Geology of Sycamore Land Trust Nature Preserves:
An Overview

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Conservation Conversations, February 9th, 2023

Presentation Overview

- Physiography
- Bedrock Geology, Cross Section and Stratigraphy
- Quaternary Geology
- Overview of Bedrock and Quaternary Geology

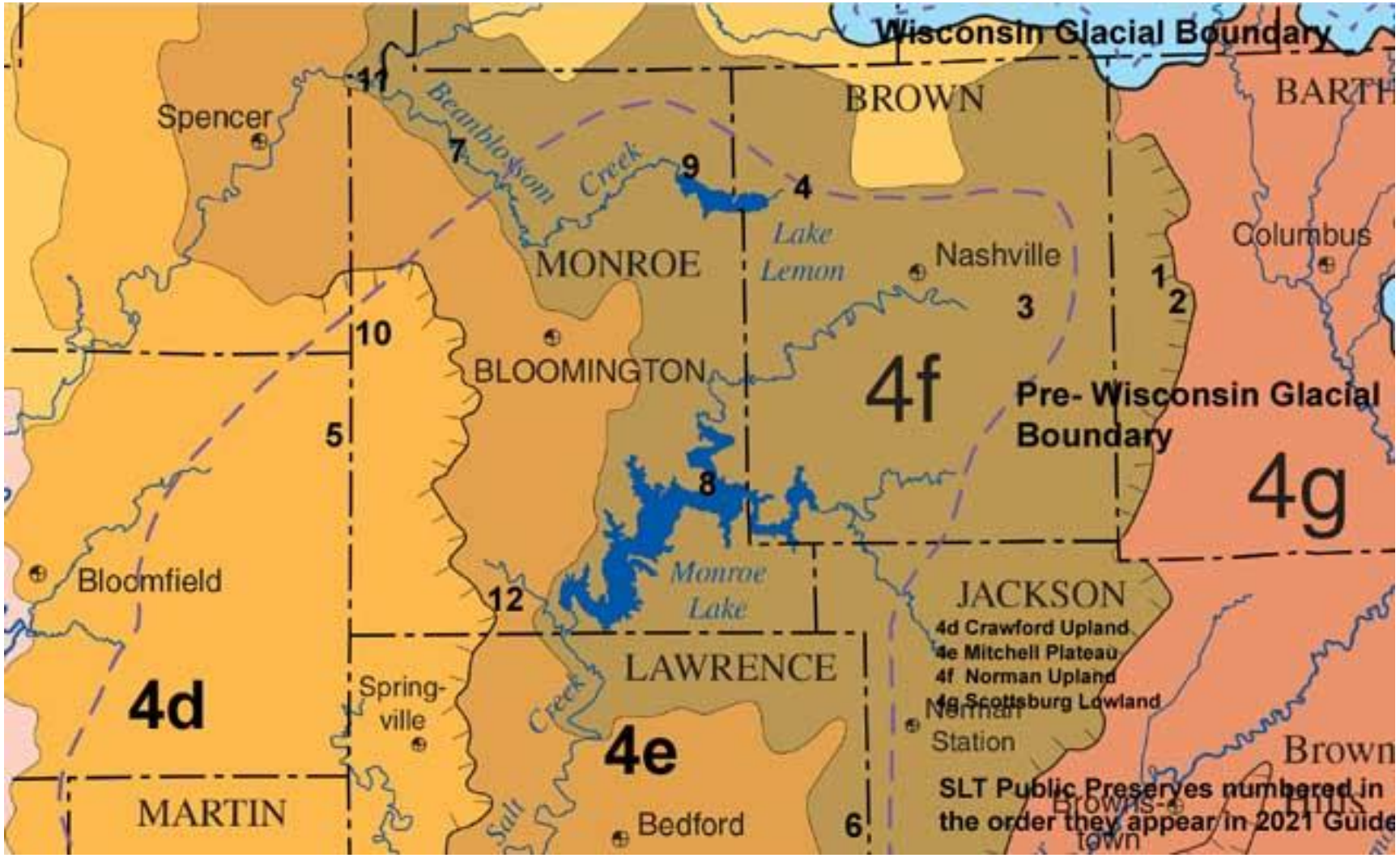
This document has three kinds of links: 1) for navigating around the document with “back to top” bringing you back to this index page, 2) links where referenced documents or web pages can be viewed/downloaded, and 3) links that provide additional information about terminology.

Preserve Maps

1. Tangeman Woods
2. Touch the Earth Natural Area
3. Laura Hare Nature Preserve at Downey Hill
4. Trevlac Bluffs Nature Preserve
5. Canyon Forest Nature Preserve
6. Jeremy Keith Oakley Preserve
7. Beanblossom Bottoms Nature Preserve
8. Amy Weingartner Branigan Peninsula Preserve
9. Bob Klawitter Lake Lemon Woods
10. Porter West Preserve
11. Powell Preserve
12. (The Cedars Preserve)

Physiography of Southcentral Indiana

Adapted from Gray (2000) Back to Index



[SLT Public Preserves in Southcentral Indiana]

Link above is for SLT's Preserve Guide and links below go to web page for individual preserves

1. Tangeman Woods
2. Touch the Earth Natural Area
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A Regional Geologic Overview

Southcentral Indiana is located on the eastern side of the Illinois Basin.

Paleozoic sediments in the basin slope to the southwest from the Cincinnati Arch, with oldest sediments outcropping on the Arch, and progressively younger sediments outcropping to the southwest.

Geologic Map of Southcentral Indiana

Adapted from Gray et al. (1987) Numbers refer to SLT preserves identified on the Index page.

Legend (east/oldest to west/youngest):

Devonian

Dm = New Albany Shale

Mississippian

M1 = Borden Group

M2 = *Sanders Group*

M3 = Blue River Group including Paoli Limestone and Ste Genevieve Limestone

M4 = West Baden Group

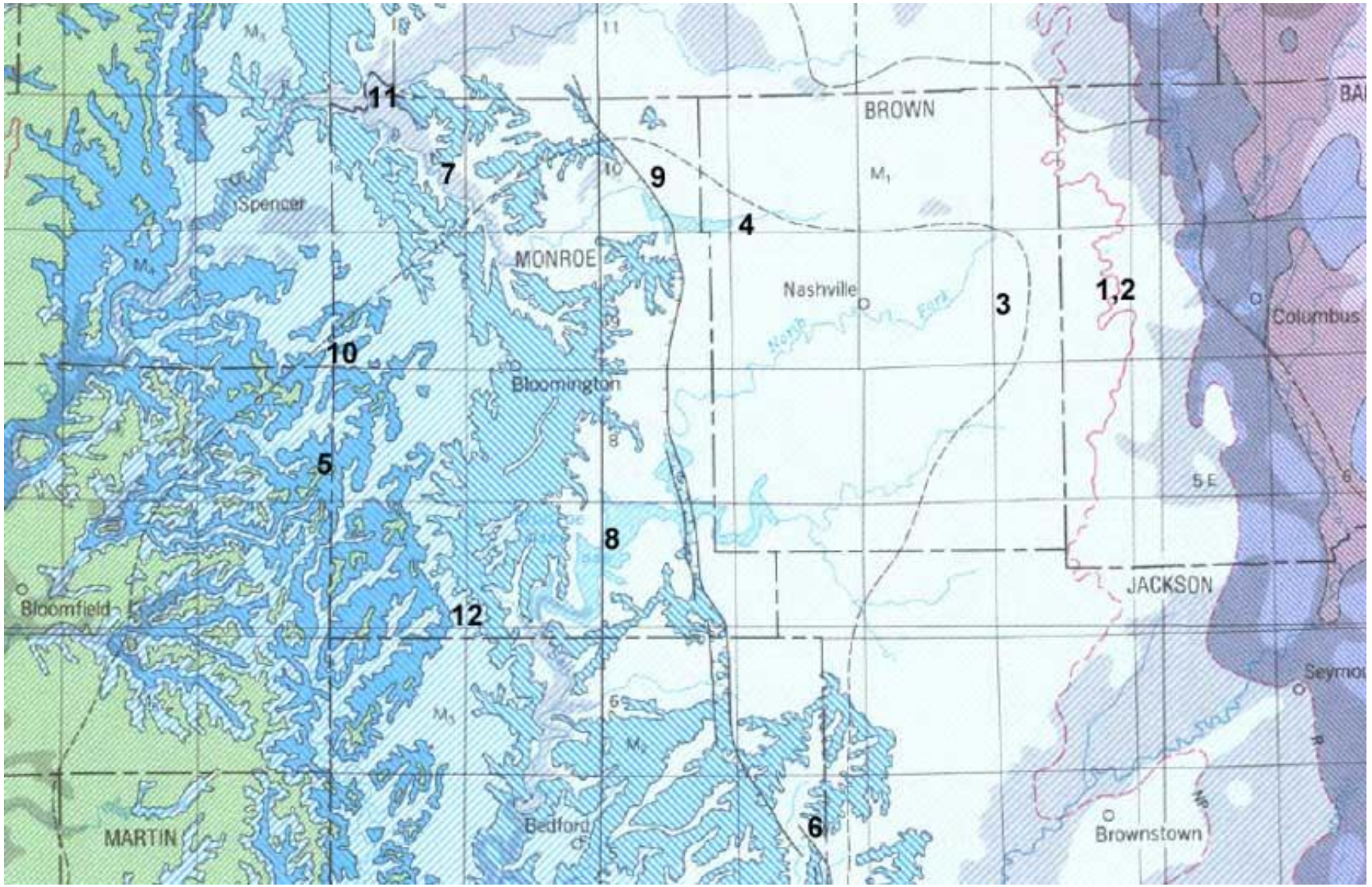
M5 = Stephensport Group

M5 = Buffalo Wallow Group

Pennsylvanian

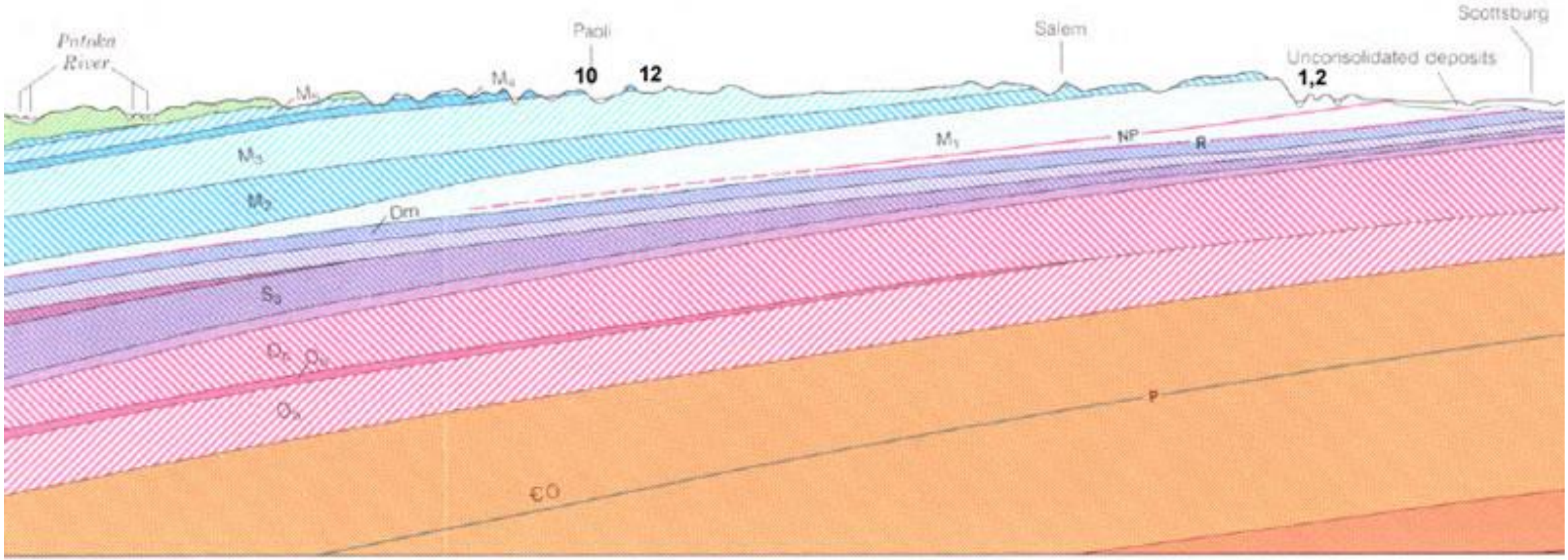
P1 = Mansfield Formation at base of the Raccoon Creek Group

Italics = Formations present at SLT preserves.



Southcentral Indiana Bedrock Cross Section Back to Index.

Adapted from Gray et al. (1987). This section lies south of SLT's preserves so only a few can be accurately shown: Tangeman Woods (1), Touch the Earth (2), Porter West (10), The Cedars (12).



CROSS-SECTION B-B' SHOWING CONFIGURATION OF LAND SURFACE AND BEDROCK UNITS

VERTICAL EXAGGERATION 20X

Stratigraphy of Norman Upland and Mitchell Plateau

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Adapted from Thompson et al. (2016)

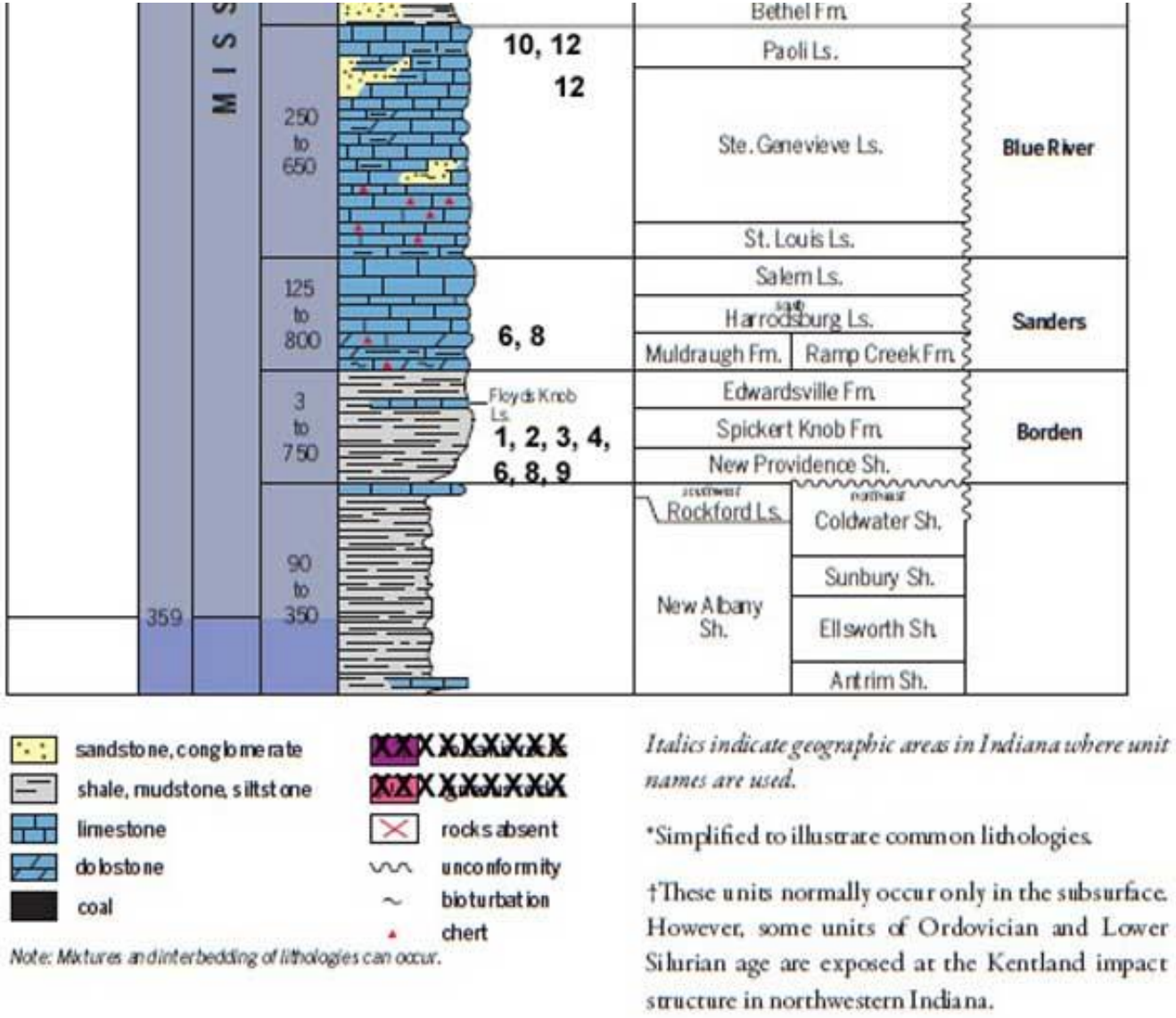
Norman Upland is underlain by siltstones of the Borden group.

Tangeman Woods (1) and Touch the Earth (2) in Bartholomew County are east of the Knobstone Escarpment near transition to the Scottsburg Lowland.

Laura Hare at Downey Hill (3), Trevlac Blufffs (4) Amy Weingartner (8) and Bob Klawitter Lake Lemon Woods (9) in Monroe County, and Jeremy Keith Oakley Preserve (6) in Lawrence County are all west of the Knobstone Escarpment.

Bedrock is buried by Quaternary and Holocene deposits in Beanblossom Bottoms (7) and Powell Preserves (11) in Monroe County.

The Cedars Preserve (12) in southwestern Monroe County is the only SLT preserve within the Mitchell Plain.



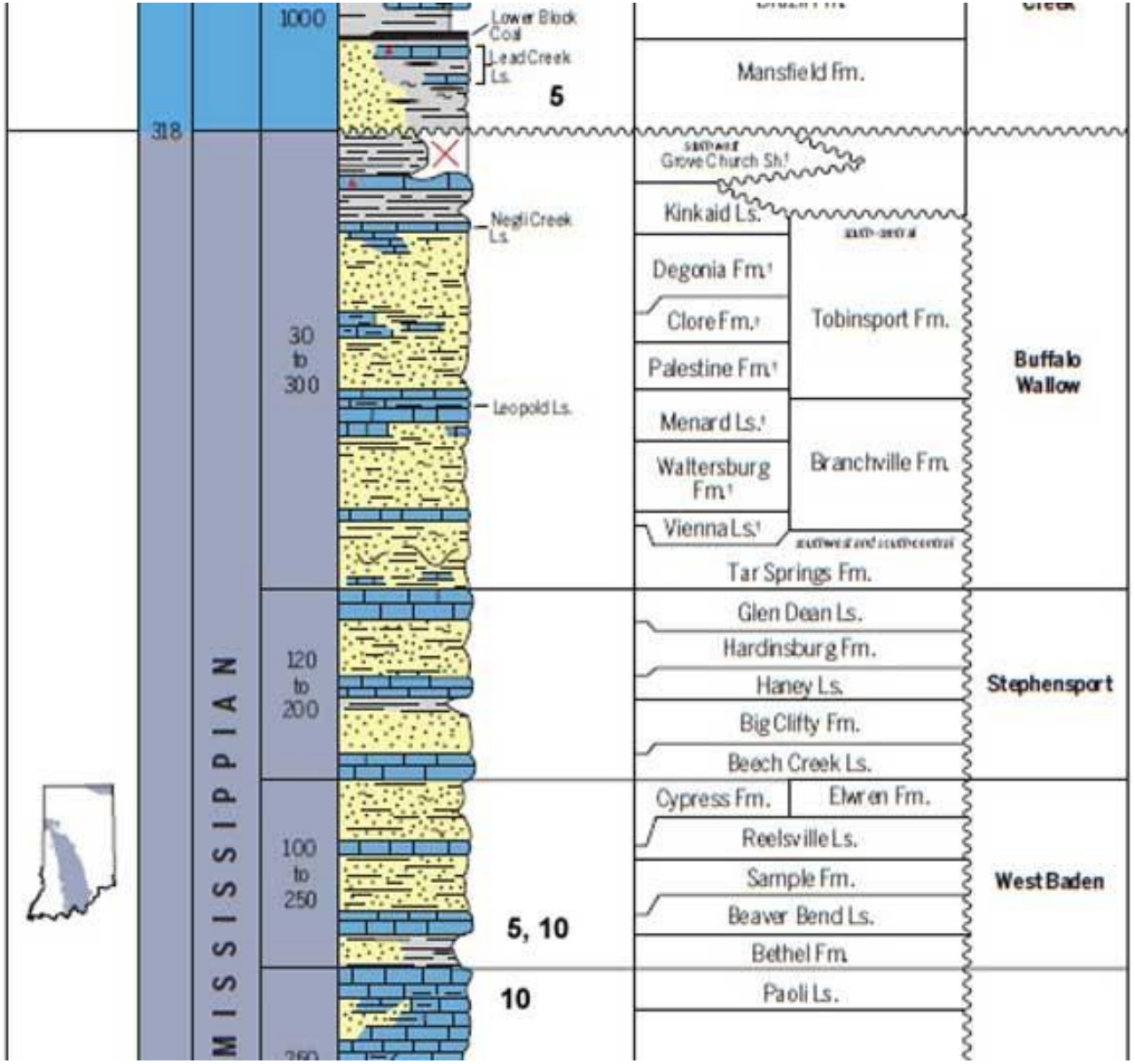
Stratigraphy of Crawford Upland

Adapted from Thompson et al. (2016), see previous slide for legend. Back to Index

The Crawford Upland includes interbedded sandstones, shales and limestones of Mississippian (eastern part) and Pennsylvanian age (western part).

The Porter Preserve (10) in western Monroe County includes formations in the West Baden Group and also Paoli Limestone in the upper part of the Blue River Group.

Forest Canyon Preserve (5) in eastern Greene County includes the Mississippian-age West Baden Group and Pennsylvania-age Mansfield Formation of the Buffalo Wallow Group.



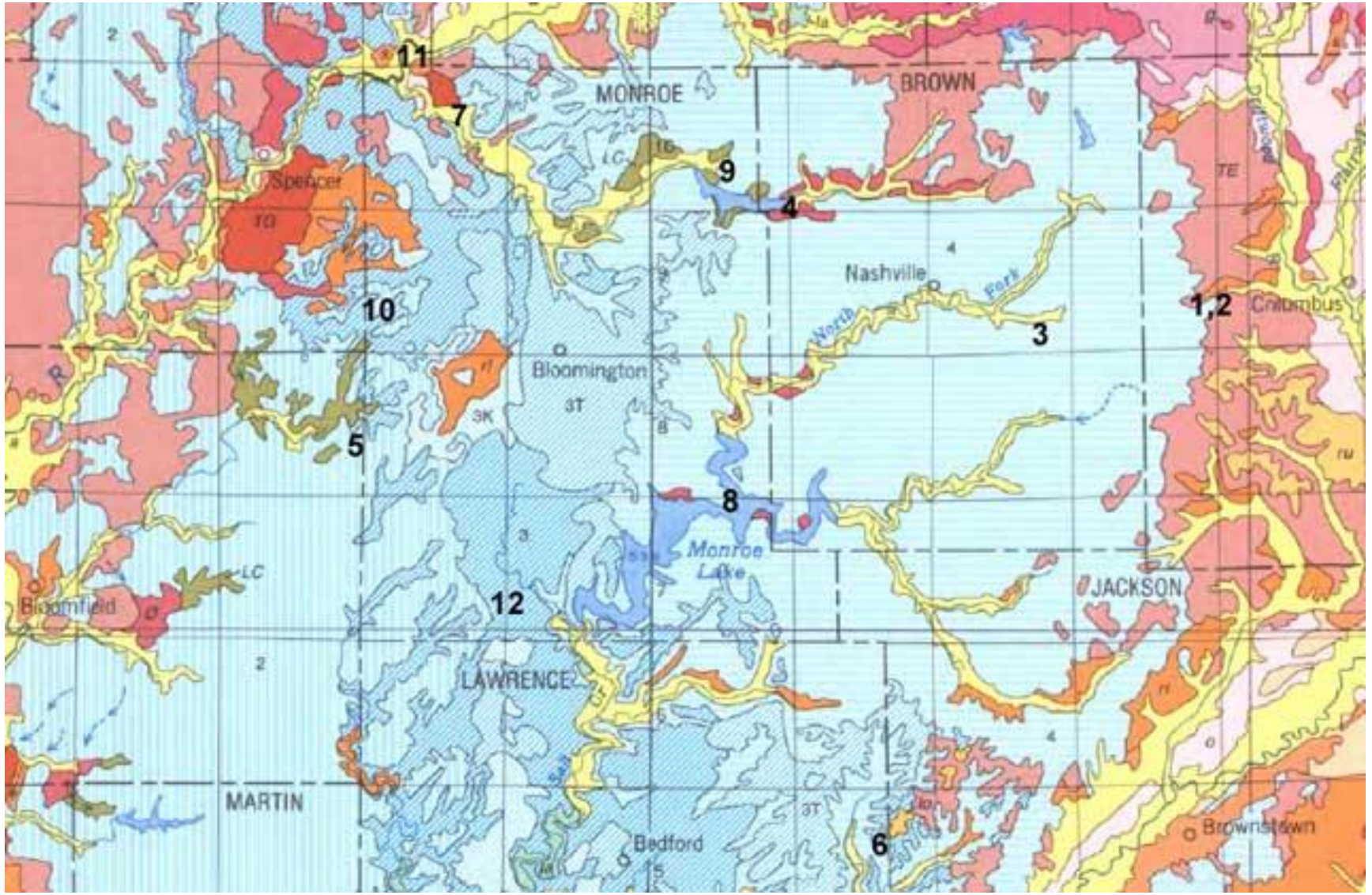
Quaternary Map of Southcentral Indiana

Adapted from Gray (1989) Numbers refer to SLT preserves identified on the Index page.

The Quaternary geologic period includes the modern Holocene epoch, which began around 12,000 years ago at the close of the most recent Wisconsin glaciation and the Pleistocene epoch which began about 2.6 Ma (million years ago).

Quaternary deposits in southcentral Indiana were mostly deposited during the Illinoian Stage and include: glacial till (light red), sandy glacial outwash terraces (red), fine-grained lacustrine deposits (olive), and modern alluvium (yellow).

Areas in blue = bedrock uplands that were not directly affected by glaciation except for being covered by up to 5 feet+ of windblown Wisconsin-age Peoria loess.



Overview of Bedrock and Quaternary Geology SLT Preserves

(Source: SoilExplorer.net) Numbers refer to SLT preserves identified on the Index page.

Key to Colors:

Upland soils formed in loess over weathered bedrock:

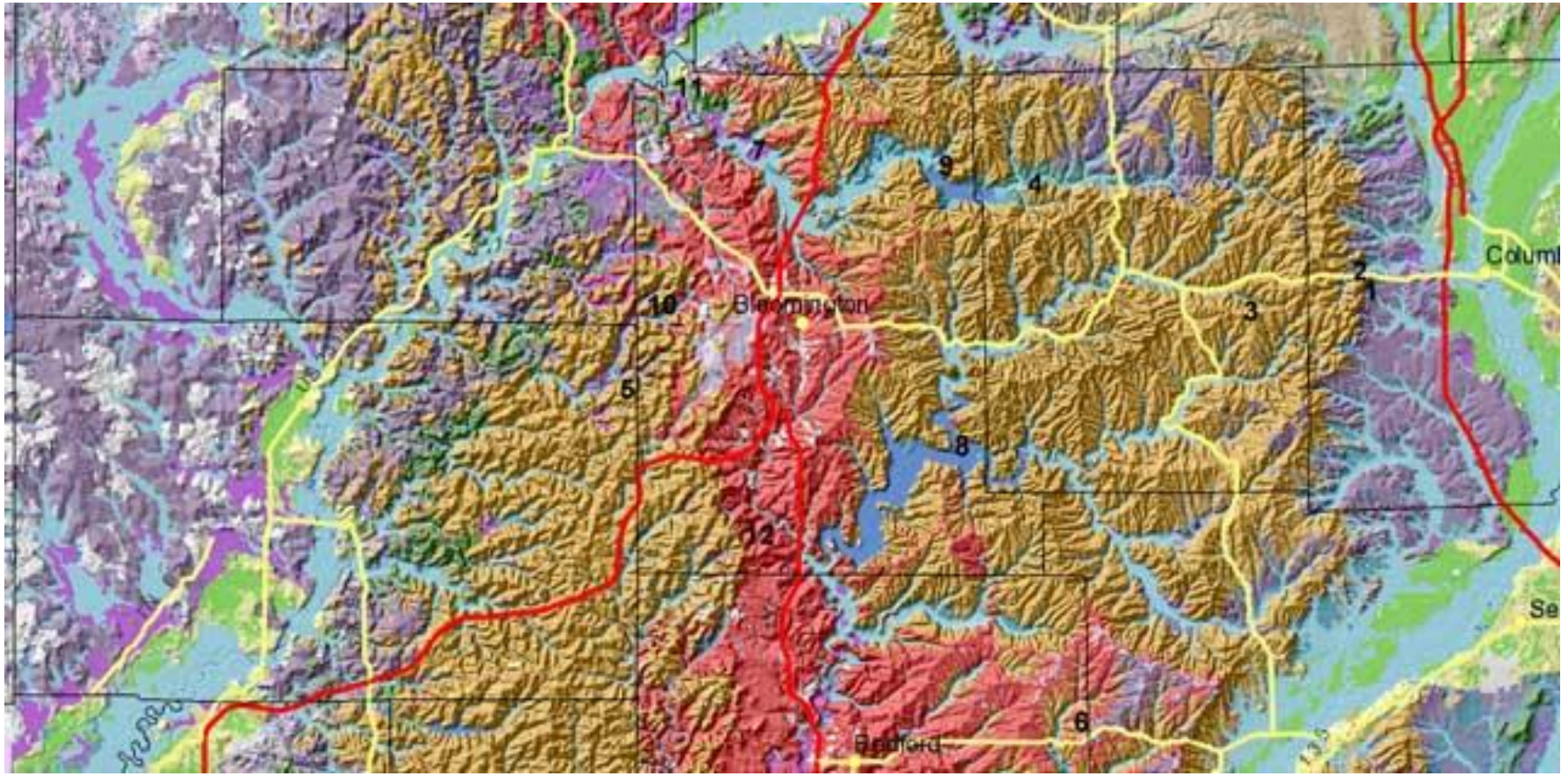
- Tan = East: mostly siltstone/Norman Upland; Central: sandstones, shales and limestones/Crawford Upland.
- Red = Limestone soils/Mitchell Plateau.

Soils formed in glacial loess over glacial tills:

- Gray = Wisconsin till.
- Purple = pre-Wisconsin till.

Alluvial soils formed on terraces and floodplains:

- Green = pre-Wisconsin sandy outwash.
- Blue = pre-Wisconsin fine-grained alluvium on terraces.
- Fuchsia = fine-grained lacustrine soils.
- Light Blue = modern floodplain alluvium (Holocene).



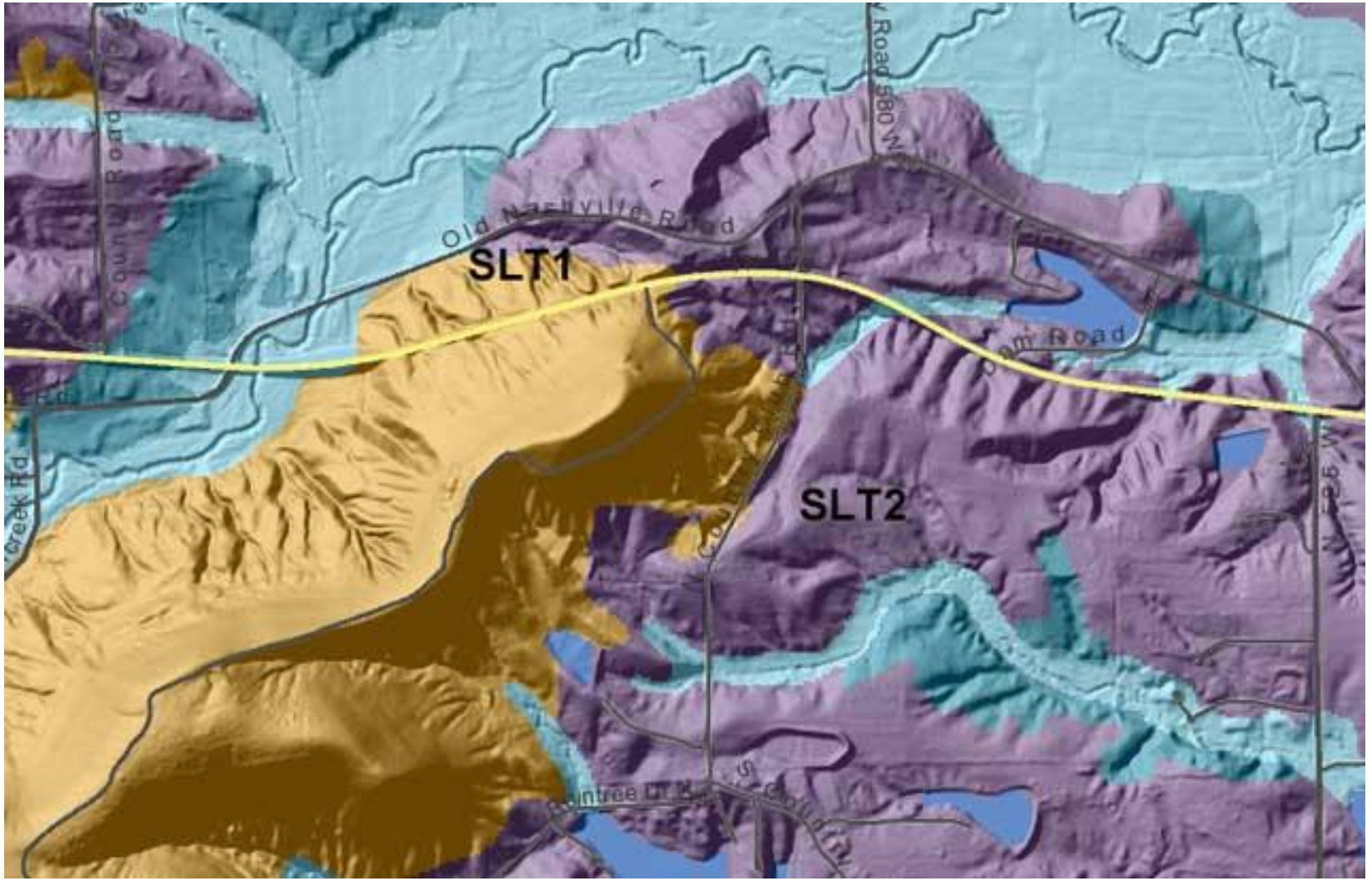
Tangeman Woods (1) and Touch the Earth (2) Back to Index

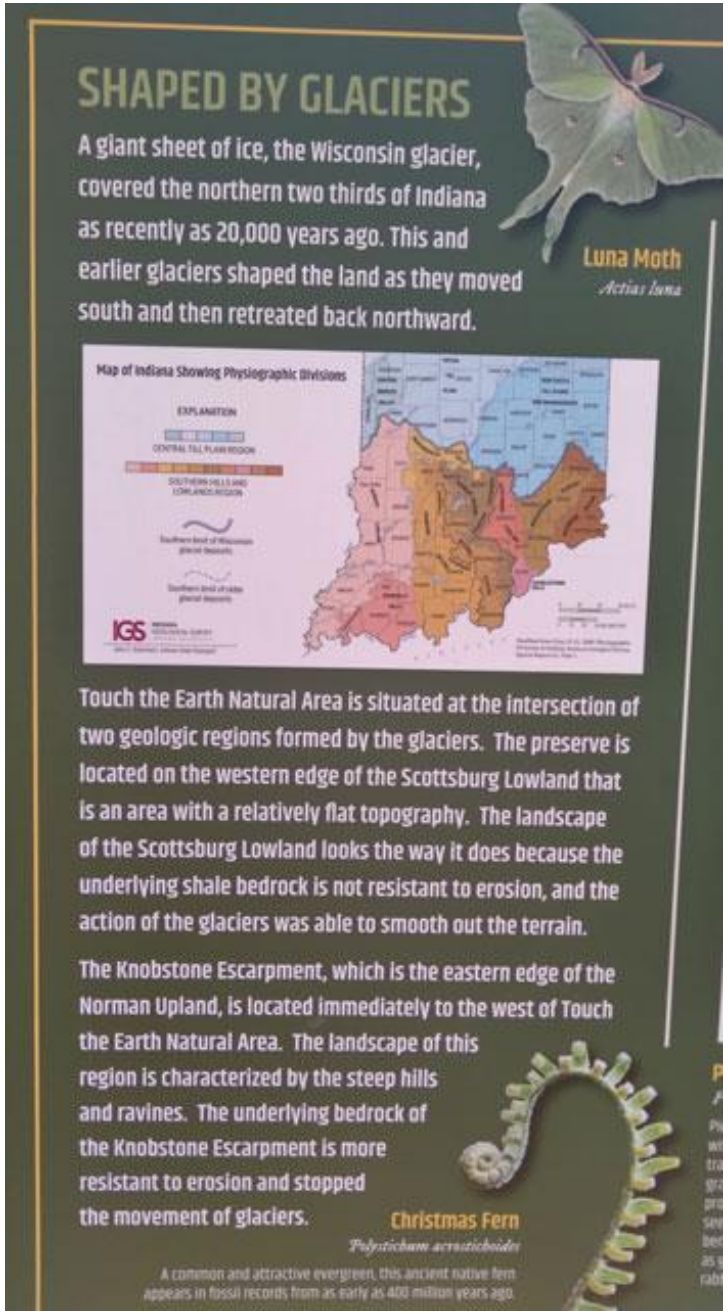
Tangeman Woods (1) and Touch the Earth (2)
Bedrock and Quaternary Geology (SoilExplorer.net)

Tangeman Woods and Touch the Earth are east of the Knobstone Escarpment close to the boundary with the Scottsburg Lowland.

At Tangeman Woods, Illinoian glacial till covers bedrock in the northeastern part. In the central part the Borden formation is present, and the western part includes the Holocene floodplain of Wolf Creek

Most of Touch the Earth has Illinoian till covering bedrock with Holocene alluvium and pre-Wisconsin terraces in the central part.

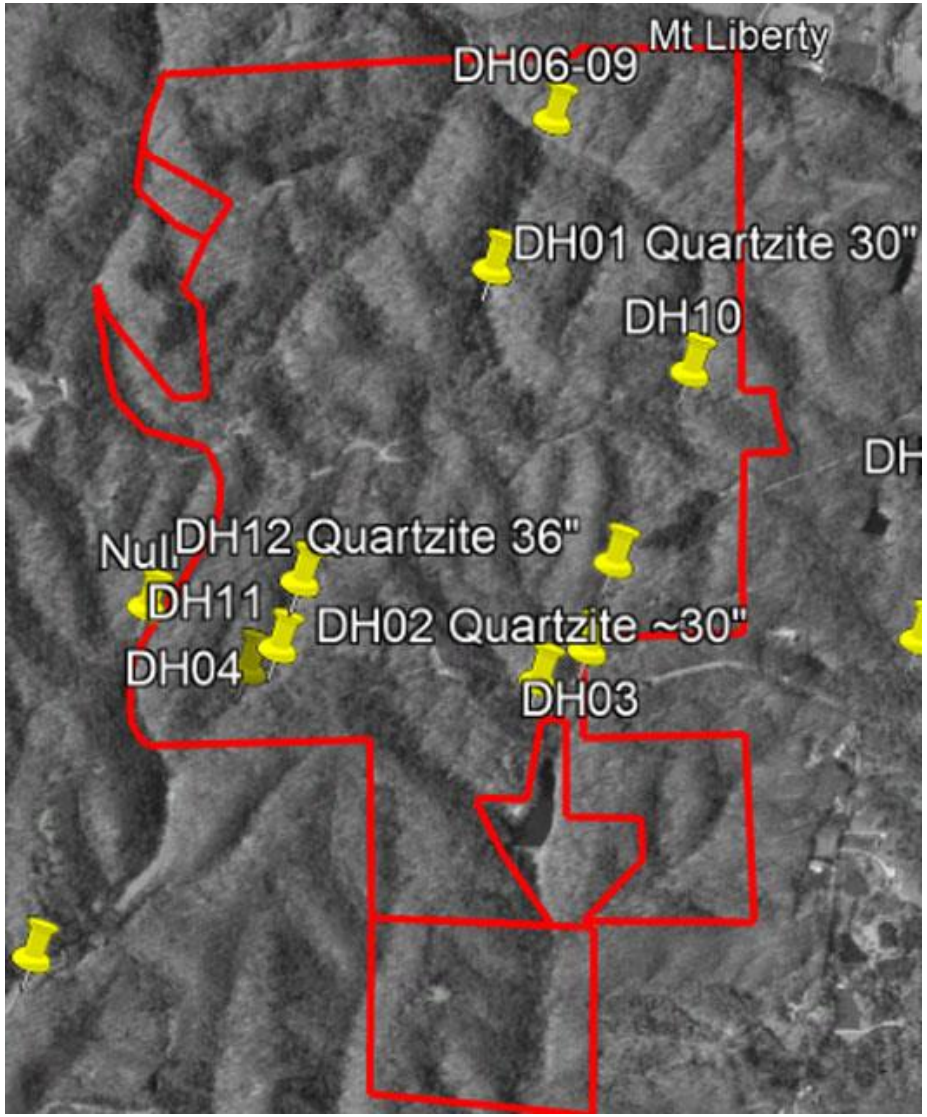


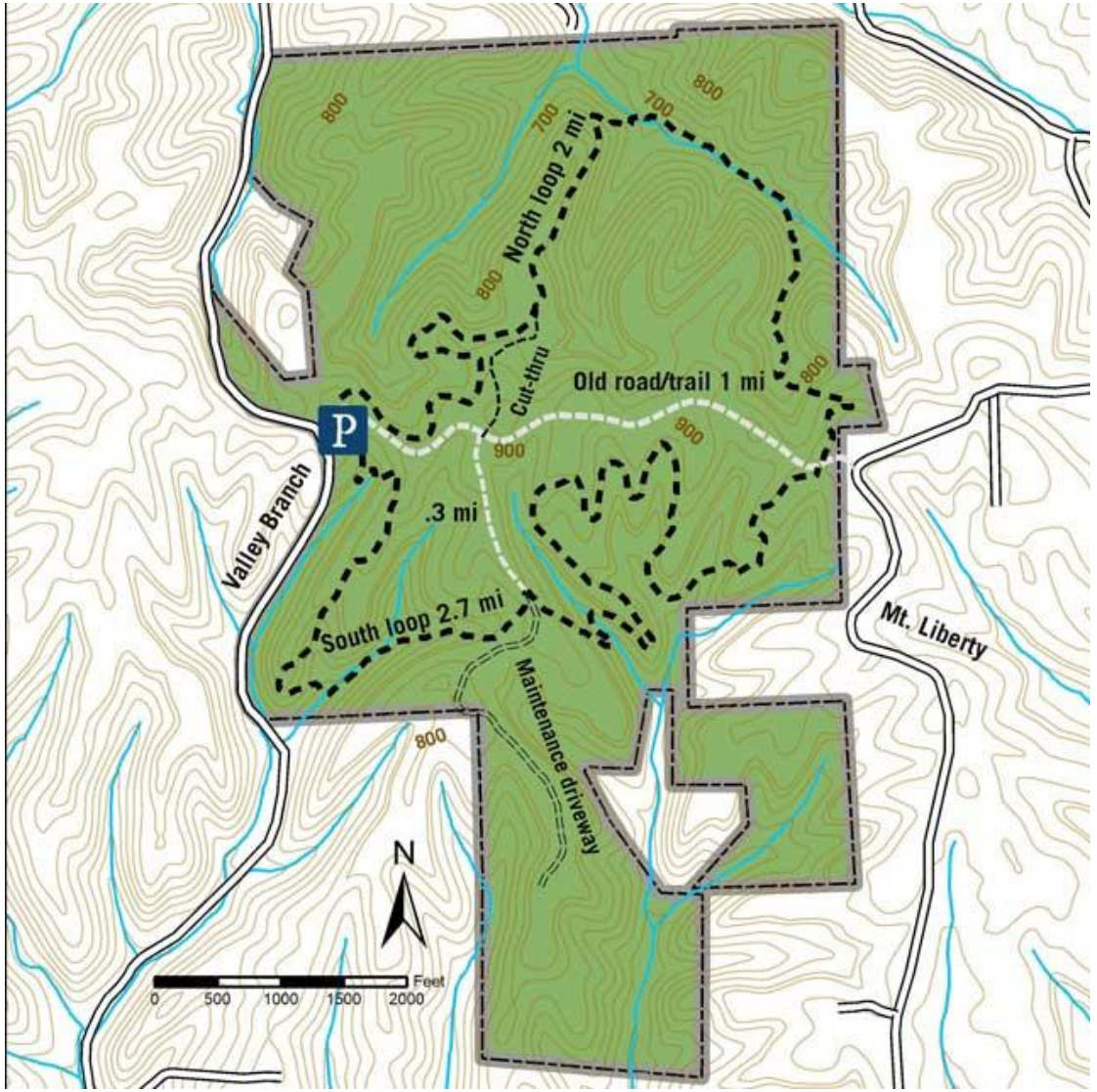


Touch the Earth (2) Glacial Erratic

Laura Hare Preserve at Downey Hill (3) Back to Index

Yellow pins show locations of glacial erratic boulders. The probable source of most of the boulders is the Lorrain Quartzite on the Canadian Shield, about 500 miles to the north.





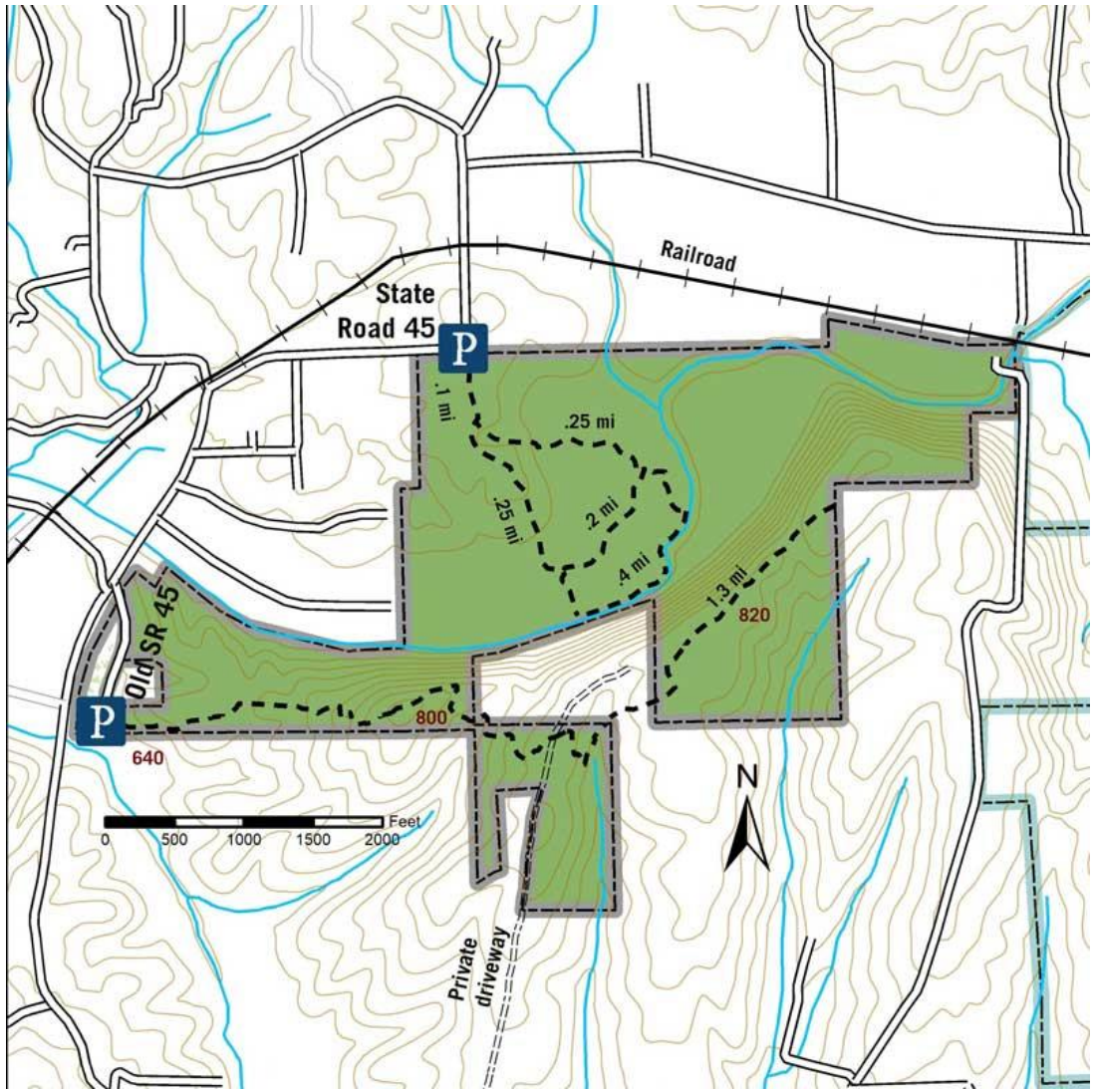
Laura Hare Preserve at Downey Hill (3) Bedrock and Quaternary Geology (SoilExplorer.net)

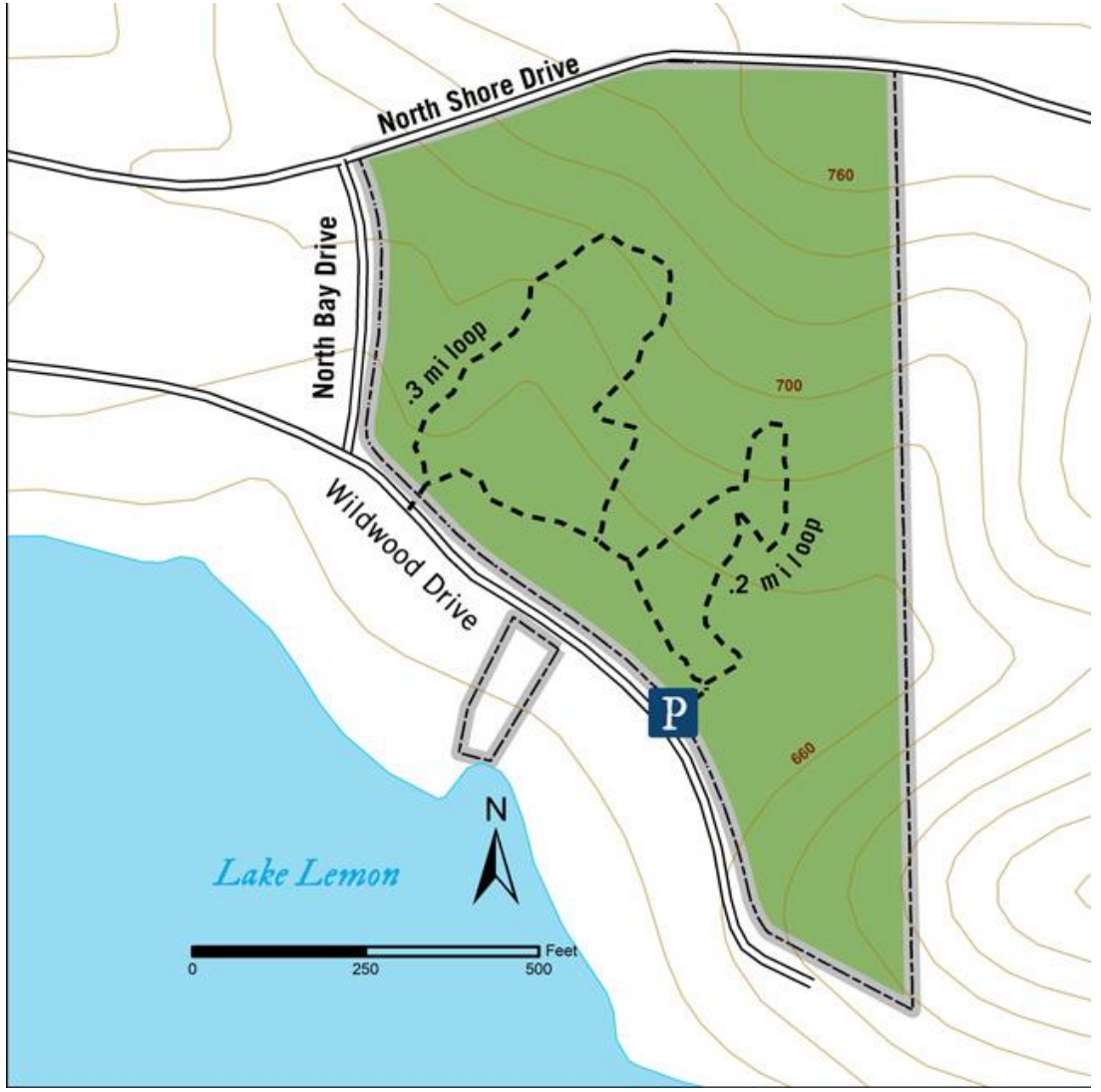
The old county road that extends east from the parking lot at Laura Hare Preserve (LHP) follows the drainage divide between the North and Middle Forks of Salt Creek. LHP exemplifies the rugged topography of the Norman Upland with narrow streams carved into the siltstone of the Borden Formation. Illinoian glacial outwash terraces line Mount Liberty Creek north of the preserve.

When I performed the Phase I Environmental Site Assessment before SLT acquired LHP in 2010 I was amazed when I found multiple large glacial boulders in the narrow streambeds miles from the mapped glacial boundary. I have proposed that they are the remnants of a mid-Pleistocene glacier that extended farther than any subsequent glacial around 1.3 million years ago (Boulding 2020).

Downey Hill Quartzite Erratics and Septarian Concretions

Trevlac Bluffs (4) and Bob Klawitter Lake Lemon Woods (9) Back to Index



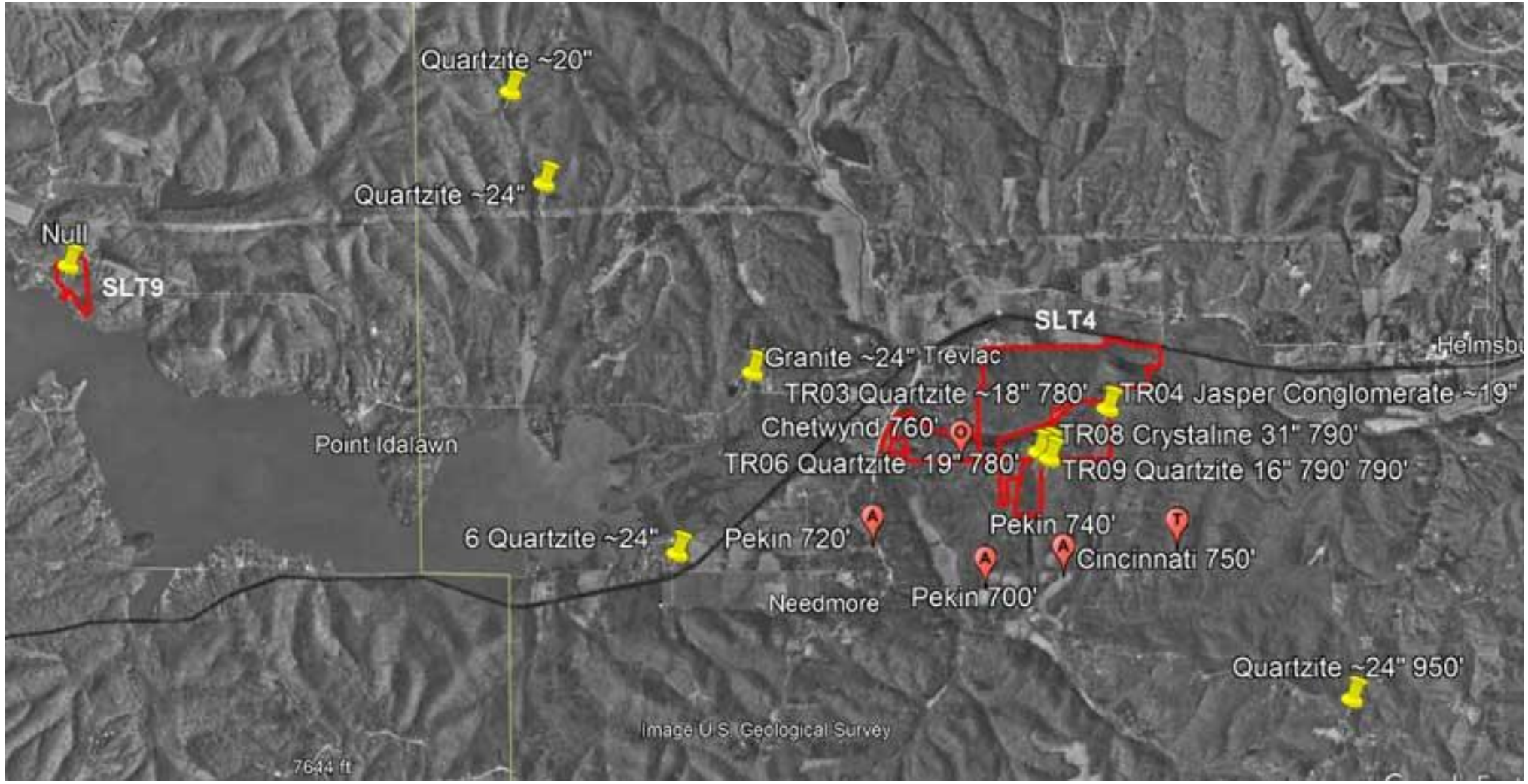


Trevac Bluffs (4) and Bob Klawitter Lake Lemon Woods (9)
Bedrock and Quaternary Geology (SoilExplorer.net)

Trevlac Bluffs (4) Jasper Conglomerate and Quartzite Glacial Erratics

Glacial Erratic Boulders, Till and Outwash in Area of Trevlac Bluffs (4) and Bob Klawitter Lake Lemon Woods (9)

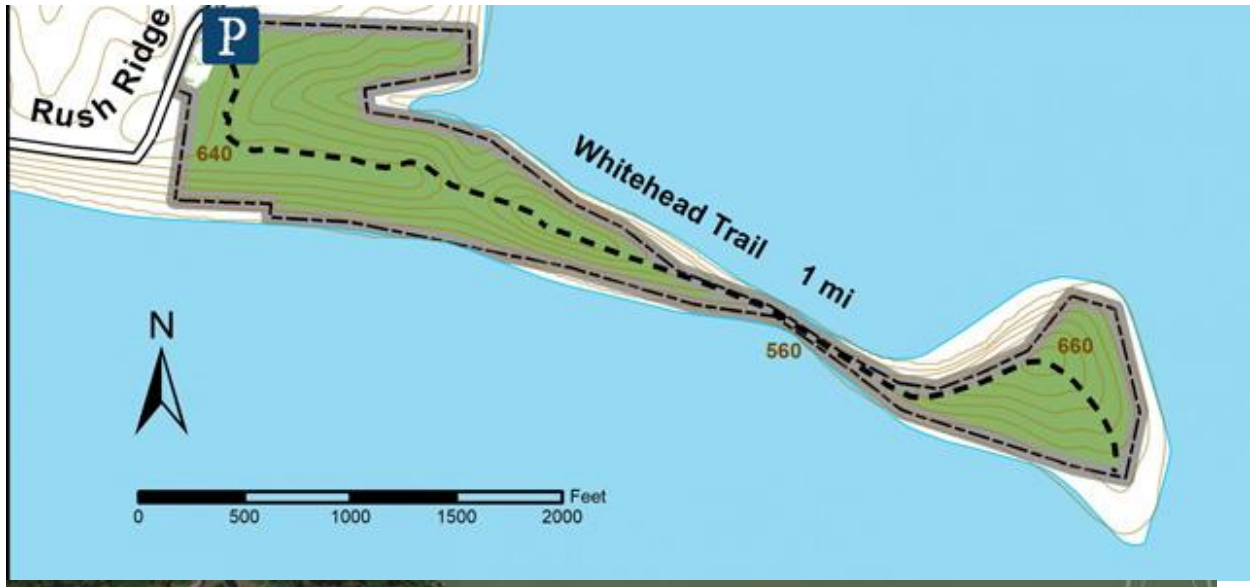
Yellow pins show locations of glacial erratic boulders (null = glacial boulders absent). Key to red pins is as follows: Pekin (A) = terrace soil formed in fine-grained alluvium, Chetwynd (O) = terrace soil formed in gravelly glacial outwash, Cincinnati (T) = Illinoian glacial till.



Amy Weingartner Branigan Peninsula Preserve (8) Back to Index

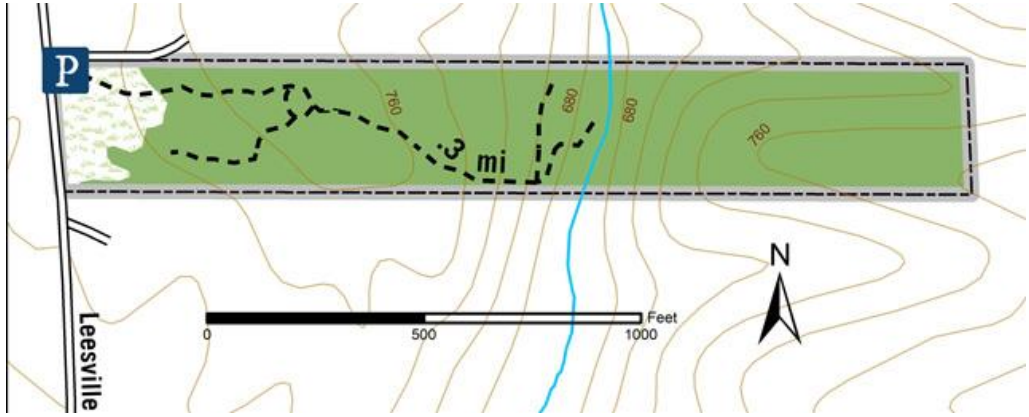
This preserve has a really, really interesting bedrock and Plio-Pleistocene history which will be covered in detail in a later presentation.

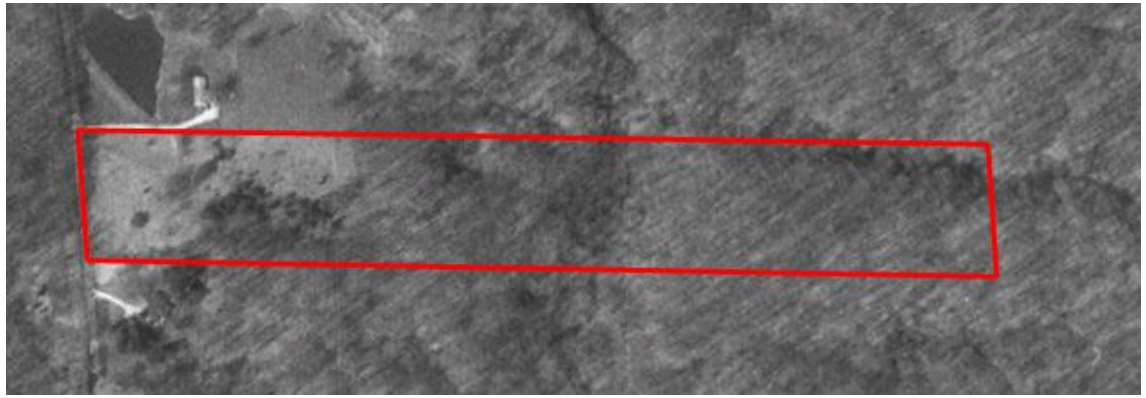
Lafayette-type gravel has a distinctive bronze patina



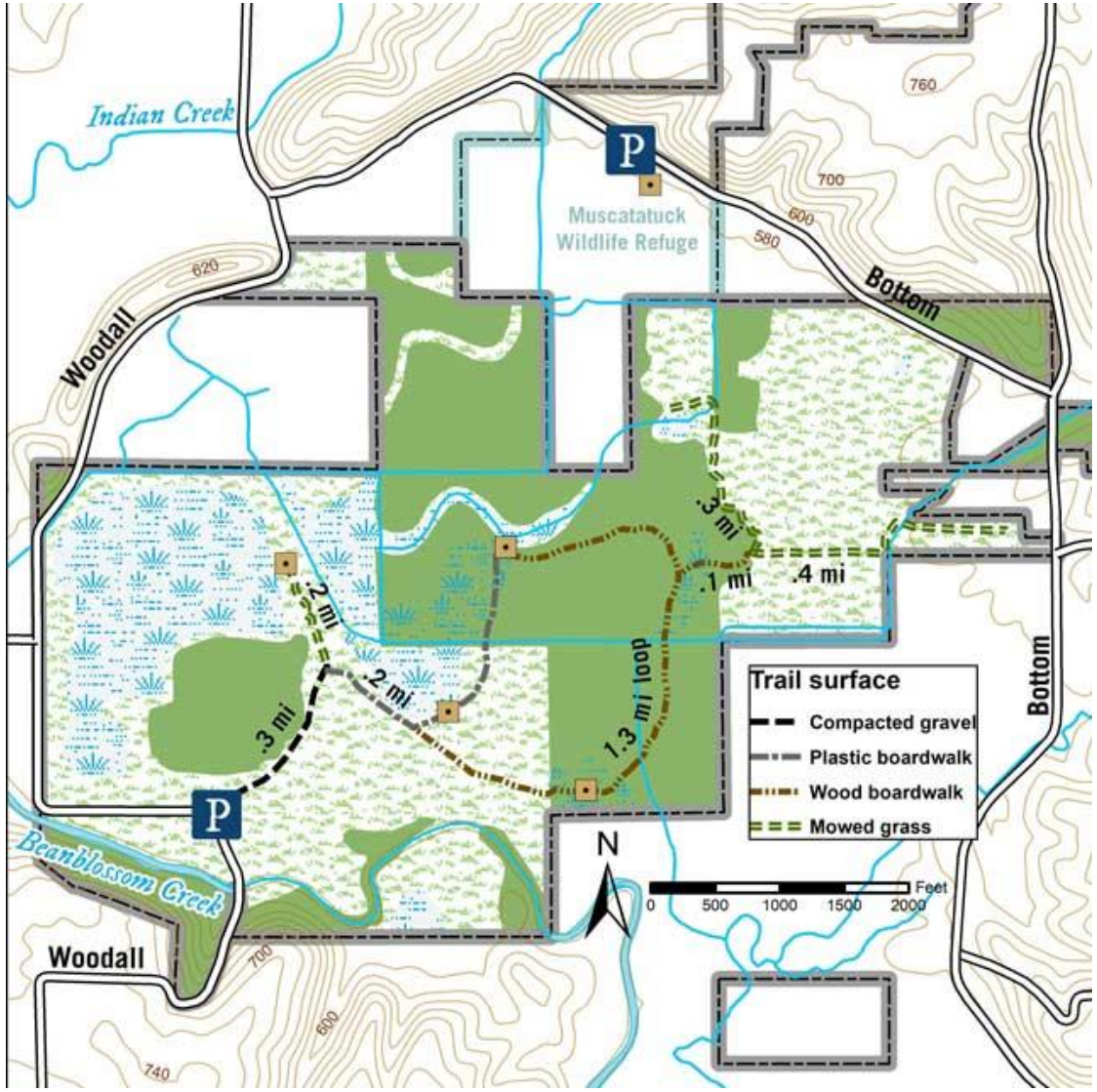
Jeremy Keith Oakley Preserve (6) Bedrock Geology Back to Index

- Located at the western edge of the Norman Upland in Lawrence County.
- Ridgetops are capped with limestone in the Sanders Formation.





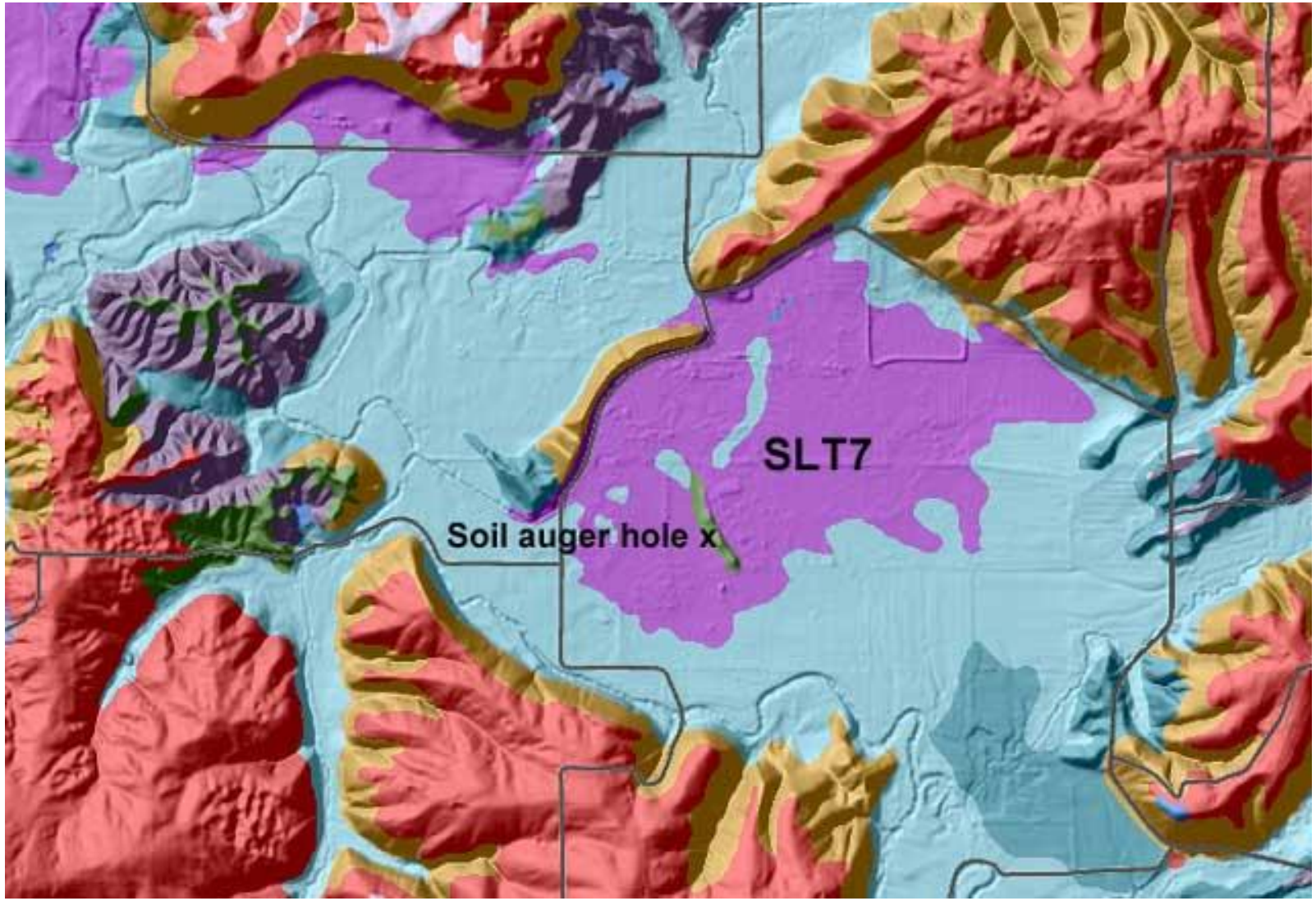
Beanblossom Bottoms Nature Preserve (7) Back to Index



Beanblossom Bottoms Nature Preserve (7) Bedrock and Quaternary Geology

(SoilExplorer.net)

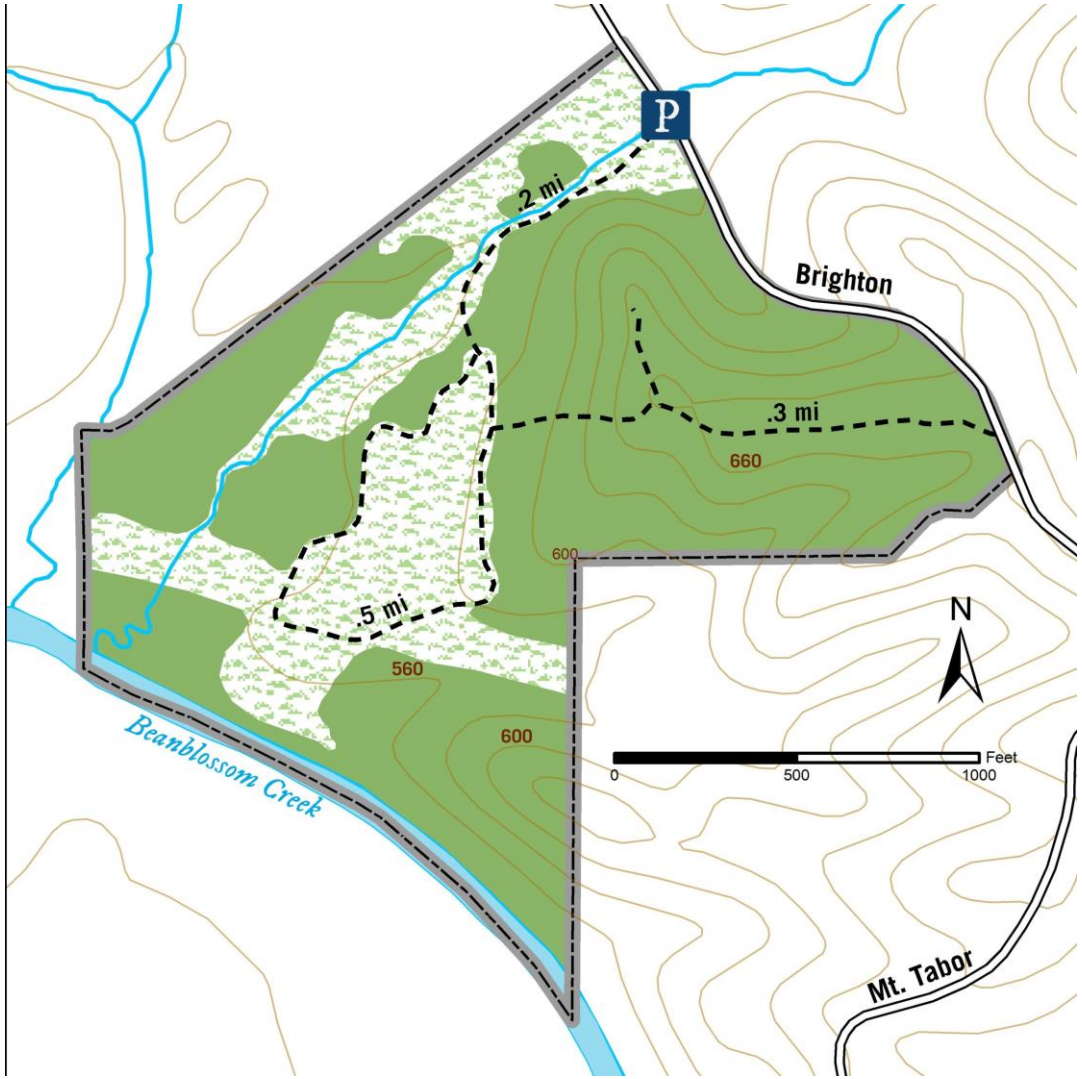
- Located entirely within the floodplain of Beanblossom Creek at the western edge of the Norman Upland.
- Illinoian glacial till (purple) extended into the lower valley of Beanblossom Creek almost as far as the preserve.
- The poorly drained lacustrine (fuchsia) and Holocene alluvium (light blue) soils support a diverse wetland ecosystem.
- The narrow glacial outwash ridge (green) has an interestingly complex soil stratigraphy that requires further study (Boulding 2020)



Beanblossom Bottoms Outwash Ridge 10-foot Soil Profile

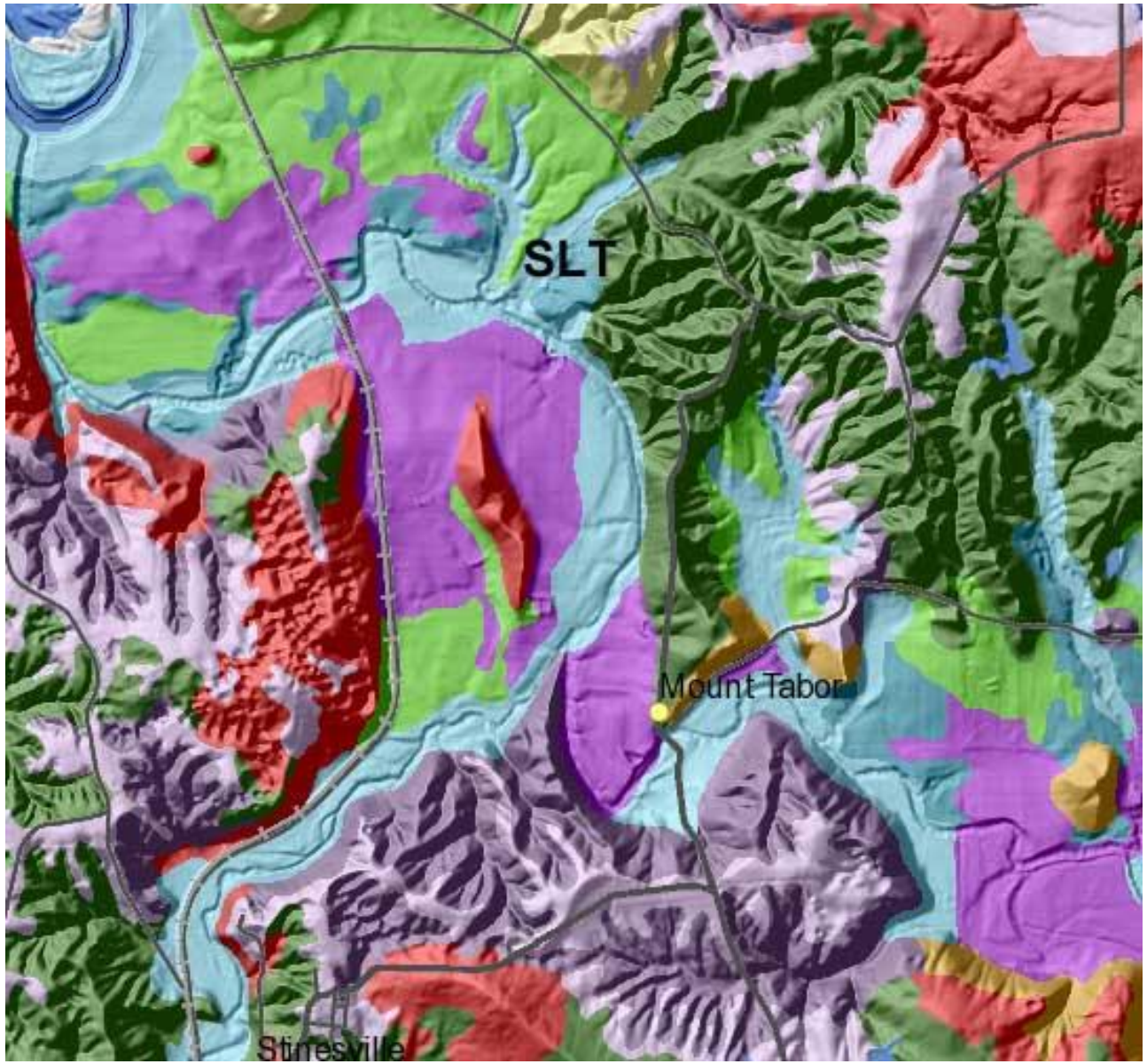
Collected in 6-inch increments with a hand auger

Powell Preserve (11) Back to Index

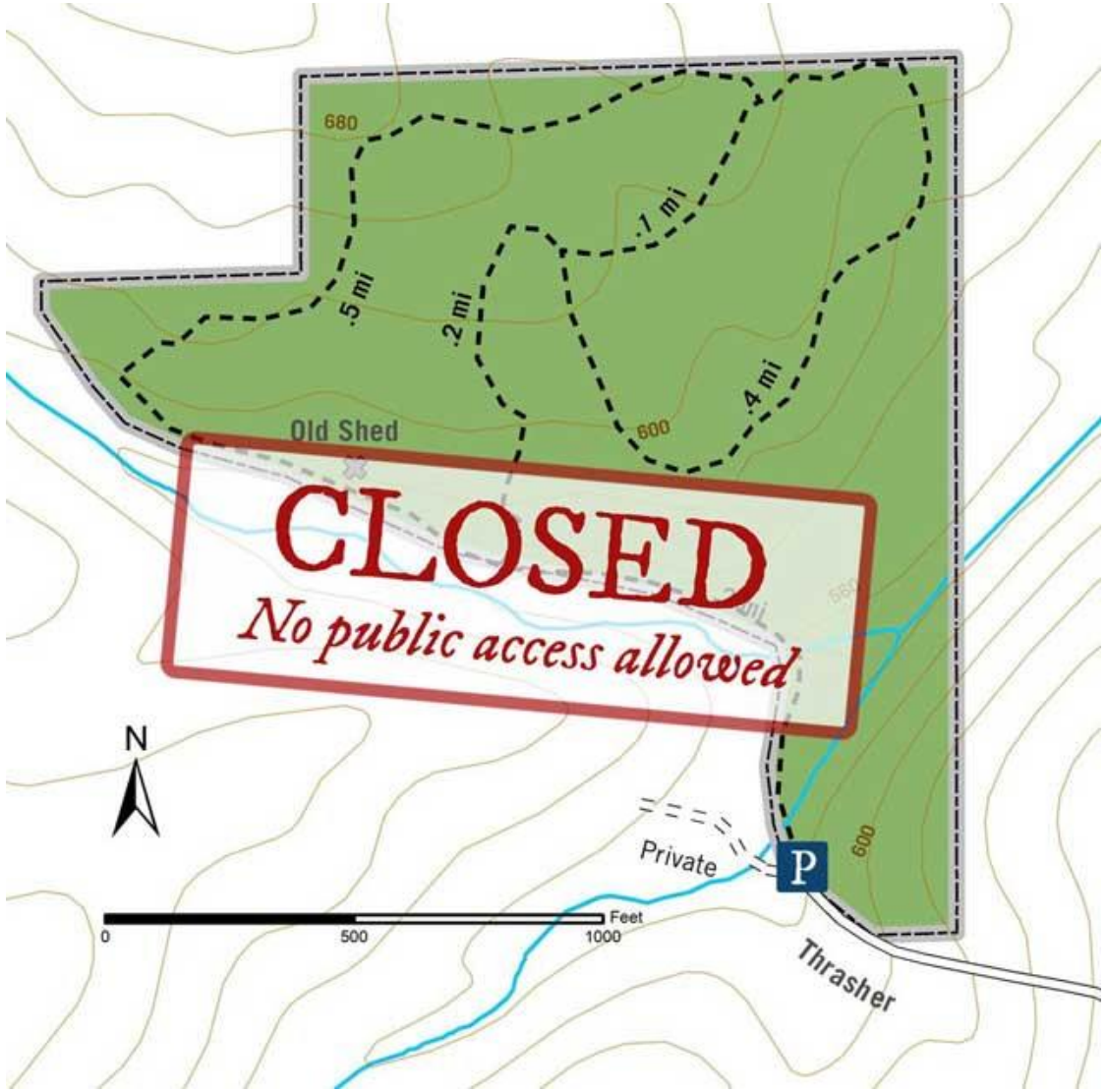


Powell Preserve (11) Quaternary Geology (SoilExplorer.net)

- Located in northwest Monroe County on Beanblossom Creek.
- Bedrock is buried by various Quaternary deposits: sandy Illinoian glacial outwash (green) and fine-grained terrace deposits (medium blue), Wisconsin-age glacial outwash, and Holocene (modern) alluvium (light blue).
- Sandy Illinoian outwash east of the preserve buries a former channel of Beanblossom Creek.
- When the retreating Illinoian glacier reached this area the old channel of Beanblossom Creek remained blocked and a new channel was cut through bedrock south of Mt. Tabor by glacial meltwaters from the upstream glacial lobe that reached as far as Trevlac (4).

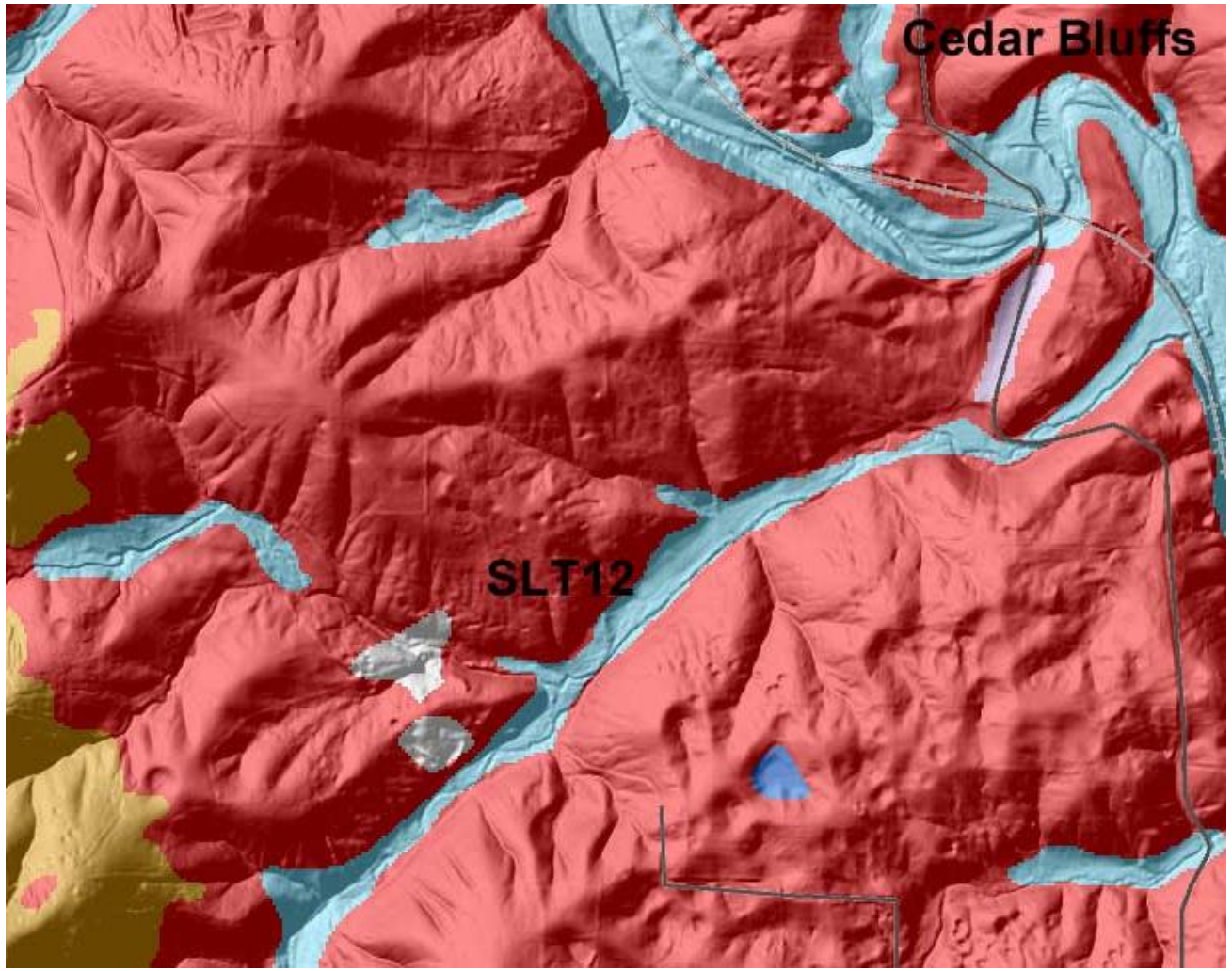


The Cedars Preserve (12) Back to Index

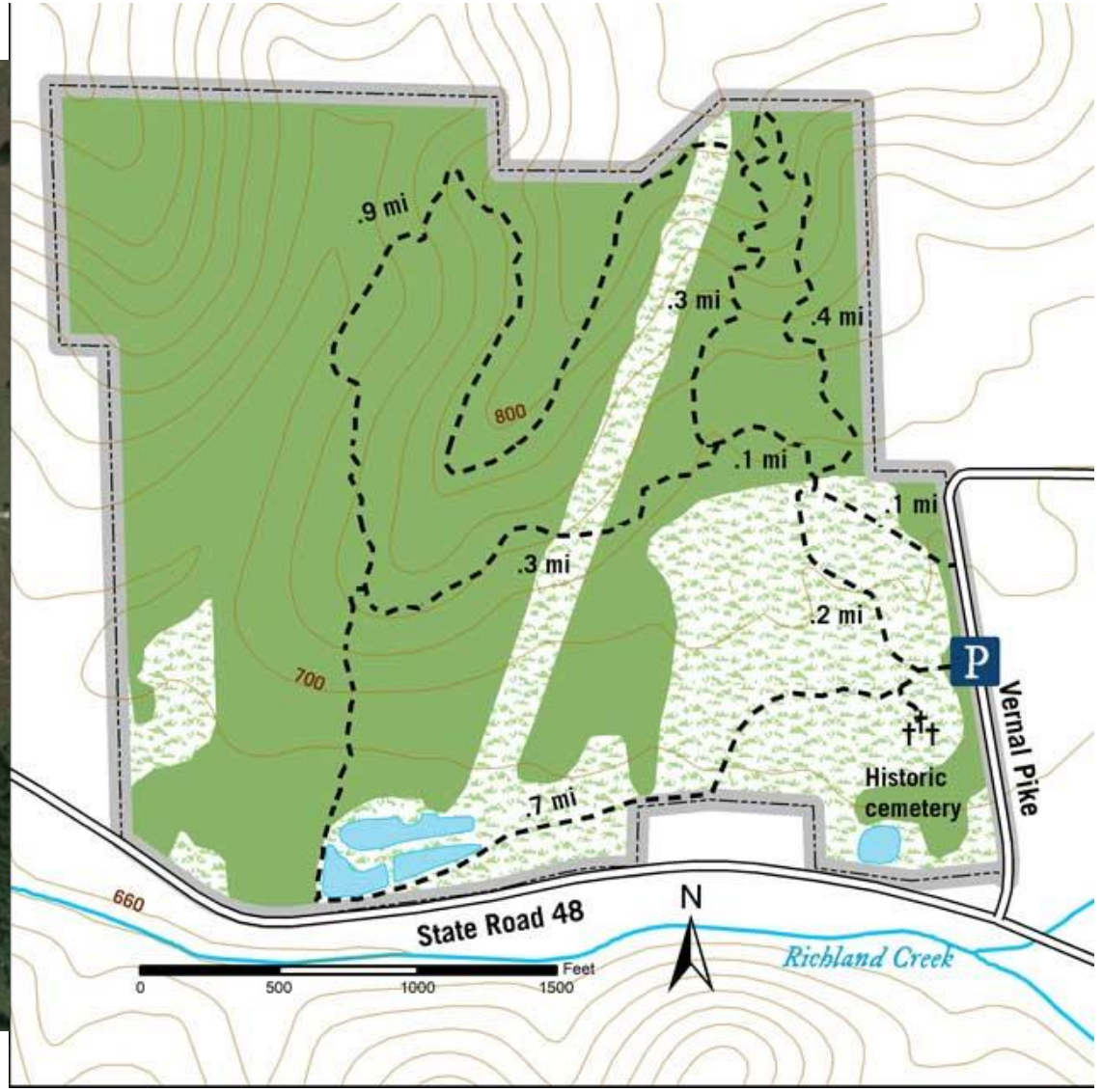


Cedars Preserve (12) Bedrock Geology (SoilExplorer.net)

- Located at the western edge of the Mitchell Plateau in southwestern Monroe County
- Paoli and Ste. Genevieve limestones are present at the preserve.
- The preserve is currently closed to allow the ecosystem to recover.
- The Nature Conservancy's Cedar Bluffs Conservation Area is one mile northeast of the preserve.

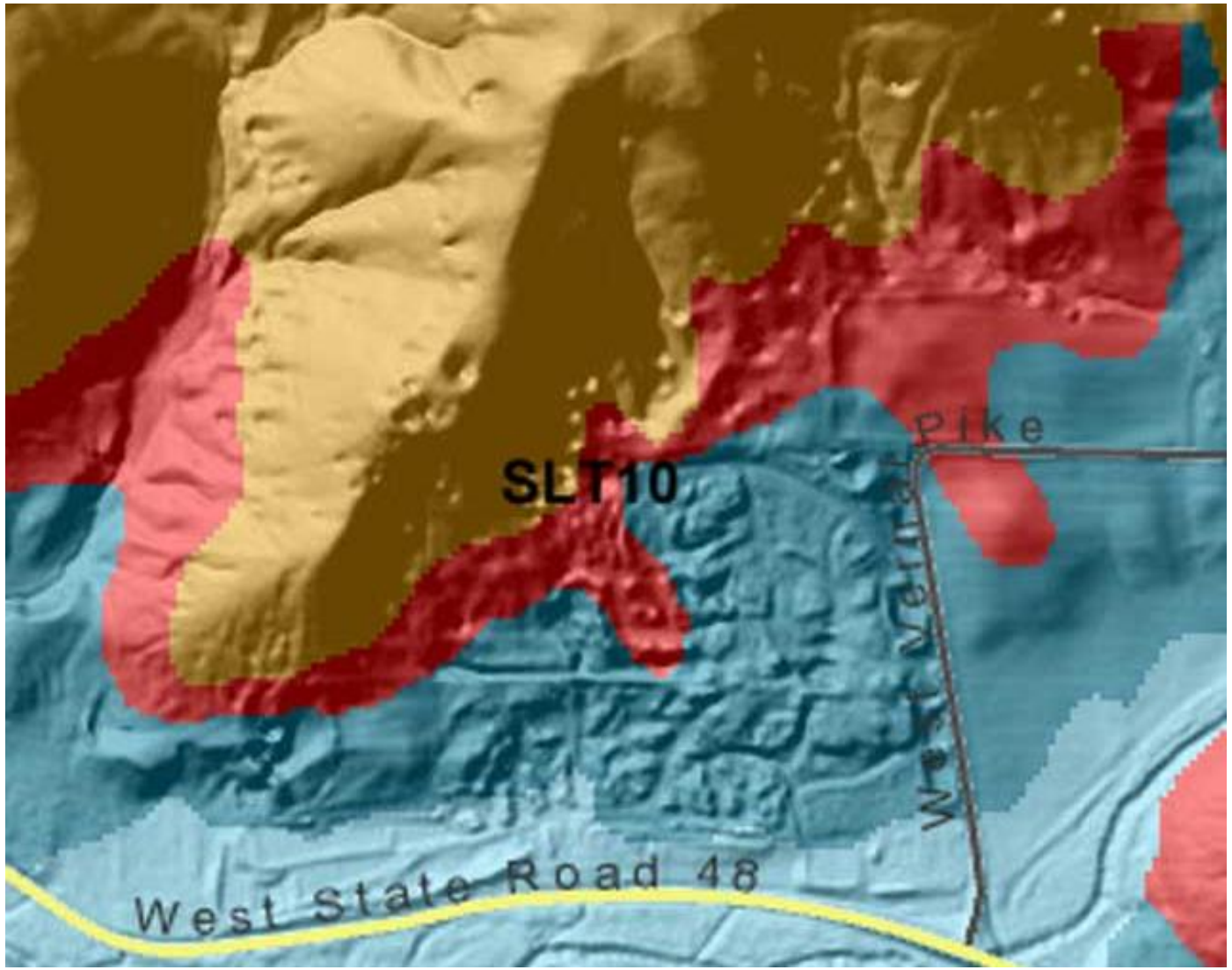


Porter West Preserve (10) Back to Index



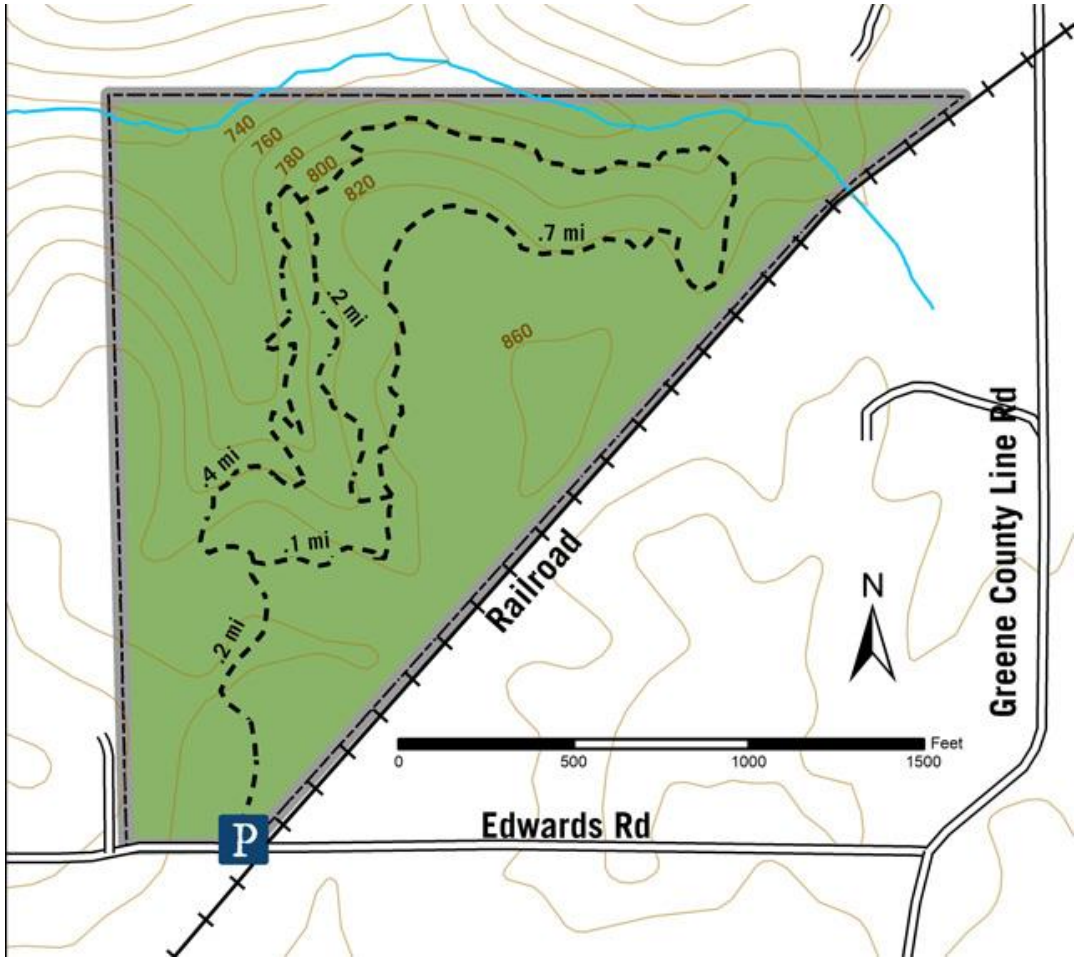
Porter West Preserve (10) Bedrock and Quaternary Geology (SoilExplorer.net)

- Located within the Crawford Upland on Richland Creek in western Monroe County.
- The southeastern part of the preserve has fine-grained terrace sediments (medium blue) that were deposited when the Illinoian glacier blocked Richland Creek to create a glacial lake.
- Paoli limestone is present in the central part and sediments of the West Baden Formation are present in the northwestern part of the preserve.



Canyon Forest Nature Preserve (5) Back to Index

Field observations recorded on the Google Earth image will be described in more detail in a later presentation



Canyon Forest Nature Preserve (5) Bedrock Geology (SoilExplorer.net)

This preserve has an exceptionally interesting bedrock geology which will be covered in detail in a later presentation.

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Physiography of Southcentral Indiana

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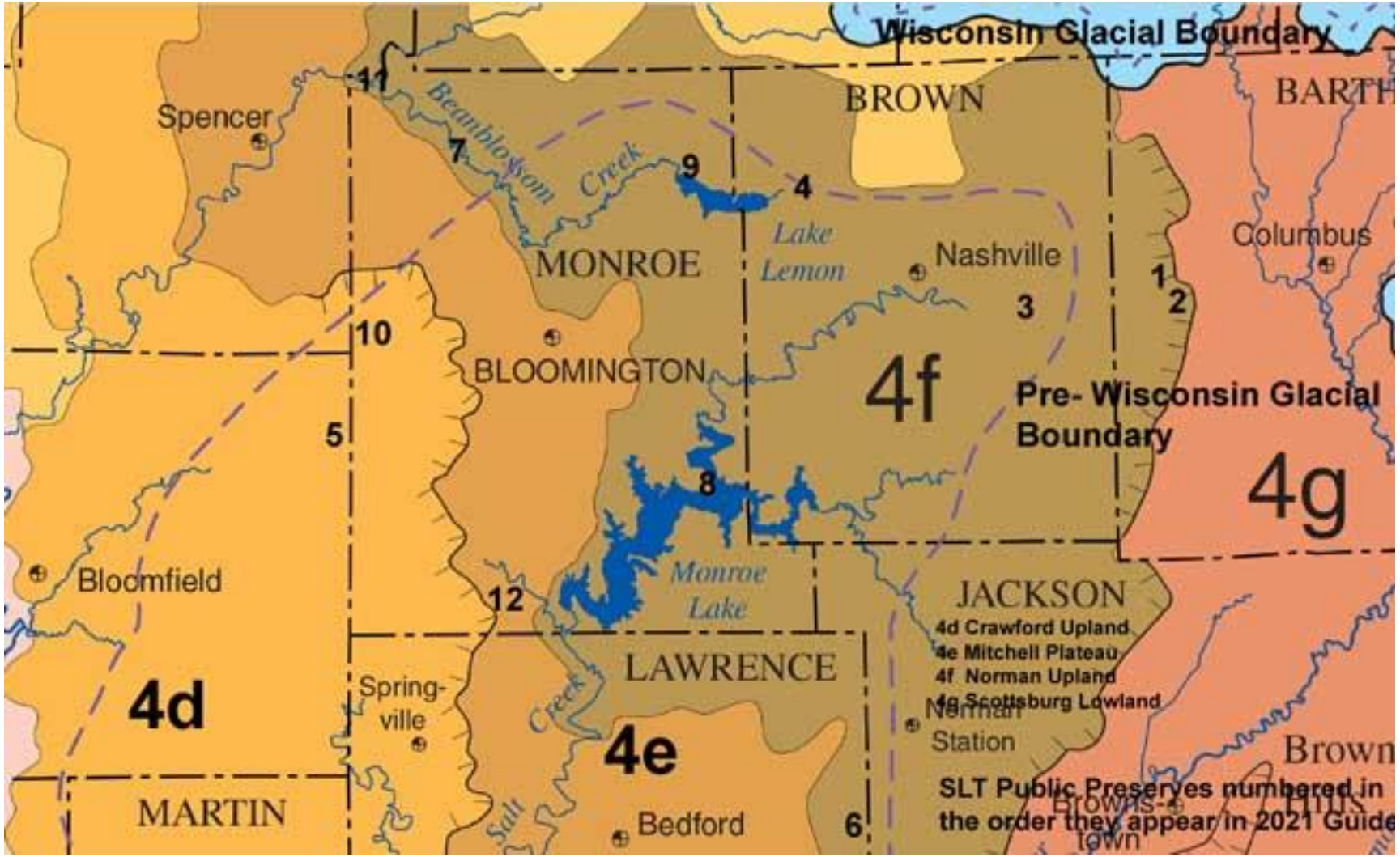

About Russell

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Russell Boulding got his BA in Geology from Antioch College in 1970 and spent several years of footloose wandering in the U.S., Europe and Africa, ending in Boulder, CO where he helped the Environmental Defense Fund set up their Denver office. In Boulder he met a pretty young geologist named Bonnie Gray from Bloomington IN, they married in 1973, and he gained as a father-in-law the eminent Indiana geologist, Henry Gray.

In 1975, after receiving an MS in Water Resources Management at the University of Wisconsin/Madison, Russell became a Hoosier, working on the State's accelerated survey program mapping soils in Dubois and Orange Counties. In 1977 he moved with Bonnie and their first of four children to Bloomington where he worked out of a home office as a free-lance environmental consultant for the next 40 years until retiring in 2017 at age 70. From 2013 to 2015 he performed Conservation Easement inspections for Sycamore Land Trust as a volunteer.

Since retiring Russell enjoys studying the glacial history of southcentral Indiana, spending time with his three grandchildren, and gardening, woodcutting and invasives clearing on a three-generation, three-household homestead near New Unionville.

Russell and Bonnie on the top of Browning Mountain, Brown County