United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Cornell University Agricultural Experiment Station

Soil Survey of Clinton County, New York

How To Use This Soil Survey

General Soil Map

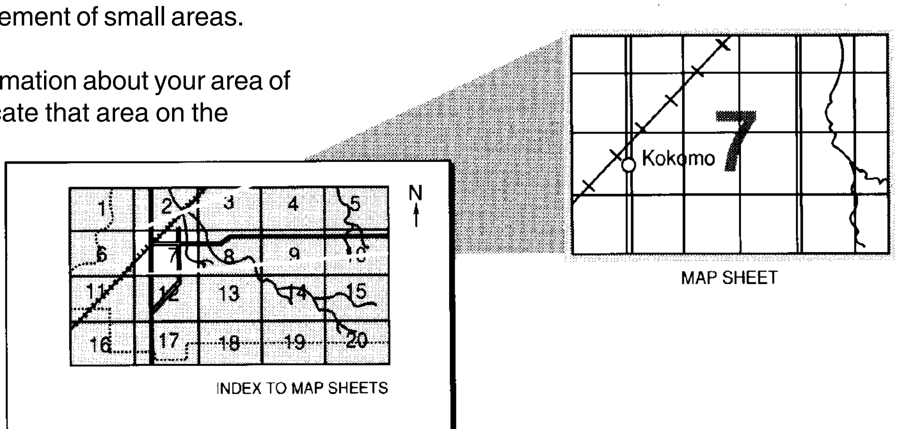
The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

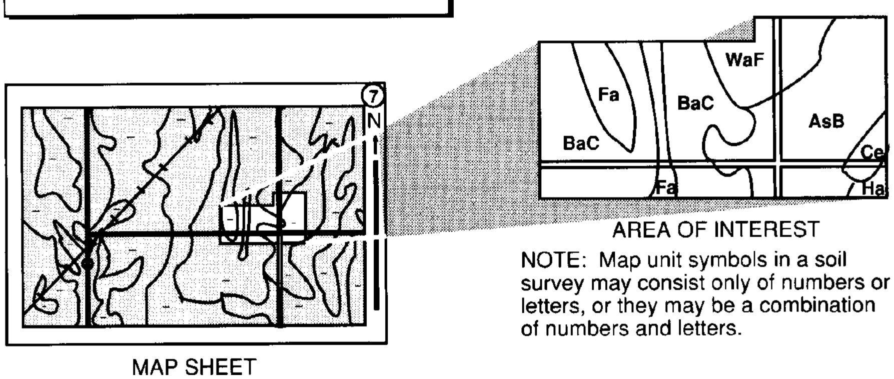
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1992. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service and the Cornell University Agricultural Experiment Station. Partial funding for this survey was provided by the Clinton County Legislature. Additional funding was also provided by the New York State Department of Agriculture and Markets. The survey is part of the technical assistance furnished to the Clinton County Soil and Water Conservation District.

Cover: An aerial view from Monty Bay in Lake Champlain looking west toward Rand Hill in center background and Dannemora Mountain to the left. Cultivated fields in the foreground are dominated by Muskellunge and Adjidaumo soils while nearby woods and shrubs are map units of Neckrock-Summerville complex or stony glacial till soils. Intermittent glacial beach ridge deposits belonging to Colosse-Trout River complex occur in the hardwood stands behind the visible fields.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.

Contents

How To Use This Soil Survey ... i
Foreword ... xi
General Nature of the County ... 1
Physiography and Geology of Clinton County, New York ... 4
How This Survey Was Made ... 10
Survey Procedures ... 11
General Soil Map Units ... 13
Areas Dominated by Soils Formed in Glacial Outwash and Glacial Lake Shoreline Deposits ... 13
1.—Champlain-Adams-Croghan ... 13
2.—Colton-Adams ... 14
3.—Colosse-Trout River ... 15
4.—Coveytown-Fahey-Malone ... 16
Areas Dominated by Soils Formed by Lacustrine and Marine Sediments ... 18
5.—Muskellunge-Adjidaumo-Swanton ... 18
Areas Dominated by Soils Formed in Non-Acid Glacial Till Deposits ... 19
6.—Malone-Hogansburg-Runeberg ... 19
7.—Neckrock-Summerville ... 20
Areas Dominated by Soils Formed in Moderately Acid and Strongly Acid Glacial Till Deposits ... 21
8.—Irona-Conic-Topknot ... 21
9.—Lyman-Tunbridge-Ricker ... 22
10.—Rockoutcrop-Ricker ... 23
11.—Schroon-Peasleeville ... 24
12.—Monadnock-Sunapee ... 24
13.—Skerry-Becket-Adirondack ... 25
14.—Becket-Tunbridge ... 26
Detailed Soil Map Units ... 29
15—Loxley-Beseman complex ... 30
17—Beseman-Rumney-Loxley complex ... 32
367—Searsport-Borosaprists-Naumburg complex ... 34
375C—Colton-Adams complex, 3 to 15 percent slopes ... 37
375F—Colton-Adams complex, 35 to 70 percent slopes ... 39
651C—Monadnock-Tunbridge-Sabattis complex, rolling, very bouldery ... 40
651D—Monadnock-Tunbridge complex, hilly, very bouldery ... 43
653C—Monadnock fine sandy loam, 3 to 15 percent slopes, very bouldery ... 45
654C—Monadnock-Sabattis complex, rolling, very bouldery ... 46
655B—Sunapee-Monadnock complex, 3 to 15 percent slopes, very bouldery ... 48
661C—Hermon fine sandy loam, 3 to 15 percent slopes, very bouldery ... 50
661D—Hermon fine sandy loam, 15 to 35 percent slopes, very bouldery ... 52
708B—Adirondack-Sabattis-Tughill complex, 0 to 8 percent slopes, very bouldery ... 53
721C—Becket-Tunbridge-Skerry complex, 3 to 15 percent slopes, very bouldery ... 56
721D—Becket-Tunbridge complex, 15 to 35 percent slopes, very bouldery ... 58

723C—Becket fine sandy loam, 3 to 15 percent slopes, very bouldery 60
723D—Becket fine sandy loam, 15 to 35 percent slopes, very bouldery 61
725B—Skerry-Becket complex, 3 to 15 percent slopes, very bouldery 63
727B—Skerry-Adirondack complex, 0 to 8 percent slopes, very bouldery 65
831C—Tunbridge-Lyman complex, 3 to 15 percent slopes, very rocky 67
831D—Tunbridge-Lyman complex, 15 to 35 percent slopes, very rocky 69
831F—Tunbridge-Lyman complex, 35 to 60 percent slopes, very rocky 71
861F—Lyman-Ricker complex, 35 to 60 percent slopes, very rocky 72
931C—Mundalite-Rawsonville-Worden complex, 3 to 15 percent slopes, very bouldery 74
931D—Mundalite-Rawsonville complex, 15 to 35 percent slopes, very bouldery 77
933C—Mundalite-Worden complex, 3 to 15 percent slopes, very bouldery 79
941C—Rawsonville - Hogback complex, 3 to 15 percent slopes, very rocky 81
941D—Rawsonville-Hogback complex, 15 to 35 percent slopes, very rocky 83
941F—Rawsonville- Hogback complex, 35 to 60 percent slopes, very rocky 85
943C—Rawsonville-Borosaprists-Ricker complex, 0 to 25 percent slopes, very rocky 87
945F—Hogback-Ricker complex, 35 to 60 percent slopes, very rocky 89
949F—Rock outcrop-Ricker-Hogback complex, 35 to 60 percent slopes, very bouldery 91
991D—Glebe-Skylight complex, 15 to 35 percent slopes, very rocky 93
997F—Ricker-Skylight-Rock outcrop complex, 35 to 70 percent slopes, very bouldery 95
AbA—Adams loamy sand, 0 to 3 percent slopes 97
AbB—Adams loamy sand, 3 to 8 percent slopes 98
AbC—Adams loamy sand, 8 to 15 percent slopes 99
AbD—Adams loamy sand, 15 to 25 percent slopes 100
AgB—Adirondack loam, 3 to 8 percent slopes 102
AhB—Adirondack loam, gently sloping, very bouldery 103
Ak—Adjidaumo silty clay 104
Am—Adjidaumo mucky silty clay 106
AtA—Amenia fine sandy loam, 0 to 3 percent slopes 107
AtB—Amenia fine sandy loam, 3 to 8 percent slopes 108
AwA—Appleton loam, 0 to 3 percent slopes 109
AwB—Appleton loam, 3 to 8 percent slopes 111
BcB—Becket fine sandy loam, 3 to 8 percent slopes 113
BcC—Becket fine sandy loam, 8 to 15 percent slopes 114
BeC—Becket fine sandy loam, strongly sloping, very bouldery 116
BeD—Becket fine sandy loam, moderately steep, very bouldery 117
BgC—Becket-Tunbridge complex, strongly sloping, very rocky 118
BgE—Becket-Tunbridge complex, steep, very rocky 120
BhC—Benson loam, strongly sloping, very rocky 122
BhE—Benson loam, steep, very rocky 124
Bo—Beseman mucky peat 125
BrB—Bice fine sandy loam, 3 to 8 percent slopes 127
BrC—Bice fine sandy loam, 8 to 15 percent slopes 128
BsC—Bice fine sandy loam, strongly sloping, very stony 129
BsD—Bice fine sandy loam, moderately steep, very stony 130
BvB—Bombay loam, 3 to 8 percent slopes 131
Bx—Bucksport mucky peat 133
CgA—Champlain fine sand, 0 to 3 percent slopes 134
CgB—Champlain fine sand, 3 to 8 percent slopes 136
CgC—Champlain fine sand, 8 to 15 percent slopes 137

ChF—Champlain and Adams soils, very steep ... 138
Ck—Churubusco muck ... 140
ClC—Colosse-Hermon complex, strongly sloping, very stony ... 141
CmB—Colosse-Trout River complex, gently sloping ... 143
CmC—Colosse - Trout River complex, strongly sloping ... 145
CnC—Colosse-Trout River complex, strongly sloping, very stony ... 147
CnD—Colosse-Trout River complex, moderately steep, very stony ... 149
CoA—Colton gravelly loamy coarse sand, 0 to 3 percent slopes ... 151
CoB—Colton gravelly loamy coarse sand, 3 to 8 percent slopes ... 152
CoC—Colton gravelly loamy coarse sand, 8 to 15 percent slopes ... 153
CpC—Colton gravelly loamy coarse sand, strongly sloping, very stony ... 155
CpE—Colton gravelly loamy coarse sand, steep, very stony ... 156
Crk—Cook mucky loamy fine sand ... 158
Crr—Cornish silt loam ... 159
Cs—Covert loamy sand ... 160
CtsA—Covertfalls loamy fine sand, 0 to 3 percent slopes ... 162
CtsB—Covertfalls loamy fine sand, 3 to 8 percent slopes ... 163
CttB—Covertfalls gravelly loamy fine sand, 3 to 8 percent slopes ... 165
CvA—Coveytown loamy sand, 0 to 3 percent slopes ... 166
CvB—Coveytown loamy sand, 3 to 8 percent slopes ... 168
CwB—Coveytown loamy sand, gently sloping, very stony ... 170
CxA—Croghan loamy fine sand, 0 to 3 percent slopes ... 171
CxB—Croghan loamy fine sand, 3 to 8 percent slopes ... 173
DeA—Deerfield fine sand, 0 to 3 percent slopes ... 174
DeB—Deerfield fine sand, 3 to 8 percent slopes ... 176
Df—Deinache fine sand ... 177
FeB—Fahey gravelly fine sandy loam, 3 to 8 percent slopes, loamy substratum ... 179
FhB—Fahey gravelly fine sandy loam, gently sloping, very stony ... 180
FkB—Fernlake cobbly loamy sand, 3 to 8 percent slopes ... 182
FlB—Fernlake cobbly loamy sand, gently sloping, very bouldery ... 183
FlC—Fernlake cobbly loamy sand, strongly sloping, very bouldery ... 184
FlD—Fernlake cobbly loamy sand, moderately steep, very bouldery ... 186
FlF—Fernlake cobbly loamy sand, very steep, very bouldery ... 187
FmB—Flackville loamy fine sand, 3 to 8 percent slopes ... 189
Fn—Fluvaquents-Udifluvents complex, frequently flooded ... 190
GfC—Gardenisle-Benson complex, strongly sloping, rocky ... 191
Gl—Gougeville mucky loamy fine sand ... 194
GrA—Grattan loamy sand, 0 to 3 percent slopes ... 195
GrB—Grattan loamy sand, 3 to 8 percent slopes ... 196
GvB—Grenville loam, 3 to 8 percent slopes ... 197
GwC—Grenville loam, strongly sloping, very stony ... 199
Ha—Hailesboro silt loam ... 200
HeB—Hermon fine sandy loam, 3 to 8 percent slopes ... 201
HeC—Hermon fine sandy loam, 8 to 15 percent slopes ... 203
HfC—Hermon fine sandy loam, strongly sloping, very bouldery ... 204
HfD—Hermon fine sandy loam, moderately steep, very bouldery ... 205
HgC—Hermon-Adirondack complex, strongly sloping, very bouldery ... 207
HlB—Heuvelton silty clay loam, 3 to 8 percent slopes ... 209
HlD—Heuvelton silty clay loam, 15 to 25 percent slopes ... 210
HoA—Hogansburg loam, 0 to 3 percent slopes ... 211
HoB—Hogansburg loam, 3 to 8 percent slopes ... 213
HrB—Hogansburg loam, gently sloping, very stony ... 215
InB—Irona-Conic complex, gently sloping, very rocky ... 216

Jn—Junius fine sand ... 218
KhB—Kalurah fine sandy loam, 3 to 8 percent slopes ... 219
KlB—Kalurah fine sandy loam, gently sloping, very stony ... 220
Kr—Kingsbury-Rhinebeck complex ... 222
Ld—Lovewell very fine sandy loam, stratified substratum ... 224
Le—Loxley mucky peat ... 225
LtF—Lyman-Tunbridge-Rock outcrop complex, very steep ... 226
Lv—Lyonmounten loam ... 228
Ly—Lyonmounten loam, very stony ... 229
MaB—Madrid fine sandy loam, 3 to 8 percent slopes ... 231
MaC—Madrid fine sandy loam, 8 to 15 percent slopes ... 232
MeA—Malone gravelly loam, 0 to 3 percent slopes ... 233
MeB—Malone gravelly loam, 3 to 8 percent slopes ... 234
MfB—Malone gravelly loam, gently sloping, very stony ... 236
Mk—Markey muck ... 237
Mn—Massena fine sandy loam ... 238
Mp—Medomak silt loam, stratified substratum ... 240
Ms—Mino loam ... 241
MtB—Monadnock fine sandy loam, 3 to 8 percent slopes ... 242
MtC—Monadnock fine sandy loam, 8 to 15 percent slopes ... 244
MuC—Monadnock fine sandy loam, strongly sloping, very bouldery ... 245
MuD—Monadnock fine sandy loam, moderately steep, very bouldery ... 246
MuF—Monadnock fine sandy loam, very steep, very bouldery ... 248
MvA—Mooers loamy sand, 0 to 3 percent slopes ... 249
MvB—Mooers loamy sand, 3 to 8 percent slopes ... 250
MwA—Muskellunge silty clay loam, 0 to 3 percent slopes ... 251
MwB—Muskellunge silty clay loam, 3 to 8 percent slopes ... 253
NeC—Neckrock-Summerville complex, strongly sloping, very rocky ... 255
NoB—Nicholville very fine sandy loam, 3 to 8 percent slopes ... 257
NrA—Northway loamy fine sand, 0 to 3 percent slopes ... 258
NrB—Northway loamy fine sand, 3 to 8 percent slopes ... 259
OcA—Occur loamy sand, 0 to 3 percent slopes ... 261
OcB—Occur loamy sand, 3 to 8 percent slopes ... 262
OgB—Ogdensburg silt loam, 0 to 8 percent slopes ... 264
PeA—Peasleeville loam, 0 to 3 percent slopes ... 265
PeB—Peasleeville loam, 3 to 8 percent slopes ... 266
PfB—Peasleeville loam, gently sloping, very stony ... 268
Pg—Pinconning mucky loamy fine sand ... 270
Ph—Pipestone fine sand ... 271
Pn—Pits, gravel ... 272
Po—Pits, quarry ... 273
Pp—Pits, sand ... 274
PtA—Plainfield loamy sand, 0 to 3 percent slopes ... 275
PtB—Plainfield loamy sand, 3 to 8 percent slopes ... 276
PtC—Plainfield loamy sand, 8 to 15 percent slopes ... 277
PvF—Plainfield and Grattan soils, very steep ... 278
RoB—Rock outcrop-Ricker complex, gently sloping ... 280
Rr—Roundabout silt loam ... 282
Ry—Runeberg mucky loam ... 284
Sb—Sabattis mucky fine sandy loam, very bouldery ... 285
Se—Saprists and Aquents, ponded ... 287
ShB—Schroon fine sandy loam, 3 to 8 percent slopes ... 288
ShC—Schroon fine sandy loam, 8 to 15 percent slopes ... 289
SkB—Schroon fine sandy loam, gently sloping, very stony ... 291

Sn—Sciota fine sand 292
So—Shaker loam 293
SpB—Sheddenbrook gravelly loamy fine sand, 3 to 8 percent slopes 295
SrB—Skerry fine sandy loam, 3 to 8 percent slopes 296
SsB—Skerry fine sandy loam, gently sloping, very bouldery 298
SsC—Skerry fine sandy loam, strongly sloping, very bouldery 299
StD—Success cobbly sandy loam, moderately steep, very bouldery 300
SwB—Sunapee fine sandy loam, 3 to 8 percent slopes 302
SxB—Sunapee fine sandy loam, gently sloping, very bouldery 303
Sz—Swanton very fine sandy loam 305
TcB—Topknot-Chazy complex, gently sloping, rocky 306
TnC—Tunbridge-Lyman complex, strongly sloping, very rocky 308
TnE—Tunbridge-Lyman complex, steep, very rock 310
Ud—Udipsamments and Psammaquents, smoothed 312
Ue—Udipsamments, mine spoil, non-acid 313
Uf—Udorthents, refuse substratum 313
Ug—Udorthents, smoothed 314
Uh—Udorthents, wet substratum 314
Un—Urban land 315
UpA—Urban land-Plainfield complex, nearly level 315
UpB—Urban land-Plainfield complex, gently sloping 316
WdB—Waddington gravelly loam, 3 to 8 percent slopes 317
Wn—Wainola loamy fine sand 318
WsB—Wallace fine sand, 3 to 8 percent slopes 320
WsC—Wallace fine sand, 8 to 15 percent slopes 321
WsE—Wallace fine sand, 25 to 35 percent slopes 323
W—Water 324
Wu—Wonsqueak muck 324
Prime Farmland 327
Use and Management 329
Interpretive Ratings 329
Crops and Pasture 329
Hydric Soils 334
Woodland Capability, Management and Productivity 337
Recreation 339
Wildlife Habitat 340
Engineering 342
Soil Properties 349
Engineering Index Properties 349
Physical Properties 350
Chemical Properties 352
Water Features 352
Soil Features 354
Engineering Index Test Data 355
Engineering Properties of Geologic Deposits 355
Classification of the Soils 359
Soil Series and Their Morphology 359
Adams Series 360
Adirondack Series 361
Adjidaumo Series 362
Amenia Series 364
Appleton Series 365
Aquents 366
Becket Series 366

Benson Series ... 368
Beseman Series ... 369
Bice Series ... 369
Bombay Series ... 370
Borosaprists ... 372
Bucksport Series ... 372
Champlain Series ... 373
Chazy Series ... 374
Churubusco Series ... 375
Colosse Series ... 376
Colton Series ... 377
Conic Series ... 378
Cook Series ... 379
Cornish Series ... 380
Covert Series ... 382
Covertfalls Series ... 383
Coveytown Series ... 384
Croghan Series ... 385
Deerfield Series ... 387
Deinache Series ... 388
Fahey Series ... 389
Fernlake Series ... 390
Flackville Series ... 392
Fluvaquents ... 393
Gardenisle Series ... 394
Glebe Series ... 395
Gougeville Series ... 396
Grattan Series ... 397
Grenville Series ... 398
Hailesboro Series ... 399
Hermon Series ... 400
Heuvelton Series ... 401
Hogansburg Series ... 402
Hogback Series ... 403
Irona Series ... 404
Junius Series ... 405
Kalurah Series ... 407
Kingsbury Series ... 408
Lovewell Series ... 409
Loxley Series ... 410
Lyman Series ... 411
Lyonmounten Series ... 412
Madrid Series ... 413
Malone Series ... 414
Markey Series ... 415
Massena Series ... 416
Medomak Series ... 417
Mino Series ... 418
Monadnock Series ... 419
Mooers Series ... 421
Mundalite Series ... 422
Muskellunge Series ... 424
Naumburg Series ... 426
Neckrock Series ... 427

Nicholville Series 428
Northway Series 429
Occur Series 430
Ogdensburg Series 431
Peasleeville Series 433
Pinconning Series 434
Pipestone Series 435
Plainfield Series 436
Psammaquents 437
Rawsonville Series 437
Rhinebeck Series 439
Ricker Series 440
Roundabout Series 441
Rumney Series 442
Runeberg Series 443
Sabattis Series 445
Saprists 446
Schroon Series 446
Sciota Series 448
Searsport Series 449
Shaker Series 450
Sheddenbrook Series 451
Skerry Series 452
Skylight Series 454
Success Series 455
Summerville Series 456
Sunapee Series 456
Swanton Series 458
Topknot Series 459
Trout River Series 460
Tughill Series 461
Tunbridge Series 462
Udifluvents 463
Udipsamments 464
Udorthents 464
Waddington Series 465
Wainola Series 466
Wallace Series 467
Wonsqueak Series 468
Worden Series 469
Formation of the Soils 471
Factors of Soil Formation 471
Processes of Soil Formation 473
References 475
Glossary 479
Tables 493
Table 1.—Temperature and Precipitation 494
Table 2.—Freeze Dates in Spring and Fall 495
Table 3.—Growing Season 495
Table 4.—Acreage and Proportionate Extent of the Soils 496
Table 5.—Prime Farmland 500
Table 6.—Land Capability and Yields per Acre of Crops and Pasture 501
Table 7.—Forestland Management and Productivity 513
Table 8.—Recreational Development 551

Table 9.—Wildlife Habitat 573
Table 10.—Building Site Development 589
Table 11.—Sanitary Facilities 619
Table 12.—Construction Materials 642
Table 13.—Water Management 662
Table 14.—Engineering Index Properties 698
Table 15.—Physical Properties of the Soils 782
Table 16.—Chemical Properties of the Soils 817
Table 17.—Water Features 842
Table 18.—Soil Features 885
Table 19.—Engineering Index Test Data 897
Table 20.—Relationship between Soil Series, their Parent Material, Landscape Position, ... 899
Table 21.—Classification of the Soils 903

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Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

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Soil Survey of
Clinton County, New York

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CLINTON COUNTY is on the west side of Lake Champlain in the northeastern part of New York state (fig. 1). It is approximately 135 miles north of the city of Albany, and 44 miles south of the city of Montreal, Canada. The Province of Quebec, Canada is to the north; Franklin County is to the west; and Essex County is to the south.

The shape of the county is irregular. It has a length of 32 to 39 miles from north to south, and a width of 25 to 33 miles from east to west. The total area of Clinton County is 1,117 square miles or 714,800 acres (U.S. Department of Commerce, 1990). The city of Plattsburgh is the county seat.

General Nature of the County

The 1987 Census of Agriculture states that 25.9 percent or 172,700 acres of land in the county is in farms (U.S. Department of Commerce, 1987). Of this total, about 19,300 acres is used for corn (grain and silage), 44,900 acres is used for hay, and 3,300 acres is used for apple orchards. The amount of land in farms declined approximately 29 percent between 1969 and 1987 (U.S. Department of Commerce, 1987, 1990). While the acres in hay has also decreased, harvested areas of corn increased by 77 percent between 1969 and 1987, and orchard acreage expanded by 44 percent. Much of the decline of farmland has been toward idle or brush land existence. Farmland conversion to residential development has been significant in some areas of the county.

Dairy farming is one of the most important industries in Clinton County. Although the number of dairy farms decreased by one-half between 1969 and 1987, the number of milk cows decreased only a slight amount. Part-time farming has steadily increased over the same period (U.S. Department of Commerce, 1976).

McIntosh apples as well as other varieties are an economically important crop in Clinton County. Specialty crops such as sweet corn and strawberries are grown in a few scattered areas near Lake Champlain, while potatoes are harvested from slightly more acid soils in the Saranac River Valley and in the northwestern part of the county.

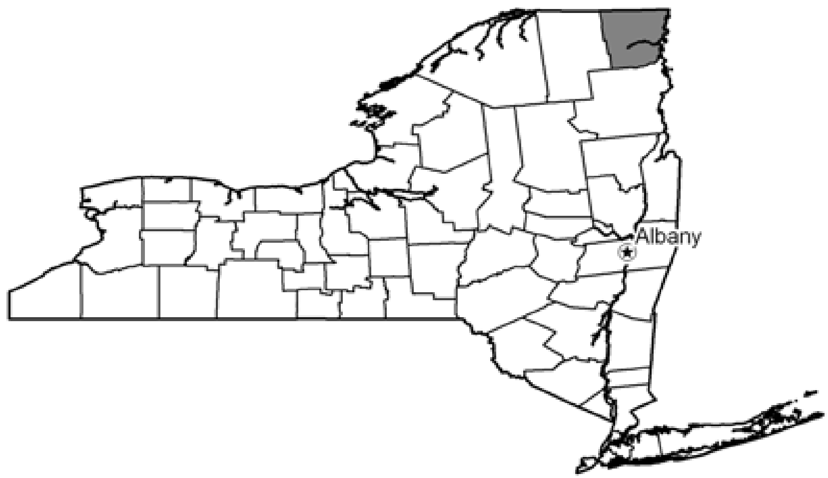

Figure 1.—Location of Clinton County in New York.

Most of Clinton County, particularly in the southwest portion, is wooded. Trees are harvested for logs, pulpwood, and fuelwood. Maple syrup is also produced in many locations. According to the U.S. Forest Service, almost two thirds of the county's land base is considered to be commercial forest land. This land is producing or capable of producing crops of industrial wood that has not been withdrawn from timber utilization (USDA, Natural Resources Conservation Service, 1993).

Two areas in Clinton County were not mapped. One place is in the town of Altona, at the site of the Ganienkeh Indian encampment. The other area is roughly delineated the old Macomb Reservation in the town of Schuyler Falls. Soil scientists were denied access to these land areas.

An earlier soil survey of Clinton County was published by the Bureau of Soils, USDA, in cooperation with Cornell University, Ithaca, New York in 1916 (USDA, Bureau of Soils, 1916). This survey updates the 1916 survey, and provides additional interpretative information and larger scale maps that show the soils in greater detail on aerial photographs.

Settlement

The first known inhabitants in the Champlain Valley were the Algonkians about 8,000 years ago. About 1300 A.D., Mohawk tribes moved into the area driving the Algonkians to the east and north. For several generations, rivalry existed between the two native groups making permanent settlement by other groups unsafe (Allan, Garland, Dugan; 1963).

Samuel de Champlain entered Lake Champlain from the St. Lawrence Valley in 1609. His voyage allowed the French to claim the entire Champlain Valley until 1759. Development did not occur because of a lack of manpower coming from French Canada. Following four major wars from 1689 to 1763 among the French, British and Indians, the victorious British began a few settlements along the shore of Lake Champlain. However, more rapid settlement took place after the American Revolution around 1783 (Allan, Garland, Dugan; 1963).

Most of the settlers became independent farmers. After providing shelter, the most pressing matter was clearing trees and stones from the land. The first consumer item from the land was potash, a byproduct of burning his felled trees. Later, farmers sold lumber and wheat to markets in Canada. Streams were impounded to run gristmills, sawmills, tanneries, asheries, and iron forges. Iron ore deposits were discovered in 1806 on Arnold Hill in the Town of Ausable, and later more deposits were mined within several other towns. Even in 1870, however, most people in Clinton County were engaged in agriculture (Allan, Garland, Dugan; 1963).

The county was named after Governor George Clinton. It was established in 1788 from a huge area that once included the present day counties of Clinton, Essex, Franklin, and Washington.

Transportation and Industry

The Champlain Valley is linked to Albany, New York by Interstate 87, railroad, the Champlain Canal, commercial bus service, and the Clinton County Airport. Interstate 87 (also known as the Adirondack Northway) connects via the Canadian highway system to the city of Montreal. The railroad consists of both the passenger service Amtrak with a station at Plattsburgh, and the freight service owned by Canadian-Pacific Railroad. Canal service also exists on the north end of Lake Champlain in the province of Quebec. Ferry service from Clinton County to Vermont embarks at Cumberland Head near Plattsburgh and at Port Kent just south of the county line. Destination points to the west are most commonly accomplished by using NY Route 3, NY Route 374, and U.S. Route 11. The Clinton Area Rural Transportation system provides service from most towns and villages throughout the county to the City of Plattsburgh.

The discovery of iron in the Arnold Hill and Lyon Mountain areas brought a major influx of settlers to the county. In 1875, the first railroad was built by the Delaware and Hudson Company to haul iron ore, eventually replacing many of the steamships. Several miles of plank roads were also developed near Lyon Mountain and Standish (Allan, Garland, Dugan; 1963). Forges throughout the county turned iron into tools, wheels, and other implements (Riley, 1976). Also, glass was manufactured at Redford on the Saranac River in the mid 1800s (Clinton County Historical Museum, 1988). A developing transportation system on Lake Champlain during this period carried iron and glass both north to Canada, and south to other markets (Riley, 1976).

Clinton County is the site of three state prisons. The prison at Dannemora is a maximum security facility and was opened in 1845 (Riley, 1976). Altona has a medium security prison and the village of Lyon Mountain has a minimum security facility.

Plattsburgh Air Force Base, a major employer in Clinton County between 1956 and 1994, deployed the FB-111 and KC-135 aircraft. Clinton County was also the site of several Atlas Intercontinental Ballistic Missiles built in the early 1960s which had a tremendous affect on the area's economy (Strictly Business, 1992).

Both Clinton Community College and the State University of New York at Plattsburgh, as well as William H. Miner Research Institute in Chazy provide educational and research opportunities as well as employment to area residents.

The paper industry has been a part of Clinton County for about 100 years. Georgia Pacific and Imperial Wallcover produce paper products from logs supplied by local timber harvesters.

Tourism is also a major industry in this county with numerous historic sites, museums, state parks, beaches, boating facilities and fishing (Riley, 1976).

Finally, agriculture continues to be a major business in the area producing over 50 million dollars in sales annually. Dairy, meat, poultry, apples, potatoes, hay, and greenhouse crops are the main farm products.

Physiography and Geology of Clinton County, New York

David A. Franzi, Professor of Geomorphology at the State University of New York in Plattsburgh, prepared this section.

Physiography

Clinton County contains parts of two physiographic regions. The southern and western portions of the county lie within the Central Highlands Section of the Adirondack Uplands (Isachsen, Landing, Lauber, Rickard, Rogers, 1991). The Adirondack Uplands is a moderate to high relief region that is underlain primarily by high-grade Precambrian granite and syenitic gneisses. Several peaks in Clinton County exceed 600 meters in elevation above mean sea level. The highest elevation in the county is 1,167 meters (3,830 feet) at Lyon Mountain summit. Local relief in upland drainage basins ranges from about 100 meters to more than 600 meters.

The northern and eastern portions of the county lie within the Champlain and St. Lawrence lowlands. The Champlain Lowland is a low to moderate relief, southward tapering, north-south trending rift valley that is underlain by lower Paleozoic sedimentary rocks and unconsolidated Pleistocene glacial, lacustrine and marine deposits. Lowland relief ranges from a few meters to a few tens of meters. The principal topographic features are generally structurally controlled by fault systems within the lowland (Fisher, 1968). The lowest surface elevation in the county is 29 meters (95 feet) above mean sea level at the shoreline of Lake Champlain. The lowest elevation beneath Lake Champlain is approximately 55 meters (180 feet) below mean sea level east of Ausable Point (Hunt, Boardman; 1968). The boundary between the Champlain Lowland and the Adirondack Uplands is marked by a prominent fault-line scarp along much of its extent in the southern portion of the country. The boundary with the St. Lawrence Lowland in the north is more gradual where the lowland sedimentary rocks rise and lap onto the Adirondack metamorphic complex.

Bedrock Geology

The oldest rocks in Clinton County are Grenville-aged (ca. 1.1 billion years before present) metamorphic rocks. Most are metaigneous granitic and syenitic gneisses that were intruded into Grenville series metasediments (Miller and Terasme, 1960; Postel, 1951; Broughton, Fisher, Isachsen, Rickard, and Offield, 1961; Fisher, 1968). Anorthositic gneisses occur locally between West Beekmantown and Jericho, and along the Essex County border near Black Brook and Keeseville (Broughton, Fisher, Isachsen, Rickard, Offield; 1961). Inclusions of Grenville series metasedimentary rocks, such as quartzites, marbles, and mixed gneisses, occur sporadically within the county. Unmetamorphosed Late Precambrian mafic dikes intrude the metamorphic rock sequence.

The metamorphic rocks are unconformably overlain by lower Paleozoic sedimentary rocks that were deposited in a shallow epicontinental sea (Iapetus Ocean) that invaded the region following the rifting and subsidence of the Grenville supercontinent (Isachsen, Landing, Lauber, Rickard, Rogers; 1991). The Cambrian Saratoga Springs Group, composed of the Potsdam Sandstone and Theresa Formation, forms the base of the sedimentary rock sequence. These rocks are overlain, in ascending order, by the Lower Ordovician Beekmantown Group carbonates and the Middle Ordovician Chazy, Black River and Trenton group carbonates and shales.

The Potsdam Sandstone is surficially exposed along the flanks of the Adirondack Uplands throughout much of northern and central Clinton County. The Potsdam consists of a coarse to medium-grained arkose (Ausable Member) that is overlain by a well-sorted, slightly feldspathic quartz sandstone (Keeseville Member) (Fisher, 1968). A thin, discontinuous basal member, consisting of hematitic, feldspathic, micaceous quartz sandstone with thin shale interbeds, crops out sporadically between Jericho and Churubusco (Fisher, 1968). The interbedded quartzose dolostone and dolomitic sandstone of the Theresa Formation overlies the Potsdam Sandstone and is surficially exposed in the northernmost part of the county near Mooers. The Lower Ordovician dolostones and dolomitic limestones of the Beekmantown Group overlies the Potsdam and Theresa formations. The Beekmantown Group is subdivided into the Cutting (cherty dolostone), Spellman (dolomitic limestone and dolostone), Fort Cassin (dolostone and dolomitic limestone), and Providence Island (dolostone) formations.

The Middle Ordovician Chazy, Black River and Trenton group carbonates are surficially exposed in eastern parts of the county in a narrow belt that parallels the shoreline of Lake Champlain. Their surficial distribution is structurally controlled by lowland faults and, in places, they are concealed by younger unconsolidated Pleistocene deposits. The Chazy Group, which consists primarily of fossiliferous limestones, is subdivided into the Day Point, Crown Point, and Valcour formations (Fisher, 1968). The Black River Group, represented by the Isle LaMotte Limestone, is exposed at only a few locations near Chazy and just south of Rouses Point. The Trenton Group consists of a lower limestone (Glens Falls Limestone) and an upper argillite (Cumberland Head and Stony Point formations). The argillites are generally found on the overthrust block east of the Isle LaMotte Thrust (Fisher, 1968). The thrust faults, high-angle normal faults, and folds in the Champlain Lowland are primarily associated with the Late Ordovician Taconic Orogeny in northeastern North America (Fisher, 1968).

The lower Paleozoic sedimentary rocks are intruded by Late Jurassic to Early Cretaceous diabase and lamprophyre dikes.

Glacial Geology

Deglaciation of northeastern New York probably began some time after 14,000 years B.P. (before present) with the recession of the Laurentide Ice Sheet from the eastern Mohawk and Hudson lowlands (Ridge, Franzi, Muller; 1991). Lobation of the ice front in response to deglacial thinning blocked many local drainage systems and created proglacial lakes that expanded as the ice receded (Franzi, 1992); (Miller, 1926). The Champlain Lobe lay in glacial Lake Vermont, a large proglacial lake in the Champlain Lowland that drained southward across the present divide between the Hudson and Champlain drainage basins near Glens Falls. Two stages of Lake Vermont in the Champlain Lowland, the Coveville and Fort Ann stages, are presently recognized (Woodworth, 1905a); (Woodworth, 1905b); (Chapman, 1937); (Denny, 1974). The older Coveville Stage is represented by shoreline deposits and landforms that locally lie more than 30 meters above those of the younger Fort Ann Stage. Coveville strandline deposits are not recognized north of Plattsburgh, which indicates that lake levels probably lowered to the highest Fort Ann level when the ice receded to the vicinity of Plattsburgh (Denny, 1974).

A discontinuous belt of bare sandstone areas, known locally as “Flat Rocks”, extend approximately 30 kilometers southeastward into Clinton County from Covey Hill, near Hemmingford, Province of Quebec, Canada (P.Q.). The Flat Rocks were created by the erosional effects of the catastrophic drainage of glacial Lake Iroquois and younger post-Iroquois glacial lakes (Woodworth, 1905a); (Woodworth, 1950b); (Coleman, 1937); (MacClintock and Terasme, 1960); (Denny, 1970); (Franzi, Adams, and Pair, 1993). Lake Iroquois occupied the Ontario Lowland and drained eastward across a threshold near Rome in the western Mohawk Valley. The lake expanded northeastward into the St. Lawrence Lowlands between the Adirondack Uplands in

Figure 2.—The Champlain Valley was once inundated by a large glacial Lake Vermont and a subsequent Champlain Sea. The approximate interface between marine deposits (right of the boundary) and lacustrine deposits (left of the boundary) is shown here (Denny, 1974).

the south and the receding ice margin to the north. Drainage of Lake Iroquois and subsequent glacial lakes in the Ontario and St. Lawrence Lowlands into the Champlain Lowland occurred as lower outlets between Clinton Mills and Hemmingford, P.Q. were exhumed. Outflow from these lakes stripped large areas of their surficial cover exposing the underlying Potsdam Sandstone. Jack pine (Pinus banksiana) barrens presently cover most of the sandstone pavements (Franzi and Adams, 1993).

The proglacial freshwater lakes drained when ice withdrew from the eastern St. Lawrence Lowland, near Quebec, P.Q., allowing marine water to flood the isostatically depressed St. Lawrence and Champlain lowlands. The marine episode, referred to as the Champlain Sea, is evidenced by stratified sediment containing marine fossils. Radiocarbon dates from stenohaline marine fossils in the western Champlain Sea basin (Rodrigues, 1988) indicates that the marine incursion probably occurred between 11,000 to 11,500 years B.P. The marine episode ended about 10,000 years B.P. after isostatic rebound raised the region above sea level, thus creating the present Lake Champlain.

A variably thick mantle of unconsolidated Pleistocene glacial, lacustrine, and marine deposits record the advance and retreat of the late Wisconsinan Laurentide Ice Sheet. These deposits provide the parent material for most of the soils in the county today.

A pervasive, yet discontinuous, layer of glacial till is generally found at the base of the Pleistocene section. Glacial till varies greatly in its texture, composition, and physical properties depending upon the nature of the underlying parent material and its mode of deposition. Subglacial lodgement till, deposited beneath active glacial ice, is generally massive, overconsolidated, and contains predominantly locally derived material. Till in the Adirondack Uplands, derived from resistant metamorphic rocks, is typically a thin, discontinuous veneer of sandy, low to moderately calcareous, massive to crudely bedded stony diamicton. Consequently, soils developed in upland tills, such as the Adirondack, Becket, Monadnock, Skerry, Sunapee, and Tunbridge series, are generally coarse-grained and acidic. Till in the St. Lawrence and Champlain Lowland is usually thicker and more continuous. It is also finer-grained and calcareous reflecting its sedimentary rock source. Soils developed in calcareous lowland tills include the Hogansburg, Malone, Neckrock, Runeberg, and Summerville series. The Bice, Conic, Irona, Peasleeville, Schroon, and Topknot series are generally less calcareous and are usually found in areas underlain by Potsdam Sandstone. The sandstone pavement of the “Flat Rocks” is characterized by the Ricker series. The Fernlake series, found in the southwestern corner of the county, consists of bedded diamictons that may represent water-laid till deposits (Dreimanis, 1976).

Ice-contact stratified drift deposits are characterized by a wide variability in sediment texture. Examples of ice-contact deposits in Clinton County include the Cadyville, Ellenburg and Covey Hill moraines (Denny, 1974) and the Ingraham Esker (Denny, 1972); (Diemer, 1988). Gravel pits in the Ellenburg Moraine south of Ellenburg Depot expose interbedded diamicton and stratified sand, gravel, silt and clay. These sediments were probably deposited, in part, as ice-contact subaqueous outwash fans in a proglacial lake impounded in the upper North Branch Chazy River valley (Franzi, Adams, and Pair, 1993). Moraine deposits similar to those of the Cadyville Moraine are exposed in a small gravel pit southeast of Jericho. The moraine deposits at this location consist primarily of massive to crudely bedded diamicton layers with only thin and discontinuous stratified interbeds. The Cadyville Moraine deposits probably represent a complex assortment of terrestrial ablation till and outwash deposits in upland areas, while interbedded sediment-flow diamictons, subaqueous outwash and lacustrine deposits reflect the areas where ice fronted proglacial lakes in the Saranac Valley.

The Ingraham Esker is a narrow, sinuous, 17 kilometer-long ridge of glaciofluvial sand and gravel that rises 3 to 10 meters above the Champlain Lowland between Beekmantown and Champlain (Denny, 1970); (Diemer, 1988). The esker sediment was deposited in a series of overlapping subsequent esker fans in Lake Vermont. The esker deposits are overlain by fine-grain lake-bottom deposits and fine to coarse, fossiliferous marine deposits.

Lacustrine and marine deposits vary greatly in texture and composition. Coarse-grained sand and gravel deposits are generally associated with high-energy littoral zone depositional environments such as proglacial lake deltas, ice-contact deltas, and beach deposits. Deltaic sandplains were deposited where rivers draining unglaciated uplands or meltwater streams from the waning ice sheet entered proglacial lakes. The large deltaic sandplains near Clintonville, Keeseville, and Morrisonville formed where the Ausable and Saranac rivers entered proglacial Lake Vermont or the Champlain Sea (Chapman, 1937); (Denny, 1974). Champlain and Plainfield series are typically associated with sandy deltaic deposits.

Beach deposits typically consist of cobbly to bouldery sediment deposited in low-relief, elongate ridges parallel to the shorelines of proglacial lakes. All of the beach ridges in Clinton County are found along the former shorelines of water bodies that occupied the Champlain and St. Lawrence lowlands (Woodworth, 1905b); (Denny, 1967); (Denny, 1970); (Denny, 1974). The Adams, Colosse, Coveytown, Croghan, Fahey, Trout River, and Waddington series are typically associated with the sandy to gravelly beach deposits.

Fine-grained lacustrine and marine sediment was deposited in low-energy environments. Deposits of interbedded fine sand, silt, and clay characterize lacustrine and marine-bottom sedimentation. Thick sequences of freshwater clay, commonly varved, and fossiliferous marine clay accumulated in bathymetric lows in the former Champlain Lowland water bodies. The Adjidaumo, Kingsbury, Muskellunge, and Swanton series are typically associated with lacustrine and marine clay deposits.

Drainage

Most of Clinton County lies within the northwestern Lake Champlain watershed which drains northward via the Richelieu River to the St. Lawrence River east of Montreal, P.Q. The principal drainage basins are the Great Chazy, Saranac, Little Chazy, Little Ausable, and Salmon. The Great Chazy, Little Chazy, Salmon, and Little Ausable Rivers originate in the low mountains within Clinton County and flow generally eastward to Lake Champlain. The Saranac River, which originates in the central Adirondack Upland near Saranac Lake, drains much of central Clinton County and empties into Lake Champlain at Plattsburgh.

The southernmost part of the county lies within the Ausable River drainage basin. The Ausable River originates in the High Peaks region (Isachsen, Landing, Lauber, Rickard, and Rogers, 1991) south of Lake Placid and Keene, and flows northward to Ausable Forks. From Ausable Forks to Keeseville, the river forms the southern boundary of the county. Its principal tributary in Clinton County is Black Brook, which flows southward from the upland near the Silver Lake Mountains.

The northwestern portion of the county is drained by the Chateaugay and English rivers. The Chateaugay River originates in the uplands around Upper Chateaugay Lake and flows northward to the St. Lawrence River. The English River originates in the lowland north of Ellenburg and flows eastward and then northward around Covey Hill, P.Q. to the St. Lawrence River.

Water Supply

This section was written with assistance from Dr. Richard Lamb, State University of New York (SUNY) Plattsburgh, and the Clinton County Planning Department.

Water is obtained from a variety of surface and underground sources including deep wells, lakes, reservoirs, and springs.

About 37 percent of the people in Clinton County are serviced from surface water. The City of Plattsburgh maintains Mead and Patterson reservoirs near West Plattsburgh. Some residents in the Towns of Champlain and Beekmantown rely on water from Lake Champlain. Chazy Lake provides water to about 1,600 people in the town and village of Dannemora.

Deep wells are used extensively by both municipalities and homeowners throughout the survey area. Approximately 14 percent of Clinton County's residents rely on public well water supplies. Cadyville, Champlain, Morrisonville, Redford, and Standish are examples of communities depending on deep water aquifers.

Most water sources in Clinton County have good quality and excellent quantity. Some supplies, particularly those of surface water, are threatened by potential pollution from residential development, industrial spills, or leachate from past use.

Soil Temperature Regimes

Temperature data from well water, air, and soil indicate three soil temperature zones within Clinton County. An approximate break between the mesic and frigid soil

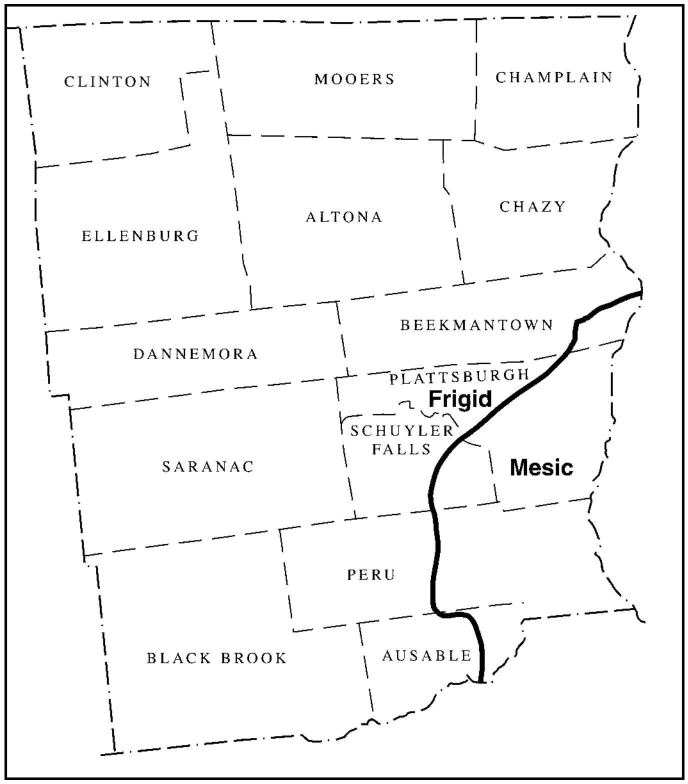

Figure 3.—Temperature data from well water, air, and soil indicate three soil temperature zones in Clinton County. An approximate break between the mesic and frigid soil temperature regimes is shown here. A colder regime (cryic) occurs on the high peaks in the southwestern part of the county; however, this regime is not shown on this map because of the map scale.

temperature regimes is shown in figure 3. A colder regime (cryic) occurs on mountains in the southwestern part of the county at elevations above 3,000 feet.

A soil with a frigid temperature regime is warmer in summer than a soil with a cryic regime, but its mean annual temperature is lower than 8 degrees C (47° F), and the difference between mean summer (June, July, and August) and mean winter (December, January, and February) soil temperatures is more than 6 degrees C (43° F) either at a depth of 50 cm (20 inches) from the soil surface, or at bedrock or a dense-layer contact, whichever is shallower. A soil with a mesic temperature regime has a mean annual soil temperature 8 degrees C or higher, but lower than 15 degrees C (59° F), and the difference between mean summer and mean winter soil temperatures is more than 6 degrees C at a depth of 50 cm from the soil surface.

The estimated break between mesic and frigid soil temperature regimes in Clinton County was based on three sources of data:

1. Soil temperature estimates from more than 27 well water temperature measurements (dug and drilled wells) during 1984 through 1986.
2. Soil temperature estimates based on average air temperature measurements plus 2 degrees F from 1951 through 1987: Chazy 46.09 degrees F; Dannemora 45.79; Plattsburgh 47.59; and Peru 46.70 degrees F.
3. Soil temperature measurements using resistance readings of thermocouples that were installed at 20 inches below the surface. Monthly readings were collected during 1986 through 1988 at 17 sites representing elevations from 110 to 2,040 feet above sea level.

As shown on the map, the mesic-frigid soil temperature break was established at 500 feet elevation in the south with Essex County, New York, and tapers in elevation toward the north to include Point Au Roche at Lake Champlain.

Climate

Ed Moldenke, Hydraulic Engineer, NRCS, helped to research data for this section.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Dannemora in the period 1961 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 19 degrees F and the average daily minimum temperature is 10 degrees. The lowest temperature on record, which occurred on January 1981, is -34 degrees. In summer, the average temperature is 66 degrees and the average daily maximum temperature is 77 degrees. The highest recorded temperature, which occurred on July 1978, is 98 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 35 inches. Of this, 20 inches, or 57 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 13 inches. The heaviest 1-day rainfall during the period of record was 3.0 inches on November 1989. Thunderstorms occur on about 10 days each year, and most occur in August. On average between May and August, there are about 30 days with daily precipitation of 0.1 inch or more.

The average seasonal snowfall is about 103 inches. The greatest snow depth at any one time during the period of record was 50 inches. On the average, 60 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a seasonal high water table within certain depths in most years, but they cannot predict that a seasonal high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Two areas in Clinton County were not mapped. One place is in the Town of Altona, at the site of the Ganienkeh Indian encampment. The other area roughly encompasses the old Macomb Reservation in the Town of Schuyler Falls. Soil Scientists were denied access to these land areas.

Survey Procedures

The general procedures followed in making this soil survey are described in the National Soils Handbook (USDA-Natural Resources Conservation Service, 1993) of the Natural Resources Conservation Service and the Soil Survey Manual (USDA-Soil Conservation Service, 1993). Soil scientists utilized existing soil information for conservation planning on individual farms prior to the start of the project, as well as preliminary notes from the 1973 General Soils Report (USDA-Soil Conservation Service, 1973). Geologic references were also used including “Pleistocene Geology of the Northeast Adirondack Region, New York” (Denny, 1974).

Before field work began, preliminary boundaries of slopes and landforms were plotted stereoscopically on aerial photographs taken in 1978. Two map scales were used for the survey. The northeastern part of Clinton County has aerial coverage at a scale of 1:15,840. All other areas of the county were mapped on aerial photos with a scale of 1:24,000, subsequent to the decision to publish at the latter scale. Color infrared aerial photographs were employed about 1989 by soil scientists taken from flights in 1985 and 1986. Soil scientists also studied U.S. Geological Survey topographic maps, at a scale of 1:24,000, to relate landform, slope, and image features to the area of survey. Commonly, a reconnaissance was made by vehicle to examine road cuts and surface features before the landscape was traversed on foot.

Sample areas were selected to represent the major landscapes in Clinton County. These areas were investigated to determine soil-landform relationships, diversity of soil types within landforms, and other data related to land use interpretations. Field notes and profile descriptions were taken to document soil series and map units. As mapping progressed, these preliminary notes were used to define map unit composition. In areas of the Coveytown-Fahey-Malone association and other areas of complex soil patterns, traverses were about 100 yards apart. On the other hand, traverses were about 1/8 mile apart in areas of the Becket-Tunbridge association where soil patterns are more predictable or relatively simple.

As the traverses were made, soil scientists divided the landscape into landforms or landform segments based on use and management of the soils. For example, a hill would be separated from a depression, and a gently sloping summit from a very steep back slope of a ridge. In most areas, soil examinations along the traverses were made 100 to 800 yards apart, depending on the landscape and soil pattern.

Observations of such items as landform, blown-down trees, vegetation, roadcuts, animal burrows, stoniness, and bedrock outcrops were made without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. Soil material was examined with the aid of a hand auger and a spade to a depth of 4 to 6 feet, or to bedrock within a depth of 6 feet. The pedons described as typical were observed and studied in pits that were dug with shovels or backhoes.

Samples for chemical and physical analyses and for analyses of engineering properties were taken from representative sites of several of the soils in the survey area. Most of this sampling occurred between 1982 and 1985. The chemical and physical analyses were made by the Soil Characterization Laboratory, Department of Soil, Crop, and Atmospheric Sciences at Cornell University, Ithaca, New York and by the National Soil Survey Laboratory, Natural Resources Conservation Service, Lincoln, Nebraska. The results of the analyses are stored in computerized data files at the respective laboratories. The analyses for engineering properties were made by the New York State Department of Transportation, Soil Mechanics Bureau. A description of the laboratory procedures can be obtained on request from the respective laboratories. The results of the studies can be obtained from Cornell University, the New York State Department of Transportation, and the state office of the Natural Resources Conservation Service.

General Soil Map Units

The general soil map units in Clinton County are described on the following pages. The texture in the descriptive heading of each general soil map unit refers to the mineral surface layer of the major soils in that map unit. The drainage class also refers only to the major soils. Some map units include soils that are less sloping or more sloping than the legend indicates. The slope range for the map unit is given in the text.

A general soil map was published in 1958 for the northern part of Franklin County. In some areas the names of adjoining map units are not exactly the same because the proportions of major soils differ from one survey area to another. Also, the concepts and names of some soil series have changed as a result of changes in the taxonomic system made since publication of the earlier survey. The matching of adjoining units is not exact because of differences in the scale of maps in the two survey areas.

Areas Dominated by Soils Formed in Glacial Outwash and Glacial Lake Shoreline Deposits

The four general soil map units in this group make up about 22 percent of the acreage in the county. The soils in this group formed in outwash material deposited by glacial meltwater and in sands and other water-worked deposits of glacial and post-glacial water bodies. Outwash deposits are mostly sandy or gravelly soils within major river valleys. Water-worked deposits are mainly on ridges and in swales at elevations of 100 to 700 feet above sea level. The dominant land use is woodland. These units contain most of the sand and gravel mining areas in the county.

1. Champlain-Adams-Croghan

Dominantly nearly level to very steep, very deep, somewhat excessively drained to moderately well drained, coarse textured soils formed in deltaic and glacial meltwater deposits

This unit consists of soils that formed in glacial outwash deposits associated with glacial lakes. It is generally on long, triangular plains that roughly parallel the major streams in Clinton County. Slope is generally 0 to 8 percent, except along streams where it is typically 35 to 70 percent.

This unit makes up about 5 percent of the county. The unit is about 34 percent Champlain soils, 18 percent Adams soils, 10 percent Croghan soils and 38 percent minor soils (fig. 4).

The Champlain soils are somewhat excessively sandy soils. Permeability is rapid throughout. The seasonal high water table is greater than 72 inches deep.

The Adams soils are somewhat excessively drained sandy soils. Permeability is rapid in the mineral surface and subsoil, and very rapid in the substratum. The seasonal high water table is greater than 72 inches deep.

The Croghan soils are moderately well drained sandy soils. Permeability is rapid in the mineral surface and very rapid in the subsoil and substratum. The seasonal high water table is 18 to 24 inches deep at some time between November and May.

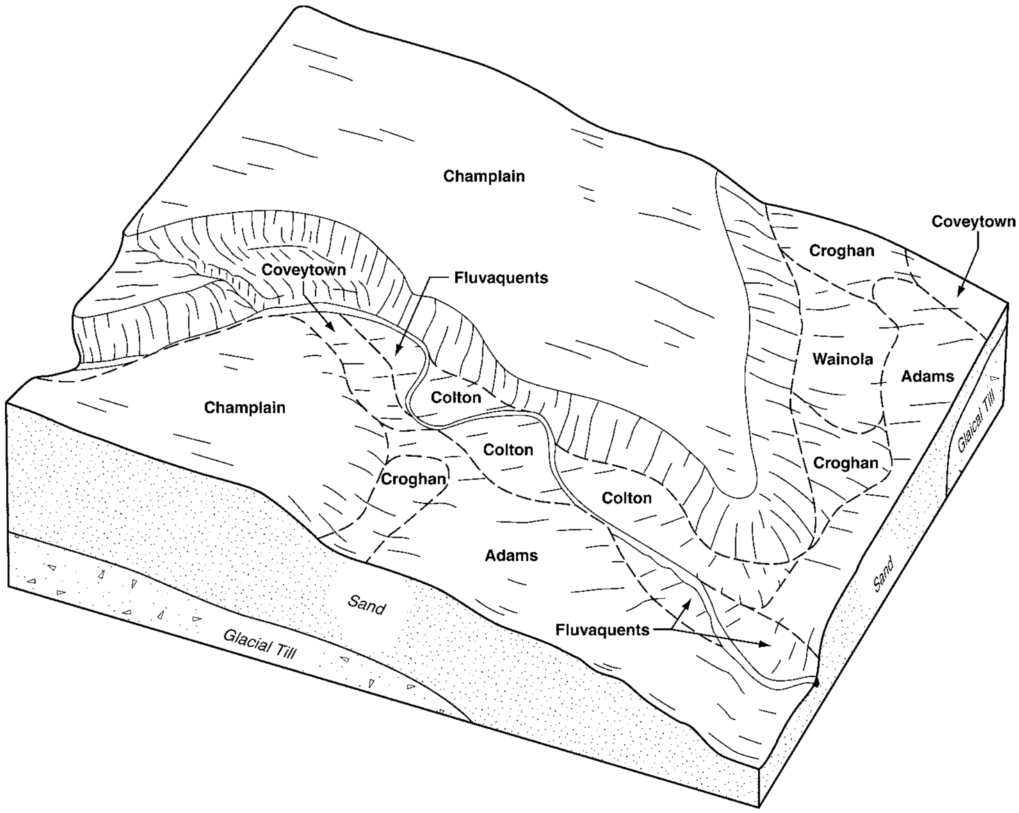

Figure 4.—Typical pattern of deltaic sands and associated soils in the Champlain - Adams - Croghan general soil map unit.

Of minor extent are the Covert, Deerfield, Wainola, Junius, Occur, Coveytown, Colton and Udifluvents soils. The moderately well drained Covert and Deerfield soils and the somewhat poorly drained Wainola and Junius soils have mottles in the subsoil, and occur along the fringe of this unit and in drainageways. Moderately well drained Occur soils and somewhat poorly drained Coveytown soils have loamy substrata and are typically near glacial till deposits. Excessively drained Colton soils are very gravelly and occur along streams. Also near streams are areas of Udifluvents which are subject to flooding.

Most areas of this unit are wooded or residential. These soils are easy to cultivate, but productivity is limited by droughtiness. Irrigation can improve productivity on nearly level and gently sloping parts of this unit. The hazard of erosion increases as the percent of slope increases. Conservation tillage, crop residue management and crop rotation are good management practices.

The less sloping areas of Champlain and Adams soils are favorable for dwellings with basements. Ground water pollution from septic tank absorption fields may be a hazard because of rapid permeability. Deep excavations are subject to caving in if not mechanically supported.

Woodland productivity is generally moderate to high. Seedling mortality, however, can be high because of droughtiness in soils with low available water capacity.

2. Colton-Adams

Nearly level to steep, very deep, excessively and somewhat excessively drained, coarse textured soils formed in glacial outwash deposits and stream terraces

This unit consists of soils that formed along valley streams and outwash plains. Slopes range from 0 to 35 percent.

This unit makes up about 5 percent of the county. It is about 35 percent Colton soils, 30 percent Adams soils, and 35 percent minor soils.

Colton soils are excessively drained, gravelly and sandy soil. Permeability is rapid in the mineral surface and subsoil, and very rapid in the substratum. The seasonal high water table is greater than 72 inches deep.

The Adams soils are somewhat excessively drained, sandy soils. Permeability is rapid in the mineral surface and subsoil, and very rapid in the substratum. The seasonal high water table is greater than 72 inches deep.

Of minor extent are the Occur, Hermon, Fernlake, Monadnock, Fluvaquents and Udifluvents soils. Moderately well drained Occur soils are on nearly level and gently sloping areas having loamy substrata within 40 inches of the surface. Hermon, Fernlake, and Monadnock soils are on similar landscapes, but have substrata with silt coating the gravel and lack stratification. Monadnock soils also have loamy subsoil. Fluvaquents and Udifluvents are soil types occupying flood prone areas near large streams.

Most areas of this unit are wooded. Crop yield is limited by droughtiness and stoniness. The hazard of erosion increases as percent of slope increases.

The less sloping areas of this unit are favorable for dwellings with basements. Ground water pollution from septic tank absorption fields may be a hazard because of rapid or very rapid permeability. Deep excavations are subject to caving in if not mechanically supported.

Woodland productivity is generally moderate to high. However, seedling mortality can be significant because of droughtiness.

3. Colosse-Trout River

Gently sloping to moderately steep, very deep, excessively drained, coarse textured soils formed in glacial lake beach ridge and outwash deposits

This unit consists of soils that formed in sand and gravel deposits and water-worked, glacial till on low, undulating beach ridges that extend roughly in a north-south direction. The soils occur most commonly at elevations of 350 to 700 feet above sea level, but some are at elevations up to 1,000 feet. Slope is dominantly 3 to 15 percent, but ranges from 3 to 25 percent.

This unit makes up about 2 percent of the county. The unit is about 40 percent Colosse soils, 35 percent Trout River soils and about 25 percent minor soils (fig. 5).

Colosse soils are excessively drained, loamy over sandy soils with a high content of gravel and cobbles. Permeability is moderately rapid in the mineral surface and subsoil, and rapid in the substratum.

Trout River soils are excessively drained, sandy soils with a high content of gravel and cobbles. Permeability is rapid throughout. The seasonal high water table is greater than 72 inches deep.

Of minor extent are the Hermon, Adams, Coveytown, Cook, Fahey, Irona, and Conic soils. Hermon soils are included in areas of glacial till with substrata having silt coatings on gravel. The excessively drained Adams soils, somewhat poorly drained Coveytown soils, and very poorly drained Cook soils have less gravel and cobbles. Moderately well drained Fahey soils are in slightly concave areas of the unit. Irona soils are shallow to bedrock. Conic soils are moderately deep to bedrock.

Most areas of this unit are wooded; however, areas that have been cleared of stones are being used for hay or corn. Although this unit is gravelly, coarse textured and droughty, the Colosse part of this unit can be productive for hay and crops having a more moderate water holding capacity. Conservation tillage, crop residue management, and rotational grazing are good management practices.

This unit commonly has cobblestones and large stones that moderately limit its use for community development. Ground water pollution from septic tank absorption fields

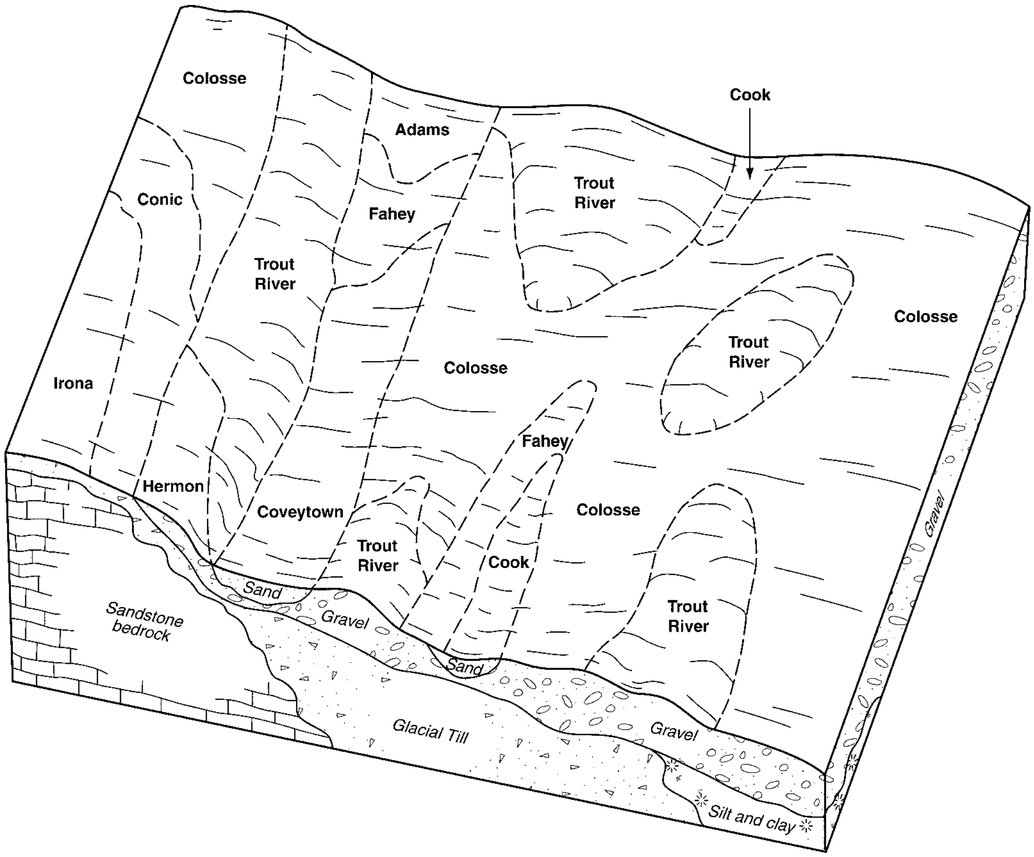

Figure 5. The Colosse-Trout River general soil map unit consists mostly of gravelly, undulating beach ridges that are oriented north-south along former shorelines of Glacial Lake Vermont.

may be a hazard because of the rapid permeability of the soil. Deep excavations are subject to caving in if the soil is not mechanically supported.

Woodland productivity is typically high with no major management problems associated with this unit. Seedling mortality can be high in parts of this unit because of droughtiness.

4. Coveytown-Fahey-Malone

Nearly level and gently sloping, very deep, moderately well drained and somewhat poorly drained, coarse textured soil overlying medium textured or moderately coarse textured deposits, on outwash plains or water-worked glacial till, and also somewhat poorly drained, moderately coarse or medium textured soils on lowland glacial till plains

This unit consists of soils formed in outwash sand and gravel and water-worked glacial till. It mainly occurs at elevations between 300 to 500 feet above sea level. Slopes range generally from 0 to 8 percent.

This unit makes up about 10 percent of the county. The unit is about 25 percent Coveytown soils, 10 percent Fahey soils, 10 percent Malone soils, and 55 percent minor soils.

The Coveytown soils are somewhat poorly drained, sandy over loamy soils. Permeability is moderately rapid or rapid in the mineral surface and subsoil, and moderately slow or moderate in the substratum. The seasonal high water table is 12 to 18 inches below the surface at some time between November and May.

Fahey soils are moderately well drained, gravelly and sandy soils, commonly having a loamy layer between 40 to 60 inches deep. Permeability is rapid in the mineral surface, subsoil and upper substratum; but moderate or moderately slow in the underlying glacial till. The seasonal high water table is 18 to 24 inches below the surface at some time between March and May.

Malone soils are somewhat poorly drained, loamy soils. Permeability is moderate in the mineral surface, and moderately slow or slow in the subsoil and substratum. The seasonal high water table is 12 to 18 inches below the surface at some time between November and May.

Of minor extent are the Trout River, Croghan, Wainola, Runeberg, Cook, Hailesboro, Pinconning, and Wonsqueak soils. Somewhat excessively drained Trout River soils generally occur on long, narrow convex landforms. The moderately well drained Croghan soils and somewhat poorly drained Wainola soils are in areas of deep sand deposits. Very poorly drained Runeberg and Cook soils are gray or dark brown in the upper subsoil, and occur in basin-like areas and along streams. The somewhat poorly drained Hailesboro soils are dominantly silt and clay. Poorly drained and very poorly drained Pinconning soils are sandy soils underlain by clayey material. Very poorly drained Wonsqueak soils have a thick organic surface layer.

Most areas of this unit are used as woodland or pasture (fig. 6). The seasonal high water table can have an adverse affect on planting and harvesting schedules in many

Figure 6.—A band of coniferous trees (mainly white and red pine) outline an area of Plainfield and Champlain soils in this landscape. These soils occur on a sandy outwash area adjacent to the Little Ausable River. Soils associated with the Coveytown-Fahey-Malone general map unit occupy the foreground and lower sideslopes in the background. Lyman-Tunbridge-Ricker association dominate the far ridgetops.

areas of this unit. Large surface stones are also a common problem for farming. Maintaining drainage systems, stone clearing, crop residue management, and rotational grazing are good management practices.

The main limitation for community development is the seasonal high water table. Rapid permeability in the Fahey soils, and the moderately slow or slow permeability in the substratum of Coveytown and Malone soils are limitations if this unit is used for septic tank absorption fields.

Woodland productivity is limited by the seasonal high water table. Heavy equipment use during wet periods is a moderate management concern and windthrow is a hazard.

Areas Dominated by Soils Formed by Lacustrine and Marine Sediments

One general soil map unit is in this category and makes up about 5 percent of the acreage in the county. The soils in this category formed in material deposited in deep areas of glacial lake or marine environments. They are mostly silts and clays on nearly level and gently sloping areas adjacent to Lake Champlain. The dominant land use is crops and hay.

5. Muskellunge-Adjidaumo-Swanton

Nearly level and gently sloping, very deep, somewhat poorly drained to very poorly drained, fine textured and moderately fine textured soils formed on glacial lake plains

This unit consists of soils formed in glacial lacustrine and marine deposits. It is on broad plains within a few miles of the Lake Champlain shoreline. Slope is generally 0 to 3 percent, but ranges up to 8 percent.

This unit makes up about 5 percent of the county. It is about 30 percent Muskellunge soils, 20 percent Adjidaumo soils, 10 percent Swanton soils, and 40 percent minor soils.

The Muskellunge soils are somewhat poorly drained soils formed in clay and silt sediments. Permeability is moderately slow in the mineral surface, and slow in the subsoil and substratum. The seasonal high water table is 12 to 18 inches below the surface at some time between November and May.

The Adjidaumo soils are poorly drained and very poorly drained soils formed in clay and silt sediments. Permeability is moderately slow in the mineral surface, slow in the subsoil, and slow or very slow in the substratum. The seasonal high water table is at the surface to a depth of 6 inches at some time between November and June.

The Swanton soils are somewhat poorly drained soils formed in a loamy mantle over clay and silt sediments. Permeability is moderately rapid in the mineral surface and subsoil, and slow or very slow in the substratum. The seasonal high water table is 12 to 18 inches deep at some time between November and May.

Of minor extent are the Hailesboro, Roundabout, Heuvelton, Kingsbury, Cornish, Hogansburg, Malone, and Neckrock soils. The somewhat poorly drained Hailesboro and Roundabout soils are on similar landscapes, but have less clay in the subsoil and substratum. The moderately well drained Heuvelton soils are on slightly higher, more convex landscape positions. Somewhat poorly drained Kingsbury soils have a higher clay content and a slightly warmer soil temperature. Lovewell and Cornish soils are on floodplains of large streams and rivers. Hogansburg and Malone soils are on slightly convex slopes and have more rock fragments. Neckrock soils are moderately deep to bedrock and are well drained.

Most areas of this unit are in corn, hay and pasture. The seasonal high water table is the main limitation if this map unit is used for growing crops (fig. 7). Water covers the surface of Adjidaumo soils for short periods of time in the spring and after heavy rain. Farm machinery also is easily bogged down when the soils are wet, and during

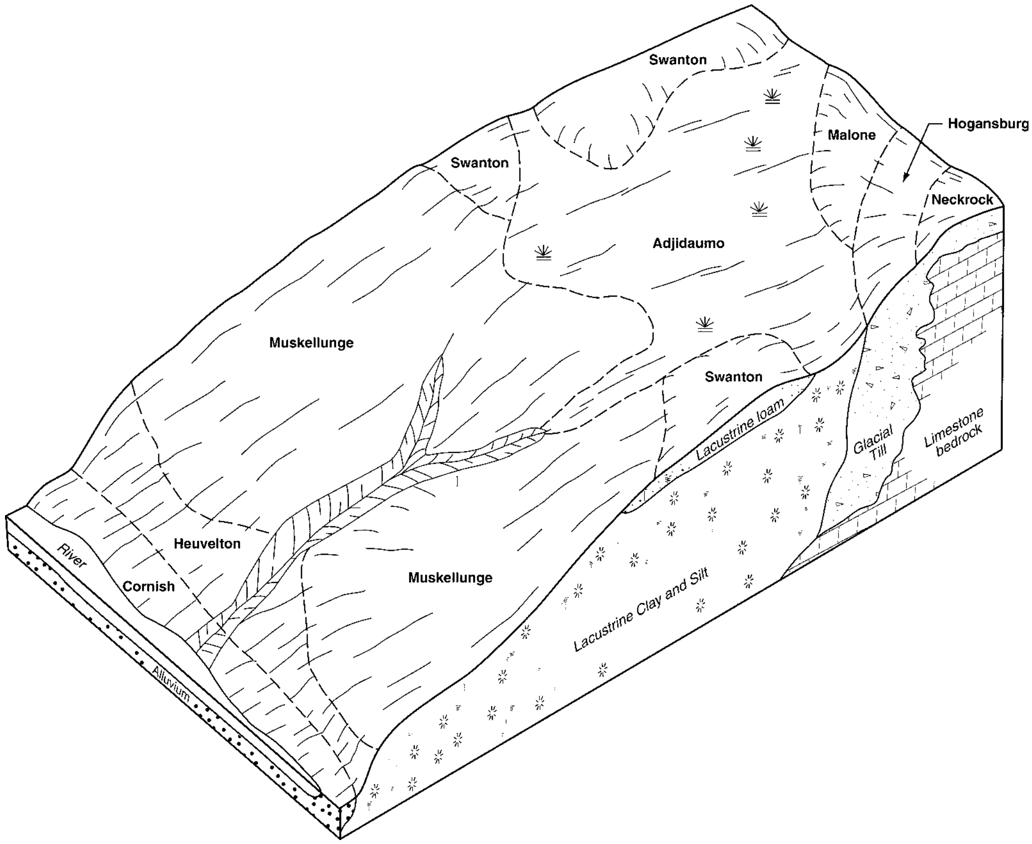

Figure 7.—Muskellunge-Adjidaumo-Swanton are used for growing corn, hay, and pasture. Because of a seasonal high water table, surface and subsurface drainage is commonly used to improve growing conditions for crops.

some years it is difficult to harvest crops. Maintaining drainage systems in cultivated fields, crop residue management, and rotational grazing are good management practices.

The main limitations for community development are the seasonal high water table and slow permeability. Frost action is also a limitation for local roads and streets.

Woodland productivity is particularly limited by the seasonal high water table in Adjidaumo soils. Heavy equipment may become stuck in the wetter part of this unit except during frozen or droughty periods.

Areas Dominated by Soils Formed in Non-Acid Glacial Till Deposits

The two general soil map units in this group make up about 11 percent of the acreage in the county. The soils in this group formed in shallow to very deep, loamy glacial till deposits derived from limestone, dolomitic limestone or calcareous shale. The dominant land uses are for hay and corn on deeper soils, and woodland on the shallow to bedrock areas.

6. Malone-Hogansburg-Runeberg

Nearly level to gently sloping, very deep, moderately well to very poorly drained, medium textured and moderately coarse textured soils formed in lowland glacial till

This unit consists of soils formed in loamy glacial till with a dense substratum. It is on smooth plains with small elongated ridges and knolls, and narrow depressions. Slopes range generally from 0 to 8 percent.

This unit makes up about 10 percent of the county. The unit is about 20 percent Malone soils, 18 percent Hogansburg soils, 7 percent Runeberg soils and 55 percent minor soils.

The Malone soils are somewhat poorly drained, loamy soils. Permeability is moderate in the mineral surface, and moderately slow or slow in the subsoil and substratum. The seasonal high water table is 12 to 18 inches below the surface at some time between November and May.

The Hogansburg soils are moderately well drained, loamy soils. Permeability is moderate in the mineral surface, subsoil and upper substratum, and moderately slow in the lower substratum. The seasonal high water table is 18 to 24 inches below the surface at some time between March and May.

The Runeberg soils are poorly drained and very poorly drained, loamy soils. Permeability is moderate in the mineral surface, moderately slow in the subsoil, and slow or moderately slow in the substratum. The seasonal high water table is at the surface to 12 inches below the surface at some time between November and July.

Of minor extent are the Coveytown, Northway, Cook, Bombay, Appleton, Massena, Muskellunge, and Neckrock soils. The Coveytown, Northway, and Cook soils have sandy mineral surface and subsoil layers overlying loamy substrata. Bombay and Appleton soils occur in areas having slightly more clay in the subsoil and generally less dense substrata. Massena soils occur on similar landscapes with a slightly warmer soil temperature. Muskellunge soils are on nearly level areas having a high clay content. Neckrock soils are on knolls where bedrock is 20 to 40 inches deep.

Most areas of this unit are used for hay, corn, or pasture. Significant acreage is also devoted to apple orchards. Although most areas of this unit are easy to work, planting and harvesting operations can be delayed by soil wetness. Erosion can be a management problem on strongly sloping areas. Conservation tillage, crop residue management, and rotational grazing are good management practices.

The main limitation if this map unit is used for community development is the seasonal high water table. The moderately slow or slow permeability in the substrata of these soils may severely limit conventional septic tank absorption fields.

Woodland productivity is also limited by the seasonal high water table in the Malone and Runeberg parts of this unit. Heavy equipment use during wet periods is a moderate management concern and windthrow is a hazard.

7. Neckrock-Summerville

Nearly level to steep, moderately deep and shallow, well drained, medium textured and moderately coarse textured soils formed in glacial till over limestone, dolomitic limestone or calcareous shale

This unit consists of soils formed in bedrock controlled glacial till. It is on linear and rolling slopes underlain by massive limestone or calcareous shale. Slopes range mainly from 3 to 15 percent.

This unit makes up about 1 percent of the county. The unit is about 30 percent Neckrock soils, 25 percent Summerville soils, and 45 percent minor soils.

The Neckrock soils are well drained, loamy soils. The depth to bedrock is 20 to 40 inches. Permeability is moderate in the mineral surface and upper subsoil, and moderate or moderately slow in the lower subsoil and substratum. The seasonal high water table is greater than 72 inches deep.

The Summerville soils are well drained, loamy soils. The depth to bedrock is 10 to 20 inches. Permeability is moderate throughout. The seasonal high water table is greater than 72 inches deep.

Of minor extent are the Ogdensburg, Hailesboro, Hogansburg, Malone, Runeberg, and Benson soils. The Ogdensburg soils are somewhat poorly drained with mottles and gray colors in the lower subsoil. The Hailesboro soils are very deep, somewhat poorly drained soils consisting of mainly silt and clay. Hogansburg, Malone, and Runeberg soils are very deep to bedrock. Benson soils have more rock fragments throughout its profile.

Most areas of this unit are used as woodland or pasture. Some areas are being used for hay. Shallow depth to bedrock and rock outcrops make management more difficult with excessive wear on machinery. Erosion can also be a management problem on strongly sloping areas. Conservation tillage, crop residue management and rotational grazing are good management practices.

The main limitation if this unit is used for community development is the depth to bedrock. Grading and smoothing operations may require additional fill material around structures. There is a risk of ground water pollution from seepage of effluent over bedrock with use of conventional septic systems on this unit.

Woodland productivity is moderately limited by depth to bedrock. Droughtiness and restricted root growth in areas of Summerville soils may cause seedling mortality during dry summers. Windthrow can be another management problem in some areas of this unit.

Areas Dominated by Soils Formed in Moderately Acid and Strongly Acid Glacial Till Deposits

The seven general soil map units in this group make up about 62 percent of the acreage in the county. The soils in this group formed in very shallow to very deep, loamy glacial till deposits derived mainly from sandstone and granite. The dominant land uses are woodland, particularly on shallow to bedrock soils, and hay and pasture on deeper soils in the Champlain Valley.

8. Irona-Conic-Topknot

Nearly level to strongly sloping, shallow and moderately deep, well drained to somewhat poorly drained, moderately coarse textured soils formed in glacial till over sandstone bedrock

This unit consists of soils formed in bedrock controlled glacial till. It is on benches and smooth plains underlain by massive sandstone bedrock. Slopes range from 0 to 15 percent.

This unit makes up about 4 percent of the county. The unit is about 25 percent Irona soils, 20 percent Conic soils, 15 percent Topknot soils, and 40 percent minor soils.

The Irona soils are well drained, loamy soils. Depth to bedrock is 10 to 20 inches. Permeability is moderate throughout. The seasonal high water table is greater than 72 inches deep.

The Conic soils are well drained, loamy soils. Depth to bedrock is 20 to 40 inches. Permeability is moderate in the mineral surface and subsoil, and slow in the substratum.

The Topknot soils are somewhat poorly drained, loamy soils. Depth to bedrock is 10 to 20 inches. Permeability is moderate throughout. The seasonal high water table is 12 to 18 inches below the surface at some time between November and May.

Of minor extent are the Chazy, Schroon, Kalurah, Peasleeville, Sabattis and Runeberg soils. Chazy soils are similar to Topknot soils, but are moderately deep to bedrock. Schroon, Kalurah, Peasleeville, Sabattis, and Runeberg soils are very deep to bedrock. Sabattis and Runeberg soils are also poorly drained and very poorly drained.

Most areas of this unit are used for woodland or pasture. Some areas are being used for hay. Depth to bedrock and seasonal high water table are the main limitations to farm management. Shallow depth to bedrock makes soil management more difficult with excessive wear on machinery. Erosion can also be a management problem on strongly sloping areas. The seasonal high water table in areas of Topknot soils may delay planting in the spring. Conservation tillage, crop residue management and rotational grazing are good management practices.

The main limitations if this map unit is used for community development are depth to bedrock and the seasonal high water table in Topknot soils. Grading and smoothing operations may require additional fill material around structures. There is a risk of ground water pollution from seepage of effluent over bedrock when conventional septic systems are installed on this unit.

Woodland productivity is limited by depth to bedrock and the seasonal high water table in Topknot soils. Droughtiness and restricted root growth in areas of Irona and Topknot soils may cause higher seedling mortality during dry periods. Windthrow can be another management problem in some areas of this unit.

9. Lyman-Tunbridge-Ricker

Gently sloping to very steep, very shallow to moderately deep, well drained and somewhat excessively drained, moderately coarse textured soils, formed in glacial till over crystalline bedrock with varying thickness of organic surficial deposits

This unit consists of soils formed in bedrock-controlled glacial till in the Adirondack Mountain region (fig. 8). It is on oval and dome-shaped hills controlled by crystalline bedrock. Slopes range from 3 to 70 percent.

Figure 8.—Fern Lake is nestled in between the bedrock-controlled ridges of Lyman-Tunbridge-Ricker association and the areas of sandy glacial till to the lower left. The Fernlake and Colton soils dominate the valley and foothills between ridges near the hamlet of Black Brook. In the center of the background are the Silver Lake Mountains and the Alder Brook Mountains are to the far left.

This unit makes up about 5 percent of the county. The unit is about 20 percent Lyman soils, 20 percent Tunbridge soils, 10 percent Ricker soils, and 50 percent minor soils.

The Lyman soils are somewhat excessively drained, loamy soils. Depth to bedrock is 10 to 20 inches. Permeability is moderately rapid throughout. The seasonal high water table is greater than 72 inches deep.

The Tunbridge soils are well drained, loamy soils. Depth to bedrock is 20 to 40 inches. Permeability is moderate or moderately rapid throughout. The seasonal high water table is greater than 72 inches deep.

The Ricker soils are well drained, dominantly organic material with a thin loamy mineral layer overlying bedrock. The depth to bedrock is 2 to 26 inches. Permeability is moderately slow to moderately rapid in the surface layer, moderately rapid in the subsurface organic material, and moderate or moderately rapid in the mineral subsurface layer.

Of minor extent are the Hogback, Rawsonville, Glebe, Skylight, Monadnock, Mundalite, and Becket soils. Hogback and Rawsonville soils have a subsoil with enriched organic matter or iron compounds (spodic horizon) that is thicker than Lyman or Tunbridge soils. Glebe and Skylight soils are in a colder soil temperature area. Monadnock, Mundalite, and Becket soils are very deep to bedrock.

Most areas of this unit are in woodland. The shallow depth to bedrock makes farm management more difficult with excessive wear on machinery in most areas of this unit. Erosion can also be a management problem on strongly sloping areas. Conservation tillage, crop residue management, and rotational grazing are good management practices.

The main limitations if this map unit is used for community development are depth to bedrock and slope. Grading and smoothing may require additional fill material around structures. There is a risk of ground water pollution from seepage of effluent over bedrock when conventional septic systems are installed on this unit.

Woodland productivity is limited by depth to bedrock. Droughtiness and restricted root growth in areas of Lyman soils may cause higher seedling mortality during dry periods. Windthrow can be another management problem in some areas of this unit.

10. Rockoutcrop-Ricker

Nearly level and gently sloping, well drained areas of sandstone bedrock exposures and very shallow to moderately deep organic soils

This unit consists of soils formed in areas referred to as “Flat Rock” in Clinton County. It is on bedrock benches and ridges. Slopes range from 0 to 8 percent.

This unit makes up about 1 percent of the county. The unit is about 45 percent bedrock outcrops, 35 percent Ricker soils, and 20 percent minor soils.

The Ricker soils are well drained organic soils with a thin mineral layer between the organic deposits and bedrock. Depth to bedrock ranges from 2 to 26 inches. Permeability is moderately rapid in the organic material, and moderate or moderately rapid in the mineral layer.

Of minor extent are the Churubusco, Topknot, Irona, and Colosse soils. Churubusco soils are very poorly drained organic soils in basin-like areas. Topknot and Irona soils are shallow, mineral soils. Colosse soils are very deep, gravelly soils that typically occur on linear ridges.

Most areas of this soil are in native, jack pine vegetation or other woodland species. This unit is not suited to farming because of common bedrock exposures and shallow soil as well as droughtiness.

The main limitation if this unit is used for community development is depth to bedrock. Fill material for landscaping around structures would have to be transported into most areas of this unit. Ground water contamination from conventional septic tank absorption fields can be a serious problem in most areas of this unit because of very thin soil conditions.

Woodland productivity is seriously limited because of restricted rooting depth in most areas of this unit. Windthrow, droughtiness, and seedling mortality can be primary management problems.

11. Schroon-Peasleeville

Nearly level to strongly sloping, very deep, moderately well drained and somewhat poorly drained, medium textured and moderately coarse textured soils formed in glacial till

This unit consists of very deep soils formed in mainly friable glacial till. It is on smooth and undulating till plains. Slopes range from 0 to 15 percent.

This unit makes up about 16 percent of the county. The unit is about 38 percent Schroon soils, 22 percent Peasleeville soils, and 40 percent minor soils.

The Schroon soils are moderately well drained, loamy soils. Permeability is moderate throughout. The seasonal high water table is 18 to 24 inches deep at some time between November and April.

The Peasleeville soils are somewhat poorly drained, loamy soils. Permeability is moderate throughout. The seasonal high water table is 12 to 18 inches deep at some time between November and May.

Of minor extent are the Bice, Lyonmounten, Runeberg, Sabattis, Wonsqueak and Chazy soils. The Bice soils are on more convex slopes and generally lack the mottles within a 24 inch depth that commonly occur in the Schroon soil profile. Lyonmounten and Runeberg soils are poorly drained and very poorly drained basin-like areas with a dominantly dark brown or gray profile. Sabattis and Wonsqueak soils also occur in low areas of the unit and have an organic surface layer. Chazy soils are moderately deep to bedrock.

Most non-stony areas of this unit are used for hay, corn or pasture. Stony areas are mainly wooded. Although most areas of this unit are easy to cultivate, planting and harvesting operations can be delayed by soil wetness in the Peasleeville soils and areas of the minor poorly drained soils. Erosion can be a management problem on strongly sloping areas. Maintaining drainage systems, conservation tillage, crop residue management, and rotational grazing are good management practices.

The main limitation if this unit is used for community development is the seasonal high water table. Conventional septic systems may not function properly in Peasleeville soils particularly after periods of heavy rainfall or snowmelt.

Woodland productivity is limited by the seasonal high water table in the Peasleeville part of this unit. Limited heavy equipment use during wet periods is a moderate management concern. Windthrow is a hazard.

12. Monadnock-Sunapee

Gently sloping to very steep, very deep, well drained and moderately well drained, moderately coarse textured soils formed in glacial till

This unit consists of very deep soils formed in mainly friable glacial till. It is on undulating upland plains and smooth, slightly convex hillsides. Slopes range from 3 to 60 percent.

This unit makes up about 14 percent of the county. The unit is about 35 percent Monadnock soils, 30 percent Sunapee soils and 35 percent minor soils.

The Monadnock soils are well drained, loamy soils having sandy substrata. Permeability is moderate in the mineral surface and subsoil, and moderately rapid in the substratum. The seasonal high water table is greater than 72 inches deep.

The Sunapee soils are moderately well drained, loamy soils. Permeability is moderate in the mineral surface and subsoil, and moderate or moderately rapid in the substratum. The seasonal high water table is 18 to 36 inches deep at some time between November and May.

Of minor extent are the Fernlake, Becket, Skerry, Adirondack, Sabattis, and Tunbridge soils. Fernlake soils are on similar landscape and have a higher sand content in the subsoil. Becket, Skerry, and Adirondack soils have a dense substratum. Sabattis soils are in basin-like areas and have gray or dark brown profiles. Tunbridge soils are moderately deep to bedrock.

Most areas are stony and wooded. Non-stony areas of this unit are used for hay, corn or pasture. Although non-stony areas are easy to cultivate, planting and harvesting operations may be delayed because of soil wetness in areas of the somewhat poorly drained to very poorly drained minor soils. Erosion can be a management problem on strongly sloping areas. Conservation tillage, crop residue management, and rotational grazing are good management practices.

The main limitation if this unit is used for community development is the seasonal high water table in the Sunapee soils. Monadnock soils are better-suited for these uses. Conventional systems may not function properly during the wetter periods of the year.

Woodland productivity is only limited by the percent of slope. Very steep slopes seriously limit the maneuverability of equipment.

13. Skerry-Becket-Adirondack

Gently sloping to steep, very deep, well to somewhat poorly drained, moderately coarse textured soils formed in glacial till

This unit consists of soils formed in glacial till with dense substrata. It is usually on smooth to slightly rolling or hilly sideslopes and toeslopes. Slopes range from 3 to 35 percent.

This unit makes up about 14 percent of the county. The unit is about 30 percent Skerry soils, 20 percent Becket soils, 20 percent Adirondack soils, and 30 percent minor soils.

The Skerry soils are moderately well drained, loamy till. Permeability is moderate in the mineral surface and subsoil, and moderately slow or slow in the substratum. The seasonal high water table is 18 to 30 inches deep at some time between November and May.

The Becket soils are well drained loamy soils. Permeability is moderate in the mineral surface and subsoil, and moderately slow or slow in the substratum. The seasonal high water table is 24 to 42 inches below the surface at some time during March and April.

The Adirondack soils are somewhat poorly drained loamy soils. Permeability is moderate in the mineral surface and subsoil, and slow in the substratum. The seasonal high water table is 12 to 18 inches deep at some time between September and May.

Of minor extent are the Sunapee, Hermon, Colton, Sabattis, Beseman, and Lyman soils. Sunapee soils do not have a dense substratum. Hermon and Colton soils are very gravelly and sandy soils. Sabattis and Beseman soils are in basin-like areas with a relatively thick organic surface. Lyman soils are shallow to bedrock.

Most areas of this unit are in woodland. The seasonal high water table in the Skerry and Adirondack soils may delay planting or other farm operations in the spring. Erosion can be a management problem on strongly sloping areas. Conservation tillage, crop residue management, and rotational grazing are good management practices.

The main limitation for community development is the seasonal high water table in the Skerry and Adirondack soils. Conventional septic system will likely perform poorly on most areas of this unit because of soil wetness and slow percolation.

Woodland productivity is limited by the seasonal high water table and dense substratum in the Skerry and Adirondack soils. Depth of root growth may be restricted by these limitations and therefore increase windthrow potential.

14. Becket-Tunbridge

Gently sloping to steep, very deep to moderately deep, well drained, moderately coarse textured soils formed in glacial till.

This unit consists of soils formed in glacial till moderately deep to a dense substratum, or to crystalline bedrock. It is associated with ridges and hillsides of bedrock-controlled landscapes in the Adirondack Mountains (fig. 9). Slopes range from 3 to 35 percent.

This unit makes up about 8 percent of the county. The unit is about 34 percent Becket soils, 21 percent Tunbridge soils, and 45 percent minor soils.

The Becket soils are well drained, loamy soils. Depth to bedrock is greater than 60 inches. Permeability is moderate in the mineral surface and subsoil, and moderately slow or slow in the substratum. The seasonal high water table is 24 to 42 inches below the surface at some time during March and April.

The Tunbridge soils are well drained loamy soils. Depth to bedrock is 20 to 40 inches. Permeability is moderate or moderately rapid throughout. The seasonal high water table is greater than 72 inches deep.

Of minor extent are the Skerry, Monadnock, Hermon, Lyman, Mundalite, Rawsonville and Worden soils. Moderately well drained Skerry soils occur on

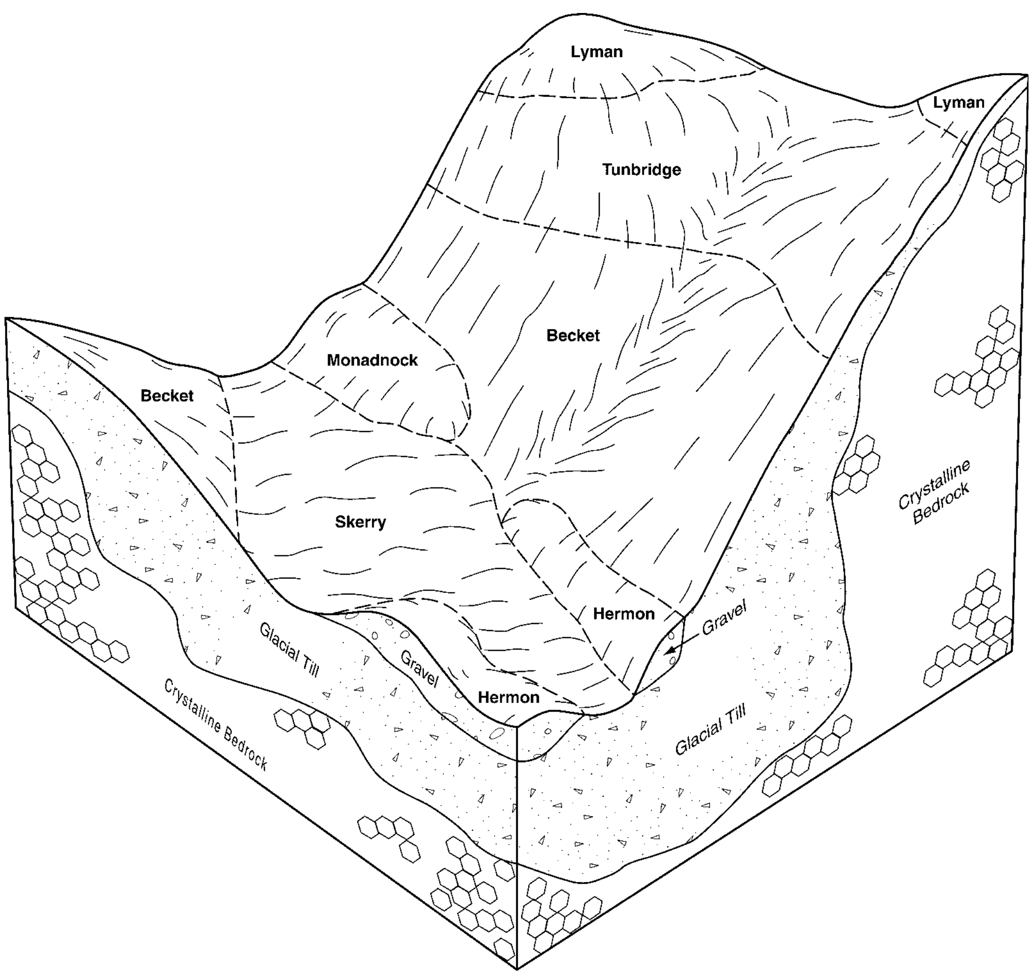

Figure 9.—Becket-Tunbridge is associated with the hillsides of bedrock-controlled landscapes in the Adirondack Mountains.

footslopes or toeslopes, and near drainageways. The Monadnock soils are very deep and lack a dense substratum. Hermon soils are very gravelly and sandy. Lyman soils are shallow to bedrock. Mundalite, Rawsonville, and Worden soils have a subsoil with enriched organic matter or iron compounds (spodic horizon) that is thicker than Becket and Tunbridge soils.

Most areas of this unit are used as woodland. Bedrock outcrops and boulders are the main obstacles to farming. Erosion can also be a management problem on strongly sloping areas. Conservation tillage, stripcropping, crop residue management, and rotational grazing are good management practices.

The main limitations if this unit is used for community development are depth to bedrock and slope. Grading and smoothing operations may require additional fill material around structures. There is a risk of ground water pollution from seepage of effluent over bedrock when conventional septic systems are installed in areas of this unit.

Woodland productivity is limited by bedrock outcrops and areas of steep slopes. Tunbridge soils can moderately restrict root growth resulting in possible windthrow. Very steep slope inclusions may seriously limit maneuverability of equipment.