-gray gritty loam or sandy loam till at 20 to 24 inches. The lower subsoil is lighter in color and texture with depth and contains some small rock fragments and gritty material. The upper part of the till is compact in place and contains some mottlings, but it becomes more compact and more highly mottled with depth. When dug out with a pick it breaks into platy fragments. All layers are acid, the reaction varying from extremely acid in the surface to strongly or medium acid in the subsoil.

Stones have been removed to such an extent that they do not materially interfere with tillage operations and mowing. Small rock fragments of granite and gneiss are common on the surface and throughout the profile.

This soil is uniform in texture and structure, the surface relief is favorable for all farming operations, and most fields are large enough to permit the use of tractors and other modern machinery. It is responsive to management and fertilization and compares favorably with any soils of the county for the production of hay and forage crops. Erosion control is not a problem. With simple practices, as contour cultivation and proper rotation of crops, it may be safely cultivated without serious damage by erosion.

The total acreage occurs in widely scattered areas, largely in Barrington, Farmington, and Milton. Practically all of it is cultivated or in pasture. Hay and silage corn are the principal crops. Small acreages are used for potatoes, vegetables, field corn, oats, and clover. Most of the available manure on dairy farms is used under silage corn. This is usually supplemented with 200 to 400 pounds an acre of superphosphate. Silage corn yields 10 to 14 tons, and field corn 35 to 50 bushels an acre. When hay fields are seeded down, 1 to 1½ tons of lime an acre are usually applied and some farmers supplement this with 300 to 400 pounds of a complete fertilizer mixture. Alfalfa and clover usually receive 1½ to 2 tons of lime and 300 to 500 pounds of a complete fertilizer when seeded. Hay and clover yield 1½ to 3 tons, and alfalfa, which is grown on a very small acreage, 2 to 3 tons an acre. Oats are generally cut and fed green or cured and fed as hay. Potatoes are fertilized with about one-half ton of 6–16–16 or 1 ton of 4–8–8 an acre and yield from 150 to 300 bushels, depending on the season and care. Vegetables are grown mostly for home use.

This loam compares favorably with Paxton loam as a pasture soil and with care and fertilization produces good pasture. The most common pasture grasses are Kentucky bluegrass, Colonial bentgrass, redtop, Canada bluegrass, poverty oatgrass, and broomsedge. On rundown pasture areas, common juniper, gray birch sprouts, hardhack, hawkweed, hairy-cap moss, and broomsedge are serious pests.

Essex loam, eroded phase.—From 25 to 75 percent of the original plow layer or surface soil has been removed from areas of this soil and only in this respect does it differ from Essex loam. Erosion has occurred chiefly in the form of sheet erosion, and no gullies have developed. On some areas, crop yields have not been reduced materially because of erosion while on others, where erosion has been heaviest, yields average 25 to 30 percent lower than on Essex loam.

Management and fertilizer practices are similar to Essex loam, with which it is closely associated, and the same crops are grown in about the same proportion. At present there is little active erosion on this land, as only a very small percentage is planted to row crops in any given year. Though the steeper slopes are very erodible if not properly handled, with simple conservation practices the soil can be stabilized and erosion held to a minimum. On some areas it will be necessary to apply manure or fertilizer and lime liberally in order to bring the fertility level up to that of Essex loam.

Essex loam, gently sloping phase.—Usually occurs on the crest of the smoothly rounded hills with the relief being nearly level to gently sloping (0 to 5 percent) (pl. 1, *B*). This soil is similar to Essex loam in all respects, except relief. Because of the smooth relief surface drainage is not so rapid, the water-holding capacity is slightly higher, and it is not so susceptible to erosion as the loam. Internal drainage is slow though adequate for the most part. Practically the entire acreage is in widely scattered areas associated with other Essex soils and is cultivated or in pasture. The same crops are grown and in about the same proportion as on Essex loam, and management and fertilizer practices are similar. Crop yields average about the same or a little higher. Although this soil requires no special practices for its conservation when cropped, rotation of crops and replenishment of plant nutrients are desirable for maintaining the productivity level.

Essex stony loam.—Largely in forest with a small percentage in open pasture or lying idle, this soil occurs on smooth slopes of 5 to 15 percent. It is found in widely scattered areas in Rochester, Farmington, Barrington, and Milton closely associated with Essex loam. East of Mendums Pond, Barrington, one small area is steeper than normal for this type (15 to 25 percent). If cleared and cultivated it would be subject to erosion.

In undisturbed conditions there is a layer of partly decomposed leaves, branches, and roots on the surface. The surface layer is brown to grayish-brown mellow loam about 2 inches deep, the upper part containing a high percentage of organic matter. This is underlain by a yellowish-brown friable loam to a depth of about 12 inches where it grades into a pale-yellow friable and gritty loam. In places the upper few inches of the subsoil is rich brown in color. These subsoil layers are firm in place but when taken out break into very soft irregular granules. Considerable small rock fragments and gritty material are found in the lower subsoil. At 20 to 24 inches the subsoil rests on gray to yellowish-gray compact granitic till, mottled and streaked with rust brown. It is very hard and compact, and when dug out with a pick it breaks into platy fragments. This compact substratum tends to retard the downward movement of water and holds a good supply for tree and grass roots. Because of the high water-holding capacity it is a good

forest soil and where cleared of trees affords good grazing. Stone and boulders, chiefly granite and gneiss, occur on the surface and throughout the soil mass. Some stones have been picked off scattered areas, but they are still present in sufficient numbers to prevent the use of improved farm machinery.

The forest vegetation consists chiefly of red maple, gray birch, yellow birch, white pine, hemlock, white and red oaks, with an undergrowth of witch-hazel, blueberry, bracken fern, mountain-holly, and wintergreen. Pasture areas support about the same vegetation as Essex loam, depending on care and fertilization. The carrying capacity of the stony pastures may be slightly lower than those on the loam under similar management and fertilization.

Essex stony loam, gently sloping phase.—Occurring in a few scattered areas of very small extent, this soil is similar to Essex stony loam except in surface relief. It generally occupies the crest of the smoothly rounded hills with nearly level to gently sloping relief, the slopes ranging from 0 to 5 percent. Surface drainage therefore is not so rapid as on Essex stony loam, and the water-holding capacity is slightly higher. For these reasons it is slightly superior as a forest soil, and, if cleared of trees, as a pasture soil. A large part is in forest; the rest is in pasture or idle. The same forest species are found as on the stony loam.

Gloucester fine sandy loam.—An inextensive and unimportant soil agriculturally, this type differs from Essex loam mainly in having a more open and friable subsoil and in being underlain by a loose gravelly till with little or no compaction. In places there are a few scattered stones of granite and gneiss but not in sufficient quantities to interfere appreciably with cultivation. Also, a small quantity of angular granite and gneiss fragments is generally scattered over the surface.

The relief is gently rolling to rolling, with gradients of 5 to 15 percent. Both surface and subsurface drainage are good, but subsurface drainage is inclined to be excessive, owing to the open and porous subsoil layers and to the loose coarse till underneath the soil. Crops often suffer during dry seasons. This soil warms up early in spring, is easily handled, and with heavy fertilization fair to good yields of general crops are obtained. It occurs in small scattered areas closely associated with the stony Gloucester soils. Bodies of this soil are most common in Barrington, Farmington, and Rochester with widely scattered areas in Milton, Dover, Somersworth, Madbury, Durham, and Lee.

In cultivated fields this soil is characterized by a light- to grayish-brown friable fine sandy loam surface 5 to 6 inches thick. The upper subsoil is brownish-yellow to yellow friable fine sandy loam, containing a small quantity of gritty material and small rock fragments. This gradually changes to a pale-yellow or grayish-yellow gritty and gravelly light fine sandy loam at a depth of 12 to 14 inches. The lower subsoil contains more gritty material with depth and rests on gray to yellowish-gray loose and gritty till at 24 to 28 inches. The till is derived largely from granitic materials and contains many granite and gneiss stones and boulders. All layers are acid, varying from very strongly acid in the surface to slightly less acid in the subsoil layers. Included with the type are a few areas with sandy loam surface tex-

tures; and where this soil is mapped in association with Brookfield or Charlton loam, the surface and subsoil layers in places are browner than the typical soil.

A large part of the soil is cultivated, and the rest is lying idle or is in pasture. Hay and silage corn are the principal crops; small acreages are used for field corn, potatoes, sweet corn, and vegetables for home use. Hay usually receives 1 to 1½ tons of lime an acre when reseeded and in some cases this is supplemented with 300 to 500 pounds of commercial fertilizer. Yields range from 1 to 1½ tons an acre, depending on fertilization, seasons, and age of the sod. Clover yields about the same as mixed hay, and alfalfa 1½ to 3 tons. Silage corn usually receives all the manure that is available and is supplemented with 200 to 400 pounds of superphosphate an acre. Yields range from 6 to 8 tons. Field corn yields 25 to 35 bushels and potatoes 100 to 175 bushels an acre, depending on fertilization and care. Sweet corn, tomatoes, early peas, string beans, and other crops would do well with heavy applications of fertilizer.

Because of the open and porous nature of this soil it is not particularly susceptible to erosion, and with simple conservation practices it may be easily controlled. Pastures are given very little attention, and the carrying capacity is usually low. From 3 to 5 acres are required to carry one cow for the normal grazing season of 130 days. Vegetation on the pastures and idle areas consists largely of broomsedge, poverty oatgrass, and redtop, with common juniper, gray birch sprouts, sweetfern, sumac, poison-ivy, blackberries, and blueberries.

Gloucester fine sandy loam, eroded phase.—Relatively unimportant agriculturally, this eroded phase occurs in small scattered areas closely associated with the fine sandy loam. From 25 to 75 percent of the surface has been lost through sheet erosion, although no gullies have formed; in this respect only it differs from the fine sandy loam.

Most of this soil is cultivated or is lying idle. Crop yields have not been reduced materially because of erosion, except in local spots where erosion has been heaviest. With simple practices, as contour cultivation, strip cropping, and proper rotation of crops, the soil may be stabilized and future erosion minimized. Where erosion is active the fertility level is low, and to restore this soil to its former fertility level, applications of manure, lime, and fertilizer will be necessary.

Gloucester fine sandy loam, gently undulating phase.—Closely associated with Gloucester fine sandy loam on nearly level to gently undulating relief, this gently undulating phase is similar to it in profile characteristics. Surface and subsoil drainage are good, but surface runoff is not so rapid as on the fine sandy loam. This level phase is also subject to little or no erosion if planted to clean-tilled crops. Owing to the smooth relief and less rapid surface drainage, this soil is slightly superior to the fine sandy loam for agricultural purposes. It is used for the same crops and in about the same proportion. Fertilizer treatments and management practices are the same, and yields average about the same or slightly higher.

Several small areas of hilly relief too small to separate on the map were included with this soil.

Gloucester stony fine sandy loam.—Fairly extensive in Barrington and the eastern part of Rochester, this soil is also found in small to

fairly large scattered areas in Farmington, Milton, Strafford, Somersworth, Madbury, Durham, and Lee. Surface relief is gently rolling to rolling, with gradients of 5 to 15 percent. The slopes for the most part are fairly long and smoothly rolling or sloping. Natural drainage is good to excessive.

Under undisturbed forest conditions there is a brown to dark-brown partly decomposed leaf litter about 2 inches thick on the surface. The dark grayish-brown friable fine sandy loam surface soil is well-matted with roots, the upper part having a high content of well-decomposed organic matter. This is underlain by a light brownish-yellow or yellow fine sandy loam slightly heavier than the surface. At about 12 to 14 inches the upper subsoil grades into a pale-yellow or grayish-yellow gritty fine sandy loam or sandy loam. This layer becomes lighter in texture and contains more gritty material with depth, and rests on gray to yellowish-gray loose and gritty till at a depth of 24 to 28 inches. The till is derived largely from granitic material and has very little or no structure. Granite and gneiss stone and boulders are scattered over the surface and throughout the soil mass. Small angular rock fragments are also common in the surface and subsoil layers. All layers are acid in reaction, varying from very strongly acid in the surface soil to slightly less acid in the subsurface layers. This soil is fairly uniform in texture and structure. Where it occurs in association with Brookfield, Charlton, or Hollis stony loam soils, some variations in color, owing to the influence of schist, are included.

Probably 85 to 90 percent of this land supports some type of forest cover, and the rest is largely in pasture. A few areas are lying idle or are in hay. Part of the surface stones have been removed from some of the areas in pasture, lying idle, or in hay, but they are still present in sufficient quantities to interfere seriously with or to prevent farming operations. On two small areas more than 25 percent of the surface soil has been removed by erosion and on the rest there was no apparent erosion. The forest cover is largely second or third growth and at present is of little value except for cordwood. The species consist chiefly of white pine, gray birch, white oak, red oak, hickory, pitch pine, hemlock, red maple, and beech, and the most common shrubs are blueberries, bracken fern, sweetfern, sheep laurel, sumac, poison-ivy, barberry, witch-hazel, and wintergreen. On the better pastures redtop, Colonial bentgrass, Kentucky bluegrass, and poverty grass are common, whereas, on the run-down or neglected areas common juniper, sweetfern, gray birch and aspen sprouts, sumac, hardhack, broomsedge, and poverty oatgrass predominate. With similar fertilizer treatment and care pastures on this soil may have a slightly lower carrying capacity than Gloucester fine sandy loam owing to the surface stone.

Gloucester stony fine sandy loam, gently undulating phase.—Differing from the stony fine sandy loam mainly in relief, this phase occurs on nearly level to gentle slopes of 0 to 5 percent, commonly on the crest of the hills. Because of the smoother relief surface drainage is not so rapid; therefore, it is slightly superior for the growth of grasses and crops if cleared. This gently undulating phase occurs in small scattered areas, largely in forest, with small spots cleared of trees and used for pasture or lying idle. Forested areas and areas in pasture or lying idle support the same vegetation as found on the stony fine sandy loam.

Gloucester stony fine sandy loam, hilly phase.—This hilly phase differs from the stony fine sandy loam mainly in surface relief. It occurs on short slopes with a gradient of 15 to 25 percent. Surface runoff is more rapid, and, if cleared of trees, this phase would be more susceptible to erosion than the stony fine sandy loam. It is found in small scattered areas in association with the other Gloucester soils. Practically the entire acreage is forested with the same species as on Gloucester stony fine sandy loam. Because of stoniness and hilly surface relief, it is best adapted to forest or grazing purposes.

Gloucester very stony fine sandy loam.—Occurring on the same relief as Gloucester stony fine sandy loam, this type differs from that soil in having more stones and boulders scattered over the surface and throughout the profile. Several fairly large bodies are found in Barrington, and scattered areas in other parts of the county, associated with Gloucester stony fine sandy loam. One area is included with nearly level to gently sloping relief. Because of stoniness this type has little potential agricultural value and is less valuable for grazing purposes and probably for forest. It is, however, largely in forest, the purpose for which it is best suited unless used for grazing. Forest cover is the same as on the stony fine sandy loam.

Gloucester very stony fine sandy loam, hilly phase.—Except for a higher content of stones and boulders on the surface and throughout the profile, this hilly phase is similar to Gloucester stony fine sandy loam, hilly phase. It occurs in a few scattered areas in Milton, Barrington, and Farmington. The entire acreage is in forest, the purpose for which it is best suited. This phase has little potential value for agricultural purposes other than grazing. If cleared of trees it would be less valuable for grazing than the stony fine sandy loam because of the higher percentage of stone on the surface.

Gravel pits.—Gravel and sand for highway grading and concrete construction have been excavated from some of the kames and terraces, and these excavated areas are shown on the map as gravel pits. A few of these occupy a rather large area but are not suitable for agricultural purposes. Gravel or sand is still being removed from most of the pits, but a few are no longer used and are gradually becoming vegetated with gray birch and aspen.

Hartland silt loam.—Generally occurs in narrow strips on the broken edges of terraces or bordering drainageways. The slopes are rather short and broken for the most part, the gradient ranging from 15 to 25 percent. The relief is the result of geologic and accelerated erosion. The soil occurs principally in Durham, Dover, Rochester, and Rollinsford. This soil is closely associated with the Suffield soils and has developed from similar materials. Where it has been protected from erosion, the profile characteristics are similar to those of Suffield silt loam except that the surface soil is usually shallower and the total depth over unaltered silt and clay is less. In general, erosion has not been severe. In places there is little evidence of accelerated erosion, but on most of this soil 25 to 75 percent of the surface has been removed.

Natural drainage is good, but internal drainage is rather slow owing to the heavy subsurface layer. The moisture-holding supply is good and is usually sufficient for grasses even in dry seasons. The

soil absorbs water slowly and is susceptible to erosion under improper management practices. There are not many active gullies at present, but old geologic gullies and old gullies owing to accelerated erosion, which are now stabilized, are fairly numerous.

The 2- to 4-inch brown to dark grayish-brown granular silt loam surface soil is underlain by a pale yellowish-brown mellow and friable silt loam, grading into an olive-yellow heavy silt loam at a depth of 6 to 8 inches. Both of these layers are firm in place and when disturbed break into irregular fragments that crush down easily into a soft granular mass. At a depth of 12 inches the material changes to a bluish-gray or greenish-gray silt loam to silty clay loam that grades into a greenish-gray heavy clay at a depth of 16 to 18 inches. This clay is very compact in place and breaks into irregular blocks that are hard to crush when dry. It is plastic and sticky when wet. The surface and subsoil layers are acid, and the unaltered silt and clay are slightly acid to slightly alkaline. Areas of this soil are free of stone and gravel.

Small areas are in forest, but most of this type is in pasture—the purpose for which it is best adapted. A few areas on the smoother slopes are used for hay. This soil supports good pasture, the carrying capacity being slightly lower than on Suffield silt loam. Owing to danger from erosion, care must be taken not to overgraze pastures. Kentucky bluegrass, redtop, Colonial bentgrass, Canada bluegrass, white clover, and poverty oatgrass are the most common pasture grasses and legumes. On the run-down areas undesirable shrubs and herbs are numerous. Forested areas support the same vegetation as found on the Suffield soils, consisting of white pine, red maple, gray and black birches, hemlock, red and white oaks, elm, and beech.

Hartland silt loam, severely eroded phase.—Located on the same topographic positions with the same degree of slope, this severely eroded soil is similar to Hartland silt loam, except in the degree of erosion. Accelerated erosion has been more active, and as a result more than 75 percent of the surface soil has been removed. The surface soil is very shallow or entirely lacking, and, in places, part of the subsoil has been lost. In places there is a thin dark grayish-brown surface layer underlain by a brownish-gray or greenish-gray slightly altered silty clay that breaks into irregular angular fragments. Active gully erosion is not very common on areas of this soil but old geologic gullies and old gullies owing to accelerated erosion, now stabilized by vegetation, are numerous.

This inextensive soil occurs in small areas in Dover, Rollinsford, and Rochester. Most of it is cleared and used for pasture. A few areas are in mowing on the smoother slopes and a few are forested. Owing to unfavorable relief and erodibility, the best use for this soil is for pasture or for long-term hay. The carrying capacity of the pastures is slightly lower than on the silt loam. Cultivation implements and mowing machines cannot be used to advantage except on the smoother slopes.

Hartland silt loam, steep phase.—Short, choppy, and broken slopes with a gradient of more than 25 percent characterize this soil. Very little uniformity occurs in degree of development or in profile characteristics. Where the surface has been protected from erosion, the depth over parent material is generally shallow. On most of this

soil at least 75 percent of the surface layer and in places part or all of the subsoil have been removed by erosion. This phase occurs principally in Dover, bordering the Bellamy and Piscataqua Rivers. About 75 percent of the total acreage is in forest; the rest is used for pasture or lying idle. Owing to steep relief and susceptibility to erosion it is best adapted to forest grazing. Forest species are the same as on the silt loam.

Hermon fine sandy loam.—The widely scattered areas in Farmington, New Durham, Middleton, and Milton are of small total acreage. They are comparatively stone-free and at one time all were under cultivation. At present about 50 percent is in young forest, and the rest is under cultivation, used for pasture, or is lying idle. The relief is gently rolling to rolling (5 to 15 percent). Because of the open and porous nature of the subsoil layer and the loose till underneath, natural drainage is good to excessive. Grasses and crops sometimes suffer from lack of moisture.

Below the 6-inch brown to grayish-brown fine sandy loam surface soil in cultivated fields is a rusty-brown or dark-brown friable fine sandy loam about 4 inches thick. This grades into a yellowish-brown loose and friable fine sandy loam that changes to a pale-yellow gritty and friable sandy loam at a depth of 15 to 18 inches. At 24 to 26 inches the lower subsoil rests on gray gritty till that is loose to firm in place. When dug out with a pick it breaks into a structureless mass. Neither the surface soil nor subsoil layer has any well-defined structure. Although most of the large stones have been removed from the surface, small angular rock fragments are common and stone and boulders are throughout the subsoil layers and the till.

The soil handles easily, responds to fertilization and management, and is not particularly susceptible to erosion if handled with care. Only a small acreage is cultivated, principally to mixed hay and corn. Small acreages are planted to potatoes and vegetables largely for home use. Fertilizers and lime are not used so extensively as on the cultivated soils in the southern part of the county. With similar fertilization and management, acre yields average about the same as on Gloucester fine sandy loam, hay 1 to 2 tons, silage corn 6 to 9 tons, field corn 25 to 40 bushels, and potatoes 100 to 200 bushels. The carrying capacity of the pasture is also about the same.

Forested areas support a young forest cover of white pine, gray birch, aspen, paper birch, beech, red maple, and hemlock. On the better pasture areas redtop, Kentucky bluegrass, Colonial bentgrass, and poverty oatgrass are the more common grasses. Idle areas and run-down pastures usually contain much broomsedge, common juniper, sweetfern, sumac, poison-ivy, blackberry, blueberry, gray birch and aspen sprouts, poverty grass, and moss.

A few small areas are included with this type where 25 to 75 percent of the surface has been removed. One area is in the extreme northern part of Milton and one southwest of the city of Farmington. On the other areas there has been slight or no erosion. With simple conservation practices erosion control is not a serious problem.

Hermon fine sandy loam, gently undulating phase.—Closely associated with Hermon fine sandy loam, this gently undulating phase differs from that soil mainly in relief. It occurs in widely scattered bodies on nearly level to gently sloping relief, but as surface drainage

is less rapid, it is less subject to erosion. About 40 percent of the area is in young forest; the rest is cultivated, idle, or in pasture. It is used for the same crops as the fine sandy loam, and yields average about the same or slightly higher. Because of the smooth relief, no special practices are required for its conservation, and the water-holding capacity is higher than the fine sandy loam. For these reasons it is more desirable for agricultural purposes.

Hermon fine sandy loam, hilly phase.—Found in a few scattered areas on 15 to 25 percent slopes, this phase is essentially the same as Hermon fine sandy loam in all respects except relief. Because of hilly relief, surface drainage is more rapid and the soil is more susceptible to erosion than the fine sandy loam if used for cultivated crops. One or two areas are included with moderate erosion, and on other areas there has been slight or very little erosion. About half this soil is cultivated, mostly to hay; the rest is idle or in forest.

Hermon stony fine sandy loam.—Largely in forest, this type is associated with the other Hermon soils and is fairly extensive. At one time considerable acreage was cleared of trees and was in tillage or pasture, but at present only small scattered areas are so used. The soil occurs on terrain that is generally smoothly sloping (5 to 15 percent), and natural drainage is good to excessive. Internal drainage is inclined to be excessive, owing to the open and friable nature of the subsoil layer and till.

In undisturbed forest conditions there is an organic layer of forest debris 3 to 4 inches thick on the surface. Below this there is a very thin layer of dark-brown fine sandy loam underlain by a light-gray to ashy-gray layer 1 to 4 inches thick, with little or no structure. Beneath the gray layer there is a rusty or dark-brown friable fine sandy loam 4 to 5 inches thick, with slight induration in places. This grades into a yellowish-brown friable light fine sandy loam with no structure. At 15 to 18 inches this grades into a pale-yellow loose and gritty light fine sandy loam or sandy loam, which contains more gritty material with depth and rests on gray loose and gritty till at 22 to 26 inches. The till is derived largely from granitic material and is firm to loose in place; when dug out or disturbed it breaks into a structureless mass. Granite and gneiss stone and boulders are scattered over the surface and throughout the profile. All layers are acid, varying from very strongly acid in the surface to slightly less acid in the subsoil layers. Except for slight variations in texture, color, and depth of the different horizons this soil is fairly uniform.

Small to fairly large areas occur in Farmington, Milton, Middleton, and New Durham, largely in forest and moderately stony. Scattered areas are cleared of trees and are used for hay or vegetables, pasture, and blueberry farms, or are idle. Part of the stones have been picked off these areas, but they are still present in sufficient quantity to interfere seriously with or to prevent the use of modern machinery. Erosion has not been significant on these cleared areas except in two or three places where 25 to 75 percent of the surface soil has been lost.

The forest vegetation consists chiefly of white pine, hemlock, beech, hard maple, red maple, paper birch, yellow birch, spruce, and red oak, with shrubs, as witch-hazel, blueberries, mountain-holly, hobblebush,

bracken fern, wintergreen, and groundpine. Common juniper, gray birch and aspen sprouts, hardhack, broomsedge, and poverty oatgrass are common in pastures and on idle areas along with some redtop, Colonial bentgrass, and Kentucky bluegrass. The carrying capacity of pastures is about the same as for Gloucester stony fine sandy loam.

Hermon stony fine sandy loam, gently undulating phase.—The gently undulating phase differs from the stony fine sandy loam mainly in that the surface relief is nearly level to gently sloping, the gradient not more than 5 percent. Because of the smoother relief, surface runoff is not so rapid and the water-holding capacity is slightly higher than on the typical soil; if cleared of trees and stone, it is more desirable for agricultural purposes. The small total acreage is in scattered areas. About the same proportion is in forest as on the stony fine sandy loam, and the rest is used for the same purposes.

Hermon stony fine sandy loam, hilly phase.—The widely scattered areas are associated with other Hermon soils and are of small extent. The phase is mapped on 15 to 25 percent slopes and in this respect differs from the stony fine sandy loam. Surface runoff is more rapid, and the soil is more susceptible to erosion if used for cultivated crops. A small percentage was cultivated at one time and was moderately eroded, but most of the areas have been allowed to revert to forest, and the soil is now stabilized. Most of it has always been in forest, the purpose for which it is best adapted unless used for grazing. The forest cover consists of the same species as found on the stony fine sandy loam.

Hermon very stony fine sandy loam.—Although less valuable for grazing purposes than Hermon stony fine sandy loam, this soil occurs on the same relief and is similar to that soil except that it contains more stone and boulders scattered over the surface and embedded throughout the profile. Because of stoniness, this soil has little potential agricultural value except for grazing.

This type is the most extensive of the Hermon soils and occurs in Farmington, Milton, Middleton, and New Durham. Practically the entire acreage is in forest, the purpose for which it is best adapted unless used for grazing. If cleared for this purpose, however, it is less valuable than Hermon stony fine sandy loam, gently undulating phase, because a higher percentage of the surface is taken up by stones and boulders. Forest cover consists of the same species as found on Hermon stony fine sandy loam. A number of small areas are included that have a smooth to undulating relief, principally in the vicinity of Middleton Corners in Middleton and Milton.

Hermon very stony fine sandy loam, hilly phase.—This phase, occurring on slopes of 15 to 25 percent, is similar to Hermon stony fine sandy loam, hilly phase, except that it has a higher content of stone and boulders scattered over the surface and throughout the soil profile. Practically the entire acreage is in forest, and it has little potential value for agricultural purposes other than grazing. It is found in small to fairly large scattered areas in the northern part of the county. One or two small areas are included with 25 to 35 percent slopes.

Hinckley loamy sand.—With decidedly hummocky, hilly, or uneven relief, this soil occurs on 15 to 25 percent slopes, except for two or three steep areas. It has developed from bedded deposits of coarse sand and gravel, mainly granitic materials, and is closely associated with the Merrimac soils.

Owing to the open and porous surface and subsoil layers and the gravelly substratum, water passes rapidly through this soil; consequently, drainage is excessive, crops and grasses suffer for lack of moisture, and tree growth is not vigorous. The soil is highly leached of organic matter and plant nutrients, and if nutrients are applied they are rapidly leached out. In small areas well distributed over the county this type occurs on less rolling relief than normal; the slopes range from 8 to 15 percent, but are generally short, choppy, and broken. The total acreage is not large, and the soil is of little agricultural importance.

In forested areas there is a thin layer of organic debris on the surface. The topmost inch of the 3- to 6-inch grayish-brown or brown loose and porous loamy sand surface soil contains some partly decomposed dark-brown organic matter. This layer is underlain by brownish-yellow or yellowish-brown loamy sand that grades into a pale-yellow gritty and gravelly loamy sand. The depth to gray or yellowish-gray coarse sand and gravel deposits varies from 14 to 20 inches. Depth of the surface and subsoil layers varies considerably, as does their content of gravel and gritty material. In places the surface texture is gravelly loamy sand. The sand and gravel deposits are more or less rounded or water-worn and contain some cobblestones and boulders ranging from a few inches to several feet in diameter.

This type occurs in small to fairly large widely separated bodies throughout the county. Considerable acreage was cleared at one time and used for pasture or tillage. At present, however, most of it supports a scrubby forest growth, mainly of white and pitch pines, with some gray birch, white oak, and red maple. Scattered areas are cleared and lying idle or pastured. The grass, dominantly broomsedge and poverty grass, furnishes poor grazing. Sweetfern, blueberry, and moss are also common on the idle and pasture areas.

Numerous gravel pits are found on this soil, the gravelly substratum being used extensively for road building. In general, this land is more valuable as a source of road-building material than for agricultural purposes. Its best agricultural use is for forest or grazing.

Small areas of sandy loam or loamy fine sand are included in mapping. In undisturbed places in the northern part of the county a definite gray layer has developed just beneath the forest duff, and this is underlain by a dark-brown or rusty-brown horizon. Had these areas been extensive enough they would have been mapped as Danby loamy sand, which is a Podzol comparable to Hinckley of the Brown Podzolic group. On a few areas, indicated by stone symbols, stones are scattered over the surface.

Hinckley loamy sand, eroded phase.—The eroded phase is similar to Hinckley loamy sand except in degree of erosion. In general, 25 to 75 percent of the surface soil has been lost, largely through sheet erosion. Evidence of slight wind erosion is seen on some exposed slopes. As most of the fine material in the surface layer has been

washed away, gravel is more noticeable on the surface than on the loamy sand.

This soil is not extensive and is not important agriculturally. It occurs in widely separated bodies, closely associated with the loamy sand. Probably 60 percent of the total acreage is in scrubby forest growth; the rest is largely idle. Its best use is for forest or for grazing.

Included are areas of less strongly rolling relief where 25 to 75 percent of the surface has been removed, largely by sheet erosion. Although there is some evidence of blowing in places, wind erosion is not serious. Owing to erosion there is little uniformity in depth and color of the surface soil, and there is more gravel and gritty material on the surface than is typical. Most of the small total acreage is in pasture or lying idle; small bodies are in scrubby forest growth. Like the typical soil its principal use is either for forest or for grazing.

Hollis loam.—Even though the acreage is not large, this is the most important of the Hollis soils from an agricultural point of view. It is found in small widely scattered bodies over the central and southern parts of the county. Most of the loose surface stone has been picked off and placed in stone walls or fences. This soil is closely associated with Charlton loam, but it is generally much shallower, surface outcrops are common, and schist fragments are more numerous in the surface and subsoil layers.

The relief is gently rolling to rolling, and slopes range from 5 to 15 percent. Drainage is well established. The moisture-holding capacity varies with the depth of the soil—where it is 18 inches or more the moisture supply is fairly good, whereas on the shallower areas crops sometimes suffer from lack of moisture.

In cultivated fields the 4- to 6-inch surface soil is rich-brown or brown mellow and friable loam with a soft granular structure where the soil has been in sod for several years. The upper few inches of the subsoil is reddish-brown mellow and friable loam, grading into a yellowish-brown friable loam. At 12 to 14 inches this changes to pale-yellow or olive gritty loam that is variable in depth to till or disintegrated schist bedrock. The till is derived largely from schist rock and is firm to loose in place. Small schist fragments are scattered over the surface and throughout the profile, usually increasing with depth. Finely divided mica flakes are noticeable throughout the soil and in places are sufficient to give it a greasy or slick feel when pressed between the fingers. All layers are acid.

Depth to bedrock is extremely variable. In many places bedrock lies very near the surface and is probably less than 2 feet below the surface on 50 to 60 percent of the areas. It is smooth in places and in others is frayed and partly weathered, so that the lower part of the solum is filled with small platy pieces of schist. Where the bedrock is in this condition near the surface, knolls or spots result in which the soil is filled with chips of this material. Roots, air, and water penetrate the soil to bedrock easily.

About 70 percent of this soil is cultivated; the rest is in pasture, lying idle, or in young forest growth. Mixed hay is the principal crop, and small acreages are used for silage corn, field corn, potatoes, oats, clover, vegetables for home use, and sweet corn. Fertilizer treatments and management practices are essentially the same as on Charlton loam, but crop yields average somewhat lower—about the

same as on Colrain loam. Hay yields 1 to 2 tons an acre, silage corn 8 to 12 tons, potatoes 100 to 200 bushels, corn for grain 30 to 40 bushels, and winter squash 8 to 10 tons. This soil responds well to fertilization, but because of shallowness over bedrock and the quantity of schist fragments in the surface layer it is not easy to work. With simple conservation practices erosion control is not a problem.

On idle areas and run-down pastures, common juniper, gray birch and aspen sprouts, blueberry, hardhack, sweetfern, sumac, meadowsweet, broomsedge, and poverty grass predominate. The better pastures contain some Kentucky bluegrass, redtop, Colonial bentgrass, and poverty oatgrass with various shrubs and herbs.

Hollis loam, eroded phase.—Occurs in widely scattered areas in Durham, Dover, Madbury, Somersworth, Barrington, Rochester, and Strafford. It is similar to Hollis loam except in the degree of erosion, 25 to 75 percent of the surface having been lost through sheet erosion. Schist fragments, left behind when the finer material washed away, are more numerous on the surface and in the surface layer. The degree of erosion may vary considerably over the same area or from one area to another. About 85 percent is under cultivation, and the rest is used for pasture or is lying idle. The cultivated land is used for the same crops in about the same proportion as on Hollis loam. With similar management practices and fertilizer treatments yields average somewhat lower than on the uneroded soil. At present there is very little active erosion, as part of it is in grass. Simple conservation practices, as contour cultivation and proper selection of crops, are adequate for protecting this soil from future erosion. The carrying capacity of the pastures is somewhat lower than on Hollis loam under similar management practices.

Hollis loam, eroded hilly phase.—The soil profile characteristics of this soil are essentially the same as those of Hollis loam, except for changes in the surface and upper subsoil layers caused by accelerated erosion. From 25 to 75 percent of the surface soil has been removed on most of the areas. A few bodies are included with only slight erosion. Because of the hilly surface relief much care is required to control erosion if planted to clean-tilled crops. Such practices as strip cropping, contour cultivation, and other conservation measures should be employed where row crops are used in the rotation. The steeper slopes are best suited for long-term hay or pasture. Most of the total acreage is used for hay, silage corn, or pasture. Yields of hay and silage corn average somewhat lower than on Hollis loam, and pastures are generally in a run-down condition.

Hollis loam, gently undulating phase.—Occupying nearly level to gently sloping positions (0 to 5 percent), this gently undulating phase differs from Hollis loam mainly in relief. Because of the smoother relief surface drainage is slower, the water-holding capacity is slightly higher, and it is not so susceptible to erosion if used for clean-tilled crops. For these reasons this soil is more desirable for agricultural purposes. No special practices are required for its management and conservation when used for clean-tilled crops, but proper selection of crops and replenishment of plant nutrients lost through cropping are desirable in maintaining the productivity level.

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This phase occurs in small bodies associated with other Hollis soils. Practically all the total acreage is under cultivation, but small areas are idle or in pasture. The same crops are grown in about the same proportion as on Hollis loam, and crop yields average about the same or a little higher. The carrying capacity of the pastures may be slightly higher under similar management, owing to better moisture conditions.

Hollis stony loam.—Most common in Strafford, Farmington, and Madbury, this soil is found in small to fairly large bodies throughout the central and southern parts of the county. It is closely associated with Hollis loam but is much more extensive. Scattered areas cleared of trees and part of the surface stone are largely in pasture or are lying idle, with a few patches in hay or cultivated crops.

The relief is gently rolling to rolling (5 to 15 percent). Most of the slopes are fairly smooth. Both surface and internal drainage are good. Although the soil is generally shallow, limiting the water-holding capacity to some extent, the moisture supply seems adequate for the growth of trees and grasses in most seasons. Roots, air, and water penetrate the soil to bedrock easily. Erosion has not been significant, except on a few small areas in pasture or lying idle, where 25 to 75 percent of the surface has been lost.

This type is generally shallow. Bedrock outcrops are numerous on the surface, and depth to bedrock ranges from a few inches to less than 2 feet over 50 percent or more of the areas. The soil has developed largely from a thin mantle of till derived from schist and to a less extent from weathered material of the underlying bedrock. The profile characteristics are similar to those of the Charlton soils where there is any degree of development.

Under forest conditions there is a layer of organic debris on the surface 1½ to 3 inches thick. The surface is a dark- or rich-brown mellow loam, well-matted with roots, and of a very soft granular structure in places. The upper few inches of the subsoil is reddish-brown friable loam grading into yellowish-brown loam. These layers are firm in place and when disturbed break into very soft irregular fragments. At 12 to 14 inches the upper subsoil grades into an olive or pale-yellow gritty loam, which is variable in depth to till or schist bedrock. The till is derived largely from schist and is firm to loose in place. Loose surface stones of schist and gneiss are scattered over the surface and throughout the profile, as well as slabs and small fragments of disintegrated schist.

Owing to its shallowness and stoniness this soil is largely in forest. On forested areas the principal species are white pine, gray birch, red maple, red oak, hickory, and white oak. The forest cover is largely second or third growth and is of little value at present except for cordwood. Grasses most common on the better pastures are redtop, Kentucky bluegrass, Colonial bentgrass, poverty oatgrass, and broomsedge, whereas on most pastures and abandoned fields, hardhack, meadowsweet, common juniper, gray birch sprouts, blueberry, cinquefoil, dewberry, sumac, poison-ivy, and sweetfern predominate. Yields of hay or other crops on small patches are generally low. From 2½ to 4 acres are required to carry one cow for the normal grazing season of 130 days, depending on fertilization and care.

Hollis stony loam, gently undulating phase.—This phase is of very small extent, though found in widely scattered areas on nearly level to 5-percent slopes, and in this respect mainly it differs from typical Hollis stony loam. Owing to its smoother relief, the water-holding capacity is slightly higher, and it is more desirable for pasture if cleared of trees. About the same proportion is in forest, the rest is largely in pasture or lying idle. Forested areas support the same vegetation as found on the stony loam, and the carrying capacity of the pastures may be slightly higher.

Hollis stony loam, hilly phase.—Differing from Hollis stony loam mainly in relief, the hilly phase occurs largely on slopes of 15 to 25 percent. Two or three small areas are included with slopes of more than 25 percent. For the most part the slopes are rather short but are not pitted and broken. Surface drainage is more rapid than on the stony loam. Areas cleared and used for cultivated crops are much more susceptible to erosion. The scattered bodies are closely associated with the other Hollis soils. Practically the entire acreage supports a forest cover of the same species as Hollis stony loam. Owing to stoniness, shallowness, and hilly relief, the best use for this soil is either for forest or for grazing.

Hollis very stony loam.—Though occurring on the same relief, this soil differs from Hollis stony loam in having a higher content of stone and boulders on the surface and throughout the profile. The surface stones are generally larger and, consequently, more difficult to remove. This type is found in small to fairly large bodies closely associated with the other Hollis soils in Strafford, the southern part of Farmington, the southwestern part of Rochester, Barrington, and Durham. Probably more than 95 percent of the total acreage is in forest. A few patches are cleared for pasture or are lying idle. This soil has little value for agricultural purposes other than grazing, and if cleared of trees is less valuable for pasture than the stony loam because a higher percentage of the surface is taken up by stone and boulders. A few small areas are included with nearly level to gently sloping relief, which would have been separated as a smooth phase if the acreage had been large enough.

Hollis very stony loam, hilly phase.—Similar to the hilly phase of Hollis stony loam, except that the stones are more numerous, generally larger, and, consequently, more difficult to remove. The stone content prohibits tillage, but the land can be used for pasture. If cleared of trees, however, it would be less desirable than the stony loam because a higher percentage of the surface is taken up by stone and boulders. This soil is not very extensive and is associated with the typical Hollis very stony loam in Strafford and Barrington. Almost the entire acreage is in forest.

Jaffrey loamy sand.—Associated with the Barnstead soils on hilly and uneven relief, this soil occurs largely on short and choppy slopes of 15 to 25 percent. A few areas are included with steep relief or on slopes of more than 25 percent.

Owing to the open and porous nature of the surface and subsoil layers and gravelly substratum, drainage is excessive. Crops and grasses suffer for lack of moisture and for the same reason tree growth

is not vigorous. The soil is highly leached of organic matter and plant nutrients. If cleared of vegetation this soil is subject to some erosion, and a few small areas are moderately eroded. This inextensive soil is not important agriculturally. It occurs in widely separated bodies in Rochester, Strafford, the northeastern part of Barrington, and the northwestern corner of Dover.

Under forest conditions there is a very thin layer of organic debris on the surface. The upper part of the 3- to 5-inch dark-brown or brown loamy sand surface soil contains some partly decomposed organic matter, resting on rusty yellowish-brown loamy sand that grades into light-yellow gritty and gravelly loamy sand or coarse sand. The depth to rusty-brown and grayish-yellow bedded sand and gravel deposits varies from 14 to 20 inches. The quantity of gravel in the surface and subsoil layers varies also. Sand and gravel deposits from which the soil has developed is derived in part from schist high in iron pyrites and mica, but generally about 50 percent is of granitic origin. All layers are acid. Variations are mainly in texture and in the intensity of the rusty-brown coloring. A few areas of fine sandy loam are included in mapping. Where this type grades toward the Hinckley soils it is lighter colored throughout.

Practically the entire acreage supports a forest cover, mainly of white pine with a small quantity of gray birch, red maple, and white oak. The few areas of cleared land are lying idle or in pasture. Broomsedge, poverty oatgrass, sweetfern, and moss constitute the dominant vegetation on these areas. The gravelly substratum is used to some extent for road building. In general, this land is more valuable as a source of road-building material than for agricultural purposes.

Small included areas, occurring on slopes of 8 to 15 percent, have a relief that is less strongly rolling. Though the slopes are smoother, they are generally short and choppy. Owing to the smoother relief most of this soil was cleared at one time and tilled or pastured. At present, however, small areas are lying idle or in pasture, and the rest supports some form of forest cover. A few exposed areas are moderately eroded. Because of low inherent fertility and droughtiness, its principal use is for forest or grazing.

Melrose fine sandy loam.—Adapted to a wide variety of crops, this soil is free of stone or gravel, is easily handled, and is responsive to fertilization and care. It occupies level to gently sloping positions, the gradient not exceeding 5 percent. It is closely associated with the Suffield and associated soils in the towns of Durham, Madbury, Dover, Rollinsford, Somersworth, Lee, and Rochester in small to fairly large scattered bodies.

Natural drainage is good, but internal drainage is somewhat retarded by the clay strata beneath the soil. The water-holding capacity is comparatively high, and crops and grasses seldom suffer for lack of moisture except in unusually dry seasons. This soil lends itself well to conservation and improvement practices and is capable of being built up to and maintained in a productive state.

The 6- to 8-inch surface soil is brown to light-brown mellow fine sandy loam with a soft granular structure where it has been in sod for several years. This is underlain by a yellow-brown friable fine sandy loam with very little structure that grades into a pale-yellow fine sandy loam at a depth of 12 to 15 inches. Below 20 to 24 inches the material

is gray to light yellowish-gray light fine sandy loam or loamy fine sand mottled and streaked with rust brown and yellow. This rests on olive-gray heavy clay at a depth of 24 to 36 inches. The depth to clay varies from 18 inches to 4 feet, but in most places it is from 2 to 3 feet. Roots, air, and water penetrate this soil to the clay substratum easily. The surface and subsoil layers are acid, the clay strata nearly neutral or alkaline.

Probably 80 percent of the total acreage is cleared and is largely under cultivation. Scattered bodies are in pasture or lying idle. Timothy or timothy and clover hay mixed, silage corn, and potatoes are the principal crops. Small acreages are planted to clover, alfalfa, oats for hay, sweet corn, vegetables, field corn, and winter squash. Commercial fertilizers and lime are used extensively. Hay generally receives 1 to 1½ tons of lime when reseeded and clover and alfalfa about 2 tons of lime and 300 to 500 pounds of a complete fertilizer mixture. Silage corn receives a heavy application of manure and 200 to 400 pounds of superphosphate an acre. Potatoes are generally fertilized with one-half ton of 8–16–16 an acre, vegetables and sweet corn with 1,000 to 1,500 pounds of a 5–8–7 or 4–8–8 mixture. Timothy or mixed timothy and clover hay yield 1 to 2½ tons an acre, silage corn 10 to 16 tons, clover 1 to 2½ tons, alfalfa 2½ to 3 tons, and winter squash about 10 tons. Potatoes yield 200 to 350 bushels, depending on the season and care, and field corn 40 to 60 bushels. Exceptionally high yields of potatoes have been produced on this soil in the county. From 2 to 3½ acres, depending on fertilization, are required to carry one cow for the normal grazing season of 130 days.

Kentucky bluegrass, redtop, Colonial bentgrass, and white clover are common on the better pastures; whereas the run-down pastures and idle areas contain much common juniper, broomsedge, poverty oatgrass, hardhack, sweetfern, gray birch sprouts, cinquefoil, hairy-cap moss, goldenrod, and wild aster. On forested areas the species are chiefly white pine, red oak, red maple, gray birch, white ash, popple, pin cherry, and elm.

Included in mapping are areas of very fine sandy loam texture, and also small areas of Suffield silt loam or very fine sandy loam too small to separate on the map of the scale used. These included areas are more productive for the general crops than the fine sandy loam type.

Melrose fine sandy loam, sloping phase.—Similar to Melrose fine sandy loam except in relief, this soil occurs on slopes of 5 to 8 percent. Surface drainage is more rapid than on the typical fine sandy loam, and the soil is susceptible to some erosion under clean tillage with poor management. Erosion has been only slight, however, on areas of this soil, and simple conservation practices are adequate for its control.

This soil is closely associated with Melrose fine sandy loam but is much less extensive. About the same proportion is cleared and is used for the same crops. Fertilizer treatments and management practices are similar, and yields of various crops average about the same.

Included with the sloping phase are some areas that through accelerated erosion have lost 25 to 75 percent of the surface soil. These occur in small widely scattered bodies of small total acreage, practically all of which is cleared and is under cultivation, in pasture, or lying idle. Erosion has not proceeded to the point where crop yields

are decidedly reduced, but where it is active, yields may average 15 to 20 percent less than on Melrose fine sandy loam, other factors being equal. Contour cultivation and proper rotation of crops will stabilize this soil and prevent further erosion, and it may easily be built up to its former state of productivity.

Melrose loamy sand.—Closely associated with Melrose fine sandy loam, this type occurs in small widely scattered bodies on nearly level to gently sloping relief, the gradient not exceeding 5 percent. There is slight wind erosion on some areas, but water erosion is insignificant because of the smooth relief and porous nature of the surface and subsoil.

Beneath the 4- to 6-inch light-brown loamy sand or loamy fine sand surface layer is yellow or brownish-yellow loamy sand that grades into a pale-yellow loamy sand at a depth of 12 to 14 inches. This changes to gray or light-gray loamy sand or fine sand at about 24 inches, which in turn rests on olive-gray clay or beds of silt and clay at 30 to 36 inches. The depth to clay ranges from 18 inches to more than 3 feet, but, in most places, it is 2½ to 3 feet. Some areas vary also in texture from loamy sand to loamy fine sand. The open and porous nature makes natural drainage good and even excessive in the surface and upper subsoil. The clay substratum tends to retard the downward movement of water to some extent, and the moisture supply is higher than in the Merrimac or Adams soils. Crops and grasses suffer for lack of moisture in dry seasons.

About half this soil is cleared and used for cultivated crops or pasture or is lying idle; the rest is in forest, mainly of white pine, gray birch, white oak, and red maple. Mixed hay, vegetables, and potatoes are the principal crops. This soil is easy to work, warms up early in spring, and is responsive to fertilization. It is especially adapted to early vegetables, and with heavy applications of fertilizer and manure fair to good yields of potatoes and other general crops may be expected when the moisture supply is adequate. One of the largest market-garden farms in the county is on this soil; it produces good yields of peas, string beans, tomatoes, carrots, spinach, beets, squash, and sweet corn. These crops are heavily fertilized with manure and commercial fertilizer. Hay yields ½ to 1½ tons an acre and potatoes 100 to 200 bushels, depending on fertilization and season. Pastures and idle areas generally contain more broomsedge, poverty oatgrass, sweetfern, cinquefoil, and weeds than pastures and idle areas on the fine sandy loam.

Melrose loamy sand, sloping phase.—Less extensive than the loamy sand, this soil is of little agricultural importance. It is found in widely scattered areas, occupying a small total acreage. Except in relief it is similar in all respects to the normal loamy sand. Owing to the relief (5 to 8 percent) the sloping phase is subject to some erosion if planted to clean-tilled crops. Erosion, however, is not likely to be serious if simple conservation practices are employed. On a few bodies erosion has been moderate, but elsewhere insignificant.

This soil is largely idle or in forest, consisting mainly of white pine and gray birch. A few areas are cultivated or in pasture. With similar fertilizer treatment and care crop yields average about the same as on the loamy sand.

Merrimac fine sandy loam.—As this soil is stone-free and works up into a mellow friable tilth it is one of the easiest to cultivate. Its relief is favorable for farming operations and allows the use of improved farm machinery. Tillage operations are possible soon after rains, owing to the open and friable nature of the surface and subsoil layers.

This soil is not very extensive; it occurs principally in several fairly large bodies in Somersworth and in scattered areas in Rochester, Dover, Madbury, Durham, Lee, Farmington, Milton, and eastern part of Barrington. Most of this land was under cultivation at one time, but at present less than 50 percent is cleared and used for cultivated crops and pasture or is lying idle. The soil is fairly uniform in all characteristics other than in one area, a large body along the Dover-Somersworth highway east and northeast of Willand Pond. This contains less gravel and gritty material in the surface and subsoil than typical and is less thoroughly drained; consequently, it is more desirable for agriculture.

In cultivated fields the 6- to 7-inch surface soil is brown mellow fine sandy loam that breaks into very soft irregular fragments when disturbed. This layer is underlain by yellowish-brown or brownish-yellow fine sandy loam, grading into yellow or pale-yellow gritty fine sandy loam or loamy sand at 15 to 18 inches. The lower subsoil contains considerable gravel and gritty material and rests on gray or yellowish-gray stratified coarse sand and gravel at an average depth of 24 inches. The subsoil layers are fairly firm in place and when disturbed break into soft irregular fragments. A small quantity of gravel and gritty material is common in the surface and upper subsoil, but nowhere is surface gravel sufficient to interfere with cultivation. All layers are acid, varying from very strongly acid in the surface to slightly less acid in the subsoil layers.

In forested areas white pine predominates, with some gray birch, red maple, pitch pine, white and red oaks, with an undergrowth of blueberry, sweetfern, common juniper, and blackberry. Idle areas or pastures generally contain much common juniper, broomsedge, poverty oatgrass, sweetfern, cinquefoil, dewberries, goldenrod, and gray birch sprouts, with a small quantity of redtop, Colonial bentgrass, and Kentucky bluegrass. The carrying capacity of the pastures is rather low, 3 to 5 acres being required to carry one cow for the normal grazing season of 130 days.

This soil is very responsive to fertilization, warms up early in spring, and is especially adapted to early vegetables. With heavy applications of manure, fertilizer, and lime fair to good yields of general crops are obtained. Moisture supply is generally the limiting factor in crop production, and crops often suffer in dry seasons.

Mixed hay, silage corn, potatoes, and vegetables are the principal crops, with small acreages planted to alfalfa, sweet corn, and small fruits. Hay yields 1 to 1½ tons an acre, silage corn 6 to 9 tons, alfalfa 1½ to 3 tons, and potatoes 100 to 200 bushels. Acre yields vary considerably, depending on the fertilizer and the season, and as high as 275 bushels of potatoes may easily be produced on this soil. Owing to the smooth relief no special practices are required for erosion control.

Merrimac fine sandy loam, sloping phase.—Similar to Merrimac fine sandy loam except in relief, and occurring in association with it in

small widely scattered bodies, for the most part on the edge of terraces or bordering small drainageways on slopes of 5 to 15 percent. Sloping relief subjects this soil when improperly handled to some erosion. A few areas have been moderately eroded, and several short gullies have developed in exposed and unprotected places. Erosion may be easily controlled, however, if simple conservation practices are employed.

The soil is largely in forest or lying idle. It is of little agricultural importance and only a small percentage is under cultivation. This is used mainly for hay and vegetables, the yields of which average about the same as on the typical soil with similar fertilizer treatment and management practices. Forest and idle areas also support the same vegetation.

Merrimac loamy sand.—Except for texture this soil is similar in profile characteristics to Merrimac fine sandy loam. It is coarser textured, loose, and incoherent throughout. The texture is mainly loamy sand, with scattered areas of loamy fine sand included. The relief is nearly level to gently sloping, the gradient not exceeding 5 percent. Drainage is excessive because of the open and porous nature of the surface soil, subsoil, and substratum. The soil is highly leached of plant nutrients and organic matter, and applied nutrients in the form of manure, fertilizer, and lime are rapidly leached out. There is evidence of slight wind erosion in places and several blow holes were noted.

The 4- to 6-inch surface soil is grayish-brown loose and porous loamy sand. In forested areas the upper part contains a small quantity of partly decomposed organic matter. Below this the material is brownish-yellow loamy sand, grading into grayish-yellow loamy sand or coarse loamy sand at 12 to 14 inches. This lower subsoil contains more gravel and gritty material with depth and rests on gray and yellowish-gray deposits of coarse sand and gravel at 20 to 24 inches. A small quantity of gravel is generally present in the surface layer. All layers are acid.

Occurring rather extensively in small to large bodies well distributed over the county, the most common areas are in Milton, Rochester, Dover, Madbury, New Durham, Durham, and Lee. Only a few small areas are used for cultivated crops, mainly hay and vegetables. A small acreage is in pasture, and the rest is lying idle or in forest. Crop yields are generally low unless heavily fertilized, and the carrying capacity of the pastures also is low. The predominating vegetation on the pastures and idle areas is broomsedge, poverty oatgrass, sweetfern, cinquefoil, and moss. Some forested areas support almost a pure stand of young white pine or pitch pine. On other areas white pine generally predominates, with some gray birch, red maple, and white oak.

Some areas in the northern part of the county differ from the typical soil in having a well-defined gray layer just beneath the forest duff in undisturbed places. This gray layer is underlain by a dark- or rusty-brown horizon. These areas would have been included in the Colton series had they been extensive enough. In places, indicated by stone symbols on the map, a few stones are scattered over the surface. These areas are not extensive and are of no agricultural significance, as none of this land is cultivated.

Merrimac loamy sand, sloping phase.—Occurring in small widely scattered bodies on slopes of 5 to about 15 percent, the sloping phase is similar in all respects, except in relief, to Merrimac loamy sand, with which it is closely associated, but it is much less extensive. In places this phase has lost 25 to 75 percent of the surface soil by either wind or water erosion or both. Gravel is more common on the surface than is typical, as most of the finer material has been removed.

Most of this land has been cleared and is now in forest or lying idle. The vegetation is the same as on forested and idle areas of the loamy sand. A few bodies are in mowing or in pasture. Owing to the low inherent fertility and present degree of erosion it would seem best to allow this land to revert to forest. On several areas, indicated on the map by stone symbols, a few stones are scattered over the surface.

Muck.—This land type, composed of well to partly decomposed plant remains that have accumulated in former ponds, depressions, and other permanently wet locations, occurs in widely scattered bodies throughout the county. The surface consists of dark-brown or nearly black well-decomposed organic matter 24 to 30 inches thick. In places it contains considerable mineral soil and also has a soft granular structure. Below 24 to 30 inches the material is dark-brown or brown less-decomposed woody material or remains of sedges and reeds. The accumulation ranges from 3 to more than 5 feet in depth. The reaction is highly acid throughout. One area in Somersworth is used for hay, and scattered areas support a cover of coarse sedges and moss. Most of this land, however, is in forest, mainly of red maple, alder, willow, hemlock, spruce, white-cedar, and gray birch.

Muck, shallow phase.—Ranging in depth from 18 to 36 inches but generally from 24 to 36, the shallow phase is similar to Muck, except that it is not more than 3 feet thick. The surface is usually higher in percentage of mineral material, and the plant remains are more thoroughly decomposed in the lower part. It rests on gray or yellowish-gray loose sandy material or gritty and gravelly gray till. The shallow phase is less extensive than the Muck and often occurs in narrow bands around the deep areas. It is found in small widely scattered bodies, mainly in the central and northern parts of the county. It is largely in forest cover with the same species as found on Muck. A few areas have been cleared and now support a sedge and moss vegetation.

Newmarket loam.—This inextensive soil occurs in small scattered areas in the southeastern part of the county in Durham, Madbury, Dover, and Rollinsford. Practically all is under cultivation or in pasture. It was originally stony, but most of the stone has been picked off and put into walls or fences.

Surface and internal drainage are good but not excessive, and the water-holding capacity is fairly high. Crops seldom suffer from lack of moisture. This type is easy to handle, works up into a good tilth, and is responsive to management and fertilization. Owing to the comparatively smooth slopes, it is not subject to serious erosion if simple conservation methods are employed. On several very small areas 25 to 75 percent of the surface soil has been removed while on the rest erosion has been negligible or slight.

In cultivated fields the surface soil is brown to rich-brown mellow and friable loam well-matted with small roots and underlain by brown loam 2 to 4 inches thick, which grades into yellowish-brown friable loam. At 12 to 14 inches this changes to an olive or pale-yellow gritty and friable light loam that with depth becomes lighter in texture and contains more gritty material. The subsoil layers are firm in place but break down easily into very soft granules. The lower subsoil rests on greenish-gray gritty till at 24 to 26 inches. The till is derived largely from granodiorite rock material and is firm to loose, with a weak platy structure in places. Scattered over the surface and throughout the profile are disintegrated granodiorite rock fragments. Roots, air, and water penetrate the subsoil layers easily.

About 75 percent of this soil is in hay, and the rest is used for silage corn, sweet corn, potatoes, vegetables, and pasture. Fertilizer and lime are used in about the same proportion for the different crops as on Charlton or Paxton loams. Crop yields average about the same as on Charlton loam: Hay 1½ to 2½ tons an acre, silage corn 11 to 15 tons, potatoes 200 to 300 bushels, and field corn 35 to 55 bushels. The carrying capacity of the pastures is about the same as on Charlton loam, or 2 to 3½ acres a cow for the normal grazing season of 130 days.

Newmarket loam, gently undulating phase.—Except for one area on the University of New Hampshire campus, all this soil is cultivated. It occurs in nearly level to gently sloping positions in small scattered areas closely associated with Newmarket loam. Management practices are the same as on the typical loam, and crop yields average about the same or slightly higher. Owing to the smoother relief, surface drainage is not so rapid, the water-holding capacity is slightly higher, and the soil is not so susceptible to erosion.

Newmarket stony loam.—More extensive than Newmarket loam, this soil occurs principally southwest, south, and north of Durham, with small scattered areas in other parts of Durham and in Madbury and Dover. Surface relief is gently rolling to rolling (5 to 15 percent). Both surface and internal drainage are good but not excessive. Roots, air, and water penetrate the subsoil layers easily, and the water-holding capacity is fair. All layers are acid.

Under forest conditions a layer of leafmold 2 to 3 inches thick has developed on the surface. Below this the surface is grayish-brown to brown mellow loam 1½ to 2 inches thick. The upper few inches of the rich-brown loam subsoil grades into a yellowish-brown friable loam. The rest of the profile is essentially the same as that of Newmarket loam. Granodiorite stone and boulders are scattered over the surface and throughout the profile. Most of this soil is only moderately stony.

This type is largely in forest, chiefly of white oak, red oak, white pine, hickory, red maple, redcedar, white ash, and gray birch. Witch-hazel, sweetfern, blueberry, common juniper, bracken fern, raspberry, sumac, and wintergreen are common shrubs.

Closely associated are small nearly level to gently sloping areas with slope gradients of less than 5 percent, practically all of them in forest. Because of the smooth relief, surface drainage is not so rapid as on the typical stony loam.

Ondawa fine sandy loam.—Composed of fairly recent alluvial deposits, this soil occurs on first bottom positions in very small bodies along the Lamprey, Cocheco, Salmon Falls, and Isinglass Rivers. It is subject to occasional flooding, usually, however, in winter or early spring, when there is no damage to growing crops. Inherent productivity is fairly high because of depositions of material in fairly recent times, recurrent floods, and the absence of appreciable leaching.

The 7- to 10-inch surface soil is brown mellow and friable fine sandy loam, the topmost few inches a darker brown than the lower part. This layer is underlain by a brownish-yellow or yellowish-brown mellow fine sandy loam or very fine sandy loam, becoming lighter in color and texture with depth. At 18 to 24 inches the material is yellowish-gray fine sandy loam, which also becomes lighter in color and texture with depth, with some rust-brown and yellow streaks or mottlings below 30 to 36 inches. The sediments are largely of granitic origin, with some schist influence in places indicated by finely divided mica flakes. All layers are acid.

Some areas of very fine sandy loam and small spots of loamy fine sand are included in mapping. Otherwise, areas of this soil are fairly uniform. Natural drainage is good, but owing to favorable texture and structure and low-lying position the moisture supply is good.

Occurrence in small scattered areas and inaccessibility account for the fact that only about half the total acreage is under cultivation or in pasture; the rest is in young forest. Timothy hay is the principal cultivated crop. A very small percentage is planted to corn and vegetables. Hay yields 1½ to 2½ tons an acre, and silage corn 12 to 16 tons, depending on fertilization and care. Pastures furnish good grazing, and from 1½ to 3 acres are required to carry one cow for the normal grazing season of 130 days. The dominant vegetation on the forested areas consists of gray birch, red maple, red oak, popple (aspen), and elm, with a thick undergrowth of shrubs and herbs.

Ondawa fine sandy loam, high-bottom phase.—Occupying positions above the level of normal overflow, this phase is subject to inundation only at times of extremely high water. Its profile characteristics are similar to those of the fine sandy loam, except that the subsoil is generally browner. Natural drainage is good, and owing to the favorable texture and structure the moisture supply is good even in dry seasons. The texture varies from fine sandy loam to very fine sandy loam, but because of the small extent the two were combined in mapping. Crop yields average higher on the very fine sandy loam areas.

This soil is closely associated with the typical soil and is more extensive. It occurs principally along the Cocheco, Bellamy, and Isinglass Rivers in Dover, Rochester, Barrington, and Madbury, with scattered bodies along the Salmon Falls and Lamprey Rivers. The largest areas under cultivation are in the vicinity of the county farm in Dover. Considerable acreage is in forest, as it occurs in small bodies and in locations unfavorable with reference to roads and other improvements.

This phase is inherently one of the more productive soils in the county for general crops because the fairly recent depositions, absence of severe leaching, and occasional flooding help to maintain fertility. Mixed hay, oats, clover, silage corn, potatoes, and vegetables are the principal crops. Manure, fertilizer, and lime are used extensively on the areas under cultivation. Timothy or timothy and clover mixed yields 1½ to 2½ tons an acre, clover 1 to 2½ tons, silage corn 12 to 18 tons, oats for hay 2 to 3 tons, and potatoes 200 to 350 bushels. Yields of more than 400 bushels of potatoes an acre have been reported. Good yields of peas, beans, tomatoes, squash, cucumbers, beets, carrots, onions, and other vegetables are obtained.

Scattered pastured areas furnish excellent grazing. The grasses and legumes are mainly Kentucky bluegrass, redtop, Colonial bentgrass, with some poverty oatgrass and white clover. Forested areas support the same species as found on the typical fine sandy loam.

Paxton loam.—Though not very extensive, this type is one of the most important agricultural soils in the county and practically all of it is under cultivation or in open pasture. A few small areas are lying idle, and small scattered areas have been allowed to go back to forest. Occurrence is usually on smoothly rounded drumlinlike hills. The relief is gently sloping to sloping, with gradients of 5 to 15 percent. Surface drainage is good, but internal drainage is rather slow. Crops seldom suffer from lack of moisture.

In cultivated fields the 6- to 8-inch surface soil is brown to grayish-brown mellow loam. In fields that have been in sod for a number of years the surface soil is well matted with small roots and has a soft granular structure. The upper subsoil is yellowish-brown friable loam, containing a small quantity of gritty material and small rock fragments. At 10 to 12 inches the upper subsoil grades into an olive-yellow gritty and friable loam, containing more gritty material with depth and at 18 to 22 inches resting on a greenish-gray or greenish-yellow compact platy till. The subsoil layers are firm in place and when taken out with care exhibit a very soft granular structure. The glacial till is derived mainly from schist, with a slight admixture of other rock materials, and is of a gritty loam texture. It is compact in place and breaks into irregular platy fragments when removed from a cut. Practically all the large stone and boulders have been picked off the surface, but slabs of schist and fragments of granitic boulders are common throughout the profile. Small chips of schist or other rock are common also on the surface and in the subsoil layers.

The compact till restricts the downward movement of water and is locally called a hardpan or clay. It is not a true hardpan, however, and only serves to slow up the downward movement of water and to hold a good supply for growing crops. Roots will penetrate this layer but not so readily as the layers above. In early spring or wet seasons there is some lateral movement of water along the hard layer and it may seep out along the lower slopes. Roots, water, and air penetrate the surface and the subsoil layers readily. All layers are acid, varying from very strongly to medium acid.

This soil is fairly uniform in texture, structure, and depth. The soil is fairly easy to handle, works up into a good tilth, is responsive to fertilization and management, and is capable of being built up to and maintained in a productive state. Because of the favorable texture

and structure of the surface and subsoil layers and the compact substratum, the water-absorbing and water-holding capacity is comparatively high. The surface relief is favorable for all farming operations, and most of the fields are large enough to permit the use of tractors and other modern machinery. Erosion conditions on this soil are none to slight, and the character of the soil and the surface relief are such that with simple erosion control methods, as contour cultivation and proper rotation of crops, erosion may be properly controlled under the present system of agriculture.

This soil is associated with Charlton, Hollis, and Brookfield soils, which also are developed from glacial till derived mainly from schist. Its most common occurrence is in Strafford, Rochester, New Durham, Milton, and Barrington. Scattered areas are found in Farmington, Madbury, Durham, and Lee. The principal crops are mixed hay, silage corn, and potatoes. Small acreages are used for clover alone, oats, alfalfa, field corn, vegetables for home use, small fruits, and orchard fruits—chiefly apples. The few idle areas are, for the most part, associated with less desirable soils and in sections of the county more remote from the population centers.

Hay yields 1½ to 3 tons an acre, depending on fertilization, seasons, and length of rotation. Lime is usually applied at the rate of 1 to 1½ tons when hay fields are reseeded. Some farmers also use 300 to 400 pounds of a complete fertilizer mixture. A few farmers top-dress their hay fields with 300 to 500 pounds of 7–6–6 or 7–7–7 mixture and in the last few years lime and superphosphate have been used to some extent for top-dressing hay fields. Clover is treated about the same as mixed hay, and yields are approximately the same. Alfalfa receives 1½ to 2 tons of lime and 300 to 500 pounds of a complete fertilizer when seeded, and yields vary from 2½ to 3 tons an acre. Silage corn receives a heavy application of manure and 200 to 400 pounds of 20-percent superphosphate or 300 to 500 pounds of 4–12–4 mixture. Yields of silage corn range from 12 to 16 tons and field corn from 40 to 60 bushels an acre. Commercial potato growers use about one-half ton of 8–16–16 or 1 ton of 4–8–8 mixture an acre, and potato yields range from 200 to about 350 bushels. Vegetables are usually fertilized with 1,000 to 1,500 pounds of a 5–8–7 or 4–8–8 mixture.

Several small commercial orchards are located on this soil. Apple trees generally receive 5 to 8 pounds of nitrogen a tree and yield 100 to 250 bushels an acre. Small scattered areas are in pasture, and with care and fertilization can be maintained in excellent condition. Depending on management and care, 2 to 3½ acres will support one cow during the grazing season of about 130 days. Kentucky bluegrass, redtop, white clover, Colonial bentgrass, poverty oatgrass, and broomsedge are common pasture grasses and legumes. On run-down areas gray birch sprouts, hardhack, broomsedge, hawkweed, common juniper, and other pests crowd out the desirable grasses. Small areas in forest now support a second growth of white pine, black and red oaks, red maple, gray birch, black birch, and hemlock.

Paxton loam, eroded phase.—Except that accelerated erosion has been more active and 25 to 75 percent of the surface soil removed, the eroded phase is similar in all respects to Paxton loam. The surface is usually lighter in color, owing to a lower percentage of organic mat-

ter, and small rock fragments are more common on the surface than in the typical soil. Also part of the yellowish-brown upper subsoil layer has been incorporated with the plow layer in places, and the average depth of the soil is less. In some cases erosion conditions may vary considerably over a small area, and because of the small scale used in the map, only the average conditions are represented.

The eroded phase is closely associated with the type and the total acreage of the two soils is about the same and approximately the same proportion is under cultivation and to the same crops. Erosion has not reached the stage where crop yields are greatly reduced. On areas that have lost slightly more than 25 percent of the surface soil, yields may be slightly lower than on the type, while on areas where 50 to 75 percent of the surface soil has been lost, the yields may be reduced considerably.

Pastures on the eroded phase are, in general, not so good as those on the normal type. Erosion is caused largely by improper cultural practices, intensive cultivation, and overgrazing. It is now partly or completely stabilized on a large part of the soil, and with proper rotations, contour cultivation, strip cropping, and spring plowing it may be easily controlled on the rest. Like Paxton loam, the eroded phase can be built up and maintained in a fairly productive state with proper management and conservation practices.

Paxton loam, eroded hill phase.—Similar in all respects except relief to the eroded phase, the eroded hill phase occurs chiefly on uniformly sloping gradients of 15 to 25 percent, from which 25 to 75 percent of the surface has been removed by erosion. Owing to the relief and compact substratum, this soil is very susceptible to erosion if planted to clean-cultivated crops. To protect this land from serious erosion, such practices as strip cropping, contour cultivation, and other conservation practices should be employed where row crops are used in the rotation. Erosion is not likely to be serious where the land is in sod most of the time, unless it is overgrazed.

The eroded hill phase is of small extent and is found in small scattered areas. Practically all is cultivated or in pasture. Most of the cultivated land is in hay and only a very small percentage is used for row crops, as corn and potatoes. Under similar management practices crop yields are about the same as on the eroded phase or slightly lower.

Small scattered areas occur in which there is severe erosion, and about 75 percent of the surface soil has been lost as sheet erosion. Cultivated land, unless heavily fertilized, yields about 50 percent less than Paxton loam. Pastures are in a run-down condition, the cover consisting chiefly of broomsedge, poverty oatgrass, common juniper, and gray birch sprouts. It should be used for long-term hay or pasture.

Paxton loam, gently sloping phase.—Having a soil profile similar to that of Paxton loam, this gently sloping phase differs from it in occupying nearly level to gently sloping positions, the gradient ranging from 0 to 5 percent. Owing to the smooth relief surface drainage is not so rapid, the water-holding capacity is slightly higher, and the soil is less susceptible to erosion.

This phase is closely associated with the other Paxton types and phases in small scattered areas. A small part is lying idle, and prac-

tically all the rest is under cultivation. Mixed hay, clover, silage corn, and potatoes are the principal crops. Because of the more favorable surface relief, this soil is slightly superior to Paxton loam for general crops and pasture. Fertilizer treatment and management practices are essentially the same on the two soils. Crop yields probably average slightly higher on this phase, but with similar care and fertilization there is very little difference in yields.

This land requires no special practices for management and conservation when cropped, but rotation of crops and replenishment of plant nutrients lost through grazing or cropping are desirable for maintaining its productivity level.

Paxton loam, hill phase.—The slopes of this phase are generally of a uniform 15 to 25 percent gradient. Surface runoff is rapid, and the soil is very susceptible to erosion if planted to clean-tilled crops. The profile characteristics are essentially the same as of Paxton loam. Owing to the steeper relief, however, the surface soil will probably not average quite so deep. This inextensive soil is mapped only on three areas, one each in Lee, Farmington, and Rochester. About 60 percent of it is in forest or pastured forest; the rest is under cultivation. The cultivated land is practically all in hay, and yields are slightly lower than on the typical soil or about the same and forested areas support the same forest cover.

Paxton loam, severely eroded phase.—Of very small extent, this severely eroded phase is found in a few small scattered areas associated with the other Paxton soils in Strafford, Farmington, and Rochester. The total acreage is under cultivation, in pasture, or lying idle. The surface relief is the same as for Paxton loam and its eroded phase, and differs only in the degree of erosion. Seventy-five percent or more of the surface layer and in places part of the subsoil have been lost largely by poor management. Erosion conditions and depth of the soil vary. The present plow layer is relatively low in organic matter and small rock fragments originally in the subsoil are now common on the surface and in the surface layer.

Most of the cultivated land is used for hay, silage, corn, and potatoes, and unless heavily fertilized the yields are 40 to 50 percent lower than on Paxton loam. Areas in pasture and idle land are usually in a run-down condition.

Because most or all of the friable surface has been lost, runoff is fairly rapid, owing to low absorptive capacity. More care must be exercised to control erosion than on Paxton loam or the eroded phase. To stabilize this soil and improve its fertility, manure, fertilizer, lime, and long rotations seem advisable and necessary.

Paxton stony loam.—This soil represents areas where only a part or none of the stone has been removed. At one time most of this land was cleared of trees and cultivated or in pasture, but now it is largely in forest. The areas are in general only moderately stony.

This stony loam is closely associated with Paxton loam and is mapped in scattered areas in Strafford, Farmington, Rochester, Barrington, and Madbury. The surface relief is gently sloping to sloping, with a gradient of 5 to 15 percent. Surface drainage is good, but internal drainage is rather slow because of the compact substratum at 18 to 20 inches.

In undisturbed forested areas a layer 1 to 2 inches thick of partly decomposed leaves, branches, and roots has developed on the surface, and in places there is a very thin ash-gray layer just beneath the forest litter. The 2-inch surface soil is grayish-brown to brown mellow and friable loam, usually well-matted with small roots, and the upper part contains more organic matter than the lower. The surface layer is underlain by a yellowish-brown friable loam to a depth of 8 to 9 inches. In places the upper 2 to 3 inches of this layer is brown to rusty brown and is firm in place but breaks into very soft granules when disturbed. It contains a few rock fragments and a small quantity of gritty material and grades into an olive or greenish-yellow gritty and friable loam of about the same structure. This lower subsoil layer becomes more gritty with depth and at 18 to 20 inches rests on a greenish-gray compact gritty till of loam texture. Medium-sized stones are common over the surface and throughout the profile. Because of the favorable texture and structure and high water-holding capacity, it is one of the best forest soils of the uplands and where cleared of trees is desirable for pasture.

About 75 percent of the acreage is in forest or pastured forest; the rest in pasture or brushy pasture. The forest vegetation consists chiefly of white pine, hemlock, red and black oaks, red maple, black and gray birches, with an undergrowth of common juniper, hazel, witch-hazel, mountain-holly, bracken fern, and wintergreen. Some old pasture areas have been almost completely taken over by common juniper, gray birch and aspen sprouts, sumac, and hardhack. With care and fertilization the carrying capacity of the pastures on the stony areas would be nearly as high as on Paxton loam.

Paxton stony loam, gently sloping phase.—Areas of the gently sloping phase are essentially the same as Paxton stony loam, except in relief. They are small and scattered, usually on the top of ridges. A large percentage is in forest; the rest is in pasture or lying idle. Forested areas support the same vegetation as on the typical stony loam. Because of the gently sloping relief, this soil is potentially the best agricultural soil of the stony types and phases; however, it is not likely that any of it will be cleared for agricultural purposes in the near future. Surface drainage is not so rapid and the water-holding capacity is slightly higher than on the typical stony loam.

Paxton stony loam, hill phase.—This phase is mapped on slopes of 15 to 25 percent, and, in this respect only does it differ from Paxton stony loam. The total acreage is slightly larger than that of the typical stony loam and several fairly large bodies occur in Rochester and Strafford. Most of this land is in forest; the rest in pasture, the best use to which it is adapted under present conditions.

Paxton stony loam, steep phase.—The total acreage of this steep phase occurs in small scattered areas, a small percentage in open pasture, the rest in forest. It differs from the other stony types and phases mainly in relief. Owing to the steep relief, the soil profile is not so deep as on the smooth areas. The slopes are for the most part short and steep, the gradient ranging from 25 to 35 percent. Steep slopes and susceptibility to erosion if cleared of vegetation, make this soil best adapted to forest and grazing.

Peat.—Composed of partly decayed fibrous plant remains, peat occurs in former ponds or lakes, low depressions, and other permanently wet situations. The surface soil is dark-brown or brown moderately decomposed fibrous peat, 1 to 2 feet thick. Below this are brown or yellowish-brown coarse and fibrous plant remains, only slightly decomposed and largely from sedges and reeds, with some woody material. The peat is light in weight and spongelike in places, with water on or very near the surface except in dry seasons. It is strongly acid throughout. The deposits range in depth from 3 to 10 feet or more and occur in small to fairly large bodies throughout the county but are most common in the central part. The land is largely in spruce, tamarack, swamp white-cedar, alder, willow, and red maple forest, with undergrowths of heath, sedges, and other water-loving plants. There are a few open heath bogs and small scattered areas once in mowing but now supporting a cover of sedges, sphagnum moss, heath, and gray birch sprouts. Attempts have been made to use the peat in several bogs for commercial purposes but with little success.

Peat, shallow phase.—Although similar to the typical peat, the shallow phase differs in depth, which ranges from 18 to 36 inches but averages 24 to 36 inches. It is composed of brown to dark-brown coarse fibrous plant remains, resting on gray or yellowish-gray loose sandy material or gravelly and gritty glacial till. The shallow phase is not so extensive as the typical peat. It occurs in small scattered areas mainly in the central and northern parts of the county. Scattered areas have been cleared and now support a cover of sedges, heath, sphagnum moss, and other water-loving plants. The rest is in forest consisting of the same species as found on typical peat.

Peru loam.—Located in the northern part of the county on imperfectly drained areas, this soil is associated with the Hermon and Canaan soils. Bodies of this soil are nearly level or gently sloping (0 to 5 percent on most areas), and some areas receive considerable water from higher positions. This type occurs in small widely scattered areas in Farmington, Milton, and New Durham.

The 6- to 8-inch dark-brown or dark grayish-brown loam surface soil, containing considerable organic matter in the upper few inches, is underlain by a yellowish-brown loam with some rust-brown and gray mottlings. At 12 to 14 inches the upper subsoil grades into a mottled yellow, rust-brown, and gray gritty loam. At 20 to 22 inches this rests on a yellowish-gray or greenish-gray compact till, highly mottled with rust brown, yellow, and gray and waterlogged most of the time. Because of the high water table and compactness, roots seldom penetrate this layer. Rock fragments of granite and gneiss are numerous on the surface and throughout the profile. All layers are acid.

This soil is naturally adapted to grasses, but because of imperfect drainage, its use for other crops is limited. It is used largely for hay or pasture, but some areas are lying idle and a few are used for silage or field corn. Yields of hay and silage corn are similar to those on Sutton loam, and pastures have about the same carrying capacity. Pastures of Kentucky bluegrass, bentgrasses, redtop, and Canada blue-

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grass usually furnish good grazing. Gray birch, hardhack, meadowsweet, highbush blueberry, bracken fern, hairy-cap moss, and alder are common on the idle areas and neglected pastures.

Peru stony loam.—Except for its generally stony appearance, this soil is similar to Peru loam. The stones are largely granite and gneiss and occur in moderate quantities over the surface and embedded in the soil. It is found in Farmington, Middleton, New Durham, and Milton associated with the loam type. The areas are largely in forest, mainly of red maple, gray, yellow, and paper birches, hemlock, spruce, white ash, beech, sugar maple, aspen, white pine, and alder, with a thick undergrowth of blueberry, dogwood, bracken fern, groundpine, and wintergreen. Small scattered areas have been cleared of trees and are in pasture, lying idle, or in mowing. Pastures usually furnish good grazing, and because of stoniness the carrying capacity may be slightly lower than on Peru loam. Pastures and idle areas support the same vegetation as similar areas on the loam type.

Peru very stony loam.—This soil is similar to the stony loam, except that the content of stone and boulders is higher on the surface and throughout the soil. It is closely associated with the other Peru soils in the northern part of the county and occurs in small to fairly large scattered bodies. Owing to stoniness and imperfect drainage, its use for agricultural purposes is largely prohibited. It is a good pasture soil but less valuable than the stony loam type because a higher percentage of the surface is taken up by stones and boulders. A few small areas are cleared of trees and used for pasture or are lying idle; the rest is in forest.

Podunk fine sandy loam.—This soil occupies imperfectly drained positions on the first bottoms. It is young, unleached, and subject to fresh deposition from occasional flooding. It is highly acid throughout.

The 8- and 10-inch dark- or grayish-brown mellow fine sandy loam surface layer is underlain by a yellow-brown fine sandy loam mottled with rusty brown and gray. The lower subsoil is dominantly gray mottled with brown, rust brown, and yellow and is usually saturated with water below a depth of 24 inches. As mapped, some variations in texture, color, and drainage are included. Surface drainage is fair, and imperfect subsurface drainage limits its use for certain crops.

This fine sandy loam occurs in very small to fair-sized bodies along the main drainageways, principally the Salmon Falls, Cocheco, and Lamprey Rivers. About half the area mapped is under cultivation, in pasture, or lying idle; the other half is in forest. Timothy or timothy and redtop mixed is the principal crop. Small acreages are planted to silage or field corn. Grass mixtures soon run out if the soil is not limed and manure or fertilizer applied. Hay yields 1½ to 3 tons an acre and silage corn 12 to 14 tons, depending on fertilization and management practices. Pastures furnish fair to good grazing with redtop, bentgrasses, Kentucky bluegrass, and white clover predominating. From 1½ to 3 acres are required for a cow for 130 days. Elm, red maple, willow, and alder are the predominating species in forested areas.

Small areas of well-drained loamy fine sand usually bordering the drainageways and poorly drained spots too small to be mapped separately are included.

Rockingham loam.—Small scattered areas, in Durham, Madbury, Dover, and Rollinsford, are comparatively free of loose surface stone, but bedrock outcrops are common and interfere considerably with cultivation. The relief is gently rolling, except on several small bodies with nearly level to gently sloping relief and on several small bodies with hilly relief. On most of this soil the range in slope is 5 to 15 percent. Natural drainage is good. Although shallowness over bedrock limits the water-holding capacity, the moisture supply seems adequate for grasses and cultivated crops in most seasons.

This type is closely associated with Newmarket loam and differs from it in being generally shallow over bedrock. Where a normal profile has developed, the characteristics of the two are similar. The 4- to 6-inch surface soil is brown or rich-brown mellow loam; and where it has been in sod for several years, a soft granular structure has developed. The upper subsoil is rich yellow-brown mellow loam, 2 to 4 inches thick, grading into a yellowish-brown loam. This changes to an olive or pale-yellow gritty and friable light loam at 12 to 14 inches. The subsoil layers are fairly firm in place but when disturbed break down into soft irregular fragments or granules. Depth to till or bedrock is very variable. The greenish-gray friable and gritty till is derived largely from granodiorite rock, soft fragments of which are common throughout the profile and in the till. All layers are acid, varying from very strongly acid in the surface to slightly less acid in the subsoil layers. Roots, air, and water penetrate this soil easily.

Probably 75 percent of the total acreage is under cultivation; the rest is in pasture or lying idle. Hay and silage corn are the principal crops. Small acreages are planted to potatoes, sweet corn, vegetables for home use, and winter squash. The soil is responsive to management, and surface outcrops are the greatest hindrance in cultural operations. Fertilizer and lime are used on the cultivated soil, and many pastures are top-dressed. Yields average about the same as on Hollis loam or Colrain loam under similar fertilizer treatment and management. Hay yields 1 to 2 tons an acre, silage corn 7 to 9 tons, potatoes 100 to 200 bushels, and winter squash 8 to 10 tons.

On the idle areas and some of the pastures the vegetation is chiefly common juniper, broomsedge, dewberries, sweetfern, poverty grass, hardhack, and blueberries. The grasses in the better pastures are chiefly redtop, Kentucky bluegrass, Colonial bentgrass, poverty oatgrass, and broomsedge.

A few areas are moderately eroded, but on the rest erosion has not been significant. As most of this soil is in hay, erosion control is not a problem, and on that used for clean-tilled crops, simple control practices are adequate.

Rockingham stony loam.—Closely associated with the Rockingham loam in Durham, Dover, Madbury, and Rollinsford, this soil is found in small to fairly large scattered bodies. It is generally shallow over granodiorite bedrock, and surface outcrops are common. Loose stones are scattered over the surface, and soft granodiorite fragments are numerous throughout the soil and in the till. The

soil is developed largely from till derived from granodiorite rock and to a less degree from residual material of the underlying rock. The dominant relief is gently rolling to rolling (5 to 15 percent), but several nearly level bodies are included. Both surface and internal drainage are good. Although the shallowness of the soil limits the water-holding capacity to some extent, the moisture supply seems adequate for tree growth. Roots, air, and water penetrate easily to bedrock.

Except under undisturbed forest conditions the profile characteristics are essentially the same as in Rockingham loam. Under forest conditions a layer of leaf litter 1 to 3 inches thick has developed on the surface, and the surface soil is dark-brown mellow loam 1 to 2 inches thick. The rest of the profile, where deep enough for profile development, is similar to Rockingham loam. Depth to bedrock or till varies from a few inches to less than 2 feet in most places.

Probably 75 percent of the total acreage is in forest cover; the rest is idle or in pasture. The forest species are chiefly white pine, white oak, gray birch, red maple, hickory, redcedar, and white ash. Such shrubs and herbs as blueberry, raspberry, witch-hazel, hazel, common juniper, sweetfern, bracken fern, groundpine, and wintergreen are common. Idle areas and pastures support the same vegetation as found on similar areas of Rockingham loam. Owing to the surface stone, this soil is slightly less valuable than the nonstony loam for pasture.

Rockingham stony loam, hilly phase.—Differing from Rockingham stony loam mainly in relief, the hilly phase occurs on 15- to 25-percent slopes, which are for the most part rather short and choppy. This soil is not very extensive and occurs in small scattered bodies associated with the other Rockingham soils. Most of it is in forest and supports the same forest cover as the stony loam. Surface drainage is more rapid than on the type, and this soil if cleared of trees would be more susceptible to erosion. Owing to hilly relief, stoniness, and shallowness, it is best adapted to forest or grazing.

Rockingham very stony loam.—This soil is similar to Rockingham stony loam except that the stones are more numerous, generally larger, and consequently more difficult to remove. It is found in scattered bodies associated with the other Rockingham soils in Durham. Practically the entire acreage is in forest, the purpose for which it is best adapted unless used for grazing. The stone content largely prohibits use for cultivated crops. A larger percentage of the surface is taken up by stone than on the stony loam, and for this reason it is less desirable for grazing purposes if cleared of trees. The forest vegetation consists of the same species as on the stony loam.

Included with this type are areas widely scattered in Durham having a hilly relief. Use of this acreage for crops is largely prohibited, owing to the hilly relief and stoniness, but it has some value for grazing. Practically all of it is in forest.

Rock outcrop.—A miscellaneous land type consisting of outcrops of bare rock large enough to separate on the map. The outcrops occur only in the vicinity of Mack Mountain, in Strafford.

Rolling stony land (Brimfield soil material).—Areas of this land type are similar to rough stony land in degree of stoniness, but they occupy smoother slopes. The relief is rolling, the gradient ranging from 8 to 15 percent. A higher percentage of the surface is taken up by stone and boulders than on the very stony areas of Brookfield or Brimfield soils. Also these areas are characterized by very large stones and boulders, some of which extend 4 to 6 feet above the surface. Stoniness prohibits its use for cultivated crops, but it can be used for pasture. Scattered bodies associated with the Brookfield and Brimfield soils occur in Milton, Farmington, Strafford, and Barrington. Except for a few small areas used for pasture the entire acreage is in forest.

Rolling stony land (Hollis soil material).—Except that more than 50 percent of the surface is taken up by stone, boulders, and surface outcrops, this land is similar to Hollis very stony loam. Some of the large boulders stand 4 to 5 feet high and cover many square feet. The rolling relief (gradient 8 to 15 percent) accounts for the designation rolling stony land. It is similar to rough stony land in degree of stoniness but is more valuable for pasture, because of the smoother slopes. In between the surface outcrops and stone the soil material is similar to that of Hollis stony loam. It occurs in scattered areas in Durham, Lee, Strafford, and Barrington. The entire acreage is in forest, chiefly of white pine, gray birch, red maple, red and white oaks, hickory, and white ash.

Rolling stony land (Rockingham soil material).—This land type occurs on rolling relief (8 to 15 percent) and consists of very stony and shallow areas associated with the Rockingham soils. Large granodiorite boulders 6 feet or more high, along with smaller stones and boulders and many ledgy outcrops, are characteristic of this land. The soil material between the ledges and surface stones is similar to Rockingham stony loam. The areas are confined to the eastern half of Durham. Scattered cleared areas have some value for grazing and are so used, but most of the land is in forest, the purpose for which it is best suited. Tree growth consists mainly of white pine, white oak, hickory, beech, red maple, and gray birch.

Rough stony land (Brimfield soil material).—Areas of this land type occur in fairly large bodies in Milton, Farmington, Strafford. and Barrington, occupying hilly or steep very stony areas, associated with the Brookfield and Brimfield soils. The soil material is similar to Brookfield or Brimfield stony loam, depending on whether it is deep or shallow over bedrock. A large part is shallow. It has some value for grazing, but stoniness and unfavorable relief limit its use largely to forest. A small area on Blue Job Mountain is used as a blueberry farm, while the rest is largely in forest of white pine, hemlock, black and red oaks, beech, red and hard maples, gray and paper birches, and redcedar. Very shallow areas support a sparse forest cover.

Rough stony land (Canaan soil material).—This land type includes stony and shallow granitic areas with steep and rough relief. Loose granitic stone and boulders are scattered over the surface with many ledgy outcrops. The areas are largely associated with the Canaan and Hermon soils, and the soil material is similar to Canaan

stony fine sandy loam. Occurrence is largely in the northern part of the county, and a few scattered areas are in Barrington. Stoniness, shallowness, and steep relief largely limit the use of this land to forest. The tree growth is chiefly hemlock, beech, red and hard maples, white pine, paper and yellow birches, and spruce.

Rough stony land (Colrain soil material).—Essentially a very stony and shallow Colrain soil this land type is characterized by many flaggy pieces of schist, large stone and boulders, and many ledgy outcrops. The relief is predominantly hilly with a few rolling areas included. Where there is any degree of development the soil material is similar to Colrain stony loam.

Areas of this land occur in Lee and the southeastern corner of Durham. It has little value except for forestry, and practically the entire acreage is in forest. The tree growth is dominantly white pine, white oak, red maple, hickory, beech, gray birch, and pitch pine.

Rough stony land (Gloucester soil material).—Associated with the Gloucester soils, this land type occupies the very stony, hilly, and rough areas. Stoniness and hilly relief make it unsuitable for cultivation and of little value for grazing. Its principal use is for forestry. Widely scattered bodies occur in Barrington and Milton, though this land type is not very extensive. The soil material is similar to that of Gloucester stony fine sandy loam. The entire acreage is in forest, mainly of white pine, gray birch, white and red oaks, hickory, pitch pine, hemlock, red maple, and beech.

Rough stony land (Hermon soil material).—This land type occurs on the very stony, hilly, and steep areas associated with the Hermon soils in the northern part of the county. The soil material is similar to Hermon stony fine sandy loam where there is any degree of development. The areas are most extensive and most common in New Durham, and small scattered bodies occur in Middleton and Milton. Stoniness and relief limit its use largely to forest. Tree growth consists mainly of white pine, hemlock, birch, red and hard maples, paper and yellow birches, spruce, and red oak.

Rough stony land (Hollis soil material).—This land type occupies the steep and very stony areas associated with the Hollis soils. The soil material is similar to Hollis stony loam, where there is any degree of development. Small to fairly large bodies are found in Durham, Barrington, Strafford, and Farmington. It has some value for grazing, but the stoniness and steep slope limit its use largely to forest. Practically the entire acreage is forested with the same species as found on the Rolling stony land (Hollis soil material).

Rough stony land (Rockingham soil material).—Associated with the Rockingham soils, this land type occupies the very stony, shallow, hilly, and steep areas. The soil material is similar to Rockingham stony loam where deep enough for any soil to develop. The small total acreage occurs in small scattered areas in the eastern half of Durham. Stoniness and steep slopes limit its use largely to forest, for which purpose it is used. Tree growth consists of the same species as found on Rolling stony land (Rockingham soil material).

Rumney fine sandy loam.—Occupying bottom land subject to overflow, this soil consists of deposited material of granite, gneiss, and

schist origin on poorly drained positions associated with the Ondawa and Podunk soils. The surface soil is lighter in color than the Alluvial soils, undifferentiated.

The 8- to 10-inch dark-brown or dark grayish-brown mellow fine sandy loam surface soil is underlain by a pale yellowish-brown fine sandy loam mottled with rust brown and light gray. Below 18 to 20 inches the material is gray to yellowish-gray loamy sand or coarse sand mottled with rust brown. The reaction is very acid throughout. Very few roots go below 2 feet, owing to the high water table. Some variations in texture and in drainage are included in mapping.

This fine sandy loam is not very extensive and is not important agriculturally. It is found in widely separated bodies along the major drainageways. About 75 percent of the total acreage is in forest, mainly of red maple, gray birch, alder, and willow. The rest is lying idle, in pasture, or in mowing. Sedges, rushes, hardhack, and goldenrod are common, with some Kentucky bluegrass, redtop, and bentgrasses in pastures and idle areas. Pastures furnish good grazing even in extremely dry seasons where weeds and brush are not allowed to crowd out the desirable grasses.

Saco silt loam.—Associated with and receiving wash from the Suffield, Buxton, and Biddeford soils, this type occupies low positions on the first bottoms. Both surface and subsurface drainage are poor.

The 10- to 12-inch dark grayish-brown to nearly black friable silt loam surface soil is high in organic matter and is underlain by a bluish-gray heavy silt loam or silty clay loam mottled and streaked with rust brown and yellow. This material breaks into irregular clods that are easily broken down into a friable mass when moderately dry but is plastic and sticky when wet. Below 18 to 20 inches the material is bluish-gray heavy silty clay or clay mottled and streaked with rust brown, sticky and plastic when wet and hard when dry.

The small total acreage occurs for the most part in small strips along the drainageways in the southeastern part of the county. Small areas are cleared and in mowing, in pasture or lying idle; the others are in forest, mainly of willow, alder, red maple, gray birch, and elm. Pastures and idle areas contain much sedge, hardhack, gray birch sprouts, goldenrod, and alder, with some Kentucky bluegrass, Canada bluegrass, redtop, and white clover. Pastures furnish good grazing even in extremely dry seasons if brush and weeds are not too thick. Hay yields 2 to 3 tons an acre depending on management practices and the season. The best use for this land is pasture.

Scarboro fine sandy loam.—Occupying poorly drained positions associated with the Merrimac, Barnstead, and Adams soils, this soil has flat or very gently sloping relief. Water stands on the surface in wet seasons, and the subsoil is waterlogged most of the time.

In forested areas there is an organic mat 4 to 6 inches thick on the surface. The 4- to 8-inch surface layer is dark grayish-brown or nearly black fine sandy loam well-matted with small roots and is underlain to a depth of 2 to 2½ feet by a yellowish-gray fine sandy loam or loamy fine sand mottled and streaked with rust brown, yellow, and light gray. Below this the material is light-gray or yellowish-gray incoherent saturated loamy sand. In places clay is encountered at a depth of 3 feet or more. Owing to the high water table, roots do not

penetrate this soil very deeply. All layers are acid, varying from extremely acid in the surface to slightly less acid in the subsurface layers.

Small to fairly large bodies occur throughout the southern and central parts of the county, but most commonly in the southeastern part. The type is largely in forest, mainly of red maple, yellow, black, and gray birches, white pine, and water-loving shrubs and herbs. A few scattered bodies are cleared and used for pasture or are lying idle. Pastures furnish good grazing in summer. The most common grasses and legumes are Kentucky bluegrass, Colonial bentgrass, and white clover. Sedges predominate on the wetter spots.

Small areas of sandy loam or loamy sand are included in mapping. Also areas are included with a light-gray layer just beneath the forest duff, underlain by a dark-brown or rust-brown horizon. Had these areas been large enough, they would have been mapped as Saugatuck fine sandy loam.

Scarboro loam.—Although closely associated with the fine sandy loam Scarboro loam differs from it mainly in texture. It is characterized by a dark grayish-brown to nearly black loam surface over a mottled subsoil, and is less extensive than the fine sandy loam. Most of it is in the southeastern part of the county. A few small bodies are cleared and lying idle or used for pasture; the rest is in forest of the same species as found on the fine sandy loam.

Sudbury fine sandy loam.—Occupying widely separated flats or low imperfectly drained areas on the terraces, this soil occurs in association with the Merrimac, Barnstead, and Adams soils. Surface drainage is only fair and subsurface drainage is imperfect. Imperfect drainage is caused largely by the low position of the areas from which ground water is unable to move. None of the soil is artificially drained. The relief is dominantly flat, with a few areas occupying gentle slopes.

Under a forest cover there is a layer of organic debris 3 to 4 inches thick on the surface. The topmost inch is dark-brown or nearly black fine sandy loam, containing a high percentage of organic matter. This material is underlain by a brown or dark-brown friable fine sandy loam 4 to 6 inches thick.

In cultivated fields the surface soil is dark grayish-brown mellow fine sandy loam. The upper subsoil is yellowish-brown or brownish-yellow fine sandy loam with some rust-brown and gray mottlings. This layer grades into a gray or yellowish-gray loamy fine sand, mottled and streaked with rust brown and yellow at a depth of 16 to 18 inches. Both layers have a single-grain consistence. Below 2 feet the material is generally gray or light-gray loamy sand mottled and streaked with rust brown and yellow. This material is saturated with water most of the time. In some places the lower part contains considerable gravel; in others there is very little or none.

This soil type occurs in small to fairly large bodies well distributed over the central and southern parts of the county. It is most common in Dover, Rochester, Madbury, and Barrington. Probably more than 90 percent of the total acreage is in forest; the rest is in pasture, lying idle, or under cultivation.

Imperfect drainage limits the range of crops that can be grown successfully. Timothy hay, silage corn, and vegetables for home use

are the principal crops. Hay yields 1½ to 2½ tons and silage corn 9 to 12 tons an acre. Pasture areas furnish fair to good grazing even in dry years. From 2 to 3 acres are required to carry one cow for the normal grazing season of 130 days.

The trees in forested areas consist chiefly of white pine, red maple, gray and yellow birches, hemlock, white and black oaks, and white ash, with an undergrowth of highbush blueberry, sweetfern, witch-hazel, wintergreen, bracken fern, and cinquefoil.

Small areas of loam or sandy loam textures are included in mapping, also small areas of poorly drained soils too small to separate on the map of the scale used. Because of the high water table, roots seldom go below 2 feet.

Suffield silt loam.—This soil is practically free of stone or gravel and occurs on 2- to 8-percent slopes with undulating to gently undulating relief. Nearly all of it is under cultivation, and it is one of the best soils in the county for the production of hay and forage crops and for pasture. Plate 3, *A*, shows pasture on Suffield and Buxton silt loams. Surface drainage is good, but internal drainage is somewhat retarded owing to the texture and structure of the subsoil layers and heavy clay substrata. The moisture-holding capacity is good, and grasses or cultivated crops seldom suffer even in unusually dry seasons. This soil absorbs water slowly and therefore is very susceptible to erosion under improper management practices.

The surface soil is brown to dark-brown mellow silt loam with a soft granular structure, 5 to 7 inches thick. This is underlain by a pale yellowish-brown mellow and friable silt loam, which at a depth of 10 to 12 inches grades into an olive-yellow heavy silt loam. Both these layers are firm in place and when disturbed break into irregular fragments that crush down easily into a soft granular mass. At 16 to 18 inches the material changes to a bluish-gray or greenish-gray silt loam to silty clay loam, which grades into a greenish-gray heavy clay interbedded with silt at about 24 inches. This material is very compact in place and breaks into hard angular blocks that are hard to crush when dry. It is plastic and sticky when wet. The surface and subsoil layer are acid, and the unaltered silts and clays are slightly acid to neutral.

This soil is responsive to fertilization and good management and may be easily maintained in a productive state. It warms up rather slowly in spring and cannot be worked so early in spring or as soon after heavy rains as the lighter textured soils; more power also is required for cultural operations. Though it is erodible under poor management, simple conservation practices, as contour cultivation, strip cropping and proper rotation of crops, are adequate for conserving the soil.

This silt loam is found mainly in the towns of Durham, Madbury, Dover, and Rollinsford, with a few areas in Somersworth, Lee, the eastern part of Barrington, and the southern part of Rochester. For the most part areas of this soil are in small bodies and the total acreage is not large. About 70 percent is under cultivation; the rest is largely in pasture, with a few areas in wood lots. Dairy farming is the principal enterprise, and mixed hay and silage corn are the chief crops. Small acreages are planted to clover, alfalfa, oats, potatoes, vegetables, and winter squash. Most of the available manure is used

under silage corn and this is usually supplemented with 200 to 400 pounds an acre of superphosphate or 300 to 500 pounds of a 4-12-4 mixture. Where hay fields are reseeded, 1 to 1½ tons of lime are usually applied, and for clover and alfalfa 2 tons of lime and 300 to 500 pounds of a complete fertilizer. Potatoes are fertilized with about one-half ton of 8-16-16 and vegetables and sweet corn with 1,000 to 1,500 pounds of a 5-8-7 or 4-8-8 mixture. For winter squash, manure is commonly applied in the hill and fertilizer around it. Timothy or mixed timothy and clover hay yields 2 to 3 tons an acre, clover 2 to 3 tons, alfalfa 2½ to 3 tons, corn silage 12 to 16 tons, oats for hay 2 to 3 tons, corn for grain 40 to 60 bushels, potatoes 150 to 250 bushels, and winter squash 10 to 12 tons.

This type is one of the best pasture soils in the county and 1½ to 3 acres are required to carry one cow for the normal grazing season of 130 days. The most common pasture grasses and legumes are Kentucky bluegrass, redtop, white clover, Colonial bentgrass, and Canada bluegrass. Hawkweed, field daisy, narrowleaf plantain, wild carrot, sorrel, and mullein are common pests in many hay fields. The few remaining tracts of woods support a mixed forest cover of white pine, hemlock, red maple, gray birch, red oak, white ash, elm, and beech.

Stony areas occur in small scattered bodies in Durham and occupy a small acreage. This soil is similar to Suffield silt loam except that an occasional rock outcrop or glacial erratic occurs on the surface. These outcrops and erratics are not very numerous and do not interfere appreciably with cultural operations. The stony soil occurs on nearly level to gently rolling relief; several small bodies are included with nearly level relief. Drainage is well established but is rather slow because of the heavy character of the subsoil. About 80 percent of this inclusion is under cultivation, largely to hay; the rest is idle or in forest. Hay yields 1½ to 2½ tons an acre and silage corn 12 to 16 tons. It is almost as valuable for pasture as Suffield silt loam. Erosion has not been serious and with simple conservation practices it is not likely to be a problem, unless the land is in short rotations with intertilled crops being grown frequently. Included in mapping are also areas of Melrose or Buxton soils too small to separate.

Suffield silt loam, eroded phase.—This phase is similar in all respects to the type except in the degree of erosion. From 25 to 75 percent of the surface soil has been lost, chiefly in the form of sheet erosion. Northwest of the Dover County farm one small severely eroded area is included with this phase. On a few scattered areas old gullies, which are generally stabilized, are evident. Only a small percentage of this soil is used for clean-tilled crops in any year, so there is very little active erosion at present. Owing to the removal of part of the surface the total depth to unaltered silts and clays averages less than in the typical soil. The surface soil is also lower in content of organic matter. Though this soil is susceptible to erosion if not handled properly, simple conservation practices are adequate for conserving it.

This eroded phase is closely associated with the type in small to fair-sized bodies, but is less extensive. Practically the entire acreage is under cultivation or in pasture. Fertilizer treatments and management practices are the same as on the typical soil, and erosion has not reached the stage where crop yields are greatly reduced. The same

crops are grown in about the same proportion, and the carrying capacity of pastures is somewhat lower than on the normal phase. This soil is responsive to fertilization and management, and run-down areas may be easily built up to and maintained in a productive state.

Suffield silt loam, eroded rolling phase.—Located on complex slopes ranging from 8 to 15 percent, this phase differs from the type mainly in relief and in degree of erosion. A few slightly eroded areas are included, but on most of this phase 25 to 75 percent of the surface soil has been lost. Because of the rolling relief it is susceptible to erosion if planted to clean-tilled crops, and such practices as strip cropping, contour cultivation, and other conservation practices should be employed. There is very little active erosion on this soil, as most of it is in grasses or legumes.

The eroded rolling phase occurs in small scattered areas closely associated with the other Suffield soils. A few scattered areas are in woods or lying idle; the rest is cultivated or in pasture. Hay is the principal crop, and yields are about the same as on the eroded phase. Small acreages are used for silage corn, potatoes, and vegetables. Because of the danger of erosion the areas should be planted to close-growing crops as much as possible.

Suffield silt loam, level phase.—Though inextensive, this phase occurs in small widely scattered areas mostly in Rochester, Rollinsford, Dover, and Durham. Except in relief it is similar in all respects to the type. It occupies nearly level positions, the gradient not exceeding 2 percent. Owing to the smooth relief, surface drainage is not so rapid, the water-holding capacity is slightly higher, and the soil is less susceptible to erosion.

Probably 60 percent of the total acreage is cultivated or in pasture; the rest is in forest. The cultivated soils are used for the same crops in about the same proportion as on the type. Fertilizer treatments and management practices are essentially the same, and crop yields and carrying capacity of the pastures average about the same or a little higher.

This soil requires no special practices for its management and conservation, but rotation of crops and replenishment of plant nutrients lost through cropping or grazing are desirable for maintaining the productivity level.

Suffield silt loam, severely eroded rolling phase.—Except in degree of erosion this soil is similar to the eroded rolling phase. On the average 75 percent or more of the surface soil and in places part of the subsoil have been removed. Originally the profile characteristics were the same as on the type, except that probably the surface was not so deep. At present, however, there is little uniformity in the surface and upper part of the subsoil because of erosion. In places part of the original surface soil remains, whereas in others all the surface and part of the upper subsoil have been removed. On a few areas old gullies are in evidence, but most of the gully erosion has been stabilized. There is also very little active sheet erosion, as only a very small proportion of this soil is used for clean-tilled crops.

This inextensive soil occurs in small scattered bodies closely associated with the other Suffield soils. Practically the entire acreage is cleared of trees and about 50 percent is in pasture; the rest is largely

in grasses for hay. With similar management practices crop yields average somewhat lower than on the type and the carrying capacity of the pastures also is lower.

Owing to the rolling relief and degree of erosion the best use for this land is for long-term hay or for pasture unless intensive erosion-control methods are employed.

Sutton loam.—Developed on nearly level to smoothly sloping relief, the dominant range is from 1 to 5 percent and on a few areas above 5 percent. Surface drainage is only fair, and subsurface drainage is imperfect. The relatively small areas are associated with the Charlton, Hollis, and Brookfield soils, usually in slight depressions in the well-drained areas, on gentle slopes that receive seepage water from above, or on narrow strips between well-drained and poorly drained areas.

The 6- to 8-inch surface soil is dark-brown mellow loam with a weak granular structure in places. This is underlain by a yellowish-brown loam or silt loam with some rust brown and gray mottling to a depth of 10 to 12 inches. Below this the material is yellow to grayish-yellow gritty loam, highly mottled and streaked with rust brown and gray. These subsoil layers are firm in place and when disturbed break into soft irregular crumbs or granules. At 18 to 22 inches the lower subsoil rests on greenish-gray or olive-gray compact till mottled and streaked with rust brown, yellow, gray, and light gray; when disturbed it breaks into irregular clods with a platy structure. Fragments of schist and granitic materials are scattered over the surface and throughout the profile. All layers are acid.

This type occurs comparatively stone-free in relatively small widely scattered areas in Farmington, Strafford, Rochester, Barrington, and Somersworth. Probably half the total acreage is under cultivation; the rest is in pasture or lying idle. Imperfect drainage limits the range of crops that may be grown chiefly to timothy hay and silage corn with small acreages in potatoes, oats, and vegetables for home use. This soil is one of the best for pasture in the county. Hay when seeded usually receives 1 to 1½ tons of lime an acre, supplemented with 200 to 400 pounds of fertilizer on a few farms. A heavy application of manure and 200 to 400 pounds of superphosphate are applied to the silage corn. Hay yields 1½ to 3 tons an acre and silage corn 11 to 15 tons (pl. 2, *B*). Potatoes are fertilized with about 1 ton of 5–8–7 or half a ton of 8–16–16, and yields are 125 to 200 bushels depending on the season and care. With fertilization excellent pastures may be produced. From 1½ to 3 acres are required to carry one cow for the normal grazing season of 130 days. Kentucky bluegrass, redtop, Colonial bentgrass, Canada bluegrass, and poverty grass constitute the principal pasture grasses. Idle areas and neglected pastures contain much hardhack, meadowsweet, blueberry, gray birch and aspen sprouts, common juniper, broomsedge, goldenrod, and daisies.

A few areas are included where the soil had developed from till derived largely from granitic materials. These areas are associated with the Gloucester soils and would have been mapped as Acton loam if the total acreage has been large enough to separate.

Sutton stony loam.—This soil is more extensive than Sutton loam and occurs in small to fairly large areas in the central and southern

parts of the county, being most common in Rochester, Farmington, and Strafford. The degree of stoniness is moderate, except on a few areas, which are very stony. Like Sutton loam it occupies nearly level to smoothly sloping positions. The upper range of slope is about 8 percent and most of the soil is on slopes of 0 to 5 percent. Surface drainage is only fair, and internal drainage is imperfect. The subsoil layers are waterlogged early in spring and during wet seasons.

In forested areas a layer of organic debris 2 to 4 inches thick has developed on the surface, which is partly decomposed and well-matted with small roots. The surface soil is dark grayish-brown friable loam 1½ to 2 inches deep underlain by a yellowish-brown heavy loam with some rust-brown and gray mottlings. At about 12 inches this grades into a yellow to pale-yellow gritty loam mottled and streaked with rust brown and gray. The lower subsoil rests on greenish-gray or olive-gray gritty compact till, highly mottled and streaked with rust brown, yellow, and gray. The till is derived largely from schist, with an admixture of granitic materials in places. When dug out with a pick the till breaks into irregular fragments with a platy structure. Schist, granite, and gneiss stone are scattered over the surface and throughout the profile. All layers are acid.

Although this type is largely in forest of red maple, gray, yellow, and black birches, red oak, elm, white ash, hemlock, and spruce with a thick undergrowth of shrubs and herbs, small cleared areas are used for pasture or are lying idle. With similar management the carrying capacity of the pastures may be slightly lower than on Sutton loam. The vegetation on the idle areas and pastures is the same as on similar areas of the loam type.

Tidal marsh.—This land type occupies shallow tidal flats that are exposed to the air during low tide and covered with water at high tide. The surface is a brown fibrous mat of grass and grass roots with sand and silt intermixed. Below this the material is generally a dark-gray fine sandy loam or sand, firm in place but loose and friable when broken up. This gradually changes to loose gray sand at 2½ to 3 feet in depth. Occurring in the southeastern part of the county in narrow fringes or in small inlets adjacent to Great Bay and the Oyster, Piscataqua, and Salmon Falls Rivers, this land type has no agricultural value or importance. The vegetation consists mainly of saltgrass, eelgrass, and sedges.

Several small areas of coastal beach too small to separate on the map are included. These areas, occurring in the vicinity of Durham Point and Adams Point, occupy level sandy fringes along the shore line, varying in width from 50 to 100 feet. The material is largely of quartz sand deposited by wave action. It supports no vegetation and is of value only for recreational purposes.

Whitman stony loam.—Throughout the county, this soil occupies low positions or swalelike depressions associated with the glaciated uplands. Natural drainage is poor, and water stands on the surface in wet seasons and after heavy rains.

The 10- to 12-inch surface soil is dark-brown or nearly black mellow loam, containing a quantity of organic matter in all stages of decomposition. In places there is a thin mucklike layer on the surface. The upper subsoil is pale grayish-brown mottled friable loam, grading at

15 to 20 inches into gray or pale yellowish-gray material mottled and streaked with rusty brown and dark gray and of the same consistence as the layer above or slightly more compact. Below 24 to 30 inches the material is gray or drab-gray slightly compact or compact till of sandy loam texture. Stones and boulders are scattered over the surface and embedded in the soil in sufficient quantities to interfere seriously with or prohibit cultivation.

Small cleared areas are used for pasture or are lying idle. The rest is in forest of red maple, alder, willow, gray birch, hemlock, and spruce, with a thick undergrowth of shrubs and herbs. On the better pastures Kentucky bluegrass, bentgrasses, Canada bluegrass, and white clover are common, but hardhack, meadowsweet, sedge, bracken fern, blueberry, and alder are abundant in most pastures and on idle areas.

Whitman very stony loam.—Compared with Whitman stony loam, this type contains a larger quantity of stones and boulders on the surface and embedded in the subsoil; otherwise the two are essentially the same, though the higher stone content makes the very stony loam slightly less valuable for grazing. The areas occur in low depressions or on gentle slopes that receive seepage water from above, and are most common in the northern part of the county. Small areas cleared of trees are used for pasture or are lying idle, but the type is largely in forest. Vegetation is the same as on the stony loam in forested or pastured areas.

ESTIMATED YIELDS, PRODUCTIVITY RATINGS, AND LAND CLASSIFICATION

In table 8 the soils of Strafford County are listed alphabetically and for each soil estimated average acre yields of the principal crops are given under both prevailing farming practices and more intensive practices of management.

TABLE 8.—*Estimated average acre yields of the principal crops on each soil in Strafford County, N. H.*

[Estimates in columns A refer to average yields obtained under prevailing practices; estimates in columns B refer to yields obtained under more intensive management practices in which larger and more frequent applications of lime, phosphate, and complete fertilizers are used]

Soil (soil types, phases, and land types)	Corn (grain)		Corn (silage)		Mixed timothy and clover hay		Alfalfa hay		Oat hay		Potatoes		Pasture		Remarks
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
	Bu.	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Acres*[1]	*Acres*[1]	
Adams fine sandy loam	25	40	6	9	1.0	1.5	1.5	2.75	1	2	100	175	5.0	3.0	Largely in forest; scattered areas used for general farming.
Adams loamy sand	15	25	4	6	.5	1.0	1.0	2.0	------	------	75	125	8.0	3.5	Largely in forest; alfalfa, corn, and other farm crops require heavy fertilization and liming.
Sloping phase	------	------	------	------	------	------	------	------	------	------	------	------	8.0	4.0	Largely in forest; scattered areas, idle or in poor pasture.
Alluvial soils, undifferentiated	------	------	------	------	------	------	------	------	------	------	------	------	4.0	2.5	Largely in forest; a few acres in pasture.
Barnstead fine sandy loam	25	40	6	9	1.0	1.5	1.5	2.5	1.0	2.0	100	175	5.0	3.0	Considerable acreage in pasture or idle; some in general crops.
Sloping phase	25	40	6	9	1.0	1.5	1.5	2.5	1.0	2.0	100	175	5.0	3.0	Practically all in forest or idle.
Barnstead loamy sand	15	25	4	6	.5	1.0	1.5	2.0	------	------	75	125	8.0	4.0	Largely in forest; formerly a considerable area cultivated.
Sloping phase	------	------	------	------	------	------	------	------	------	------	------	------	8.0	4.0	Practically all in forest or idle.
Becket loam	35	50	10	14	1.5	3.0	------	------	2.0	3.0	175	300	3.5	2.0	Largely used for dairying and general farming; principal crops, hay and silage corn.
Eroded phase	35	50	9	12	1.5	3.0	------	------	2.0	2.75	150	250	3.5	2.5	Do.
Eroded hill phase	------	------	------	------	1.0	2.0	------	------	1.75	2.50	------	------	4.0	2.5	Largely in forest or idle.
Gently sloping phase	35	50	10	14	1.5	3.0	------	------	2.0	3.0	175	300	3.5	2.0	Used for same crops as Becket loam.
Becket stony loam	------	------	------	------	------	------	------	------	------	------	------	------	3.5	2.0	Largely in forest; scattered areas in hay; well suited to pasture.
Gently sloping phase	------	------	------	------	------	------	------	------	------	------	------	------	3.5	2.0	Do.
Hill phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------	Practically all in forest.
Biddeford silty clay loam	------	------	------	------	[2] 2.0	[2] 3.0	------	------	------	------	------	------	3.0	1.5	Largely in forest or pasture; a few areas drained artificially, mainly in hay.
Brimfield stony loam	------	------	------	------	------	------	------	------	------	------	------	------	6.0	3.0	Approximately 90 percent in forest; rest largely idle or in pasture.
Hilly phase	------	------	------	------	------	------	------	------	------	------	------	------	6.0	3.0	Do.
Brimfield very stony loam	------	------	------	------	------	------	------	------	------	------	------	------	------	------	Practically all in forest.
Hilly phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------	All in forest.
Brookfield loam	25	40	5	9	1.0	1.5	------	------	1.0	2.0	100	200	5.0	3.0	Used largely for general farming; principal crops hay and silage corn.
Eroded phase	25	35	5	8	1.0	1.5	------	------	1.0	2.0	75	200	5.0	3.0	Do.
Gently undulating phase	25	40	5	9	1.0	1.5	------	------	1.0	2.0	100	200	5.0	3.0	Practically all cultivated.
Hilly phase	------	------	------	------	1.0	1.5	------	------	------	------	------	------	5.0	3.0	Approximately 75 percent in forest; rest in hay or idle.

See footnotes at end of table.

TABLE 8.—*Estimated average acre yields of the principal crops on each soil in Strafford County, N. H.*—Continued

Soil (soil types, phases, and land types)	Corn (grain)		Corn (silage)		Mixed timothy and clover hay		Alfalfa hay		Oat hay		Potatoes		Pasture		Remarks
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
	Bu.	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Acres*[1]	*Acres*[1]	
Brookfield stony loam	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.0	3.0	Largely in forest.
Gently undulating phase	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.0	3.0	Do.
Hilly phase	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	Nearly all in forest.
Brookfield very stony loam	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	Do.
Hilly phase	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	Do.
Buxton silt loam	30	40	9	12	2.0	3.0	-----	-----	2.5	3.0	-----	-----	2.0	1.0	Approximately 80 to 85 percent in hay and pasture.
Gently sloping phase	30	40	9	12	2.0	3.0	-----	-----	2.5	3.0	-----	-----	2.0	1.0	Do.
Canaan fine sandy loam	25	40	-----	-----	1.0	1.5	-----	-----	-----	-----	100	200	5.0	3.0	About a half used for hay, potatoes, and vegetables; rest idle or in pasture.
Hilly phase	-----	-----	-----	-----	1.0	1.5	-----	-----	-----	-----	-----	-----	6.0	3.0	About a half in hay or pasture; rest idle or in forest.
Canaan stony fine sandy loam	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.0	3.0	Largely in forest.
Hilly phase	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.0	3.0	Do.
Canaan very stony fine sandy loam.	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	Do.
Hilly phase	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	Do.
Charlton loam	40	60	10	14	1.5	3.0	2.5	3.0	2.0	3.0	200	350	3.5	2.0	About ¾ cultivated; dairying is principal type of farming.
Eroded phase	35	50	9	12	1.5	2.75	2.5	2.75	2.0	2.75	150	300	4.0	2.0	About 90 percent cultivated and used for same crops as Charlton loam.
Eroded hilly phase	25	50	6	12	1.0	2.5	2.0	2.5	1.75	2.5	100	300	5.0	2.5	Largely in hay and pasture.
Gently undulating phase	40	60	10	14	1.5	3.0	2.5	3.0	2.0	3.0	200	350	3.5	2.0	About 75 percent used for cultivated crops, including hay.
Charlton stony loam	-----	-----	-----	-----	[3]1.0	[3]2.5	-----	-----	-----	-----	-----	-----	3.5	2.0	Largely in forest; scattered areas in pasture and hay.
Gently undulating phase	-----	-----	-----	-----	[3]1.0	[3]2.5	-----	-----	-----	-----	-----	-----	3.5	2.0	Do.
Hilly phase	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	Practically all in forest.
Colrain loam	35	50	8	12	1.0	2.5	-----	-----	2.0	3.0	150	300	4.0	2.5	Nearly a half in forest; rest in general crops and pasture.
Gently undulating phase	35	50	8	12	1.0	2.5	-----	-----	2.0	3.0	150	300	4.0	2.5	Do.
Hilly phase	-----	-----	7	11	1.0	2.5	-----	-----	-----	-----	-----	-----	4.0	2.5	Largely in forest; rest principally in hay and pasture.
Colrain stony loam	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.0	2.5	Largely in forest; scattered cleared areas in pasture or lying idle.
Hilly phase	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.0	2.5	Do.
Essex loam	35	50	10	14	1.5	3.0	2.0	2.75	2.0	2.5	150	300	3.5	2.0	Nearly all cultivated or in pasture; responsive to management.
Eroded phase	30	45	9	12	1.5	2.5	2.0	2.5	2.0	3.0	150	250	3.5	2.5	Do.
Gently sloping phase	35	50	10	14	1.5	3.0	2.0	2.75	2.0	3.0	175	300	3.5	2.5	Do.

Essex stony loam													3.5	2.0	Largely in forest; scattered cleared areas in pasture or lying idle.
Gently sloping phase													3.5	2.0	Do.
Gloucester fine sandy loam	25	35	6	8	1.0	1.5	1.5	2.75	1.0	2.0	100	175	5.0	3.0	Largely cultivated to general crops; some idle or in pasture.
Eroded phase	25	40	6	9	1.0	1.5	1.5	2.75	1.0	2.0	100	200	5.0	3.0	Do.
Gently undulating phase	25	40	6	9	1.0	1.5	1.5	2.75	1.0	2.0	100	200	5.0	3.0	Do.
Gloucester stony fine sandy loam					.5	1.0							5.5	3.0	Largely in forest; rest in pasture, hay, or idle.
Gently undulating phase					.5	1.0							5.5	3.0	Do.
Hilly phase															Nearly all in forest; scattered areas in pasture or idle.
Gloucester very stony fine sandy loam.															Do.
Hilly phase															All in forest.
Gravel pits															Abandoned pits growing up in gray birch and aspen.
Hartland silt loam					1.5	2.5							3.5	2.0	Largely in pasture; some areas in hay, a few in forest.
Severely eroded phase					1.0	2.0							4.0	2.5	Do.
Steep phase													4.5	2.5	Largely in forest; some pasture.
Hermon fine sandy loam	25	40	6	9	1.0	2.0	1.5	2.5	1.0	2.0	100	200	5.0	3.0	About a half in young forest; small acreage in general crops; rest in pasture or idle.
Gently undulating phase	25	40	6	9	1.0	2.0	1.5	2.5	1.0	2.0	100	200	5.0	3.0	About 40 percent in young forest; rest cultivated, in pasture, or idle.
Hilly phase					1.0	1.5							5.0	3.0	About a half cultivated, largely hay.
Hermon stony fine sandy loam					[3].5	[3]1.0							5.5	3.0	Largely in forest; scattered areas in hay, vegetables, or pasture.
Gently undulating phase					[3].5	[3]1.0							5.5	3.0	Do.
Hilly phase															Nearly all in forest; areas formerly in cultivation reforested.
Hermon very stony fine sandy loam.															Nearly all in forest.
Hilly phase															Do.
Hinckley loamy sand														5.0	Largely in forest; formerly a considerable acreage cleared.
Eroded phase														5.0	About 60 percent in forest; rest idle.
Hollis loam	30	40	8	12	1.0	2.0	2.0	2.75	1.5	2.5	100	200	3.0	2.5	About 70 percent cultivated, principally in hay; small acreages of general crops.
Eroded phase	25	35	7	9	1.0	2.0	2.0	2.5	1.5	2.5	75	200	4.0	2.5	About 85 percent cultivated; rest in pasture or idle.
Eroded hilly phase	25	35	6	9	1.0	2.0	2.0	2.5	1.5	2.5	75	200	4.0	2.5	Largely in hay, silage corn, and pasture.
Gently undulating phase	30	40	8	12	1.0	2.0	2.0	2.75	1.5	2.5	100	200	3.0	2.5	Nearly all cultivated.
Hollis stony loam					[3]1.0	[3]2.0							4.0	2.5	Largely in forest; scattered areas in pasture, hay, or idle.
Gently undulating phase					1.0	2.0							4.0	2.5	Do.
Hilly phase															Nearly all in forest.
Hollis very stony loam															Do.
Hilly phase															Do.
Jaffrey loamy sand														5.0	Do.
Melrose fine sandy loam	40	60	10	16	1.0	2.5	2.5	3.0	2.0	3.0	200	350	3.5	2.0	About 80 percent cleared, used for general crops and pasture.
Sloping phase	35	55	10	14	1.0	2.5	1.5	2.75	2.0	3.0	175	300	4.0	2.5	Do.

See footnotes at end of table.

959707—40——8

TABLE 8.—*Estimated average acre yields of the principal crops on each soil in Strafford County, N. H.*—Continued

Soil (soil types, phases, and land types)	Corn (grain)		Corn (silage)		Mixed timothy and clover hay		Alfalfa hay		Oat hay		Potatoes		Pasture		Remarks
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
	Bu.	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Acres*[1]	*Acres*[1]	
Melrose loamy sand	25	35	6	8	0.5	1.5	1.0	2.0	1.5	2.0	100	200	5.0	3.0	About 50 percent cleared; especially adapted to early vegetables.
Sloping phase	25	35	6	8	.5	1.5	1.5	2.0	1.5	2.0	100	200	5.0	3.0	Largely in forest.
Merrimac fine sandy loam	25	40	6	9	1.0	1.5	1.5	2.75	1.0	2.0	100	275	5.0	3.0	About half cleared, used for general crops, pasture, or idle.
Sloping phase	25	40	6	9	1.0	1.5	1.5	2.75	1.0	2.0	100	225	6.0	3.0	Largely in forest or idle; scattered areas principally in hay and vegetables.
Merrimac loamy sand	15	25	4	6	.5	1.0	1.0	2.0	------	------	75	125	8.0	4.0	Do.
Sloping phase	------	------	------	------	.5	1.0	------	------	------	------	------	------	8.0	4.0	Largely in forest or idle.
Muck	------	------	------	------	------	------	------	------	------	------	------	------	------	------	Largely in forest.
Shallow phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------	Do.
Newmarket loam	35	55	11	15	1.5	2.5	2.5	3.0	2.0	3.0	200	350	3.5	2.0	Practically all cultivated or in pasture.
Gently undulating phase	35	55	11	15	1.5	2.5	2.5	3.0	2.0	3.0	200	350	3.5	2.0	Do.
Newmarket stony loam	------	------	------	------	------	------	------	------	------	------	------	------	4.0	2.0	Largely in forest.
Ondawa fine sandy loam	40	60	12	16	1.5	2.5	------	------	------	------	150	250	3.0	1.5	About 50 percent cleared, used for general crops or pasture.
High-bottom phase	40	60	12	16	1.5	2.5	------	------	2.0	3.0	200	350	3.0	2.0	Do.
Paxton loam	40	60	12	16	1.5	3.0	2.5	3.0	2.0	3.0	200	350	3.5	2.0	Practically all cultivated or in open pasture.
Eroded phase	35	50	10	14	1.0	2.5	2.0	2.5	2.0	2.75	150	300	4.0	2.0	Do.
Eroded hill phase	25	50	6	12	1.0	2.5	2.0	2.5	1.75	2.5	100	300	5.0	2.0	Practically all cultivated or in pasture; principal crop, hay.
Gently sloping phase	40	60	12	16	1.5	3.0	2.5	3.0	2.0	3.0	200	350	3.5	2.0	Practically all cultivated or in open pasture.
Hill phase	40	55	10	14	1.5	3.0	2.0	2.5	1.75	2.5	100	300	4.0	2.0	About 60 percent in forest or pastured forest; rest cultivated, principally hay.
Severely eroded phase	25	35	6	9	1.0	2.0	1.5	2.5	1.75	2.5	100	250	5.0	2.0	Practically all cultivated, in pasture, or idle.
Paxton stony loam	------	------	------	------	------	------	------	------	------	------	------	------	3.5	2.0	Nearly all in forest; formerly a large part cleared.
Gently sloping phase	------	------	------	------	------	------	------	------	------	------	------	------	3.5	2.0	A large part in forest; rest in pasture or idle.
Hill phase	------	------	------	------	------	------	------	------	------	------	------	------	4.0	2.0	Largely in forest.
Steep phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------	Do.
Peat	------	------	------	------	------	------	------	------	------	------	------	------	------	------	Do.
Shallow phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------	Do.
Peru loam	30	40	9	12	1.5	3.0	------	------	2.0	3.0	------	------	3.0	1.5	Largely used for hay or pasture.
Peru stony loam	------	------	------	------	------	------	------	------	------	------	------	------	3.0	1.5	Largely in forest; scattered areas in pasture or hay, or idle.
Peru very stony loam	------	------	------	------	------	------	------	------	------	------	------	------	3.5	2.0	Nearly all in forest; a few areas in pasture or idle.
Podunk fine sandy loam	40	45	12	14	1.5	3.0	------	------	------	------	------	------	3.0	1.5	About half in forest; rest in pasture, idle, or cultivated; timothy and redtop principal crops.

Rockingham loam	30	40	7	9	1.0	2.0			1.25	2.25	100	200	5.0	2.5	About 75 percent cultivated; rest in pasture or idle.
Rockingham stony loam													5.0	2.5	About 75 percent in forest; rest idle or in pasture.
Hilly phase													5.5	2.5	Nearly all in forest.
Rockingham very stony loam															Do.
Rock outcrop															Waste and.
Rolling stony land:															
Brimfield soil material													8.0	3.5	Nearly all in forest; small areas in pasture.
Hollis soil material															All in forest.
Rockingham soil material													6.0	3.0	Nearly all in forest; small areas in pasture.
Rough stony land:															
Brimfield soil material															Do.
Canaan soil material															Nearly all in forest.
Colrain soil material															Do.
Gloucester soil material															All in forest.
Hermon soil material															Nearly all in forest.
Hollis soil material															Do.
Rockingham soil material															Do.
Rumney fine sandy loam													4.0	2.0	About 75 percent in forest; rest idle, in pasture, or in hay.
Saco silt loam					2.0	3.0							3.0	1.5	Largely in forest; small areas in pasture, hay, or idle.
Scarboro fine sandy loam													4.0	2.0	Largely in forest; small areas in pasture or idle.
Scarboro loam													3.0	2.0	Do.
Sudbury fine sandy loam	30	40	9	12	1.5	2.5							3.0	2.0	Largely in forest; rest in pasture, cultivated, or idle; principal crops, hay and silage corn.
Suffield silt loam	40	60	12	16	2.0	3.0	2.5	3.0	2.0	3.0	150	250	3.0	1.5	Largely cultivated or in pasture; well suited to dairy farming.
Eroded phase	35	55	11	15	2.0	2.5	2.5	3.0	2.0	2.5	125	225	3.0	1.5	Do.
Eroded rolling phase					2.0	2.5	2.5	3.0					3.0	1.5	Largely cultivated or in pasture; principal crop, hay.
Level phase	40	60	12	16	2.0	3.0	2.5	3.0	2.0	3.0	150	250	3.0	1.5	About 60 percent cultivated or in pasture; well suited to dairy farming.
Severely eroded rolling phase					1.5	2.5	2.0	3.5					4.0	2.0	Largely in pasture or hay.
Sutton loam	30	40	11	15	1.5	3.0			2.0	3.0	125	200	3.0	1.5	About 50 percent cultivated; rest in pasture or idle.
Sutton stony loam													3.0	1.5	Largely in forest; a few areas in pasture or idle.
Tidal marsh															Wasteland.
Whitman stony loam													3.5	1.5	Largely in forest; a few areas in pasture or idle.
Whitman very stony loam													4.0	2.0	Do.

[1] Per cow for 130-day grazing season. Figures in column A refer to the carrying capacity of unimproved pasture that usually carries some brushy growth.
[2] Estimates of yields obtained on areas that have been drained artificially.
[3] Estimates of yields from small scattered areas on which stone interferes with seeding and harvesting operations.

The estimates in columns A indicate yields obtained under the prevailing practices, which on most farms include growing hay for 4 to 6 years in a long rotation with corn, potatoes, or small grain. About 1 to 1½ tons of lime are applied to hay land at the time of seeding. Corn usually receives an application of manure and about 200 pounds of superphosphate. Potatoes are fertilized with about 500 pounds of 8–16–16. The estimates for pasture refer to unimproved pasture land that usually carries some brushy growth.

The estimates in columns B indicate yields obtained, or to be expected under more intensive management practices, in which larger and more frequent applications of lime, phosphate, and complete fertilizer are used. Hay land is top-dressed with 300 to 500 pounds of complete fertilizer, as a 7–7–7 mixture, and 1½ to 2 tons of lime at time of seeding. Corn and potato land receive heavier applications of manure, phosphate, or complete fertilizers. Incorporation of organic matter by the use of green manures and erosion control, where necessary, are other practices. Pastures are improved by liming, fertilization, and the removal of brush.

The indexes in table 8 are estimates of yields based primarily on interviews with farmers, the county agricultural agent, members of staffs of the New Hampshire Agricultural Experiment Station and College of Agriculture, and others who have had experience in the agriculture of the county. They are presented only as estimates of the average production over a period of years according to the two general levels of management as broadly defined and may not apply directly to specific tracts of land for any particular year, as the soils shown on the map may vary somewhat from place to place, management practices may differ slightly from farm to farm, and climatic conditions may fluctuate from year to year. On the other hand, these indexes are as accurate as can be obtained without further detailed and lengthy investigations and serve to bring out the relative productivity of the soils shown on the map.

In order to compare directly the yields obtained in Strafford County with those in other parts of the country, yield figures have been converted in table 9 to indexes based on standard yields. The soils are listed in the approximate order of their general productivity under prevailing practices (column A), the most productive at the head of the table.

TABLE 9.—*Productivity ratings of the soils of Strafford County, N. H.*

[Indexes in columns A are based on estimated average yields under prevailing management practices; those in columns B on estimated yields under more intensive management practices]

Soil (soil types, phases, and land types)[1]	Crop productivity index [2] for—														Remarks
	Corn (grain) 100=50 bushels		Corn (silage) 100=12 tons		Mixed timothy and clover hay 100=2 tons		Alfalfa hay 100=4 tons		Oat hay 100=2 tons		Potatoes 100=200 bushels		Pasture 100=100 cow-acre-days [3]		
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
HIGH TO VERY HIGH GENERAL PRODUCTIVITY															
Suffield silt loam	80	120	100	133	100	150	62	75	100	150	75	125	43	87	Soils generally highly productive, well suited to all crops commonly grown under prevailing practices, respond well to intensive practices of good management. Favorable relief, freedom from stoniness, good drainage, and response to management are principal factors that make them rank relatively high in suitability for cropland.
Level phase	80	120	100	133	100	150	62	75	100	150	75	125	43	87	
Ondawa fine sandy loam, high-bottom phase	80	120	100	133	75	125	------	------	100	150	100	175	43	65	
Paxton loam	80	120	100	133	75	150	62	75	100	150	100	175	37	65	
Gently sloping phase	80	120	100	133	75	150	62	75	100	150	100	175	37	65	
Charlton loam, gently undulating phase	80	120	83	117	75	150	62	75	100	150	100	175	37	65	
Charlton loam	80	120	83	117	75	150	62	75	100	150	100	175	37	65	
Melrose fine sandy loam	80	120	83	133	50	150	62	75	100	150	100	175	37	65	
MODERATELY HIGH GENERAL PRODUCTIVITY															
Suffield silt loam, eroded phase	70	110	92	125	100	125	62	75	100	125	63	112	43	87	Soils, in general, slightly less productive under prevailing practices than soils in first group, some more restricted in number of crops for which well suited, most respond about as well to intensive practices of management as those in first group, but conditions of relief, drainage, stoniness, or fertility require more intensive and careful management.
Newmarket loam, gently undulating phase	70	110	92	125	75	125	62	75	100	150	100	175	37	65	
Newmarket loam	70	110	92	125	75	125	62	75	100	150	100	175	37	65	
Ondawa fine sandy loam	80	120	100	133	75	125	------	------	------	------	75	125	43	87	
Becket loam, gently sloping phase	70	100	83	117	75	150	50	69	100	150	88	150	37	65	
Becket loam	70	100	83	117	75	150	------	------	100	150	88	150	37	65	
Essex loam, gently sloping phase	70	100	83	117	75	150	------	------	100	150	88	150	37	52	
Essex loam	70	100	83	117	75	150	50	69	100	150	75	150	37	65	
Charlton loam, eroded phase	70	100	75	100	75	137	62	69	100	137	75	150	33	65	
Paxton loam, eroded phase	70	100	87	117	50	125	50	62	100	137	75	150	33	65	
Melrose fine sandy loam, sloping phase	70	110	83	117	50	125	38	62	100	150	88	150	33	52	
Becket loam, eroded phase	60	90	75	100	75	150	------	------	100	137	75	125	37	52	
Essex loam, eroded phase	60	90	75	100	75	125	50	62	100	125	75	125	37	52	
Paxton loam, hill phase	80	110	83	117	75	150	50	62	88	125	50	150	33	65	
Sutton loam	60	80	75	100	75	150	------	------	100	150	62	100	43	87	
Buxton silt loam	60	80	92	125	100	150	------	------	125	150	------	------	65	130	
Gently sloping phase	60	80	75	100	100	150	------	------	125	150	------	------	65	130	

See footnotes at end of table.

TABLE 9.—*Productivity ratings of the soils of Strafford County, N. H.*—Continued

MEDIUM GENERAL PRODUCTIVITY

Soil (soil types, phases, and land types)[1]	Crop productivity index [2] for—														Remarks
	Corn (grain) 100=50 bushels		Corn (silage) 100=12 tons		Mixed timothy and clover hay 100=2 tons		Alfalfa hay 100=4 tons		Oat hay 100=2 tons		Potatoes 100=200 bushels		Pasture 100=100 cow-acre-days [3]		
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Podunk fine sandy loam	80	90	100	117	75	150							43	87	Soils less productive under prevailing practices and less responsive to intensive practices of good management than those in first 2 groups. One or more of the following conditions may tend to cause them to be less suitable for crop production: Sloping relief, inadequate drainage, excessive drainage or droughtiness, stoniness, low level of fertility, or seriously eroded condition. Some are better used as hay or pasture land than for intertilled crops, although their best actual use may vary from farm to farm depending in part on extent and character of associated soils.
Sudbury fine sandy loam	60	80	75	100	75	125							43	65	
Colrain loam, gently undulating phase	70	100	67	100	50	125			100	150	75	150	33	52	
Colrain loam	70	100	67	100	50	125			100	150	75	150	33	52	
Peru loam	60	80	75	100	75	150			100	150			43	87	
Hollis loam, gently undulating phase	60	80	66	100	50	100	50	62	75	125	50	100	43	52	
Hollis loam	60	80	66	100	50	100	50	62	75	125	50	100	43	52	
Rockingham loam	60	80	58	75	50	100			62	112	50	100	26	52	
Hollis loam, eroded phase	50	70	58	75	50	100	50	62	75	125	38	100	38	52	
Barnstead fine sandy loam	50	80	50	75	50	75			50	100	50	88	26	43	
Sloping phase	50	80	50	75	50	75			50	100	50	88	26	43	
Charlton loam, eroded hilly phase	50	100	50	100	50	125	50	62	88	125	50	150	26	52	
Gloucester fine sandy loam, gently undulating phase	50	80	50	75	50	75	38	69	50	100	50	100	26	43	
Gloucester fine sandy loam	50	80	50	75	50	75	38	69	50	100	50	100	26	43	
Eroded phase	50	70	50	67	50	75	38	69	50	100	50	88	26	43	
Hermon fine sandy loam, gently undulating phase	50	80	50	75	50	100	38	62	50	100	50	100	26	43	
Hermon fine sandy loam	50	80	50	75	50	100	38	62	50	100	50	100	26	43	
Merrimac fine sandy loam	50	80	50	75	50	75	38	69	50	100	50	138	26	43	
Sloping phase	50	80	50	75	50	75	38	69	50	100	50	112	22	43	
Paxton loam, eroded hill phase	50	100	50	100	50	125	50	62	88	125	50	150	26	65	
Severely eroded phase	50	70	50	75	50	100	38	62	88	125	50	125	26	65	
Adams fine sandy loam	50	80	50	75	50	75	38	69	50	100	50	88	26	43	
Biddeford silty clay loam					[4] 100	[4] 150							43	87	
Saco silt loam					100	150							43	87	
Suffield silt loam, eroded rolling phase					100	125	62	75					43	87	
Brookfield loam, gently undulating phase	50	80	42	75	50	75			50	100	50	100	26	43	
Brookfield loam	50	80	42	75	50	75			50	100	50	100	26	43	
Hollis loam, eroded hilly phase	50	70	50	75	50	100	50	62	75	125	38	100	33	52	
Brookfield loam, eroded phase	50	70	42	67	50	75			50	100	38	100	26	43	
Canaan fine sandy loam	50	80			50	75					50	100	26	43	
Colrain loam, hilly phase			58	92	50	125							33	52	
Melrose loamy sand	50	70	50	67	25	75	25	50	75	100	50	100	26	43	
Sloping phase	50	70	56	67	25	75	38	50	75	100	50	100	26	43	
Suffield silt loam, severely eroded rolling phase					75	112	50	56					33	65	
Hartland silt loam					75	125							37	65	

MODERATELY LOW GENERAL PRODUCTIVITY															
Merrimac loamy sand	30	50	33	50	25	50	25	50			38	63	16	33	Soils limited in suitability for production of crops because of low productivity and high management requirements. Conditions of slope, stoniness, fertility, moisture supply, or erosion generally unfavorable.
Barnstead loamy sand	30	50	33	50	25	50					38	63	16	33	
Adams loamy sand	30	50	33	50	25	50	25	50			38	63	16	37	
Becket loam, eroded hill phase					50	100			87	125			33	52	
Charlton stony loam, gently undulating phase					[5] 50	[5] 125							37	65	
Charlton stony loam					[5] 50	[5] 125							37	65	
Hartland silt loam, severely eroded phase					50	100							33	52	
Brookfield loam, hilly phase					50	75							26	43	
Canaan fine sandy loam, hilly phase					50	75							22	43	
Hermon fine sandy loam, hilly phase					50	75							26	43	
Hollis stony loam					[5] 50	[5] 100							33	52	
Gently undulating phase					[5] 50	[5] 100							33	52	
LOW GENERAL PRODUCTIVITY															
Gloucester stony fine sandy loam					25	50							24	43	Soils generally unsuited to crop production, limited largely to use as forest or pasture, although a few scattered areas of some in hay. Stoniness probably biggest factor in restricting suitability for agricultural production, although other conditions, as inadequate drainage, droughtiness, or steep relief, may be limiting factors.
Gently undulating phase					25	50							24	43	
Hermon stony fine sandy loam					[5] 25	[5] 50							24	43	
Gently undulating phase					[5] 25	[5] 50							24	43	
Merrimac loamy sand, sloping phase					25	50							16	33	
Peru stony loam													43	87	
Sutton stony loam													43	87	
Scarboro loam													43	65	
Whitman stony loam													37	87	
Becket stony loam, gently sloping phase													37	65	
Becket stony loam													37	65	
Essex stony loam, genty sloping phase													37	65	
Essex stony loam													37	65	
Paxton stony loam, gently sloping phase													37	65	
Paxton stony loam													37	65	
Peru very stony loam													37	65	
Newmarket stony loam													33	65	
Paxton stony loam, hill phase													33	65	
Rumney fine sandy loam													33	65	
Scarboro fine sandy loam													33	65	
Whitman very stony loam													33	65	
Alluvial soils, undifferentiated													33	52	
Colrain stony loam													33	52	
Hilly phase													33	52	
Hartland silt loam, steep phase													29	52	
Rockingham stony loam													26	52	
Canaan stony fine sandy loam													26	43	
Rockingham stony loam, hilly phase													24	52	
Brimfield stony loam													22	43	
Hilly phase													22	43	
Brookfield stony loam, gently undulating phase													22	43	

See footnotes at end of table.

TABLE 9.—*Productivity ratings of the soils of Strafford County, N. H.*—Continued

LOW GENERAL PRODUCTIVITY—Continued

Soil (soil types, phases, and land types)[1]	Crop productivity index [2] for—														Remarks
	Corn (grain) 100=50 bushels		Corn (silage) 100=12 tons		Mixed timothy and clover hay 100=2 tons		Alfalfa hay 100=4 tons		Oat hay 100=2 tons		Potatoes 100=200 bushels		Pasture 100=100 cow-acre-days [3]		
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Brookfield stony loam													22	43	
Canaan stony fine sandy loam, hilly phase													22	43	
Rolling stony land:															
Rockingham soil material													22	43	
Brimfield soil material													16	37	
Adams loamy sand, sloping phase													16	33	
Barnstead loamy sand, sloping phase													16	33	
Hinckley loamy sand														26	
Eroded phase														26	
Jaffrey loamy sand														26	
VERY LOW GENERAL PRODUCTIVITY															
Becket stony loam, hill phase															Soils too stony, steep, or poorly drained to be reclaimed; used for crops or pasture under prevailing economic conditions.
Brookfield stony loam, hilly phase															
Charlton stony loam, hilly phase															
Gloucester stony fine sandy loam, hilly phase															
Hermon stony fine sandy loam, hilly phase															
Hollis stony loam, hilly phase															
Brimfield very stony loam															
Brookfield very stony loam															
Canaan very stony fine sandy loam															
Gloucester very stony fine sandy loam															
Hermon very stony fine sandy loam															
Hollis very stony loam															
Rockingham very stony loam															
Paxton stony loam, steep phase															
Rolling stony land (Hollis soil material)															
Brimfield very stony loam, hilly phase															
Brookfield very stony loam, hilly phase															

Canaan very stony fine sandy loam, hilly phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Gloucester very stony fine sandy loam, hilly phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Hermon very stony fine sandy loam, hilly phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Hollis very stony loam, hilly phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Rough stony land:														
Canaan soil material	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Colrain soil material	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Hollis soil material	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Rockingham soil material	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Brimfield soil material	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Gloucester soil material	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Hermon soil material	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Muck, shallow phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Muck	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Peat, shallow phase	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Peat	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Rock outcrop	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Tidal marsh	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Gravel pits	------	------	------	------	------	------	------	------	------	------	------	------	------	------

[1] The soils are listed in the approximate order of their general productivity under the prevailing practices of soil management, the most productive first.

[2] The soils are given indexes that indicate the approximate average production of each crop in percentage of the standard of reference. The standard represents the approximate average yield obtained without the use of amendments on the more extensive and better soil types of those regions of the United States in which the crop is most widely grown. Absence of an index shows that the crop is not grown on the particular soil type. The indexes are based on estimates of yields, as specific yield data are very limited.

[3] Cow-acre-days, used to express the carrying capacity of pasture land, is the product of the number of animal units carried per acre multiplied by the number of days that animals can be grazed without injury to pasture; for example, a soil that supports one animal unit per acre for 360 days rates 360; a soil supporting one animal unit on 2 acres for 180 days rates 90; and a soil supporting one animal unit on 4 acres for 100 days rates 25.

[4] These estimates refer to yields obtained on areas drained artificially.

[5] These estimates refer to yields from small scattered areas on which stone interferes with seeding and harvesting operations.

The rating compares the productivity of each of the soils for each crop to a standard of 100. This index represents the approximate average acre yield obtained without the use of amendments on the more extensive and better soil types of the regions of the United States in which the crop is 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 is given at the head of its column. Soils given amendments of lime and commercial fertilizers or special practices, as irrigation, and unusually productive soils of small extent, may have productivity indexes of more than 100 for some or all crops.

Six classes of general productivity are indicated in table 9. The order in which the soils are listed in these classes is based largely on personal judgment of relative suitability, combined with a percentage weighting of its crop indexes in column A according to the relative acreage and value of the individual crops.[8]

Since 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, too much significance should not be given to the precise order in which each soil is listed. The arrangement, however, does give information as to the general productivity of the soils.

In the "Remarks" column, the more important characteristics of conditions that determine the relative suitability of the soils in each productivity class for agricultural use are mentioned.

The principal factors affecting the productivity of land are climate, soil (including 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 some one may dominate. The factors listed may be grouped simply as the soil factor and the management factor. Slope, drainage, and most of the aspects of climate may be considered characteristics of a given soil type, since the soil type as such occupies specific geographic areas characterized by a given range of slope and climatic conditions. Crop yields over a long period of years furnish the best available summation of the associated factors and are used therefore where available.

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 according to designated generalized levels of management. They cannot picture in a given county the total quantitative production of crops by soil areas without the additional knowledge of the acreage of the individual soil types used for each of the specified crops.

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[8] The relative percentage weights assigned to the crop indexes are as follows:

Mixed timothy and clover hay	50
Corn (grain)	10
Corn (silage)	20
Potatoes	20

No weight was assigned to hay, either oat or alfalfa, because of the relatively small acreage of each. For soils commonly used largely for pasture, the pasture index was given a weight of 25.

Economic considerations play no part in determining the crop productivity indexes. They cannot be interpreted, therefore, into land values except in a very general way. Distance to market and other costs of production, 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. Ease or difficulty of tillage and ease or difficulty with which productivity is maintained are examples of considerations other than productivity that influence the general suitability of a soil for agricultural use. In turn, steepness of slope, presence or absence of stone, resistance to tillage offered by the soil because of its consistence or structure, and the size and shape of areas are characteristics of soils that affect 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 in some degree by all these and other factors, as moisture-holding capacity of the soil and its permeability to roots and water, and so they are not factors to be considered entirely separately from productivity. On the other hand, schemes of land classification to designate the relative suitability of land for agricultural use must give some recognition to such factors.

LAND USE AND MANAGEMENT

The location of Strafford County in regard to climate and soil is favorable for the production of a wide variety of crops and for a diversity in farming activities. Dairying is the chief activity on most farms, followed in order of importance by poultry raising, potato growing, market gardening, and orcharding.

The soils vary widely in their external and internal characteristics, including texture, structure, stoniness, relief, and drainage, and therefore vary in their capability for producing crops, grasses, and trees. At the peak of the agricultural development about 65 percent of the total acreage of the county was classified as improved land, that is, tilled or in pasture. Through a gradual selective process the better soils have remained under cultivation and much of the less desirable land at one time cleared has been allowed to revert to forest or brush pasture. This, of course, was caused in large measure by the changes in economic conditions brought about by the opening up of the West and the industrial development in the East.

Extensive areas of the light-textured soils of the terraces were at one time cleared but owing to low inherent fertility and droughtiness they are now largely in forest, lying idle, or used for pasture. The smooth terrace soils, as the Suffield soils and Melrose, Merrimac, Barnstead, and Adams fine sandy loams, with favorable texture, structure, and good water-holding capacity have always been desirable for agriculture, and practically all are now under cultivation or in mowing. Clearing the land on the glaciated uplands was a slow process even during the expansion period, owing to the presence of stone that severely hindered tillage operations and work with improved farm machinery. Much of this land on the steeper slopes and

the poorly drained areas have always been in forest, and extensive areas that were cleared of trees and partly cleared of stone are now in young forest or brushy pasture. Areas of cultivated land on the glaciated uplands now are comparatively stone-free and occur for the most part in scattered bodies.

Less than 40 percent of the land area of the county is in improved land including plowable pasture, according to the 1940 census. With a few exceptions the improved land represents the best agricultural land, and in general the texture and structure are favorable for good aeration and deep root penetration. Drainage is adequate, and the water-holding capacity is fair to good. The soils respond to fertilization and care and are capable of being built up to and maintained in a fairly productive state. A large percentage now in forest is probably best adapted to that use or for pasture because of such factors as stoniness, hilly or steep relief, poor drainage, and low inherent fertility, which limit their use for hay or cultivated crops. The trend has been and still is toward the use of the soils for purposes to which they are best adapted.

On many dairy farms large acreages are used for hay and pasture and little attention is given to improving these lands, especially the pastures by removing brush or by fertilization. Dairy cows are often allowed to roam over large areas of open, brushy, or woodland pastures where grazing is very scant.

From a forestry point of view unrestricted grazing is always destructive and even light grazing is harmful and should be discouraged. The most palatable seedlings are often the most desirable forest species. Therefore, if some of the open pasture lands were improved and cows kept out of the wooded parts, it would pay dividends in increased milk production and in improved forest.

Erosion is not a serious problem on most of the cultivated soils; therefore few farmers pay any attention to its control. Plowing up and down hill is common. Most of the erosion early in spring is the result of fall plowing, whereas in some cases spring plowing might be satisfactory.

The form of crop rotation followed varies widely. Long rotations are the general rule on dairy farms. On the better farms a 5- or 6-year rotation of corn, potatoes, or sweet corn 1 year and hay or legumes 5 or 6 years is the most common practice. The time that elapses before the rotation cycle is completed varies widely, depending on the needs of the individual farm. It may run as long as 9 or 10 years, but the general practice is to top-dress, reseed, and rotate crops just often enough to keep the soil in good condition. The New Hampshire Agricultural Experiment Station is not particularly interested in shortening the rotation on the dairy farms but is interested in improving the fertility of the hay and pasture lands by top dressing more often.

On the commercial potato farms the length of rotation also varies. Some farmers follow a 3-year rotation, potatoes 1 year and grass or legumes 2 years. Others plant potatoes in 2 of 4 years or in 3 of 5 in the rotation. Recent experiments conducted by the experiment station indicate that desirable organic-matter content cannot be maintained where potatoes are planted in a 3-year rotation and when no barnyard manure is used.

Fertilizers and lime or both are used on a large percentage of the farms. Most of the manure on the dairy farms is used under silage corn, which is supplemented with 200 to 400 pounds of superphosphate an acre. A few farmers use 300 to 400 pounds of a 4–12–4 mixture, especially if little or no manure is available. Lime is usually applied at the rate of 1 to 1½ tons when hay fields are seeded. Some farmers also use 300 to 400 pounds of a complete fertilizer. Alfalfa and clover usually receive 1½ to 2 tons of lime and 300 to 500 pounds of a complete fertilizer when seeded. The quantity of lime used depends on the reaction of the soil and the past history. A few farmers top-dress their hay fields with 300 to 500 pounds of a 7–6–6 or 7–7–7 mixture, and in the last few years lime and superphosphate have been used to some extent for top-dressing hay fields and pastures. Lime is usually applied at the rate of 1 ton an acre and superphosphate at the rate of 100 to 200 pounds. Potatoes commonly receive about ½ ton of 8–16–16 or 1 ton of 4–8–8, and vegetables and sweet corn 1,000 to 1,500 pounds of a 5–8–7 or 4–8–8 mixture. Commercial apple trees usually receive 5 to 8 pounds of nitrogen a tree in the form of nitrate of soda or cyanamide. Fertilization is practically the same on all soils, but in some cases more attention is given to the requirements of particular crops. The fertilizers and quantities used are generally the same as recommended by the agricultural experiment station and by the county agent.

Table 10 gives grades of fertilizer suggested for New Hampshire by the experiment station. This is to be used as a general guide only. The quantity of fertilizer that should be used will depend on the soil type, how often the fertilizer is to be applied, the need for feed, and the quantity and kind of vegetation present.

TABLE 10.—*Fertilizers and pounds per acre recommended for certain crops of Strafford County, N. H.*

Crop	High analysis		Medium analysis	
	Mixture	Use per acre	Mixture	Use per acre
		Pounds		*Pounds*
Corn	8–16–8	300–400	5–10–5	500–600
	[1] 8–24–8	150–200	[1] 4–12–4	300–400
Mixed hay or pasture seedings	6–12–15 or 8–16–16	500–600	4–8–10 or 5–10–10	800–900
	[1] 0–20–20	300–400	[1] 0–12–12	500–700
Top dressing for hay (largely grass)	10–10–10	300–400	7–7–7	400–600
Top dressing for pasture	[2] 0–20–20	200–400	0–12–12	300–700
	[3] 8–16–16 or 8–16–14	200–400	5–10–10	300–700

[1] Manured.
[2] Safe minimum fertilizer combination on soils suited to clover.
[3] Will give best pasture where grazing can be controlled.

The hay mixture most commonly used on the well-drained soils includes timothy, redtop, red clover, and alsike clover. On imperfectly drained or poorly drained soils red clover is left out of the mixture. On heavily limed well-drained soils a mixture of alfalfa, timothy, and red clover is common.

Table 11 gives the seeding mixtures suggested for New Hampshire by the experiment station.

TABLE 11.—*Ten seeding mixtures suggested for hay and pasture for soils of Strafford County, N. H.*

[Seeding rates given in pounds an acre]

Seeding mixtures	For well-drained soils [1]				For imperfectly to poorly drained soils [2]			For well-manured or otherwise fertilized soils, planted in—		
	Unlimed		Limed					May		June 10
	1	2	3	4	5	6	7	8	9	
Mixed hay: [3]	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Alfalfa			8	15						
Red clover	5		5		6					
Alsike clover	4		3		4	6				
Timothy	10		6	8	8	8				
Redtop	3				4	6				
Rotation or permanent pasture:										
Sweetclover or alfalfa			10							
Alsike clover	5	2	3		5	5				
Ladino or other white clovers	2	2	2		2	2				
Red clover		5			3					
Timothy	5	8	5		8	5				
Redtop	5		2		5	5	5			
Orchard grass	5									
Meadow fescue						5				
Reed canary grass							15			
Kentucky bluegrass		5								
Annual hay:										
Soybeans										90
Hungarian millet										15
Oats								48	48	
Vetch									30	
Peas								60		
Emergency pasture:										
Japanese millet									15	30
Oats								[4] 32		
Sweetclover								[4] 20		
Soybeans									60	

[1] Charlton, Paxton, Merrimac, Newmarket, Suffield, and Gloucester soils.
[2] Buxton, Sutton, Sudbury, Scarboro; and Biddeford soils.
[3] For hay fields that will be pastured later the mixture should contain 1 pound of Ladino clover.
[4] Soils limed.

Following is a list of varieties suggested for the principal field crops:

Potatoes.—Green Mountain, Chippewa, Irish Cobbler.
Alfalfa.—Grimm, Variegated.
Silage corn.—Sweepstakes, Cornell 29-3, Surecrop.
Soybeans.—Dunfield, Wilson, Manchu.
Oats.—Lenroc, Cornellian, Richland, Gopher.
Vetch.—Hairy.
Barley.—Alpha (Bearded), Wisconsin (Barbless).

Reduction of hay yields is caused largely by the exhaustion of available plant-food supplies (*9*). Desirable hay grasses have moderately high requirements for fertility nutrients, especially so for nitrogen. When the nitrogen level is reduced to the point at which timothy and other high-yielding species will not grow so large, grasses of a lower order of fertility creep in, causing severe competition and finally the exclusion of the desirable species with a consequent reduction in yield.

In 1933 a top-dressing experiment, in which nitrogen carriers were compared with each other and with complete fertilizers, was carried

out on a field of the university farm at Durham on Biddeford silt loam that had been tile-drained. If undrained the soil is not so well adapted to the production of hay.

Table 12 gives the dry hay and protein yields when the soil was top-dressed with fertilizers carrying only nitrogen or complete fertilizers.

TABLE 12.—*4-year average hay yields per acre on Biddeford silt loam after treatment with nitrogen carriers and complete fertilizers*

Fertilizers [1]	Dry hay yield	Difference in yield from check	Protein content	Difference in content from check
	Pounds	*Pounds*	*Pounds*	*Pounds*
None (check)	1,703		164	
Cal Nitro	2,434	731	251	87
Sulfate of ammonia	2,344	641	233	69
Nitrate of soda	2,239	536	229	65
Cyanamide	2,236	533	219	55
Calcium nitrate	2,198	495	229	65
8-6-6 (home-mixed)	3,335	1,632	312	148
8-6-6 (factory-mixed)	2,928	1,225	284	120
10-20-20 (factory-mixed)	3,289	1,586	291	127

[1] All plots except the check received an application that would furnish 32 pounds of nitrogen per acre.

Yields that resulted from the use of fertilizers carrying only nitrogen were greater than those obtained where no nitrogen was applied. Only slight differences in yields, however, were obtained when one nitrogen carrier was compared with another. The increased production as a result of the use of complete fertilizers was in two cases more than double the increase recorded for the nitrogen carriers alone.

Pasture top dressing experiments in New Hampshire indicate that the response of pasture sods to fertilizers and lime seems to be governed by the moisture relations of the soil (*8*). The lighter, drier soils respond mainly to nitrogen, while the heavier moist soils respond to all the fertilizer nutrients and lime. The response to nitrogen from nitrate of soda on Newmarket loam, in Rockingham County, is given in table 13. The comparison was made between applications of 25 and 50 pounds of nitrogen an acre annually.

TABLE 13.—*7-year average yield from applications of nitrate of soda on Newmarket loam, Rockingham County, N. H.*

Fertilizer	Fertilizer application per acre	Dry hay yield	Difference in yield from check	Protein content	Difference in content from check
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
None (check)		1,740		260	
Nitrate of soda	312	2,449	709	453	193
	156	2,217	477	371	111

With both dry matter and protein as guides, the lighter application increased yields more per unit of nitrogen applied than the heavier application.

The chief reason for the low carrying capacity of New Hampshire pastures is lack of fertility (*8*). Restoring this fertility with fertilizer and lime will improve the land and increase the carrying capacity of

the pasture, so that the farmer can confine his improvement work to a small part of his pasture acreage. Mapping out a definite fertilizer and lime schedule over a period of years will solve the pasture problem on many farms. Reasonable quantities of materials to apply are 1 ton of lime an acre every 5 or 8 years; 200 to 300 pounds of 47-percent or 500 to 700 pounds of 20-percent superphosphate every third or fourth year or in divided applications; and 150 to 250 pounds of one of the nitrogen carriers annually. If complete fertilizers are used, annual applications are preferable in quantities approximating 200 to 400 pounds of an 8–16–16 fertilizer, or if less nitrogen is needed, similar quantities of a 4–16–20.

All the farming lands in New Hampshire, except certain flooded lands along the Connecticut River, are so acid as to handicap the successful production of all crops except potatoes (*6*). Experiments indicate that on all forage crops grown in the State lime may be expected to increase the yield to such an extent that a reasonable application will pay for itself two or three times during the rotation if legumes are included in the cropping system. Also, data thus far assembled indicate that lime not only pays a good profit where used alone but also serves to make manure and chemical fertilizers considerably more effective. Results from the use of lime on grasses, legumes, and soybeans are shown in Experiment Station Circular 44 (*6*).

Fertilizer studies with potatoes on Paxton loam in Merrimack County indicate that omitting potash causes the greatest reduction in yields, phosphoric acid second, and nitrogen third (*7*). Results for fertilizer variations with potatoes on Paxton loam over a period of 6 years are presented in table 14.

TABLE 14.—*6-year average yields of potatoes on Paxton loam, Merrimack County, N. H., with 1 ton an acre of varied fertilizers, 1933–38*

Fertilizer	Yield per acre	Difference in yield from check	Fertilizer	Yield per acre	Difference in yield from check
	Bushels	*Bushels*		*Bushels*	*Bushels*
4–8–7 (check)	239		4–16–7	258	+19
0–8–7	231	−8	4–8–0	184	−55
8–8–7	250	+11	4–8–14	259	+20
4–0–7	202	−37			

These results and other experimental data on other soils in the State indicate the need for slightly more phosphoric acid and potash than is found in a 1-2-2 or similar ratio.

Other experiments were conducted on Paxton loam for the purpose of comparing high- and low-analysis fertilizers over a period of 6 years, using equal quantities of plant food (*7*). An average increase of 30 bushels an acre of potatoes was obtained when ½ ton of an 8–16–14 mixture was used instead of 1 ton of a 4–8–7, both fertilizers of regular commercial mix. The results favored the double-strength of high-analysis formula. Concentrated fertilizers cost less per unit of plant nutrition.

Much information on farm management, crops, pasture and pasture management, fertilizers, lime, and forest management may be obtained from the New Hampshire Agricultural Experiment Station, at Durham.

WATER CONTROL ON THE LAND

Water control on the land has three phases—control of runoff and erosion, drainage, and overflow. Control of runoff is the most important and the only one that presents a problem in the area. Although there are extensive areas of poorly drained and imperfectly drained soils, drainage is not a problem, as these soils are not needed for crops that would require drainage; they are generally more valuable for grazing or for forestry in their present state than if artificially drained. Small areas along the larger streams are flooded occasionally, usually in winter. The results of flooding are generally more beneficial than harmful. Recurrent floods, except in local areas, deposit sediments that tend to maintain and improve the fertility.

CONTROL OF RUNOFF AND EROSION[9]

The control of runoff requires a proper selection and rotation of crops along with contour farming, strip cropping, terracing, and any other means whereby soils are made more absorptive to water and any surplus water is conducted safely off the land. Erosion is not generally severe and is largely in the form of sheet erosion, in which the surface is left generally smooth and the soil loss is imperceptible to the average person.

Fall plowing, where the land is left bare all winter and subjected to considerable soil loss during the spring thaws, and running rows up and down the hill are commonly practiced. Both of these practices tend to accelerate runoff and erosion. As in any other humid region it is impossible for the soil to absorb all the moisture that falls on it at times. On clean-tilled land, therefore, where the gradient of slope is sufficient for rapid runoff some soil loss is inevitable unless proper control methods are employed. On a large percentage of the cultivated land, the character of the soils and gradient of slope are such that with good management and simple conservation practices, erosion may be effectively controlled.

In 1940 about 81.5 percent of the total area of 236,160 acres in the county supported some form of forest cover, according to the census. The rest was in harvested crops, including hay and plowable pasture, brushy and stony pasture, idle or fallow land, and miscellaneous lands.

On most of the cultivated land, except the smooth terraces, there has been some erosion. The degree of erosion ranges from slight to severe with the highest percentage of the soils falling in the slightly eroded group (0 to 25 percent of the original surface soil removed), much less in the moderately eroded group (25 to 75 percent of the original surface soil removed), and relatively little in the severely eroded group (75 percent or more of the original surface soil removed).

Active gullies are rare but occur in all three groups. Many former gullies have been stabilized by changing the use of the land from cultivated crops to pasture or woodlands. Most of them are shallow and are crossable with farm machinery, with the exception of a few short and deep ones that generally occur on the breaks of the sandy

[9] Prepared by Ford S. Prince, Louis T. Kardos, and Paul T. Blood, Agronomy Department, University of New Hampshire, and Allan J. Collins, Soil Conservation Service.

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terraces. After heavy rains rills are noticeable on most sloping cultivated areas. On the light sandy soils of the terraces, there is evidence of slight to moderate wind erosion in places. A few blow holes are on the loamy sands in exposed places.

Erosion is temporarily stabilized on hay lands, which will be subjected to erosion hazards as it is plowed, planted to cultivated crops, and reseeded to a hay land mixture. In occasional overgrazed pastures there is some soil loss by erosion. The most active erosion each year occurs on the land planted to clean-tilled crops, as corn, potatoes, market vegetables, and winter squash.

When hay land is first plowed the soil is well granulated and relatively high in humus, and it takes about 2 years for the bulk of the roots to decompose. During that period moderate rains are readily absorbed, whereas, rains of high intensity on sloping areas result in loss of soil. This is evidenced by the following field observations in the county after a rainfall of 0.79 inches during a 30-minute period as recorded by the weather bureau at the New Hampshire Agricultural Experiment Station. Prior to this storm the soil had become very dry due to subnormal rainfall in June and July. The following day observations were made of the effects of the relatively heavy precipitation in six widely scattered fields throughout the county. At each of the six selected fields new accumulations of soil varying from 1 to 8 inches were found at the base of the slopes. Shallow gullies, which were observed in these fields prior to the storm, had been accentuated. Shallow, grassed gullies, which had been observed in meadow land previously, did not show any perceptible changes as a result of the storm.

The Suffield and Hartland soils, which consist of a silt loam surface soil over a clay or clay loam subsoil, are the most erodible in the county under improper management. The Paxton, Essex, and Becket soils, which are characterized by a friable loam surface soil and subsoil over compact till at about 2 feet in depth, are fairly erodible if insufficiently protected, especially in spring or during heavy rains. With these soils as soon as the layer above the heavy subsoil or compact layer becomes saturated further absorption is very slow. Consequently runoff and soil losses are heavy unless adequate cover is provided. The Gloucester, Hermon, and Brookfield soils absorb water readily, owing to their friable and porous surface and subsoil layers over loose and friable glacial till. Soils on the light-textured terraces, as the Merrimac, Adams, Melrose, and Barnstead, are subject to little washing unless the gradient of slope is sufficient to cause rapid runoff.

In view of the erodibility conditions described above, the following methods are recommended for general control of runoff on moderate slopes (3–15 percent):

1. A crop rotation involving at least 3 years of sod out of 5.
2. Maintenance of a good cover of meadow or pasture grasses and legumes by adequate annual fertilization.
3. Contour cultivation or strip cropping of intertilled row crops.
4. Use of diversion terraces for the removal of surplus water from these fields or in preventing it from coming onto them from higher surroundings, pastures, or woodland pasture land.

The very gently sloping land (0–3 percent) may be used for cultivated crops without special practices when not subjected to concentra-

tion of runoff water from adjacent areas. The steeply sloping land (15–30 percent) should be utilized for long-term hay or pasture, except on the light-textured soils of the terraces, which should be retired to woodland. The scattered small areas of very steeply sloping land (over 30 percent) and those with both severe sheet and gully erosion should also be retired to woodland.

DRAINAGE

Drainage is a minor problem in the area. Although there are extensive areas of poorly and imperfectly drained soils, there is no present need for extensive artificial drainage.

The Whitman soils, occurring in small to fairly large bodies well distributed throughout the county, are the most extensive of the poorly drained soils. Areas of Muck and Peat also are fairly extensive, whereas Scarboro, Biddeford, Saco, Rumney, and Alluvial soils, undifferentiated, are found in relatively small scattered areas, mainly in the southern part of the county. Of the imperfectly drained soils, Peru and Sutton are the most extensive. Buxton, Sudbury, and Podunk are much less extensive, the Buxton and Sudbury occurring mainly in the southeastern part. The Peru are found in scattered areas associated with the Hermon and Canaan in the northern part of the county, whereas the Sutton are associated with the Charlton, Paxton, Brookfield, and associated soils throughout the central and southern parts. The poorly drained soils are largely in forest, with scattered bodies cleared and used for pasture or lying idle. A larger percentage of the Peru and Sutton soils is cleared and used for pasture or hay and corn, but they also are largely in forest. Considerable acreage of the Buxton, Sudbury, and Podunk is in pasture or used for the production of hay and corn.

Practically none of the soils with imperfect or poor drainage is artificially drained. Open ditches are on a few areas of Biddeford silt loam and one small area has tile drainage. Silage corn, hay, and other forage crops are successfully grown on the tile-drained area, while the areas with open ditches are used almost exclusively for the production of hay. Otherwise, no attempt has been made to drain any of the land with impeded drainage.

Under the present system of agriculture there is little call for artificial drainage. The poorly drained soils are not needed for crops and are just as valuable, or more so, for grazing or forest in their present state than if artificially drained. Silage corn, hay, and other crops can be successfully produced on the imperfectly drained soils, which are excellent for pasture.

Areas of Buxton and Sudbury soils would be expected to drain fairly easily, as they generally occur on very gently sloping or undulating positions; the absence of stone would make the task of opening ditches relatively easy. The Peru and Sutton soils would be more difficult to drain owing to stoniness and consequent difficulty in digging ditches. Generally, the areas of Whitman soils would be very difficult to drain because of their low position and stoniness. Muck and peat also would be difficult to drain because of their low depressed position and in some cases the absence of natural drainage outlets.

Drainage ditches would be easier to dig in the Biddeford and Saco soils than in the Whitman, owing to the absence of stone, but the heavy subsoil would make subsurface drainage slow even with drainage ditches.

OVERFLOW

Areas frequently flooded include the Ondawa, Podunk, Rumney, Saco, and Alluvial soils, undifferentiated. These soils occur in narrow strips along the main drainageways. The Ondawa and Podunk are the only soils used extensively for cultivated crops and frequent flooding generally occurs in winter when there is no damage to growing crops. Except in local areas, flooding deposits sediments that tend to maintain and improve fertility. Therefore, frequent flooding of the small areas on the first bottoms is generally beneficial rather than harmful.

FORESTRY [10]

Strafford County is centrally located in southeastern New Hampshire in a north-south position within the so-called New England white pine region (*15*). The range in elevation is from sea level in the southeast to 1,000 to 1,700 feet in the northern part; the dominant relief is gently rolling to rolling and hilly. Drainage is mainly to the southeast; a large percentage of the soil is well drained.

Agriculture in the county reached its highest development around 1880; since then there has been a gradual decline in the proportion of improved land. At present, about 75 percent of the total area supports some type of forest cover. In general, the most extensive areas of cleared land are in the southeastern and east-central parts, and the most extensive wooded areas in the northern and western. A large proportion of the forested areas is on stony to very stony well-drained upland soils, poorly drained upland soils, and very light soils on the terraces.

Because of easy water access to Portsmouth, parts of the county were especially prominent commercially in colonial days, particularly in relation to the production of white pine timber for shipmasts, spars, and construction purposes. Water transportation was a simple matter, so that a gradual process of high grading, which has become traditional, was instituted, but as the select trees decreased in number, lower grades were logged. The resulting timber stand is a mixture of white pine and hardwoods. Associated with the white pine on the light soils are pitch pine, gray birch, aspen, red maple, pin cherry, and white oak. On the heavier soils, paper, black, yellow, and gray birches, white ash, red oak, sugar maple, basswood, beech, and hemlock are the chief associates. On old agricultural sites pine predominates, often as a pure stand. Areas that have always supported forest growth are more likely to be characterized by mixtures of birch, maple, hemlock, beech, and other hardwoods.

The occurrence of pure stands of white pine on cut-over areas is largely due to chance, as white pine seed stored in the duff does not germinate well. Seed developed just prior to the time of cutting may be depended upon to produce good stands of pine on well-drained

[10] Prepared by Lewis C. Swain, assistant professor of forestry, and William A. Medesy, instructor in forestry, University of New Hampshire. For further details on the native trees and shrubs see section on Vegetation, p. 9.

soils. The same has not held true on heavier soils, as the rapid development of hardwood sprouts or seedlings and other heavy vegetative cover chokes out the young seedlings.

Mixtures of hardwoods and pine are desirable, not only because they assist in maintaining biological balance, but also because the quality of pine grown under these conditions is superior to that produced in pure stands. The problem of protection in relation to disease, insects, and other injurious agencies is also decreased by maintaining mixtures of species and uneven age classes. The present stand, while variable in density, is in general understocked with the more desirable species. Contemplated operations should emphasize the removal of poorly formed and mature cull trees.

Although products of inferior quality are exceedingly slow in finding a market, some of the lower grades may usually be absorbed together with select material. Local sawmills and wood-using industries should supply the major outlet for products of the farm woodland. The number of portable sawmills usually operating within the county varies with market conditions. Also, several permanent mills are turning out well-manufactured material.

The lumberyards carry on hand southern and western stocks of material, and local preference has encouraged this practice. Only small quantities of native lumber are shipped from the area to outside consumers. The indication therefore is that when high-quality products are produced in the county a local market will be capable of absorbing them. With such a high percentage of the area in forest it is hardly necessary to consider additions of woodland as a beneficial economic measure. On the contrary, it may be desirable to enlarge or improve the pastures in some localities. Improving pastures, however, would not necessarily reduce the total forested area, as better grazing conditions can be provided by making good use of a much smaller acreage.

Several towns and cities have found it profitable to make recreational grounds and other uses of municipally owned land. Several well-managed town and city forests are in the county. No national forests and only a few State-owned lands have been established, probably owing to difficulties in the administration of small scattered tracts.

In the interest of watershed protection, balanced biological conditions, and the general conservation of natural resources, it appears desirable to recommend further State acquisition or cooperative regulation of several relatively large woodland areas. Smaller tracts would receive wide uses as picnic areas or day camping grounds. Similarly private development of well-situated roadside or shore properties may prove to be a means of increased income.

The prevalence and extent of fires in earlier years are indicated by the composition of the present stand, in which are represented pin cherry, aspen, gray birch, paper birch, and scrub oak. Fire prevention and suppression are administered by the State forester at present. The organization includes a district leader, town wardens, and deputies throughout the county. Each district is supplied with observation towers and power-pumping equipment. Recent developments include the use of short-wave radio. Although improvements may be expected in relation to the efficiency of fire-suppression crews and communication systems, the fire record is satisfactory.

Insect and disease control presents a serious problem. Both Federal and State agencies are doing effective work with private cooperation. Without considering the beneficial aspects or effectiveness of direct control, forests composed of various age classes and a mixture of species are less easily destroyed by either insects or disease than are pure even-aged stands.

Unrestricted grazing of dairy cattle and other livestock is always destructive to the forest. Some of the most palatable seedlings are also the better forest species. Recent investigations show that even light grazing is harmful and should be discouraged. Other effects of grazing are soil compaction and mechanical injury to roots and trees.

Lumbering until recently has been carried on almost entirely by operators who either purchased standing timber or bought woodlands outright. This practice usually results in cutting the larger and more valuable trees for lumber and selling the rest as fuel wood. In these circumstances very little is left to form the basis of another forest. Serious soil deterioration frequently follows this practice.

Another system consists in cutting hardwood for fuel, and until a decade ago large quantities of excellent hardwood were disposed of in this manner. The latter practice encouraged softwoods and did less harm than clear cutting. Judicious planning and cutting with regard to continuous or sustained yield, however, are to be recommended as the best methods of maintaining productive forests.

Wood-using industries, which are well scattered throughout the area, are dependent upon a local supply of lumber. Since the success of these organizations depends upon the forest, and local labor is dependent upon the woodworking establishment, it is of the highest importance to maintain the balance between supply and demand.

The plan of management should contemplate removing overmature and inferior trees as rapidly as possible to make room for others that are more desirable. Reproduction should be attained as far as possible by natural means, and what little planting may be necessary should be confined to the drier sites and ridge tops. Native species are satisfactory for planting, and there is little need to consider exotics. In general, the light dry soils can be planted to red pine, and on those slightly heavier, white pine can be expected to grow well. Among the hardwoods, maple, ash, and oak are found occupying heavier soils with more available moisture. Since good hardwood stands can usually be developed from existing seedlings or sprouts, very little consideration need be given to other than natural reproduction.

MORPHOLOGY AND GENESIS OF SOILS

Soil is the product of the forces of weathering and soil development acting on the parent material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point depend on (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and has existed since accumulation; (3) the plant and animal life in and on the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of development have acted on the material. The climate, and its influence on soil and plants depends not only on temperature, rainfall, and humidity but also on the physical character-

istics of the soil or soil material and on the relief, which, in turn, strongly influences drainage, aeration, runoff, erosion, and exposure to sun and wind.

Strafford County lies within two great soil groups of the United States—the Brown Podzolic and the Podzol. About three-fourths of the area, in the southern and central parts of the county, is in the Brown Podzolic region, and the true Podzols are found at higher elevations in the northern part.

The area lies within two physiographic sections of the New England province, the Seaboard Lowland and the New England Upland. The Seaboard Lowland section, in the southeastern part, consists of nearly level to gently rolling sand plains and lacustrine deposits interspersed with fairly smooth glacial hills of gentle slope for the most part. The general range in elevation is from sea level to 200 feet above, with a few scattered hills rising above 200 feet. The New England Upland presents features of a thoroughly dissected plateau, which slopes gently southeastward. Elevations range from about 200 feet in the southeastern part to 1,000 to 1,700 feet on a low range of mountains in the northwestern corner of the county. The relief varies from nearly level or rolling on the interstream ridges to steep and broken. Drainage conditions range from excessive on some of the sandy terraces to poor on the low-lying flat or depressed areas.

The climate of the area may be classified as oceanic and modified continental. At Durham, in the southern part of the county, the mean annual temperature is 46.1° F. and the average annual precipitation is 38.01 inches. In the northern part, the mean average temperature is several degrees lower and the average annual precipitation several inches higher.

The Podzol soils in the northern part have developed under climatic conditions of comparatively high rainfall and low evaporation, resulting in a rather high percentage of percolating water in the soil. The ground is frozen for several months during the year. All these factors favor the growth of a dense forest vegetation, conifers being common. Organic matter from fallen leaves is abundant and highly acid and does not break down readily, thereby accumulating on the forest floor as a mat. As most of the parent material is rather low in minerals that furnish bases, this organic mat is more acid than it would be were the parent material higher in content of lime. Under these conditions the bases or soluble salts are readily removed by the downward movement of water as fast as they become available, and only a small quantity remains in the thin upper layer of the true soil. The normal well-developed Podzol soils are characterized in undisturbed forest areas by a surface mat of partly decayed leaves, branches, and wood fragments over a light-gray to light brownish-gray (*10*) leached layer averaging a few inches in thickness, with or without a very thin intermediate dark-gray mineral layer (*13*). The upper subsoil (B_1) is brown or rusty brown, somewhat heavier textured than the surface soil, and grades through the yellowish-brown lower B horizon to the parent material.

The Brown Podzolic soils develop under conditions of slightly higher temperature, more rapid evaporation, less leaching, and less accumulation of organic matter on the surface than do the true Podzols.

These conditions favor the dominance of deciduous trees in the forest vegetation. The higher summer temperatures favor more rapid evaporation and more disintegration and leaching of the organic matter on the surface. A normal mature profile, under undisturbed forest cover, has an organic mat on the surface and a very thin gray leached layer just beneath it varying in thickness from a mere film to generally less than 1 inch (*13*). The B horizon is largely yellowish-brown and has only the beginnings of a dark-brown orterde just below the gray layer. The total depth of the solum is usually less than 30 inches.

The original forest cover was mixed hardwoods and softwoods of red, scarlet, and white oaks, hickory, red and sugar maples, white and pitch pines, beech, yellow birch, white ash, basswood, and spruce. The distribution and dominance of the various species were governed somewhat by soil, drainage, and climatic conditions. An unusually large number of species was present, owing to the fact that the area lies in a transitional belt between the central hardwood forest typified by oak, chestnut, and pine, and the beech, hard maple, and hemlock forest of the north. Practically all the original forest growth has been removed, and the present forest consists of second- and third-growth trees of the original species.

The area lies within the glaciated region of North America where the material from which the soils have developed has accumulated largely through glacial action and been deposited by the receding ice as till or as outwash from the melting glacier. Fairly large areas in the southeastern corner of the county have developed from marine or lacustrine deposits on an old sea floor or in temporary lakes formed near the glacier. In the glaciated region the till varies from very shallow to deep. Extensive areas of shallow soils exist where outcrops are numerous; the glacial drift is generally shallow, and the soils are influenced to some extent by residual material. The glacial outwash from terraces consists of assorted coarse sands and gravel. The marine or lacustrine deposits consist of bedded silts, clays, and sands. Alluvial soils on the present stream flood plains are composed of recently deposited sediments.

As much of the glacial material was 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. Rock of the area shows a wide variety of highly metamorphosed sedimentary rocks, as granite, gneiss, syenite, granodiorite, coarse crystalline gneiss and schist, and weak mica, calciferous, and pyritiferous schists. The relatively complex geologic pattern with further mixing of these materials by overdrag from glacier movement gives an even more complex pattern of soil parent material. In poorly drained positions little profile development has taken place, whereas on the well-drained uplands the soils have reached a fair degree of maturity. The soils in the Podzol region have developed from the same kind of material as those in the Brown Podzolic region, and the difference in profile characteristics is caused by different environmental conditions.

The Gloucester soils may be considered typical of the normal mature profile developed from granitic materials in the Brown Podzolic area.

A profile description of Gloucester stony fine sandy loam on an 8-percent slope in a wooded area of mixed hardwoods and conifers 1½ miles south of Peaked Hill, Barrington, is as follows:

A_0. 2 to 0 inch, brown to dark-brown partly decomposed leaf litter.
A_1. 0 to 1½ inches, brownish-gray or grayish-brown friable fine sandy loam, firm in place and well matted with small roots.
B_2. 1½ to 9 inches, yellowish-brown friable fine sandy loam, heavier than layer above; the upper few inches a light reddish brown in places. A small quantity of gritty material in upper part increases with depth. The soil is structureless to weak medium granules.
B_3. 9 to 26 inches, pale-yellow or grayish-yellow loose and friable gritty and gravelly sandy loam with some stone and rock fragments, becoming lighter in texture and containing more gritty material with depth.
C. 26 to 40 inches +, gray or yellowish-gray loose and gritty granitic till with little or no compaction; stone, boulders, and small rock fragments throughout.

This soil is developed from glacial till of granitic origin, and granitic boulders and small rock fragments are present on the surface and throughout the profile. All layers are acid. The mechanical analysis of a sample of Gloucester sandy loam from Medway, Mass., indicates that there has been little transfer of material within the profile (*2*). No significant variations in colloid content were observed, but the chemical analysis of the same sample indicates that eluviation of iron and alumina has been marked. The silica-sesquioxide ratio of the colloid of the B_2 horizon is 0.64 and the silica-alumina ratio 0.79.

The Essex soils are closely associated with the Gloucester and differ from them mainly in being developed on compact granitic till. They generally occur on smoothly rounded hills where apparently the glacier exerted great pressure to form the compact till. The dominant relief is gently sloping to sloping.

The Charlton soils, which are fairly extensive, are representative of the soils developed in this region from schistose glacial till. A profile description of Charlton stony loam, samples of which were taken in a forested area 1½ miles southwest of Meaderboro Corner, Rochester, is as follows:

A_0. 1½ to 0 inch, dark-brown partly decomposed organic debris.
$A_{1\,1}$. 0 to 1 inch, brownish-gray loose and fluffy loam high in organic matter and well matted with roots.
$A_{1\,2}$. 1 to 2½ inches, rich-brown mellow loam well matted with roots and having a very soft granular structure.
B_2. 2½ to 13 inches, moderate yellowish-brown loam firm in place and with a soft granular structure; upper few inches darker brown than lower part. A small quantity of gritty material and small rock fragments that increase with depth is present. Roots are well distributed throughout.
B_3. 13 to 23 inches, light yellowish-brown gritty light loam with about the same structure as layer above; becomes lighter in texture and color and contains more coarse material with depth; not so many roots as layer above but well distributed.
C. 23 to 48 inches, greenish-gray or greenish-yellow slightly compact schistose till of a loam texture; breaks into soft plates or granules that are easily crushed with pressure. Schist and granite boulders and slabs and chips of schist are scattered over the surface and throughout the soil. The relief is rolling, and drainage is well established. The forest species consist of white and pitch pines, red and black oaks, red maple, and gray birch.

The profile characteristics of the Paxton soils are somewhat similar to those of the Charlton, except that they are underlain by a compact till. They usually occur on smoothly rounded drumlinlike hills where apparently great pressure was exerted by the glacier in forming the compact substrata.

The Hollis soils are closely associated with the Charlton, and are generally shallow over schist bedrock. They are derived largely from till similar to that from which the Charlton soils are developed and to a less extent from residual material from the underlying bedrock.

The Brookfield soils are developed from till derived mainly from reddish-brown mica schist rock that contains iron pyrites in places. These soils are characterized by a rusty-brown or strong yellowish-brown color throughout. The relief is rolling, and drainage is well established. A profile description of Brookfield stony loam in a forested area 2½ miles southwest of East Barrington, Barrington, is as follows:

A_0. 2 to 0 inch, brownish-black organic mat.
A_1. 0 to 1 inch, brownish-gray mellow loam well matted with roots.
B_2. 1 to 8 inches, strong yellowish-brown loam, firm in place, but breaking down when disturbed into very soft granules; contains some gritty material and small rock fragments; roots well distributed throughout.
B_3. 8 to 26 inches, brilliant brownish-yellow loose and gritty fine sandy loam or sandy loam; contains more coarse material and rock fragments with depth.
C. 26 to 48 inches, light yellowish-brown gritty and gravelly coarse sandy loam till derived mainly from micaceous schist rock; mica schist boulders and some granite and gneiss scattered over the surface and embedded in the soil.

The Brimfield soils are closely associated with and are essentially shallow Brookfield soils. They are generally shallow over mica-schist bedrock, and surface outcrops are numerous.

The Newmarket soils are developed from till derived mainly from granodiorite rock. The till is greenish gray, gritty, and contains many disintegrated fragments of granodiorite rock. Closely associated with these soils are the Rockingham which are generally shallow over granodiorite bedrock.

Soils of the Colrain series are inextensive in this area and are generally shallow over schist bedrock or disintegrated and partly weathered schist. They are developed largely from a thin mantle of glacial till derived mainly from calciferous phyllite schist and siliceous limestone and to a less extent from residual material from the underlying rock. Leaching of carbonates has been rather thorough, and the reaction of the surface and subsoil layers is very strongly to medium acid. The reaction of unaltered till ranges from nearly neutral to neutral. In profile characteristics these soils closely resemble the Hollis, except that the brown coloring is slightly more intense throughout.

The Sutton soils occupy the imperfectly drained positions associated with the Charlton, Paxton, Brookfield, and associated soils. They are characterized by a brown to grayish-brown surface soil over a mottled gray and brown subsoil. The poorly drained dark-surface Whitman soils occupy the poorly drained areas associated with these soils.

The Hermon soils may be considered typical of the Podzol soils. They have developed from granitic till and granite, and gneiss stone and boulders are scattered over the surface and embedded in the soil. All layers are acid. Drainage is good. A profile description of Hermon stony fine sandy loam collected 3 miles southeast of Middleton Corners, Middleton, on a 9-percent slope in a forested area of white pine, hemlock, spruce, beech, maple, red oak, and gray, yellow, and paper birches is as follows:

A_0. 4 to 0 inch, darkbrown nearly raw to fairly well-decomposed organic debris well matted together with roots under about 2 inches of raw leaves.

A_2. 0 to 2½ inches, light-gray or brownish-gray fine sandy loam, having a very thin dark-gray layer at the top and a very thin grayish-brown layer near the bottom. This material in place has a very soft platy structure that breaks down easily into a structureless mass.

$B_{2\,1}$. 2½ to 8 inches, brown or rusty-brown fine sandy loam with weakly indurated lumps, containing some gritty material and fragments of granite rock. These lumps are reddish brown on the outside and yellowish brown on the inside when crushed. This layer is firm in place and when disturbed breaks down into very soft granules.

$B_{2\,2}$. 8 to 18 inches, yellowish-brown loose and friable fine sandy loam, containing more gritty material and rock fragments than the layer above and having very little structure.

B_3. 18 to 23 inches, pale yellowish-brown loose and gritty fine sandy loam or sandy loam, containing considerable coarse gritty material and rock fragments.

C. 23 to 40 inches +, gray to yellowish-gray loose and gritty till of a sandy loam texture, with soft platy structure in places and numerous fragments of parent rock.

The results of the chemical analysis of a sample of Hermon sandy loam taken 4 miles north of Canaan Center, Grafton County, N. H., shows that it is characteristic of the Podzol profile in that the silica remains high in the A horizon while there is a marked increase in one of the sesquioxides in the B horizon (*2*).

The Becket soils are closely associated with the Hermon in the northern part of the county and are somewhat similar to them. They generally occur on smoothly rounded hills and are underlain by compact granitic till. Soils of the Canaan series are essentially shallow Hermon. They are generally shallow over granite or gneiss bedrock, and surface outcrops are numerous.

The Peru and Whitman soils occupy the imperfectly drained and poorly drained positions, respectively, in association with the Hermon, Becket, and Canaan soils.

The Merrimac soils are typical of the Brown Podzolic soils on the outwash terraces. A profile description of Merrimac fine sandy loam taken in a forested area 2¾ miles west of Salmon Falls is as follows:

A_0. 1 to 0 inch, dark-brown partly decomposed organic debris.

A_1. 0 to 7 inches, pale-brown mellow and friable fine sandy loam, with a very soft granular structure.

B_2. 7 to 15 inches, yellowish-brown friable fine sandy loam fairly firm in place and when disturbed breaking down into very soft irregular fragments.

B_3. 15 to 24 inches, yellow or pale-yellow gritty light fine sandy loam with considerable gritty material and gravel at lower depths.

C. 24 to 40 inches, mixture of gray, yellowish-brown, and yellowish-gray stratified coarse sand and gravel, with a few rust-brown streaks at the top of the layer.

The soils of the Barnstead series are similar to the Merrimac in texture, structure, and consistence. They are developed from outwash material derived in part from schist high in iron pyrites and mica and are characterized by a rich-brown surface over a rusty-brown or strong-brown subsoil.

The soils developed on hummocky or uneven relief associated with the Merrimac and Barnstead soils are represented by the Hinckley and Jaffrey series, respectively. The Adams are developed on sandy terraces and are similar to the Merrimac in profile characteristics, except that there is little or no gravel in the profile or parent material and they may be underlain by clay at a depth of 8 to 10 feet.

The Sudbury and Scarboro soils occupy, respectively, the imperfectly drained and poorly drained positions in association with the sandy terrace soils.

Suffield silt loam is representative of the mature profile developed on the terraces from marine or lacustrine silt and clay sediments. A profile description of Suffield silt loam on a 4- to 5-percent slope in a forested area 1 mile west of Durham post office is as follows:

A_0. 1 to 0 inch, brownish-gray partly decomposed leaf litter.

A_1. 0 to 5 inches, brown mellow and friable loose and fluffy light silt loam with a soft granular structure and well matted with small roots.

$B_{2\,1}$. 5 to 10 inches, yellowish-brown friable and mellow silt loam, firm in place but breaking down easily into irregular clods or lumps that crumble into a soft granular mass with little pressure.

$B_{2\,2}$. 10 to 17 inches, olive- or weak-yellow silt loam; when distrubed breaks into irregular fragments easily crushed into soft granules; slightly plastic when wet.

B_3. 17 to 24 inches, olive-yellow mottled with gray silt loam, compact in place, and when disturbed breaking out into irregular blocks or clods, which when moderately dry crush down to a granular mass; plastic when wet.

C. 24 to 40 inches, greenish-gray silty clay loam very compact in place and breaking out into hard fragments hard to crush when dry; sticky and plastic when wet. The surface and subsoil layers are acid but the unaltered silts and clays may be slightly acid or neutral.

The Hartland soils are closely associated with the Suffield, occupying the hilly to steep broken and eroded areas. They generally occur on the broken edges of terraces or bordering small drainageways. Associated with the Suffield soils on the imperfectly drained and poorly drained positions, respectively, are the Buxton and Biddeford soils. The Melrose soils also are closely associated with heavy marine soils and are characterized by shallow sandy deposits over silts and clays.

The recent alluvial soils are young and have been subjected to little or no leaching. They bear a direct relation to the material from which derived. The Ondawa soils are well drained, and the Podunk soils imperfectly drained, and the Rumney, Saco, and Alluvial soils, undifferentiated, poorly drained.

The organic soils vary in degree of decomposition and depth. The brown fibrous peat has undergone little decomposition. Muck contains considerable mineral matter and is fairly well decomposed, especially in the upper part.

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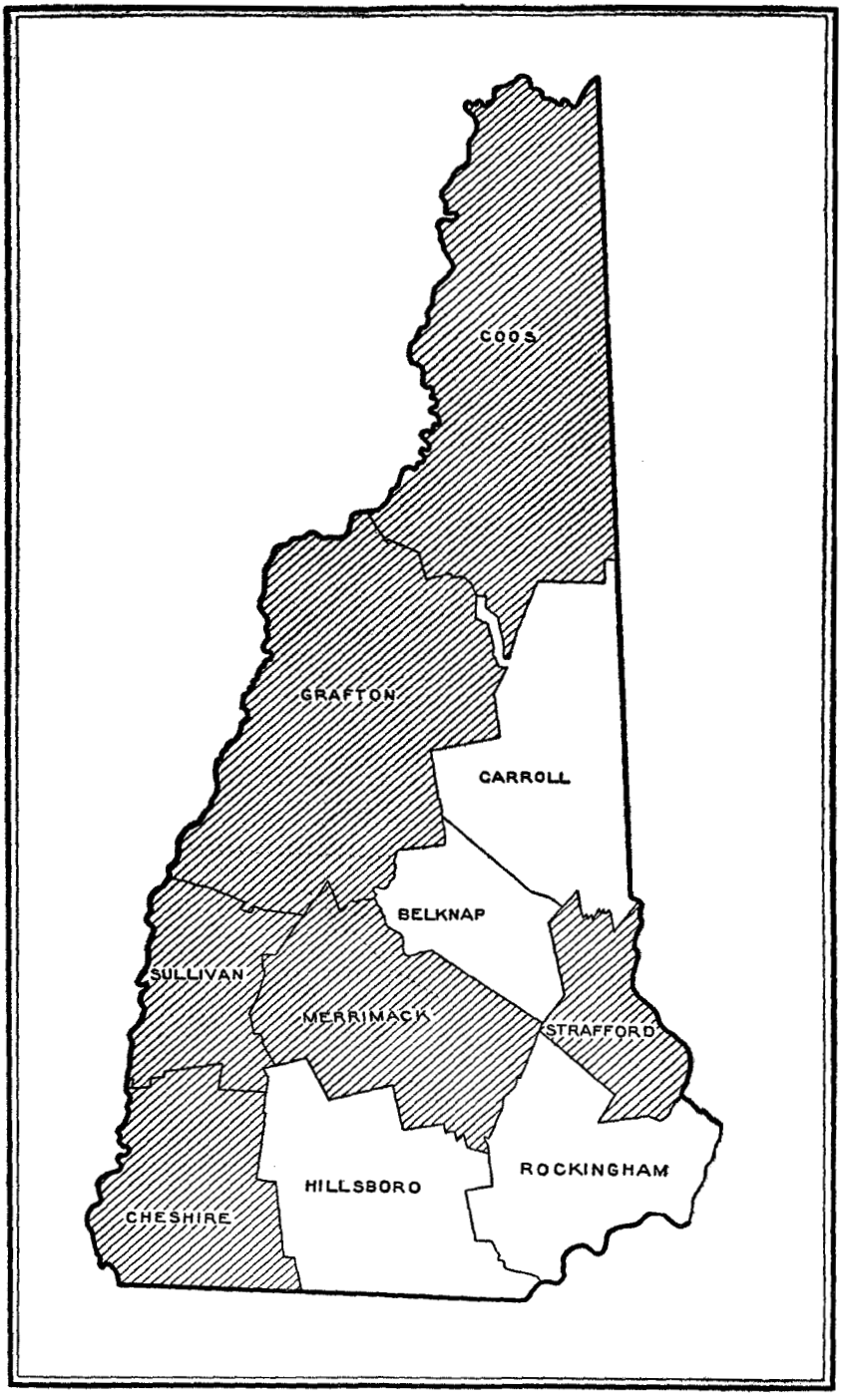

Areas surveyed in New Hampshire shown by shading.

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