The History of Bristol Hills Soil

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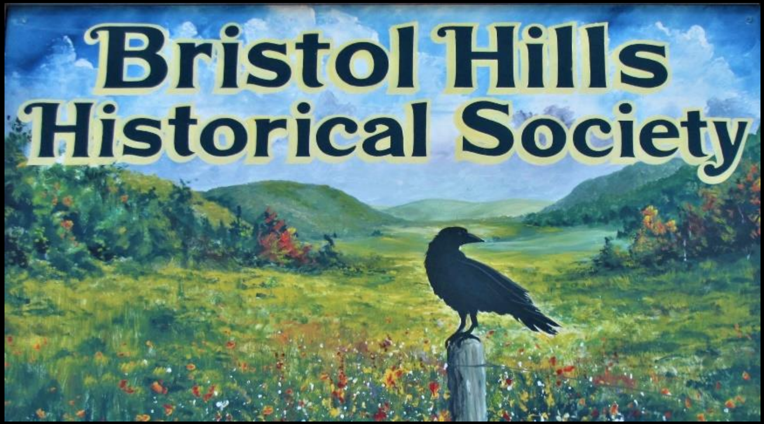
Public Presentation
Wednesday,
September 14
7:00 - 9:00pm



Tonight's educational program, the second in a series of three natural history lectures, begins after the **Great Ice Age.**

What we already know: glacial abrasion by a continental ice sheet gouged out the Finger Lake Valleys during its advance, and later when the ice melted away many types of glacial deposits were left behind resting on a greatly altered landscape.

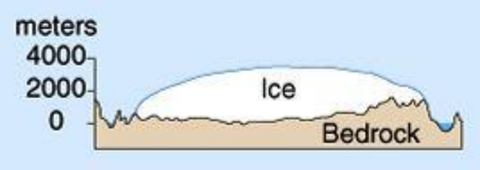
We will be discussing how these deposits influenced the development of different types of soil, and then gain an understanding of which soils have properties that allow them to support productive plant communities.

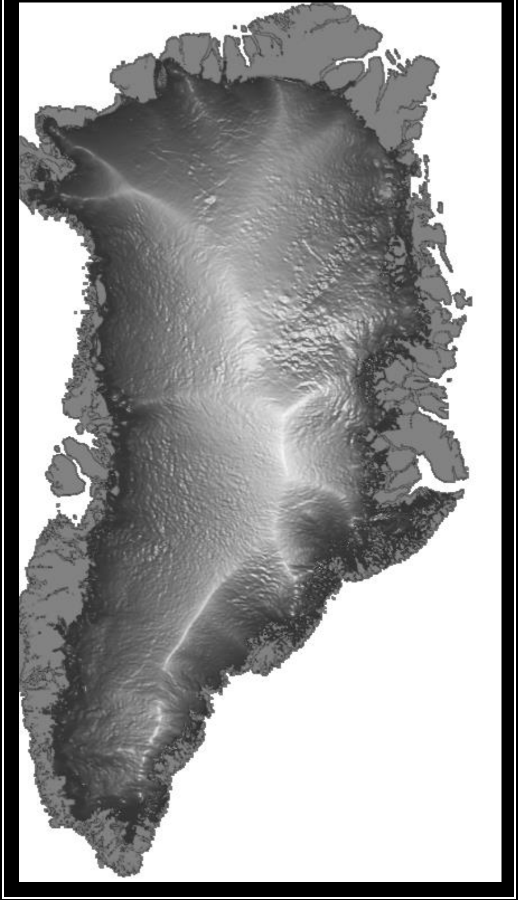
Get ready, this will be a down and dirty discussion!

What we already know…

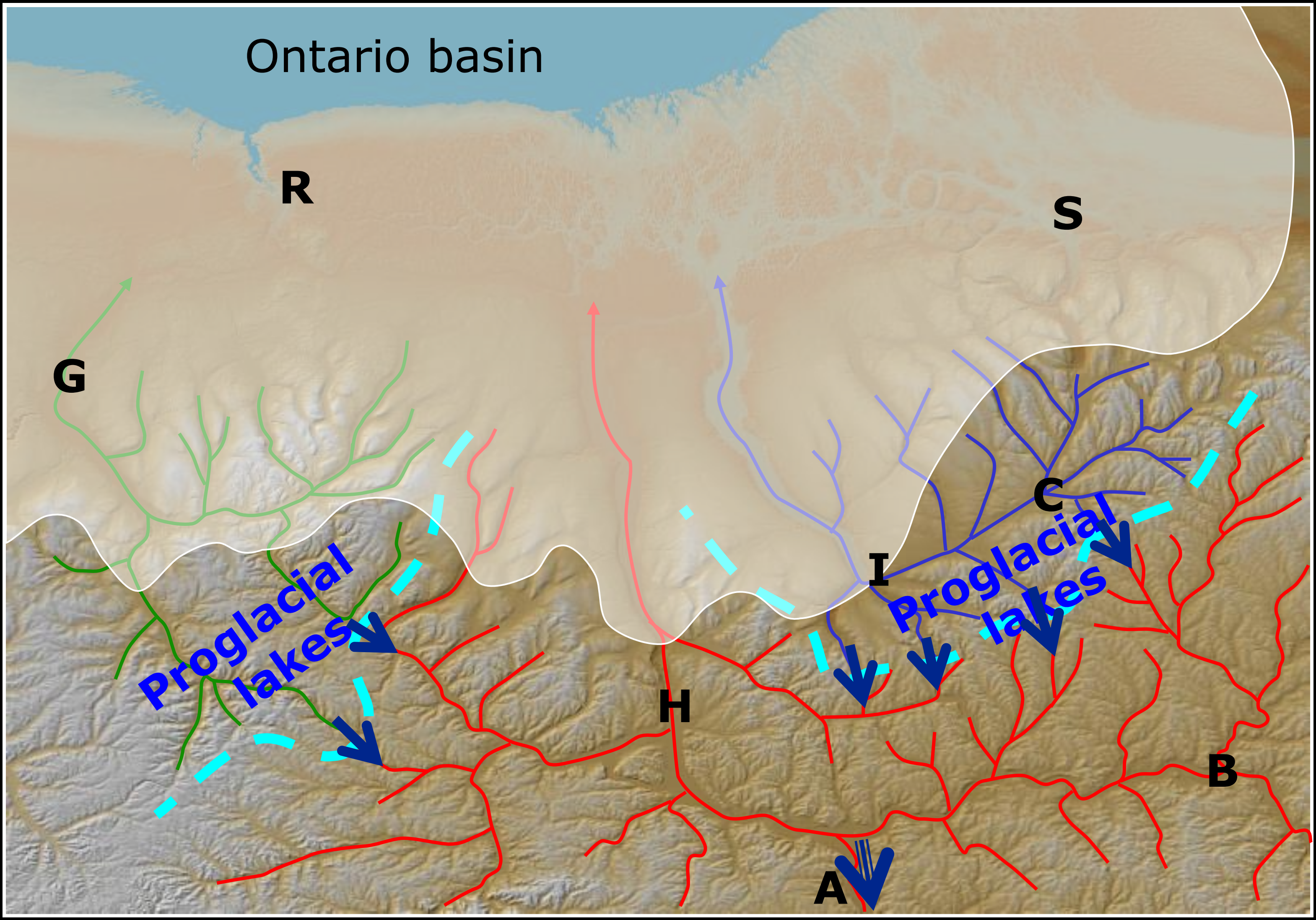
Quaternary North America - Ron Blakey

Greenland IS

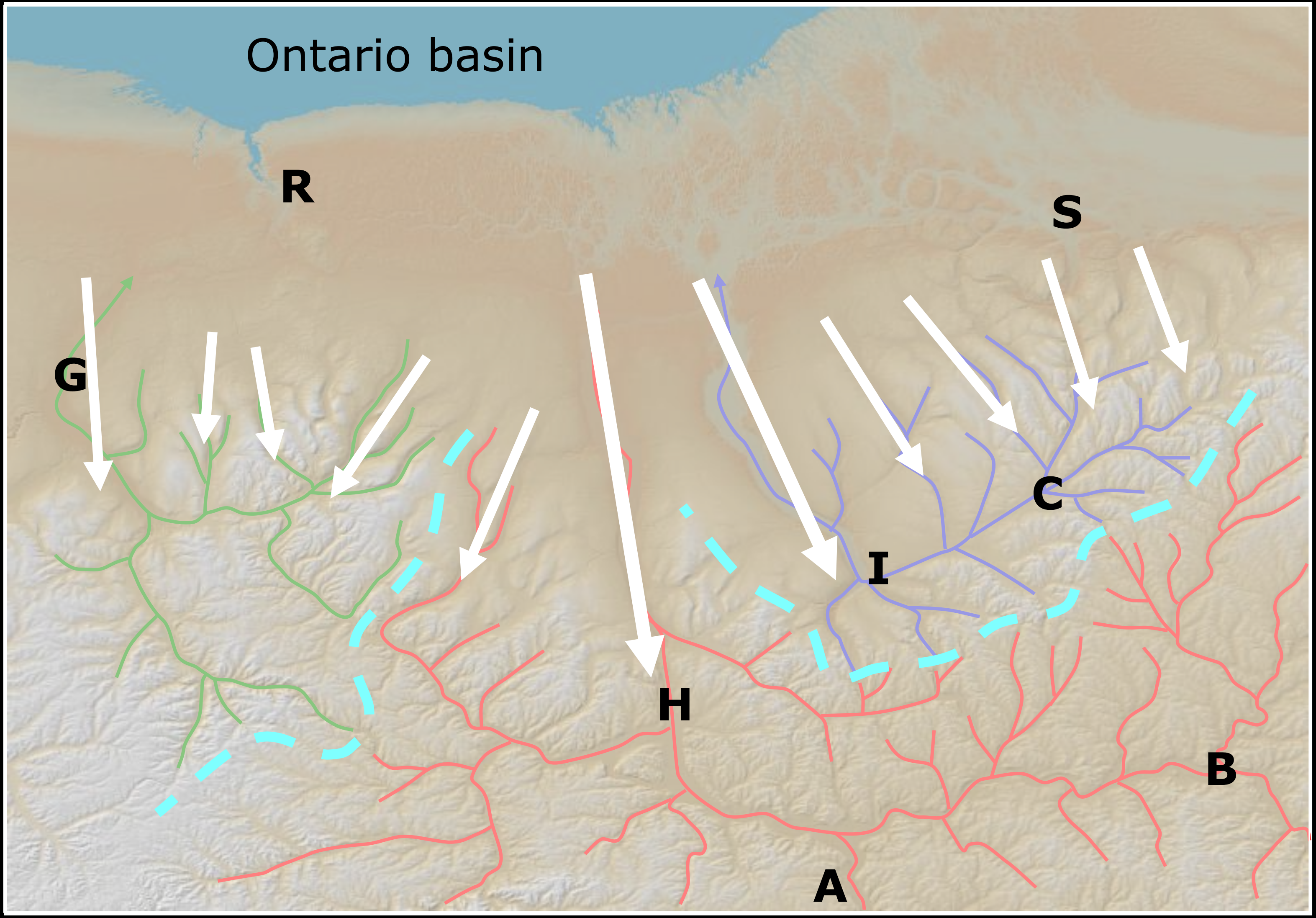




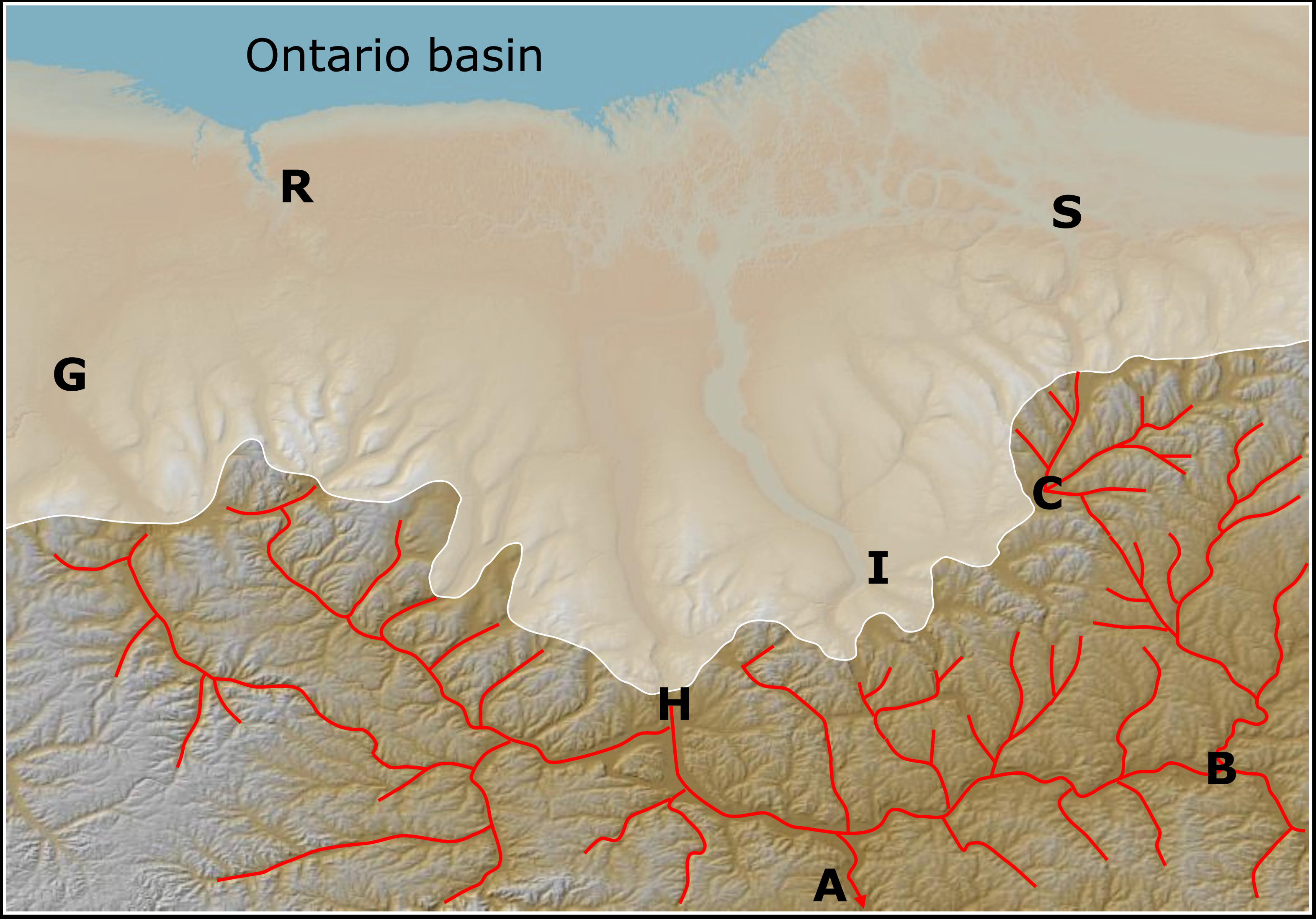
Finger Lakes Formation (ice sheet advance)



Finger Lakes Formation (ice sheet maximum)



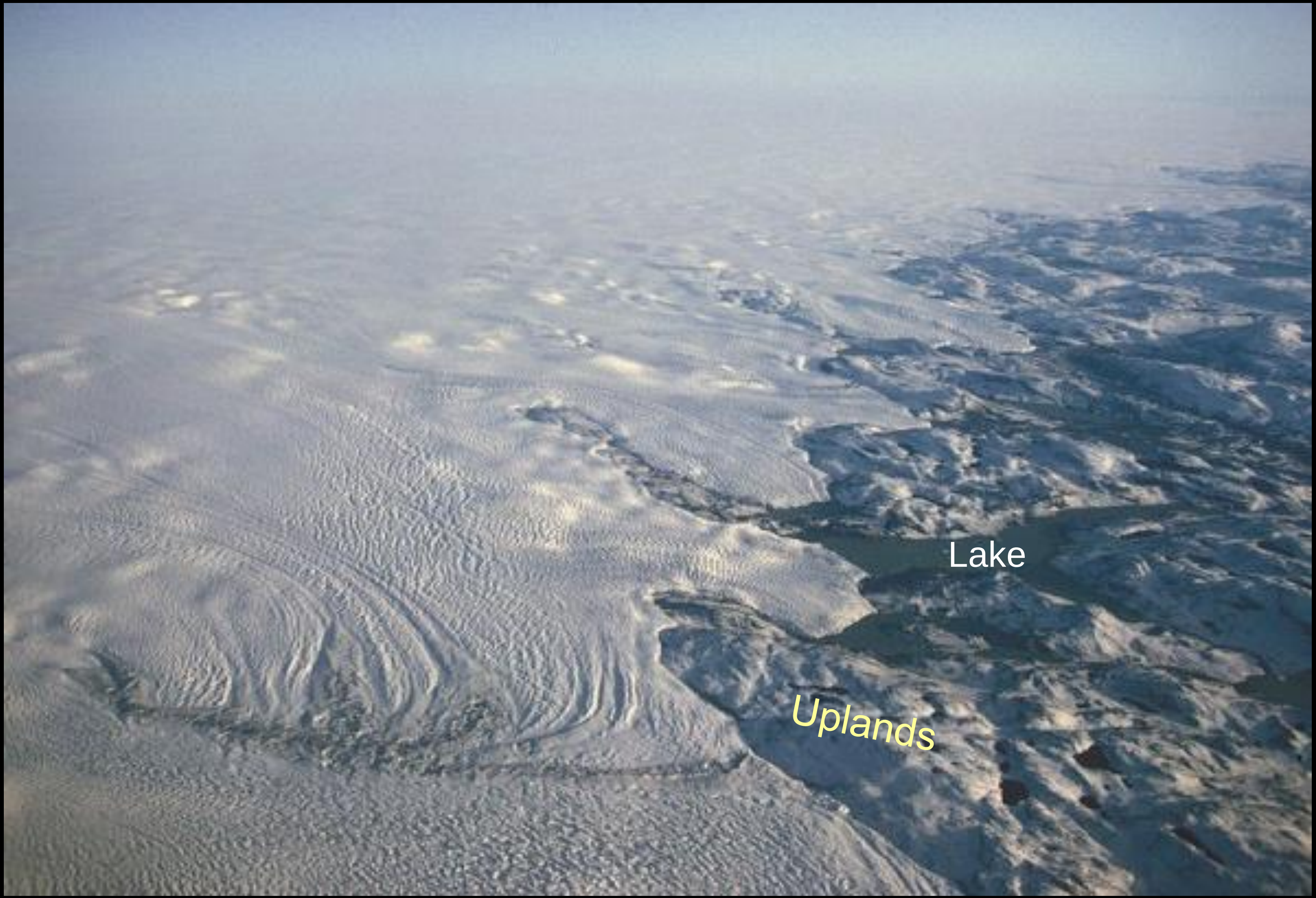
Valley Heads Moraine Deposition (during ice sheet retreat)



Valley Heads Moraine (glacial till, 600 feet thick)

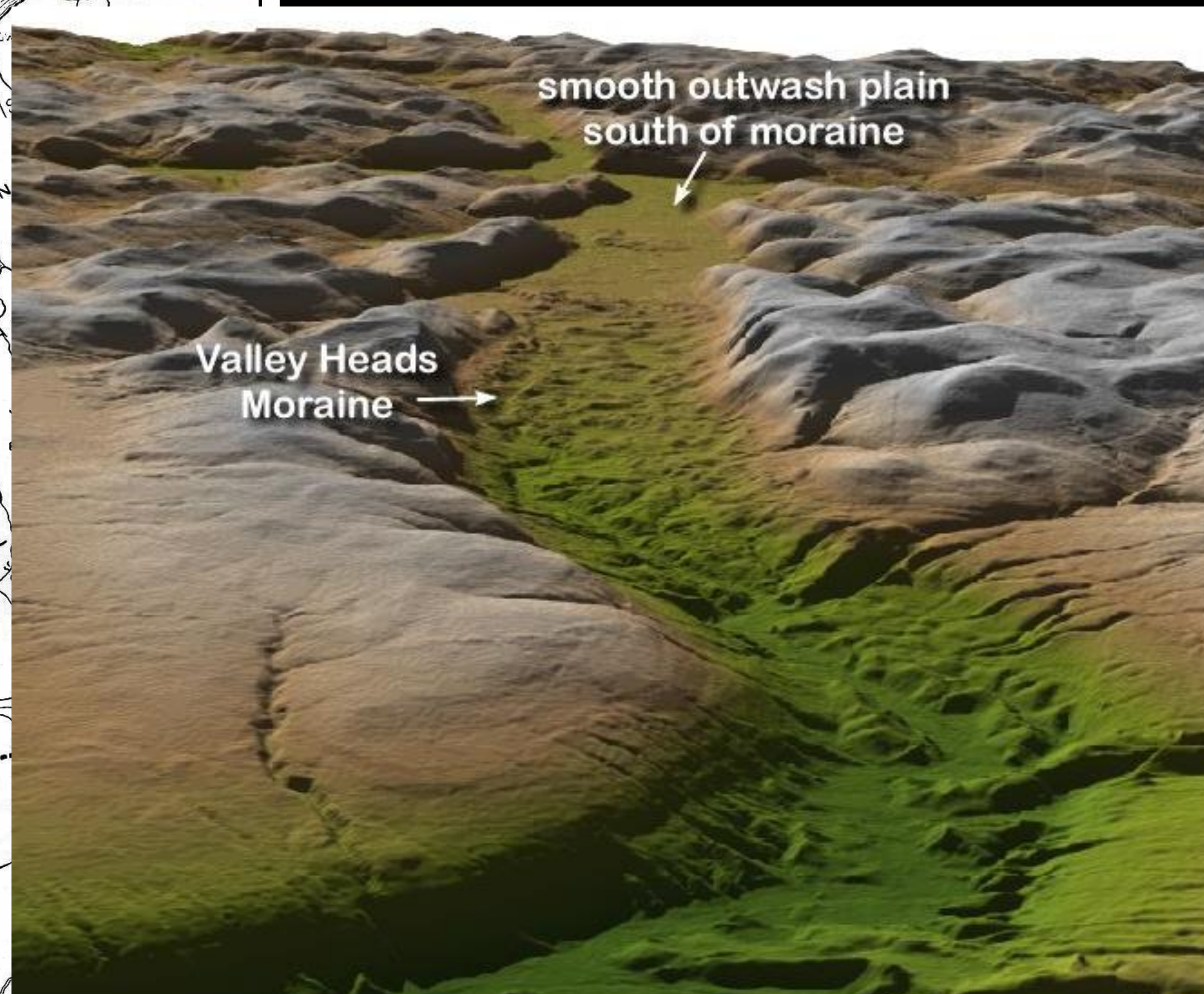
North Cohocton, New York

Proglacial Lakes stood along the retreating ice margin



major glacial landforms

Figure 108. PHYSIOGRAPHY OF CENTRAL NEW YORK.



these lakes all drained south

What is the evidence for these proglacial lakes?

abandoned shorelines
on the valley walls

lake bottom deposits
on the valley floor,
rhythmic couplets of silt
and clay (varves) with
iceberg rafted stones
dropped to the bottom
as icebergs melted

Northern Bristol Valley

Lateral moraines formed along sides of an ice lobe extending south into the narrowing valley

Glacial erratics sloughed off on upper valley walls and hilltop summits

Valley floor with varves, dropstones and muck

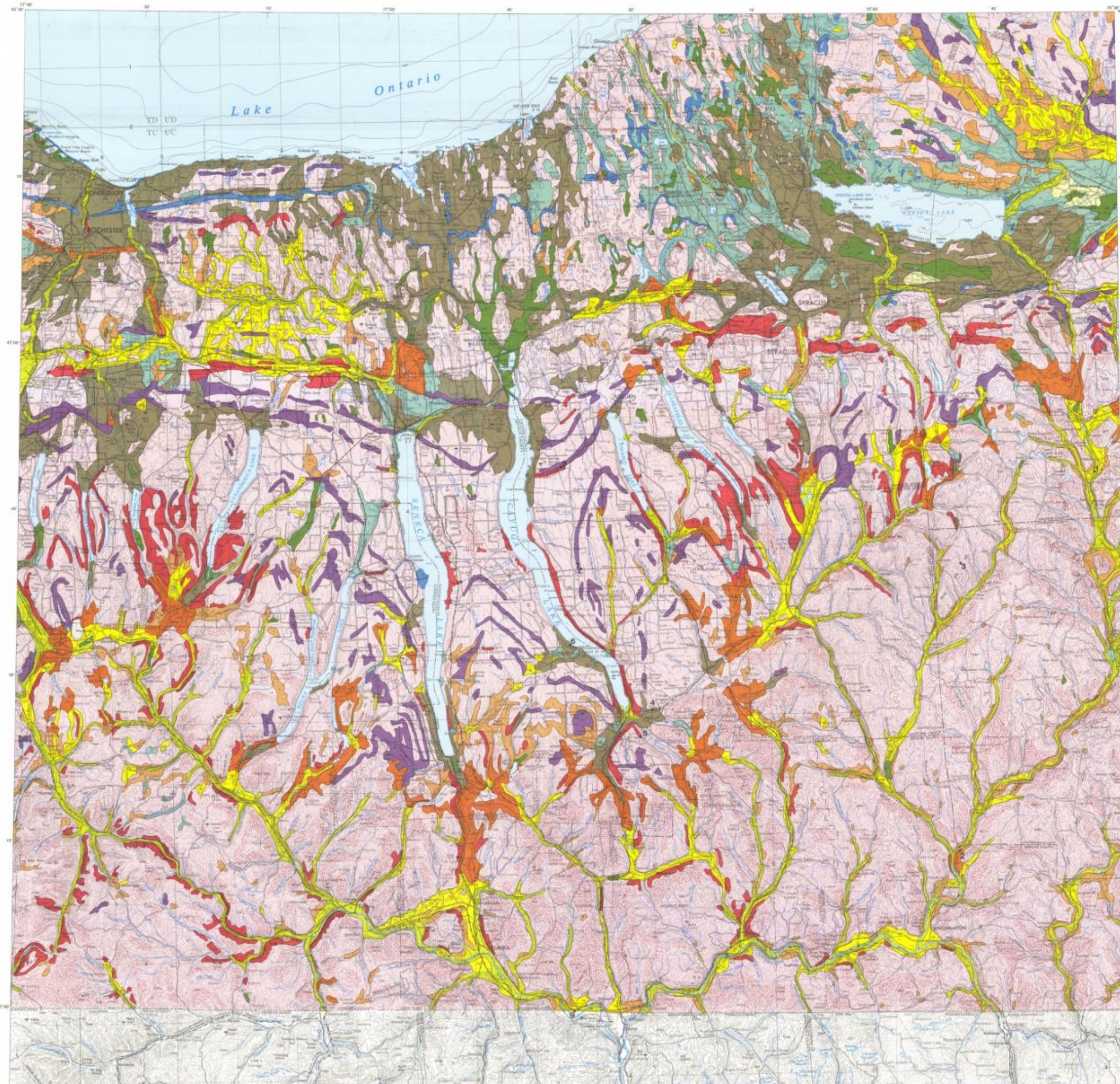
Southern Bristol Valley

Steep valley walls with large vertical drops in elevation

Strandlines, that is, abandoned shorelines

Valley floor with varves, dropstones topped by recent deposits of muck

Proglacial lake outlets with alluvial deltas and outwash plains



EXPLANATION

af - alluvial fan

Swamp deposits

Dunes

Lacustrine beach

Lacustrine delta

Lacustrine silt and clay

Lacustrine sand

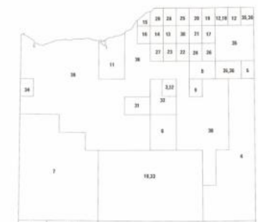
Outwash sand and gravel

Kame deposits

MAP SYMBOLS

RADIOCARBON DATING

REFERENCES FOR RADIOCARBON DATES



GEOMORPHIC HISTORY OF CENTRAL NEW YORK

MAP REFERENCES

Cadwell, D.H., and others, 1986
Surficial Geologic Map of New York
New York State Museum — Geological Survey
Map and Chart Series #40.

SURFICIAL GEOLOGIC MAP OF NEW YORK

FINGER LAKES SHEET

Compiled and Edited by: Ernest H. Muller, Donald H. Cadwell

Reconnaissance field review (1985) by: G. Gordon Connally, Richard A. Young

1986

Prepared under contract with the New York State Electric and Gas Corporation

CONTOUR INTERVAL, 100 FEET

THE ISOGONIC LINES VARY FROM APPROXIMATELY 10° WEST TO 12° 30' WEST, RUNNING IN A NORTHWEST TO SOUTHEAST DIRECTION.

EXPLANATION

al - Recent deposits
Generally confined to floodplains within a valley,
oxidized, non-calcareous, fine sand to gravel,
in larger valleys may be overlain by silt,
subject to frequent flooding, thickness 1-10 meters.

alf - alluvial fan

pm - Swamp deposits
Peat-muck, organic silt and sand in poorly drained areas,
unoxidized,
may be overlying marl and lake silts,
potential land instability,
thickness generally 2-20 meters.

d - Dunes
Fine to medium sand,
well-sorted, stratified,
non-calcareous, unconsolidated,
generally wind-reworked lake sediments,
permeable, well-drained,
thickness variable (1-10 meters).

lb - Lacustrine beach
Generally well-sorted sand and gravel,
stratified, permeable and well-drained,
deposited at a lake shoreline,
generally non-calcareous,
wave-winnowed lag gravel in isolated drumlin localities,
thickness variable (2-10 meters).

ld - Lacustrine delta
Coarse to fine gravel and sand,
stratified, generally well-sorted,
deposited at a lake shoreline,
thickness variable (3-15 meters).

lsc - Lacustrine silt and clay
Generally laminated clay and silt
deposited in proglacial lakes,
generally calcareous,
potential land instability,
thickness variable (up to 50 meters).

ls - Lacustrine sand
Sand deposits associated with large bodies of water,
generally a near-shore deposit or near a sand source,
well-sorted, stratified,
generally quartz sand,
thickness variable (2-20 meters).

og - Outwash sand and gravel
Coarse to fine gravel with sand,
proglacial fluvial deposition,
well-rounded and stratified,
generally finer texture away from ice border,
thickness variable (2-20 meters).

k - Kame deposits
Includes kames, eskers, kame terraces, kame deltas,
coarse to fine gravel and/or sand,
deposition adjacent to ice,
lateral variability in sorting, coarseness and thickness,
locally firmly cemented with calcareous cement,
thickness variable (10-30 meters).

km - Kame moraine
Variable texture (size and sorting) from boulders to sand,
deposition at an ice margin during deglaciation,
locally cemented with calcareous cement,
thickness variable (10-30 meters).

tm - Till moraine
Much like till, but more variable in sorting,
generally more permeable than till,
deposition adjacent to ice,
more variably drained,
may be ablation till,
thickness variable (10-30 meters).

t - Till
Variable texture (e.g. clay, silt-clay, boulder clay),
usually poorly sorted diamict,
deposition beneath glacier ice,
generally calcareous in northern part of map,
relatively impermeable (loamy matrix),
variable clast content - ranging from abundant well-rounded diverse lithologies in valley tills to relativ
angular, more limited lithologies in upland tills,
potential land instability on steep slopes,
thickness variable (1-50 meters).

r - Bedrock
Exposed or within 1 meter of surface,
the following types of rock may be exposed:
Paleozoic limestone, sandstone, shale.

Bedrock stipple overprint
bedrock may be within 1-3 meters of surface,
may sporadically crop out,
variable mantle of rock debris and glacial till.

MAP SYMBOLS

Contact

Esker

Glacial meltwater channel

2 • Dated radiocarbon locality

Now,
imagine the
formation of
soil from
these many
landscape
features at
the end of the
Ice Age…

And remember,

"Geology is never stagnant.
It can be slow, but it is
relentless and continual."

Fred Haynes 2019

What is soil?

Thin outer layer of the earth, an interface between the atmosphere and the lithosphere, and having characteristics of both systems

A biochemically weathered product of nature

A habitat for the growth of plants and animals

A site of continual change – it's dynamic!

Soil formation necessarily begins with a discussion of the parent materials of soils

POSSIBLE ORIGINS OF PARENT MATERIALS:

1. residual
2. transported
3. cumulose

Residual Parent Materials

- Residual means they still reside at their site of formation
- Consolidated rock = native bedrock

  (the study of bedrocks is petrology)

  – Types of bedrock:
    - IGNEOUS
    - METAMORPHIC
    - SEDIMENTARY

SEDIMENTARY ROCKS

- A secondary rock that is formed from the eroded sediments of other rocks
- Eroded sediments are deposited, often in water, then re-cemented to form a new type of rock
- What sedimentary rocks occur here?

Transported Parent Materials

- Moved from site of formation to a new location some distance away
- Responsible force may be:
  - flowing ice (glacial)
  - moving water (lacustrine, alluvial, marine)
  - blowing wind (eolian)
  - gravity (colluvial)

What transported parent materials occur here?

How would you classify these examples of transported parent materials?

- – stream floodplains and deltas
- – lake shoreline sediments
- – avalanches, mud slides, talus slopes
- – drumlins, eskers, moraines
- – freshwater lake bottoms
- – sand dunes

Cumulose Parent Materials

- Forms at a location over time, not there originally
- Accumulated organic debris
  - often builds up in wet places, why?
  - plant growth > plant decomposition
- Peat vs. muck

Five Factors of Soil Formation

- Parent Material
- Climate
- Biosphere (the Living Organisms, mostly the type of vegetation where soil forms)
- Topography
- Time

CLIMATE

Influences weathering rate of parent materials and soil erosion losses

- annual rainfall - chemical weathering and erosion by surface runoff
- annual temperature - heat/cool, freeze/thaw, and shrink/swell effects on parent material
- alters patterns of plant growth and types of animal activity

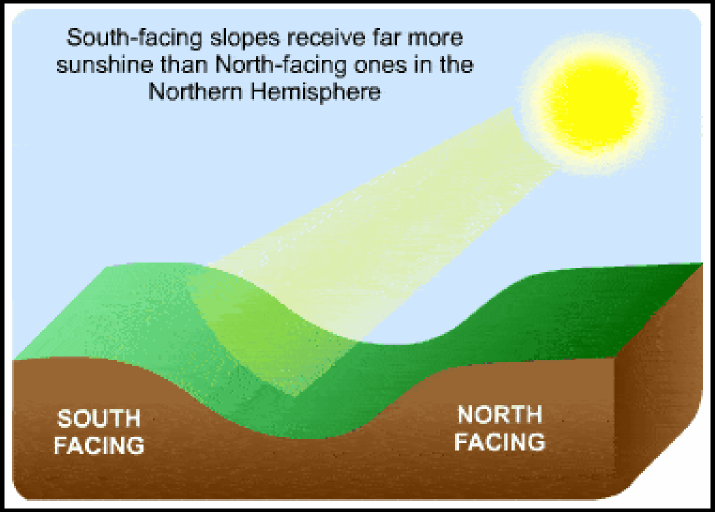
BIOSPHERE, THE LIVING ORGANISMS

Living on or within parent material

- algae and lichens living on rock surfaces
- plant roots expanding cracks
- animals traveling over rock, wearing paths, burrowing, etc.
- both plants and animals add organic matter - decay releases organic acids
- humans - mining, road building, etc.

TOPOGRAPHY

- the slope of the land and the compass direction it faces (aspect) affects the amount of precipitation received, soil temperature, build-up of organic matter, and the presence of living organisms



TIME

It takes a long time for soil to form!!!

- depends on the other 4 soil forming factors
- well developed fertile soil may take thousands of years to form

- how old are the soils in the Finger Lakes?

Soil Weathering Processes

- Destruction of parent materials and synthesis of the soil

- Types of weathering processes:
  – physical
  – chemical
  – biological

Physical Weathering

- Wetting and drying
- Freezing and thawing
- Exfoliation
- Grinding, abrasion

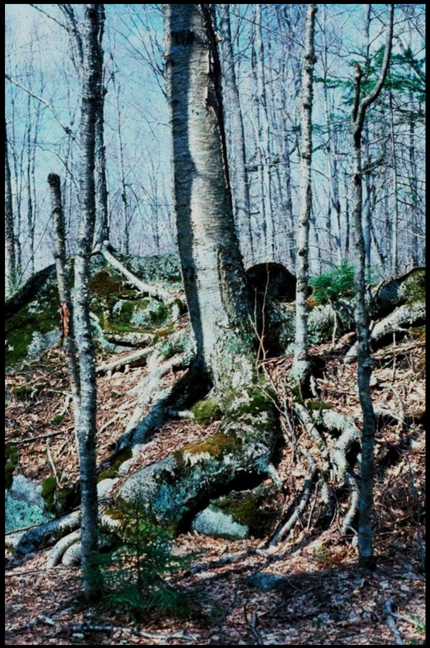
"needle ice action"

Chemical Weathering

- Hydration
- Carbonation
- Dissolution
- Oxidation / Reduction

Biological Weathering

- Plant exudates
- Trampling
- Burrowing
- Root upheaval



Weathering Summary

- All 3 types of weathering and the many individual processes may occur together and will synergistically influence and accelerate soil change

BUT

- Soil development is slow and complex!

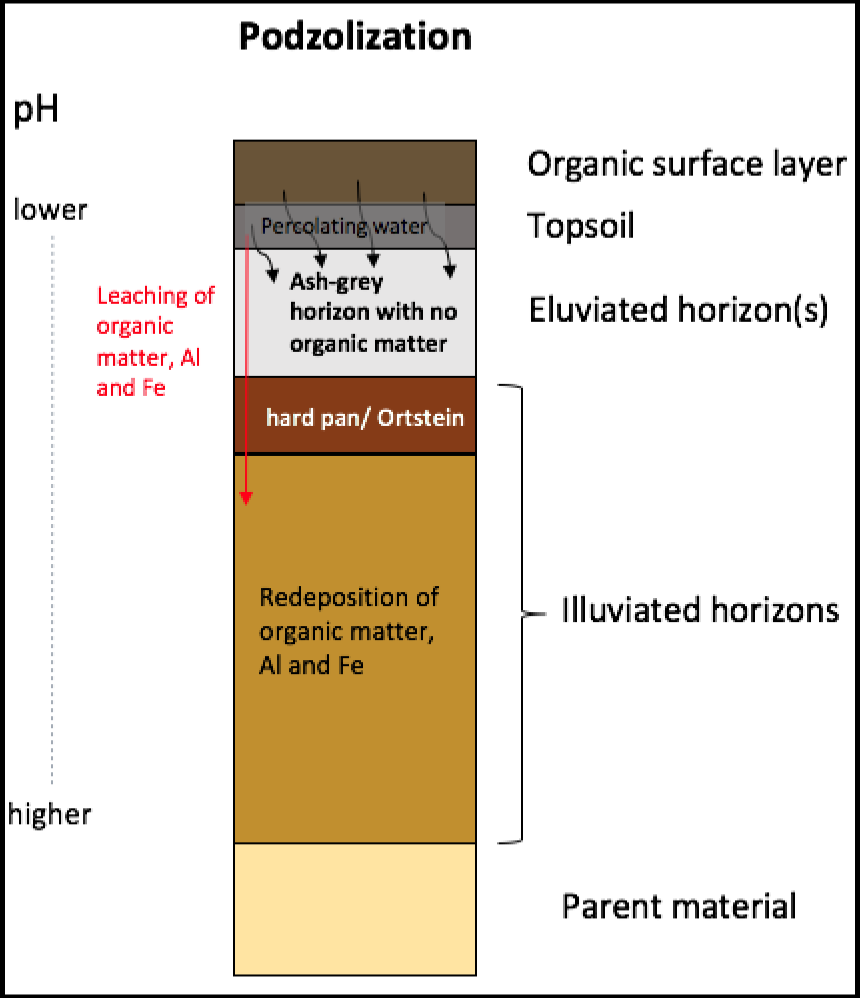
Some Soil Development Processes

- Dissolution and leaching
- Translocation of materials
- Synthesis of new substances
- Biological activity including residue effects
- Formation of soil structure

Forest Soils - Podzolization

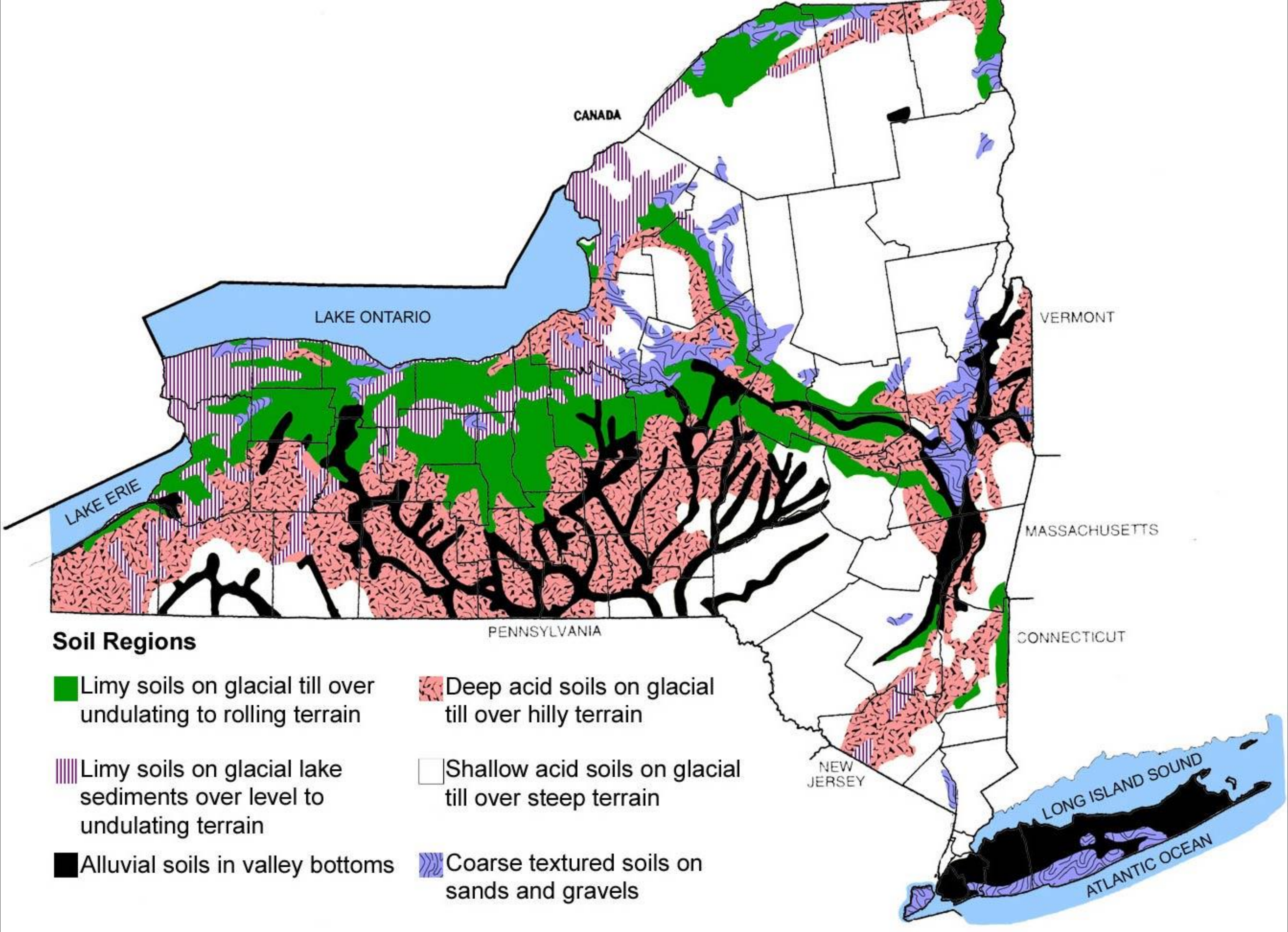
- Conditions:
- Mechanics:
- Results:

Horizons in a soil profile formed through podzolization

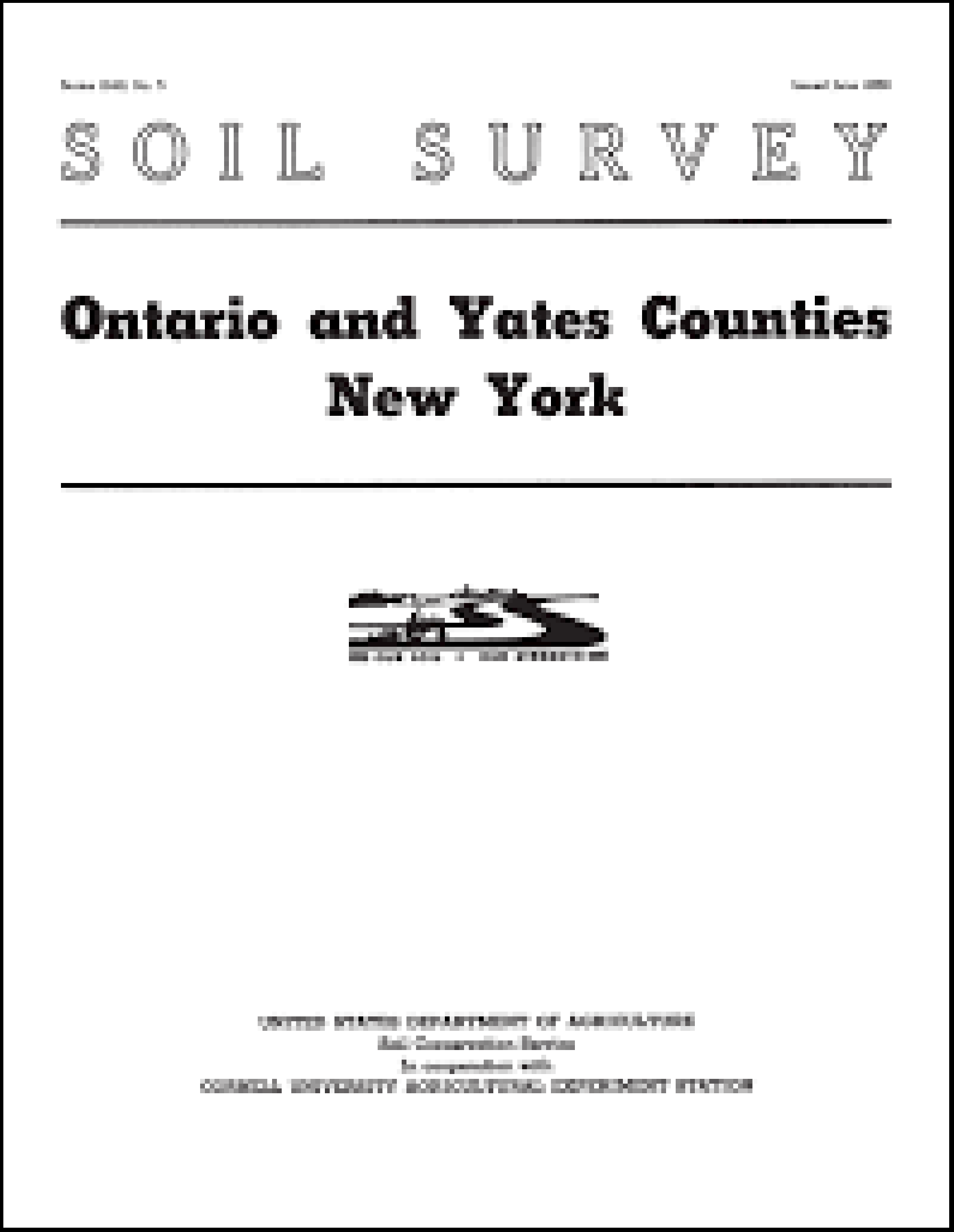


Summary of Soil Formation in New York State

note the role of glacial deposits



Sources: U.S. Bureau of the Census, 2002 Census of Agriculture
Thompson, John Henry. *Geography of New York State.* Syracuse, NY: Syracuse University, 1977.


SOIL SURVEY

Ontario and Yates Counties
New York

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Available in most public libraries of our region

What is a published soil survey?

A soil survey is a detailed report on the soils of an area.

The soil survey has maps with soil boundaries and photos, descriptions, and tables of soil properties and features.

Soil surveys are used by farmers, real estate agents, land use planners, engineers and others who desire information about the soil resource.

The major parts of a soil survey publication...

- Table of Contents
- Detailed soil map units
- Use and management and interpretive tables
- Classification of soils
- References
- Glossary
- Index to map sheets
- Soil maps

Using the soil survey...

- Obtain a printed soil survey from the NRCS, USDA office, or local conservation office or access a Web version at: http://soils.usda.gov/survey/
- Open the soil survey to *Index To Map Sheets*
- Locate your area of interest or property on the *Index.*
- The numbers in rectangles correspond to the map sheet number located in the second half of the publication.
- Look at the aerial map closely and locate landmarks such as roads or streams to find your area of interest.

Using the soil survey continued...

- The lines on the image separate different soil types. Your area of interest may include one or more types.
- The small letters or numbers that are within the same polygon as your area of interest, such as ScC, or KnC, or LaC designate a map unit. Note this map unit symbol. It is the key to finding information.
- Turn to the *Index to Map Units* which shows the page where these map units are described. Also go to the various tables or reports which are organized by map unit symbol.

Using the soil survey continued...

- This process is simplified in Web-based soil surveys but follow the same sequence:

1. Locate your area of interest on the aerial photos.
2. Note the map unit symbol.
3. Go to the text or tables for information on that map unit.

Using the soil survey continued...

Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere . . .

- If you find a term or soil description in the detailed information sheet on your soil and you would like to learn what that term means, go the *Glossary* section of the report. The *Glossary* is located in the center of the publication.

Using the soil survey--*Tables*

TABLE 1.--TEMPERATURE AND PRECIPITATION

TABLE 2.--FREEZE DATES IN SPRING AND FALL

TABLE 3.--GROWING SEASON

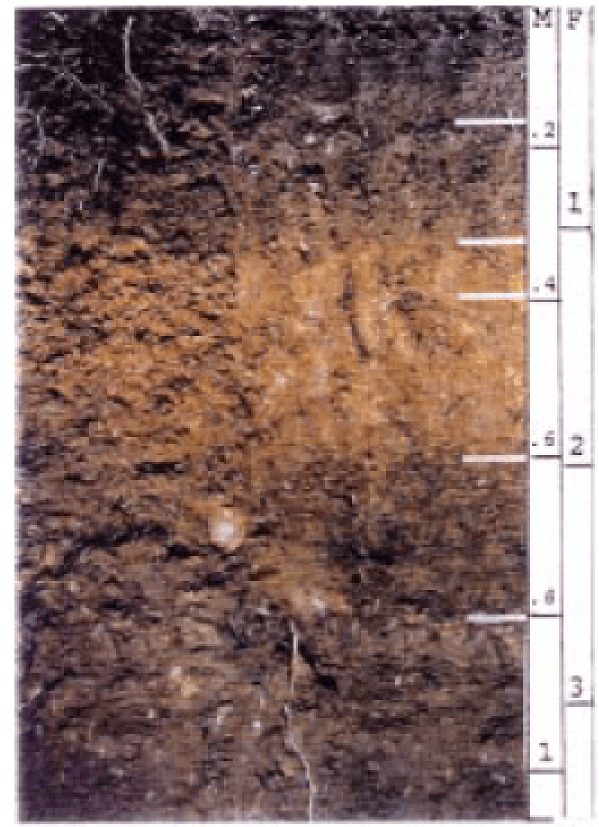
TABLE 4.--ACREAGE AND PROPORTIONAL EXTENT OF THE SOILS

- The *Tables* section of the soil survey report provides detailed information on soil properties and their suitability and limitations as well as management and production potential of the various soils.

Using the *Tables* continued...

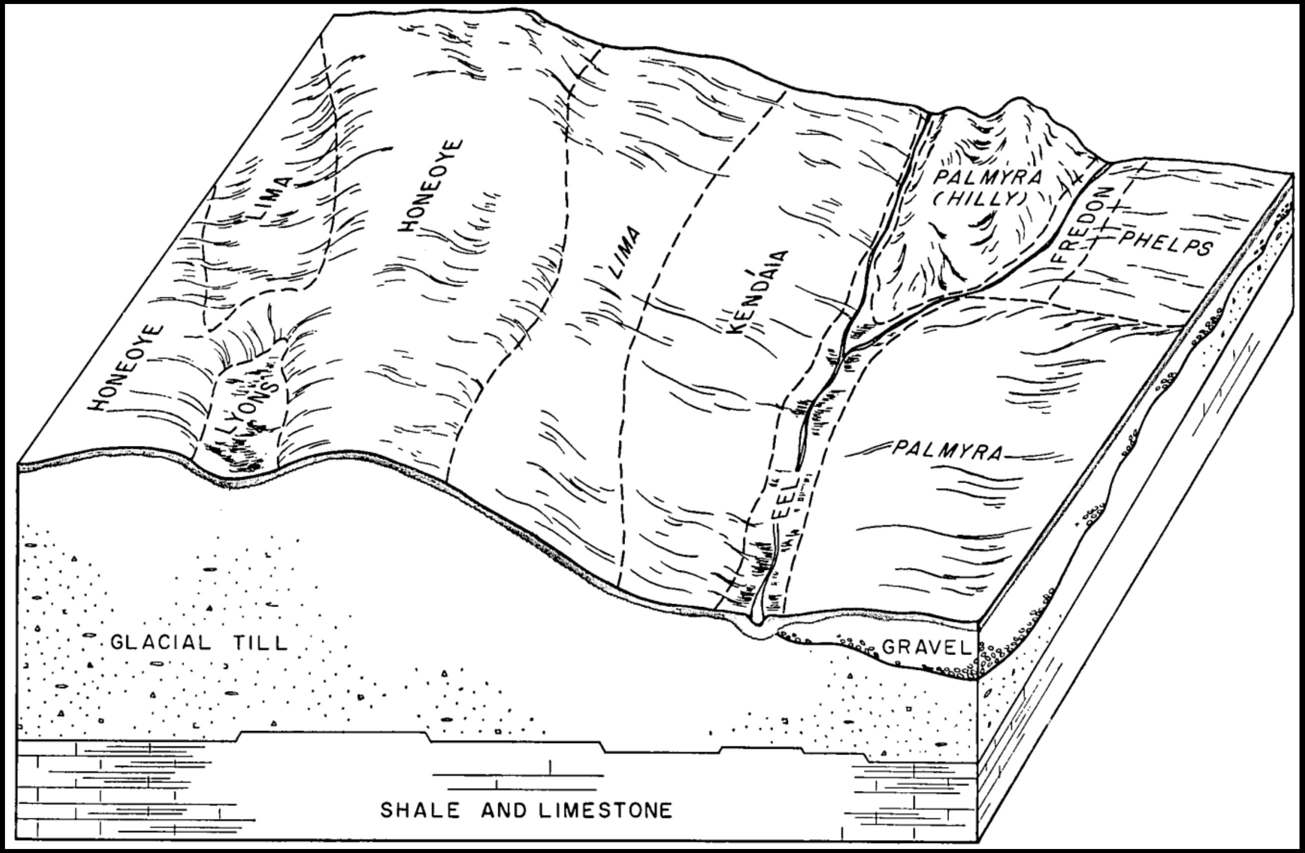
- The *Tables* section has detailed information on engineering index properties, physical and chemical properties, and soil and water features.
- The *Tables* section also has detailed information on soil use, such as crops and pasture, recreation, and engineering.
- To use the tables, simply remember your map unit symbol and find it in the appropriate table.

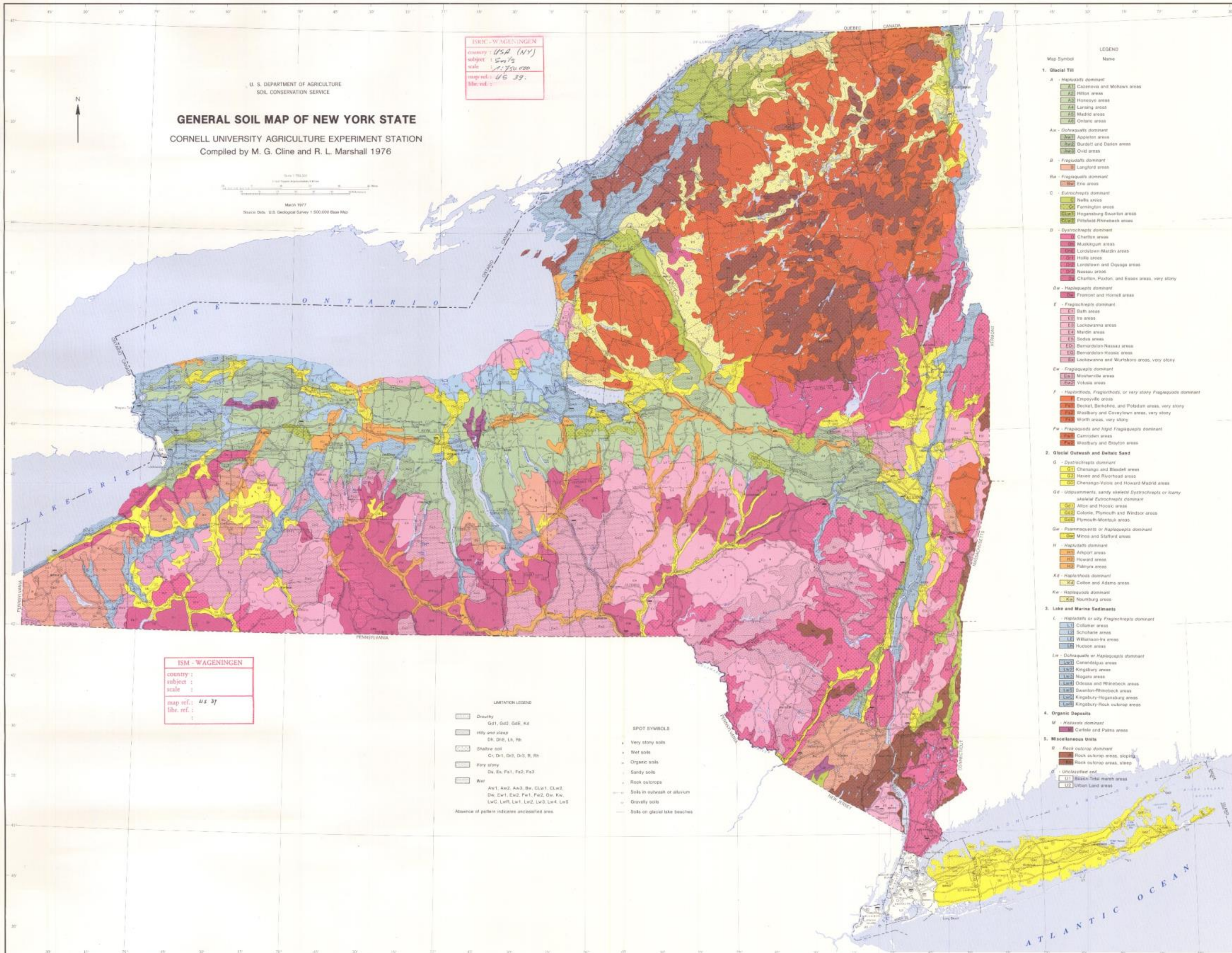
Example:
Honeoye soil series

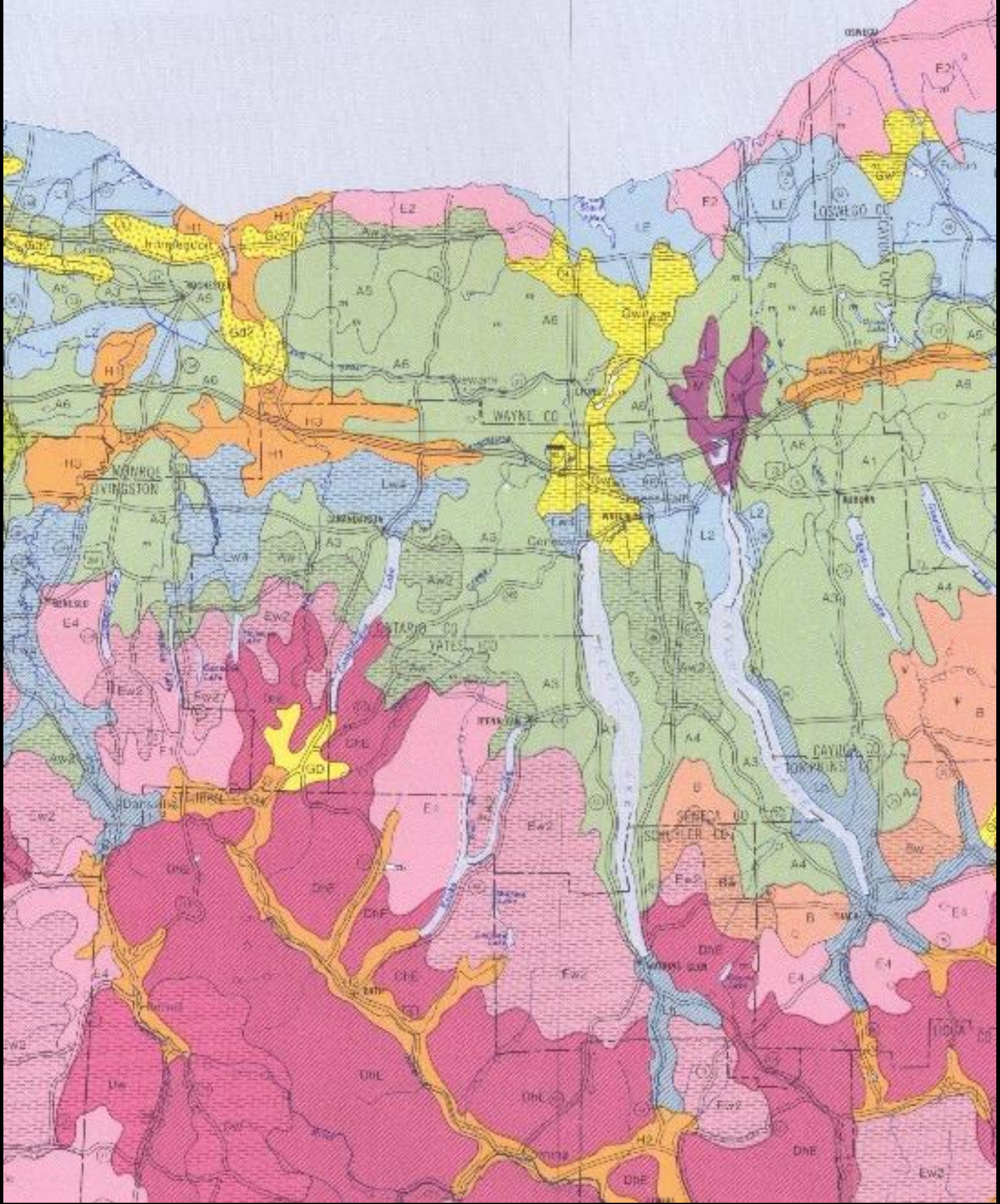


Honeoye Soil Profile
Surface layer: dark grayish brown loam
Subsurface layer: brown loam
Subsoil - upper: brown loam
Subsoil - lower: brown gravelly loam
Substratum: dark grayish brown very gravelly loam

Honeoye Soil Catena (topographic patterns)




U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GENERAL SOIL MAP OF NEW YORK STATE
CORNELL UNIVERSITY AGRICULTURE EXPERIMENT STATION
Compiled by M. G. Cline and R. L. Marshall 1976
March 1977
Source Data: U.S. Geological Survey 1:500,000 Base Map
N
LAKE ONTARIO
LAKE ERIE
ATLANTIC OCEAN
QUEBEC
CANADA
PENNSYLVANIA
NEW JERSEY
CONNECTICUT
MASSACHUSETTS
VERMONT
LEGEND
Map Symbol
Name
1. Glacial Till
A - Hapludalfs dominant
A1 Cazenovia and Mohawk areas
A2 Hilton areas
A3 Honeoye areas
A4 Lansing areas
A5 Madrid areas
A6 Ontario areas
Aw - Ochraqualfs dominant
Aw1 Appleton areas
Aw2 Burdett and Darien areas
Aw3 Ovid areas
B - Fragiudalfs dominant
B Langford areas
Bw - Fragiaqualfs dominant
Bw Erie areas
C - Eutrochrepts dominant
C Nellis areas
Cr Farmington areas
CLw1 Hogansburg-Swanton areas
CLw2 Pittsfield-Rhinebeck areas
D - Dystrochrepts dominant
D Charlton areas
Dh Muskingum areas
DhE Lordstown-Mardin areas
Dr1 Hollis areas
Dr2 Lordstown and Oquaga areas
Dr3 Nassau areas
Ds Charlton, Paxton, and Essex areas, very stony
Dw - Haplaquepts dominant
Dw Fremont and Hornell areas
E - Fragiochrepts dominant
E1 Bath areas
E2 Ira areas
E3 Lackawanna areas
E4 Mardin areas
E5 Sodus areas
ED Bernardston-Nassau areas
EG Bernardston-Hoosic areas
Es Lackawanna and Wurtsboro areas, very stony
Ew - Fragiaquepts dominant
Ew1 Mosherville areas
Ew2 Volusia areas
F - Haplorthods, Fragiorthods, or very stony Fragiaquods dominant
F Empeyville areas
Fs1 Becket, Berkshire, and Potsdam areas, very stony
Fs2 Westbury and Coveytown areas, very stony
Fs3 Worth areas, very stony
Fw - Fragiaquods and frigid Fragiaquepts dominant
Fw1 Camroden areas
Fw2 Westbury and Brayton areas
2. Glacial Outwash and Deltaic Sand
G - Dystrochrepts dominant
G1 Chenango and Blasdell areas
G2 Haven and Riverhead areas
GO Chenango-Valois and Howard-Madrid areas
Gd - Udipsamments, sandy skeletal Dystrochrepts or loamy skeletal Eutrochrepts dominant
Gd1 Alton and Hoosic areas
Gd2 Colonie, Plymouth and Windsor areas
GdE Plymouth-Montauk areas
Gw - Psammaquents or Haplaquepts dominant
Gw Minoa and Stafford areas
H - Hapludalfs dominant
H1 Arkport areas
H2 Howard areas
H3 Palmyra areas
Kd - Haplorthods dominant
Kd Colton and Adams areas
Kw - Haplaquods dominant
Kw Naumburg areas
3. Lake and Marine Sediments
L - Hapludalfs or silty Fragiochrepts dominant
L1 Collamer areas
L2 Schoharie areas
LE Williamson-Ira areas
Lh Hudson areas
Lw - Ochraqualfs or Haplaquepts dominant
Lw1 Canandaigua areas
Lw2 Kingsbury areas
Lw3 Niagara areas
Lw4 Odessa and Rhinebeck areas
Lw5 Swanton-Rhinebeck areas
LwC Kingsbury-Hogansburg areas
LwR Kingsbury-Rock outcrop areas
4. Organic Deposits
M - Histosols dominant
M Carlisle and Palms areas
5. Miscellaneous Units
R - Rock outcrop dominant
R Rock outcrop areas, sloping
Rh Rock outcrop areas, steep
U - Unclassified soil
U1 Beach-Tidal marsh areas
U2 Urban Land areas
LIMITATION LEGEND
Drouthy
Gd1, Gd2, GdE, Kd
Hilly and steep
Dh, DhE, Lh, Rh
Shallow soil
Cr, Dr1, Dr2, Dr3, R, Rh
Very stony
Ds, Es, Fs1, Fs2, Fs3
Wet
Aw1, Aw2, Aw3, Bw, CLw1, CLw2, Dw, Ew1, Ew2, Fw1, Fw2, Gw, Kw, LwC, LwR, Lw1, Lw2, Lw3, Lw4, Lw5
Absence of pattern indicates unclassified area.
SPOT SYMBOLS
Very stony soils
Wet soils
Organic soils
Sandy soils
Rock outcrops
Soils in outwash or alluvium
Gravelly soils
Soils on glacial lake beaches



colored polygons indicate soil series

Soil Productivity

Depends on:

- Nutrient availability
- Adequate moisture
- Proper length of growing season
- Absence of inhibitory factors

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

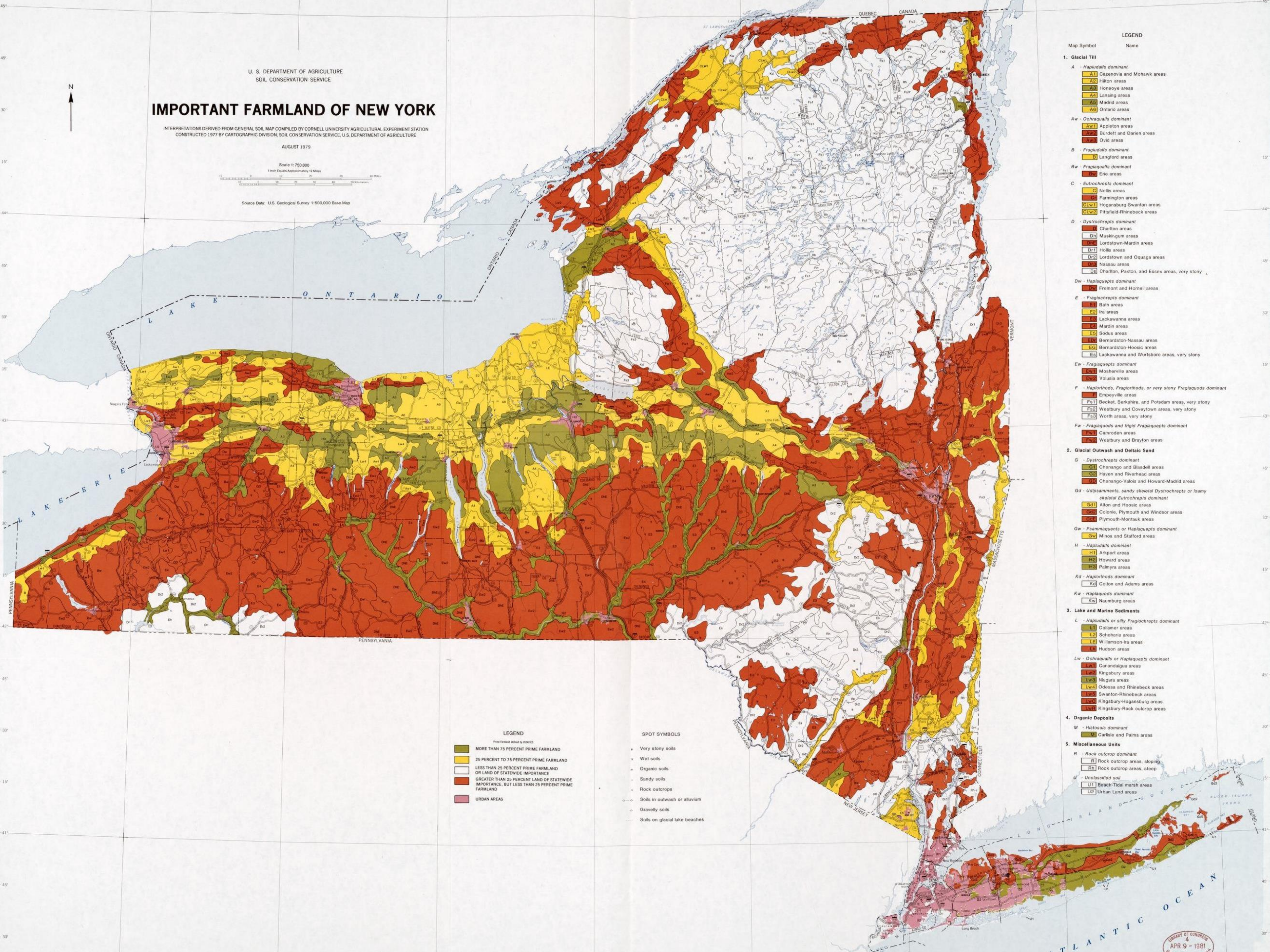
IMPORTANT FARMLAND OF NEW YORK

INTERPRETATIONS DERIVED FROM GENERAL SOIL MAP COMPILED BY CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION
CONSTRUCTED 1977 BY CARTOGRAPHIC DIVISION, SOIL CONSERVATION SERVICE, U.S. DEPARTMENT OF AGRICULTURE

AUGUST 1979

Scale 1: 750,000
1 Inch Equals Approximately 12 Miles

Source Data: U.S. Geological Survey 1:500,000 Base Map



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PRIME FARMLAND OF NEW YORK

INTERPRETATIONS DERIVED FROM GENERAL SOIL MAP COMPILED BY CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION
CONSTRUCTED 1977 BY CARTOGRAPHIC DIVISION, SOIL CONSERVATION SERVICE, U.S. DEPARTMENT OF AGRICULTURE

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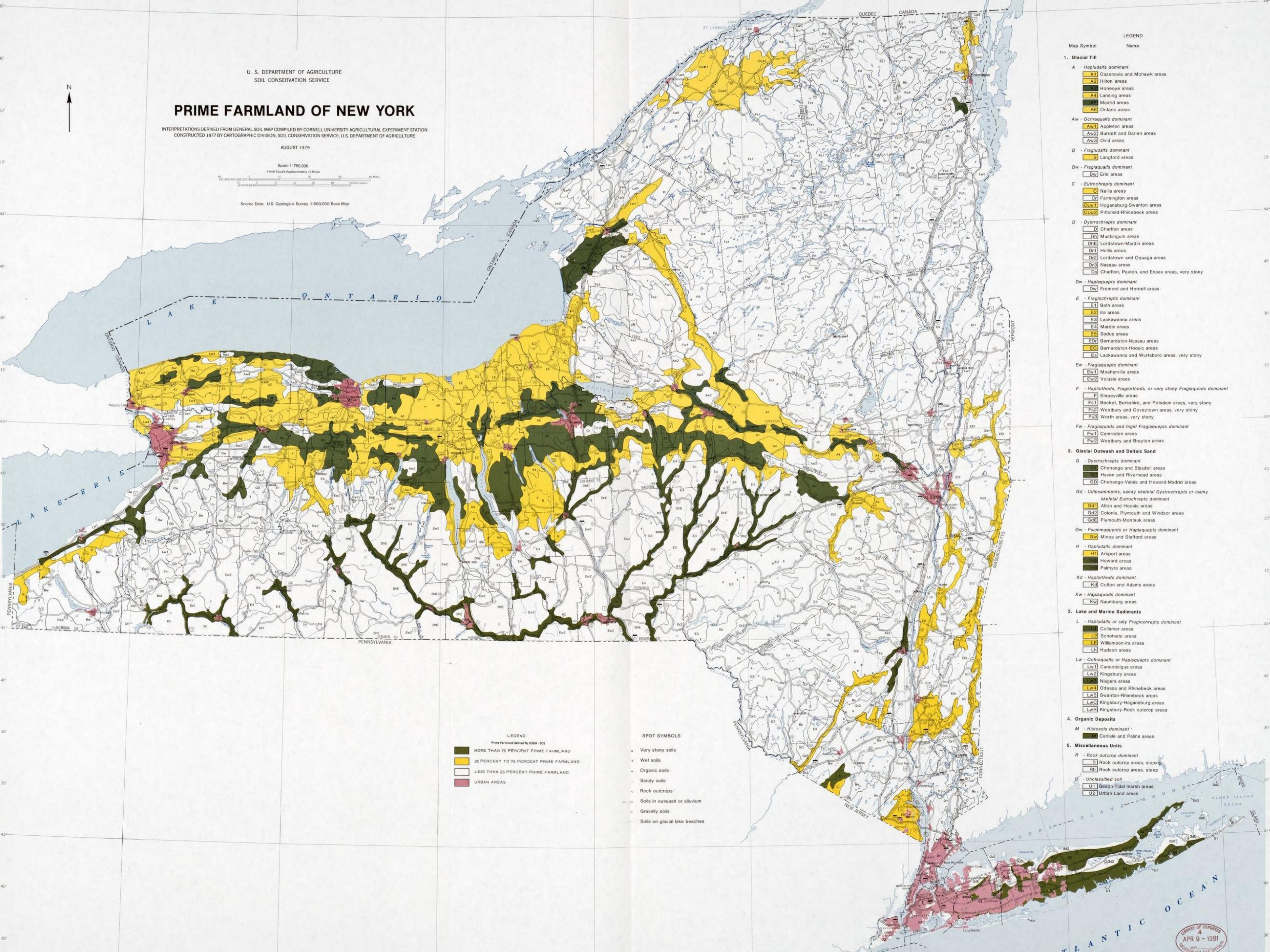


What natural communities colonized our newly forming soils?

- role of Ice Age refugia
- rates of migration
- vectors of migration
- climatic adaptation and tree physiology
- ecological succession

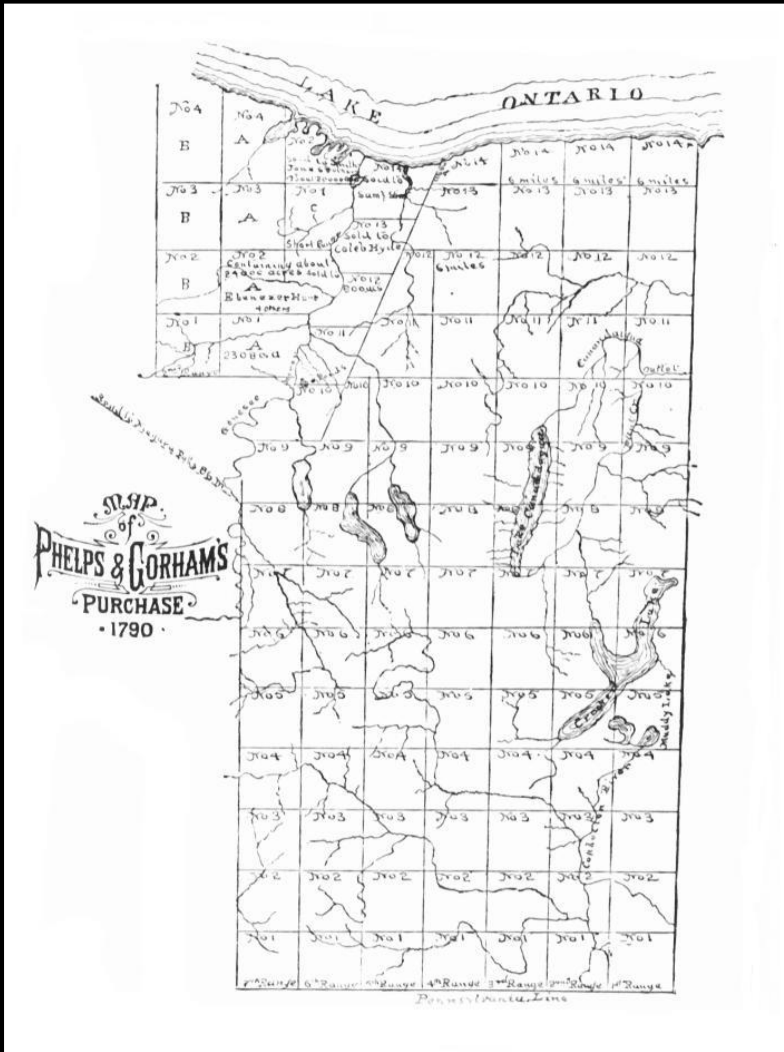
Visualizing forest community change using historic records

- The science of palynology
- The science of dendrochronology
- The original land survey records
- A modern land use/land cover field research project to describe our modern plant communities - stay tuned for PART 3 of studying our landscape coming Spring 2023!

The pre-European settlement forest

Gosnell's Woods, Webster NY

Just a hint of what's to come in part 3 of our series…



The mosaic of habitats make up our natural forest communities



Each wildflower occupies a particular forest habitat



Thank You!