When you don’t have rocks: Mapping vegetation to determine soils and using SoilWeb to “ground truth”

Mary Beck

Valencia College, Orlando FL

marybeck9@gmail.com

College policy: Travel time must fall within the time that class is scheduled to meet.

- Nearest outcrop is 50 minutes away if traffic is good.
- Small outcrop of limestone at mouth of spring.

Ocala Limestone
Rock Springs, Kelly Park, FL

St. Augustine Coquina
Washington Oak Gardens State Park, FL

Much of central Florida and Valencia College is situated on relict dunes of quartz sand.

Larger areas of sand are exposed in:

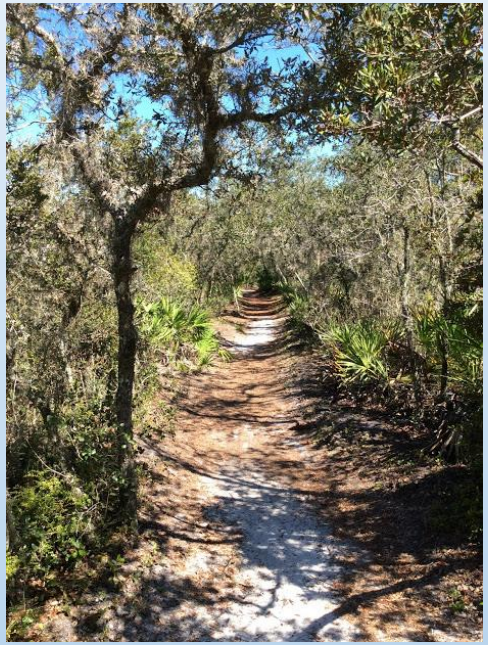
- Sand quarries (60 minutes away if traffic is good)
- Areas of slope erosion (dependent on new sink hole occurrence or erosion of existing ones)
- Construction sites (dependent on campus expansion)

One way to introduce students to geologic mapping is to have them map vegetation as a proxy for the soils that form in the quartz sands.

Tibet-Butler Nature Preserve

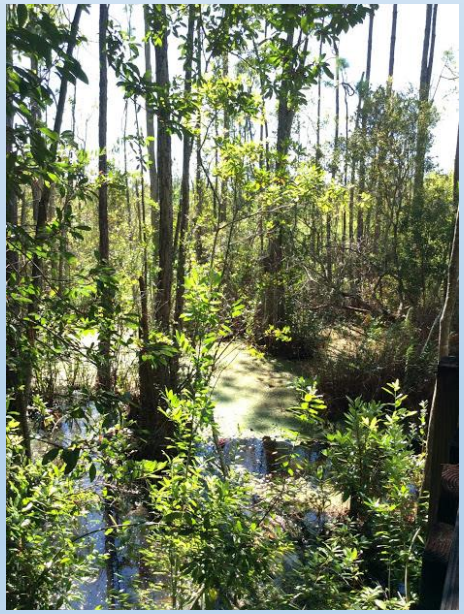
- in western Orlando (30 minutes from campus)
- natural area, little to no human alteration or development
- variety of distinct ecosystems – distinctive vegetation and soils

Natural communities including scrub, pine flatwoods, bay and cypress swamps, a cypress dome, and freshwater marshes.



scrub

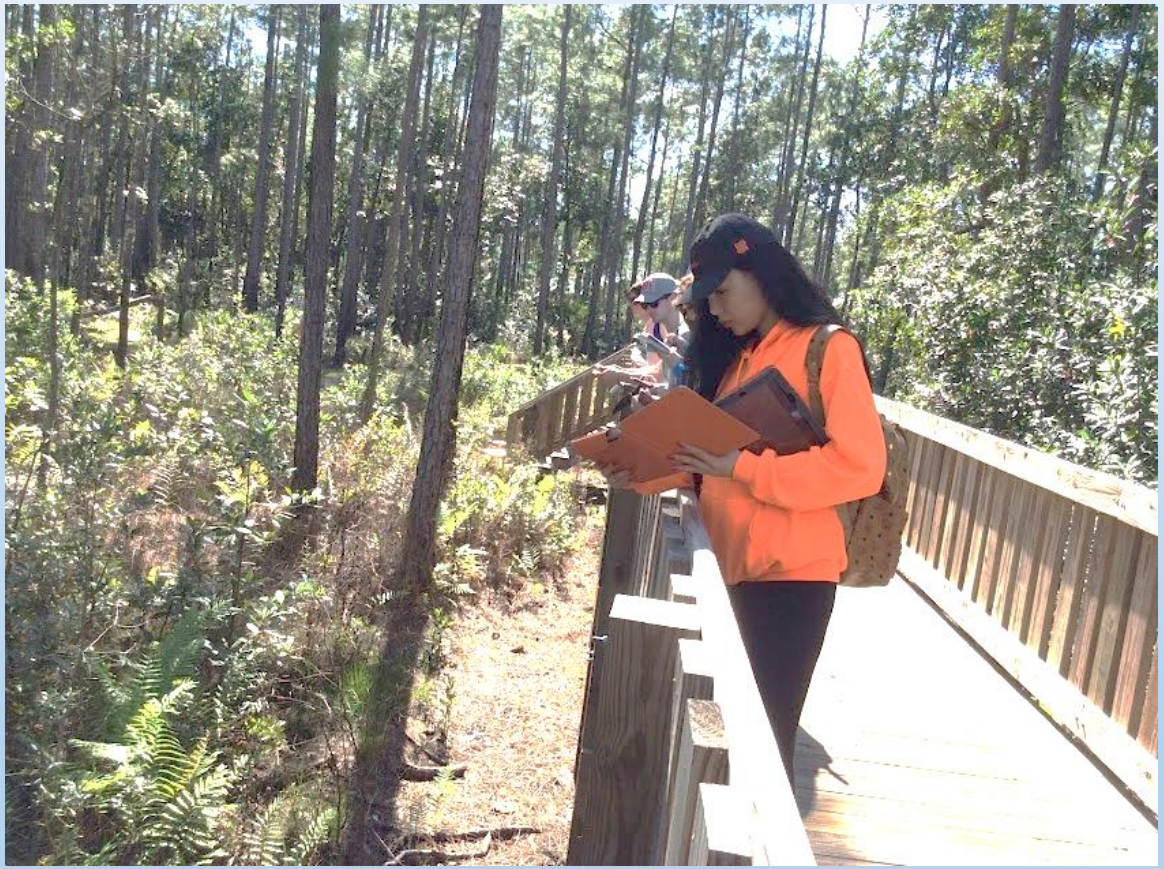
pine flatwoods



bay swamp

freshwater marsh

- Students work in teams of 2 or 3
- Use data-logging app with Ipads and GPS sensors to record locations of changes in vegetation



- Changes are notated with a waypoint

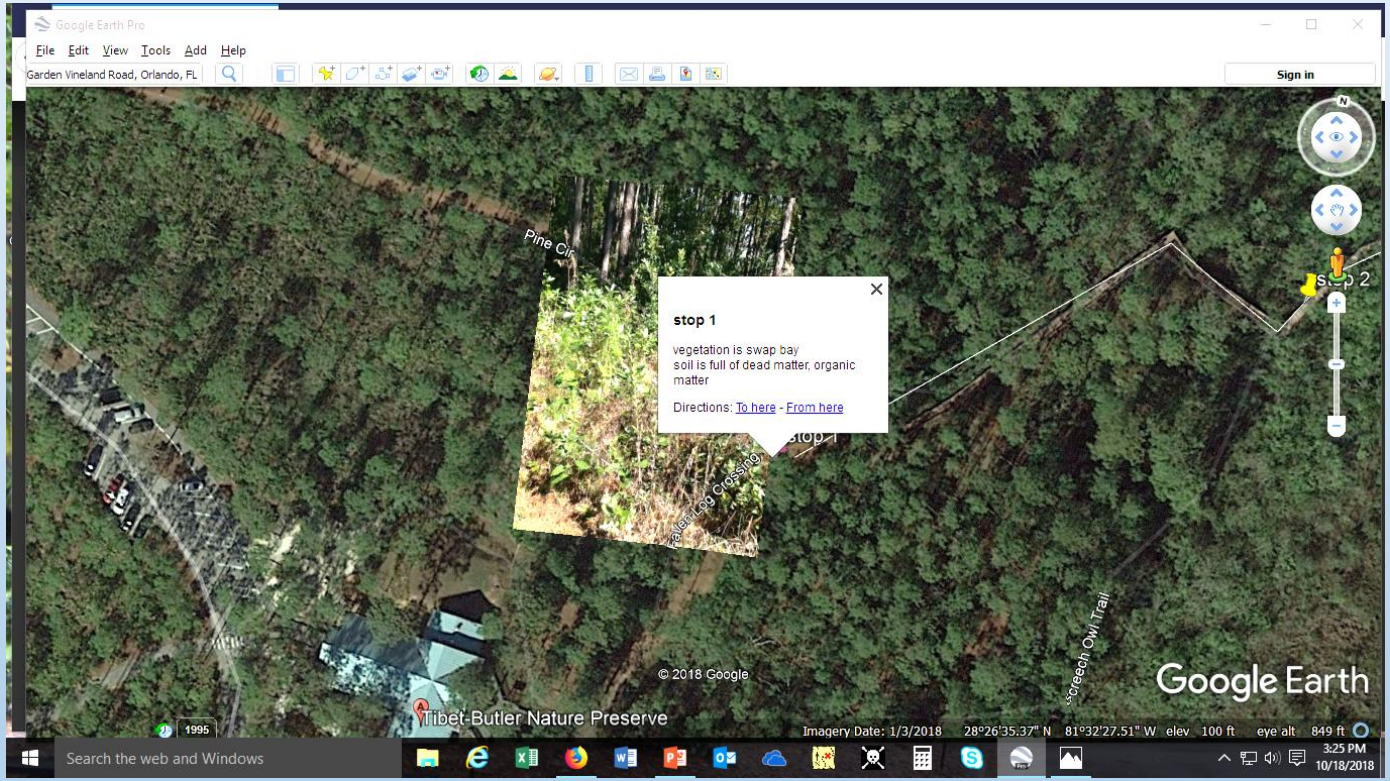
- Different species are photo documented

Dahoon holly

- Soil sampled, noting color and composition (percent quartz and percent organic material).

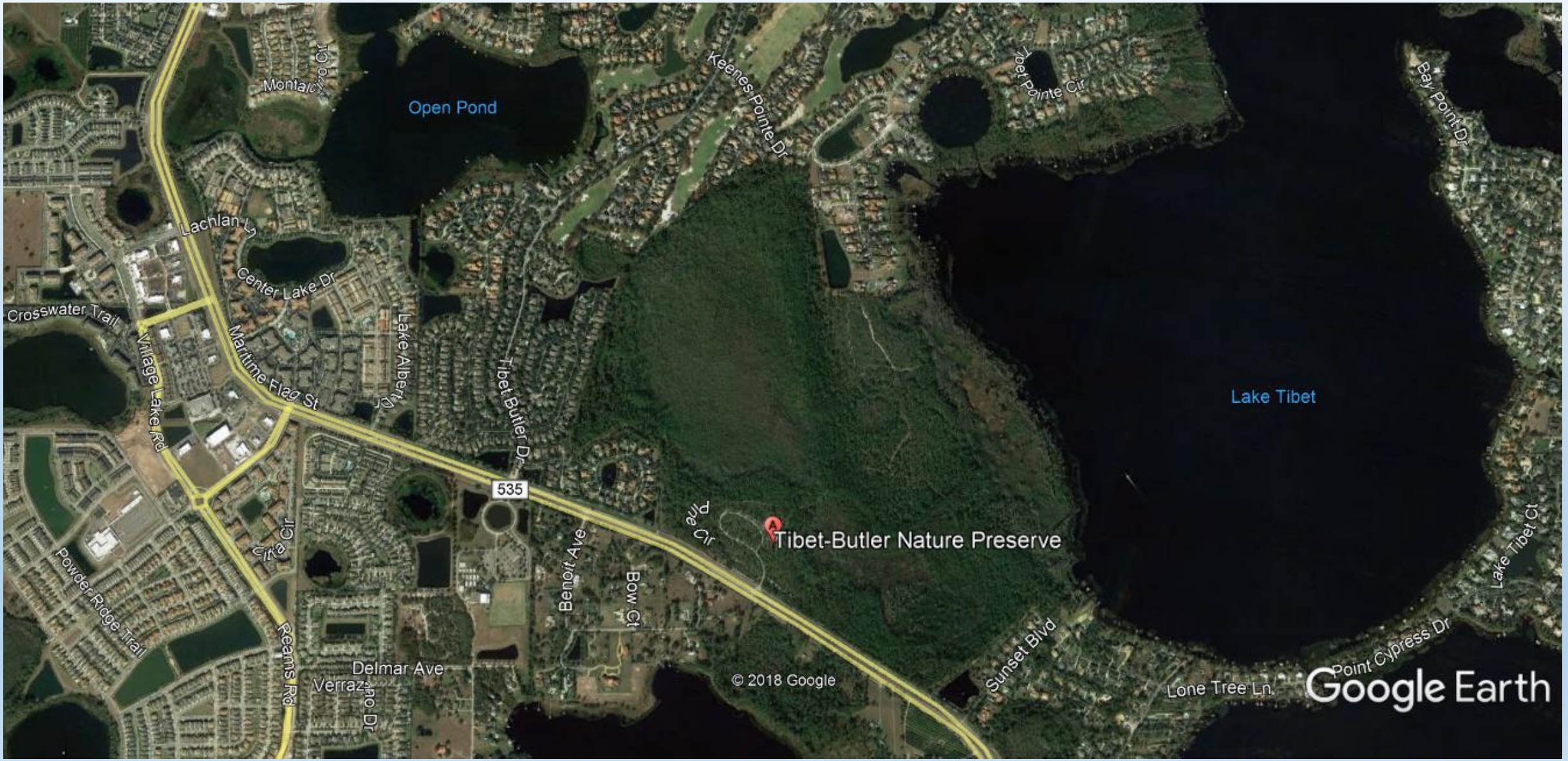
(But sampling is not always possible)

- Results of GPS data saved as KML files (Google Earth)
- Used to produce annotated maps of changes in natural communities and soils along the trails.

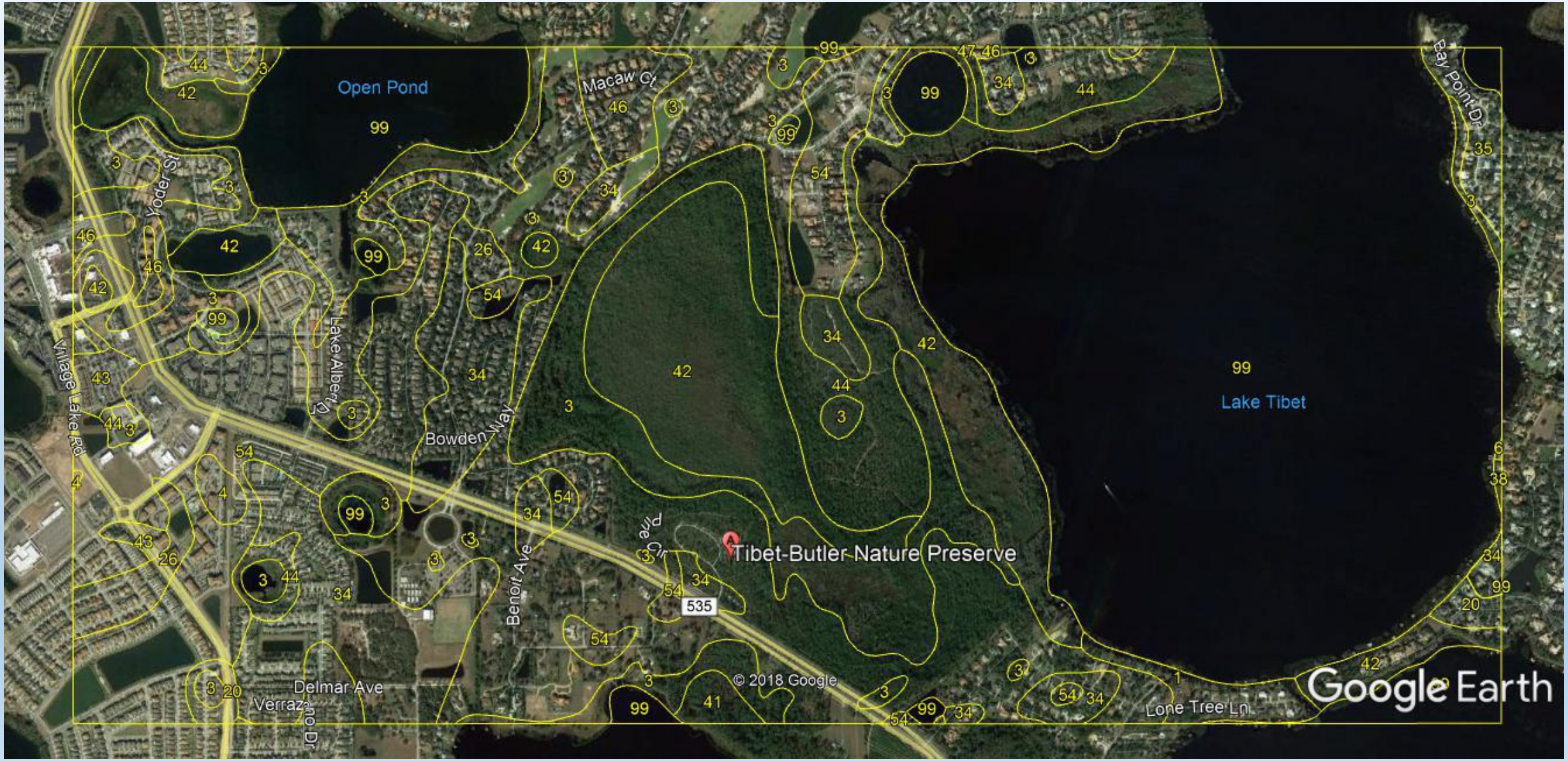


- Finally, students compare their results (KML data) with USDA SoilWeb (Google Earth) maps.

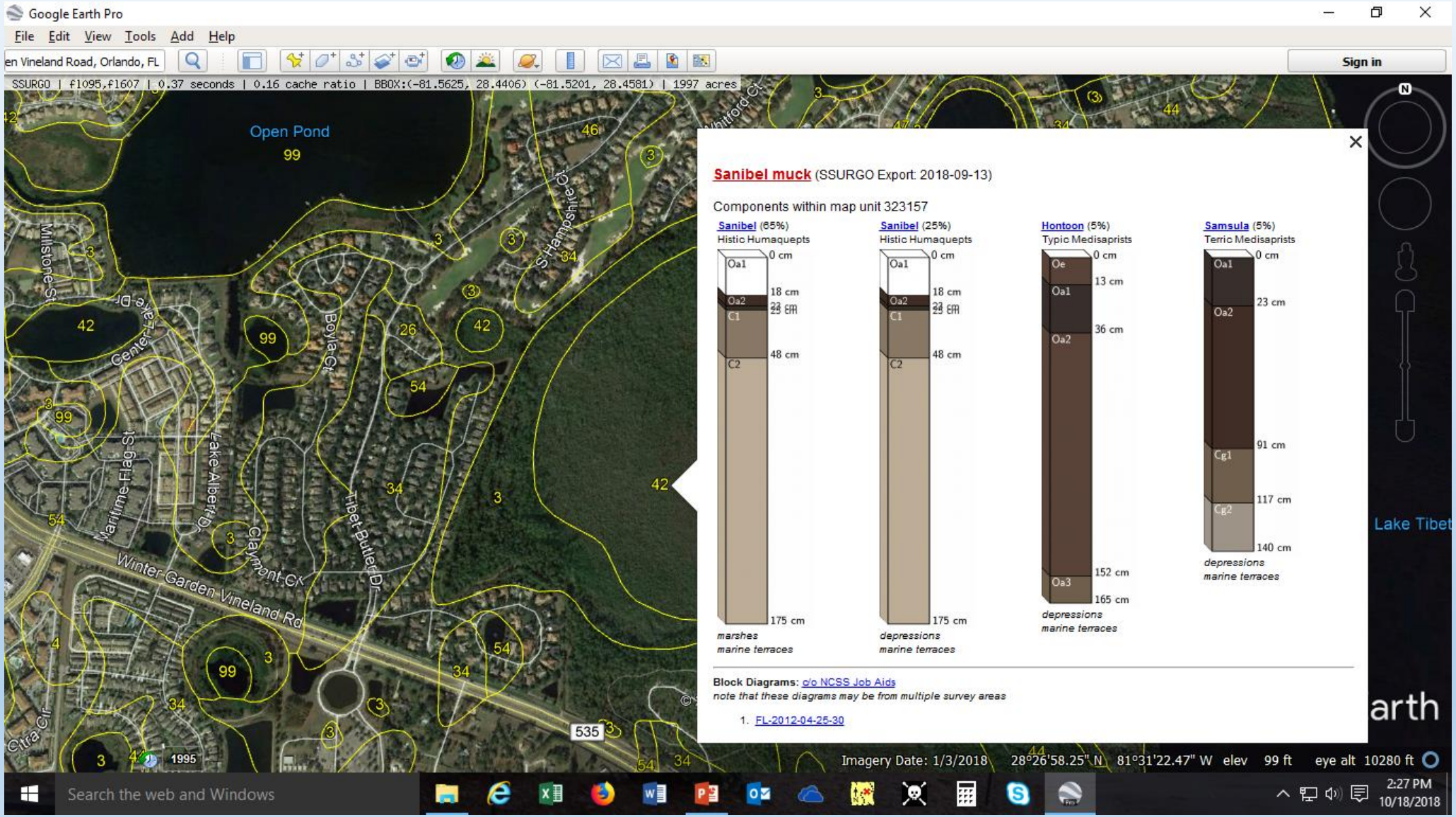
Google Earth Map of Tibet-Butler Nature Preserve



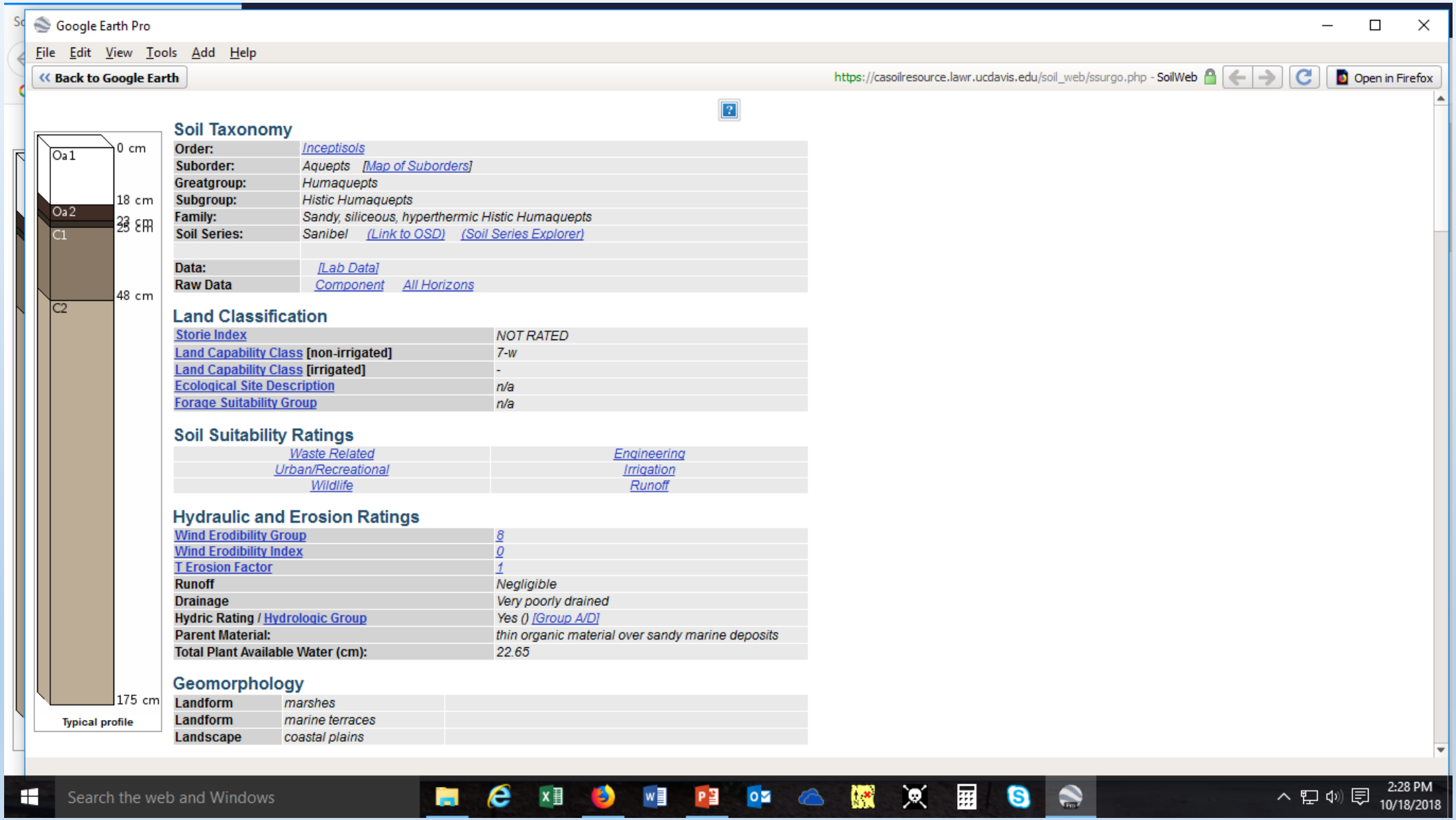
Google Earth Map of Tibet-Butler Nature Preserve with SoilWeb Overlay



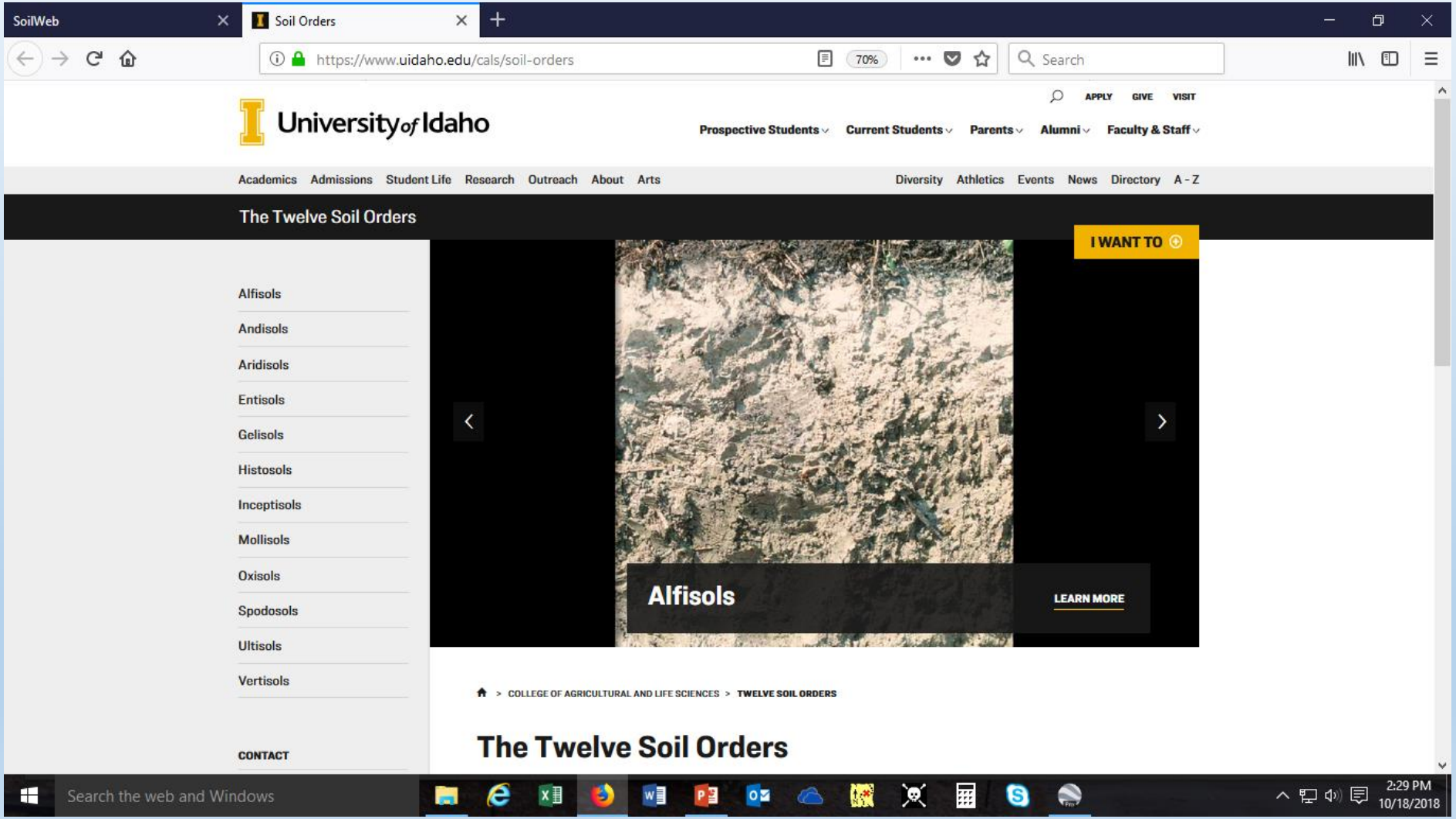
Soil profile for Sanibel Muck



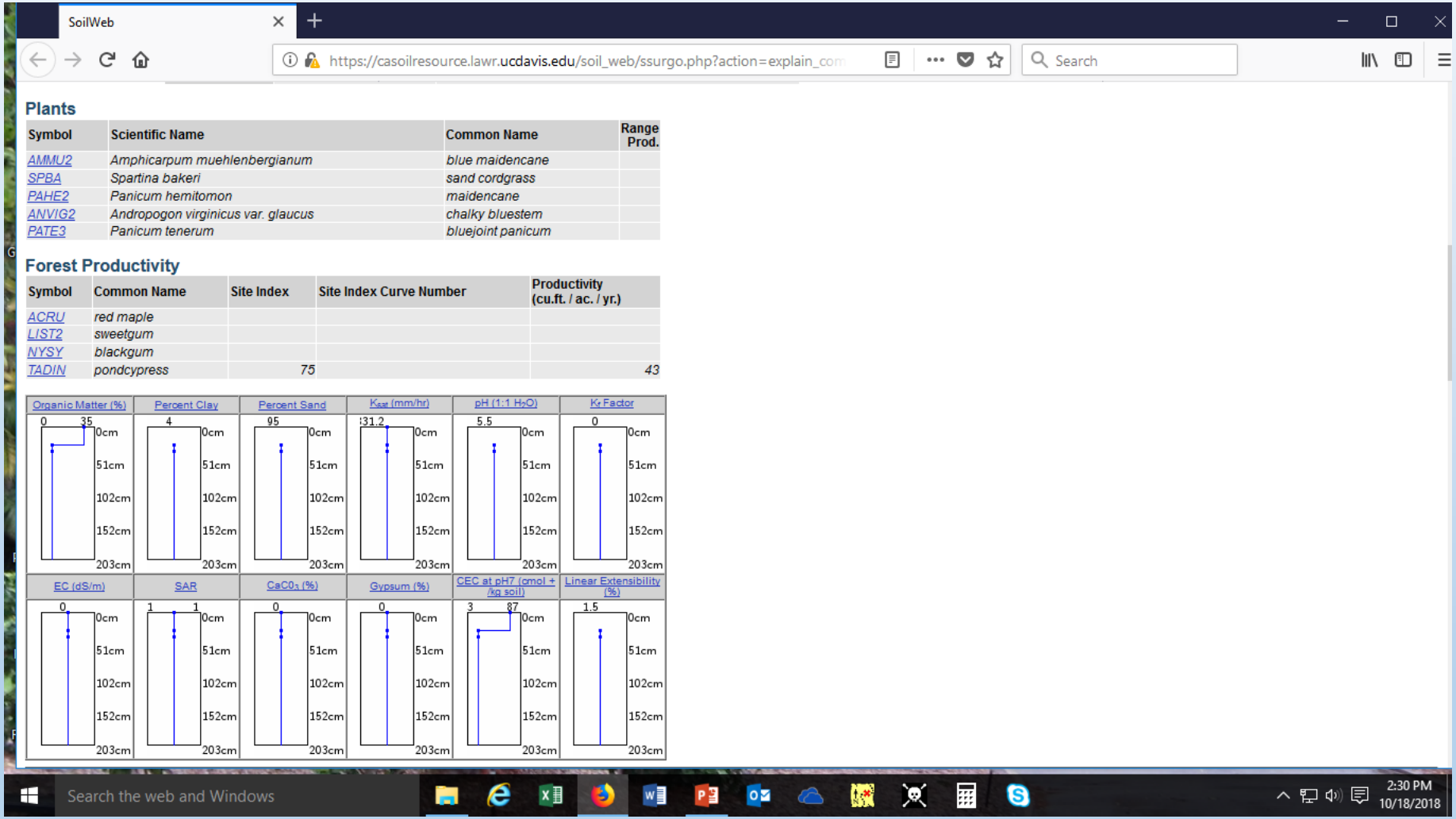
Soil Characteristics and Related Physiography for Sanibel Muck



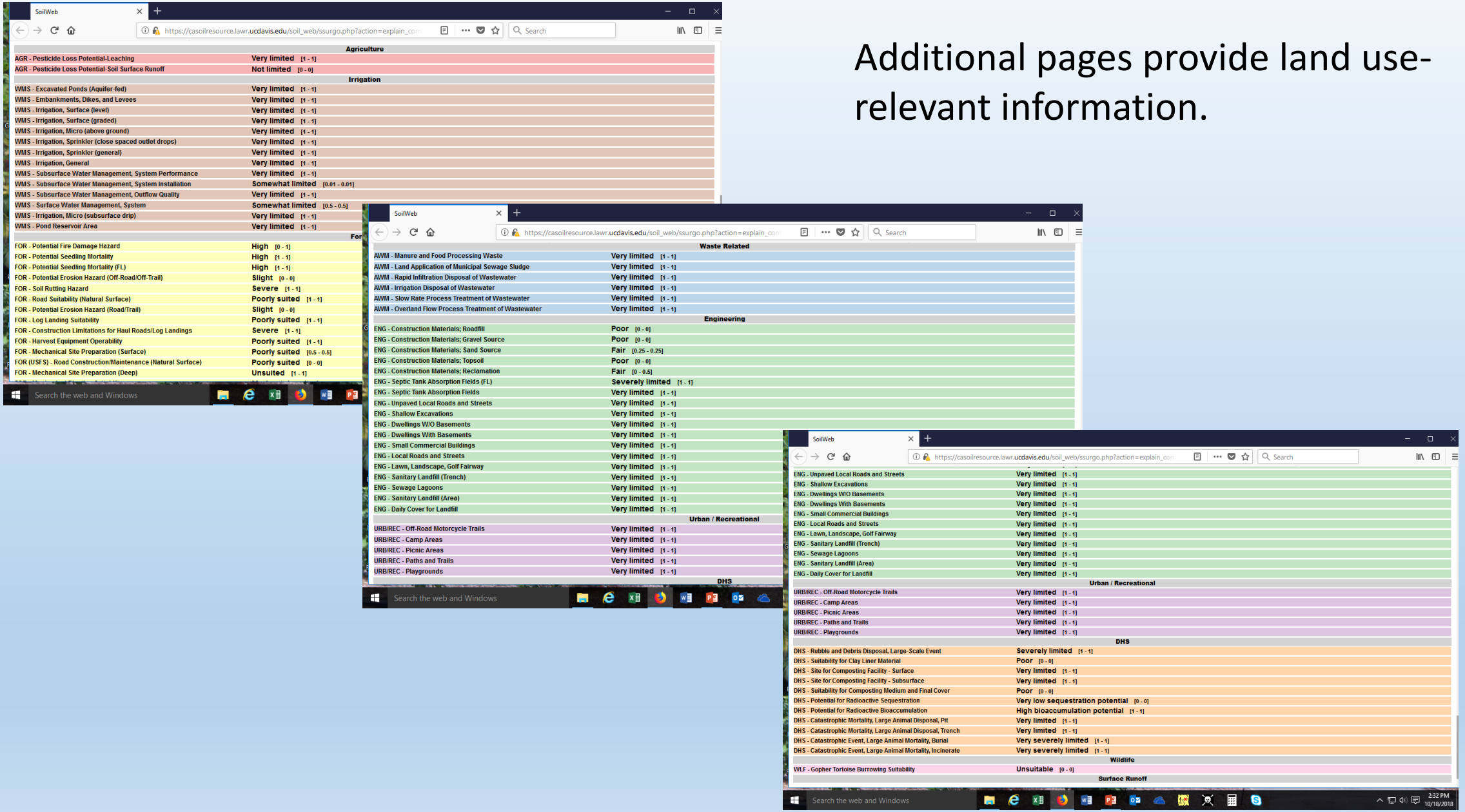
SoilWeb uses (and links to) soil orders information from University of Idaho website



Ecosystems Information for Sanibel Muck



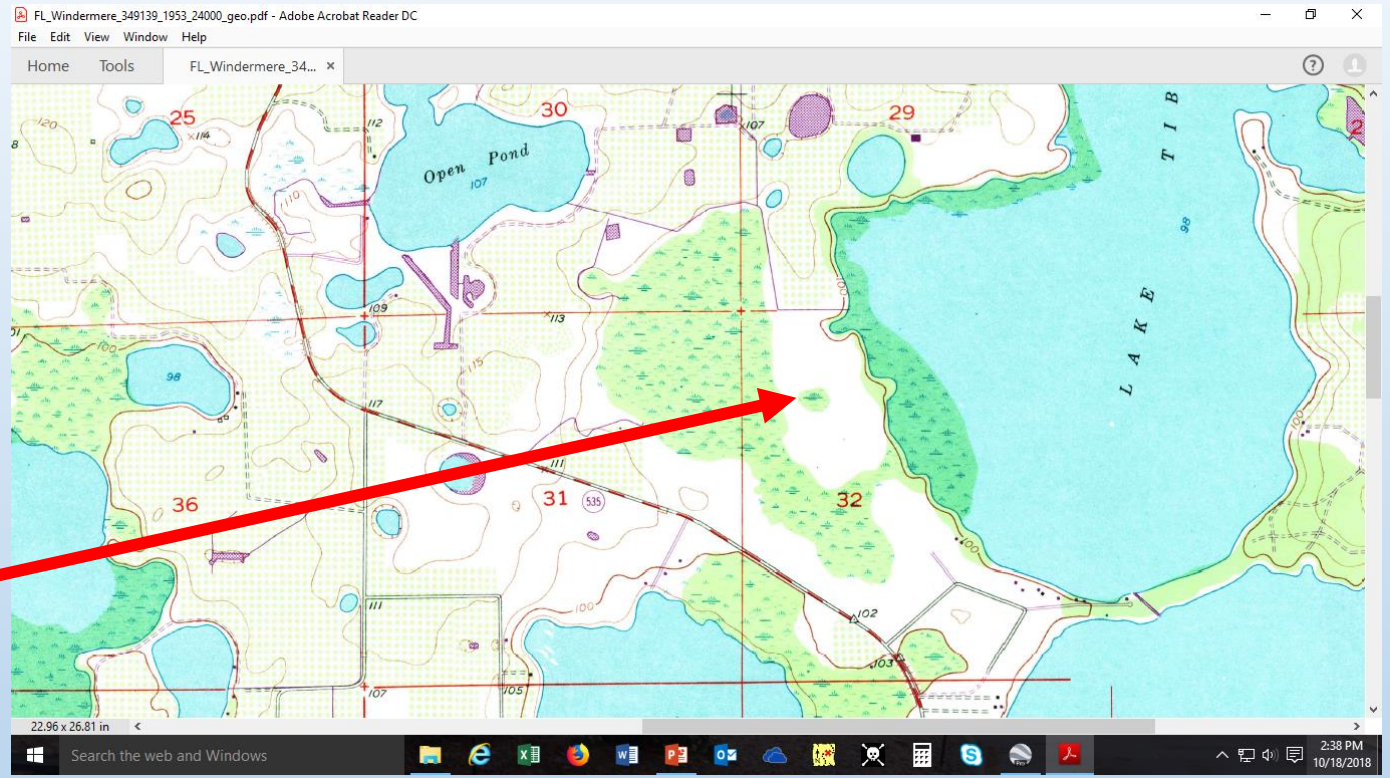
This page includes the names of vegetation associated with this soil type.

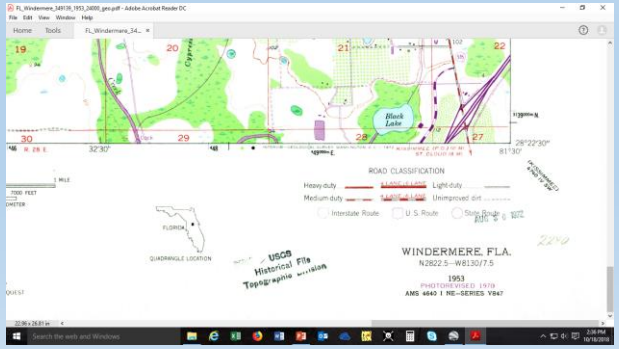


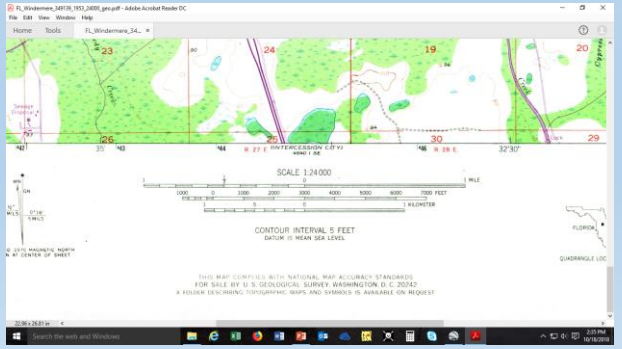
Additional pages provide land use-relevant information.

Students are provided with several electronic resources that are downloaded to Ipads before leaving for the preserve.

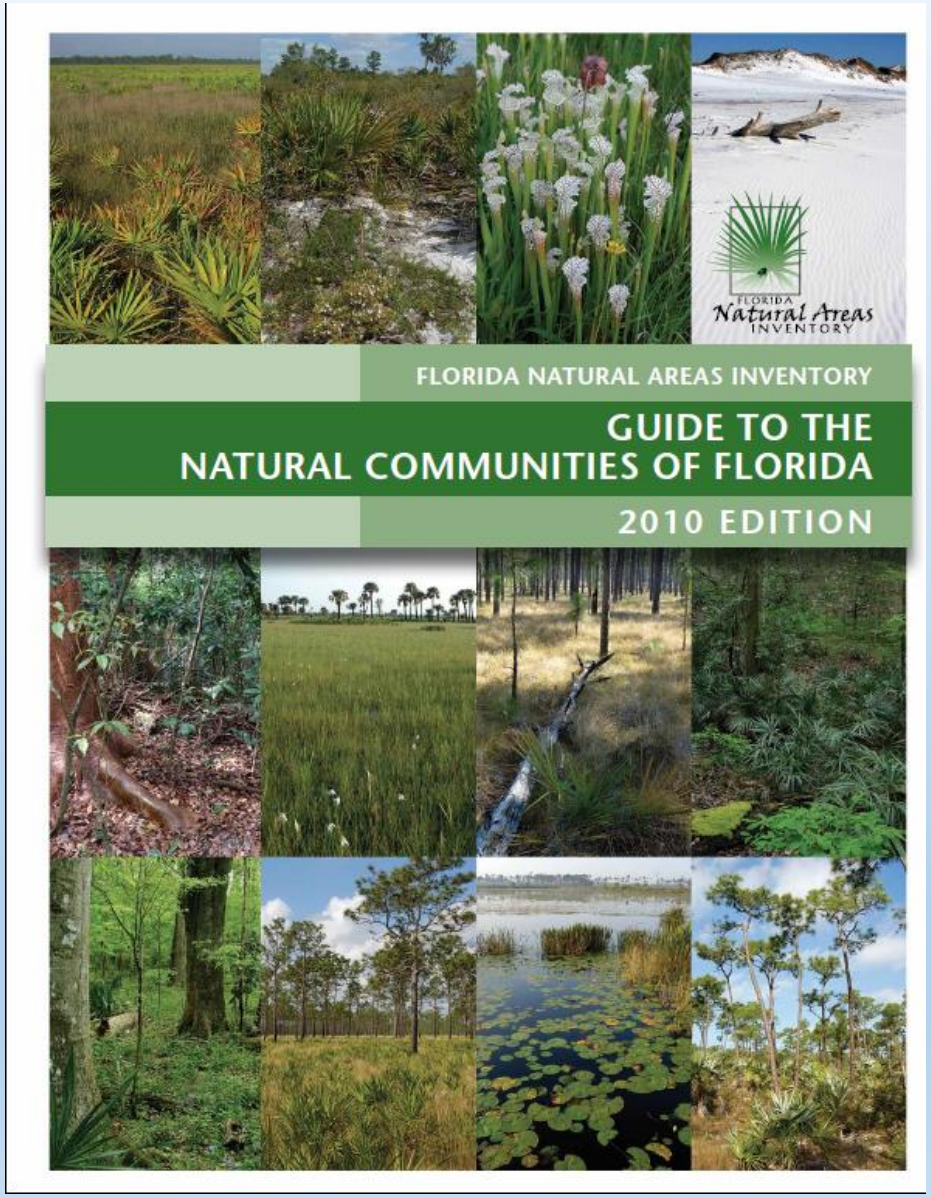
Older topographic map shows pre-development physiographic and topographic information, including location of cypress dome.

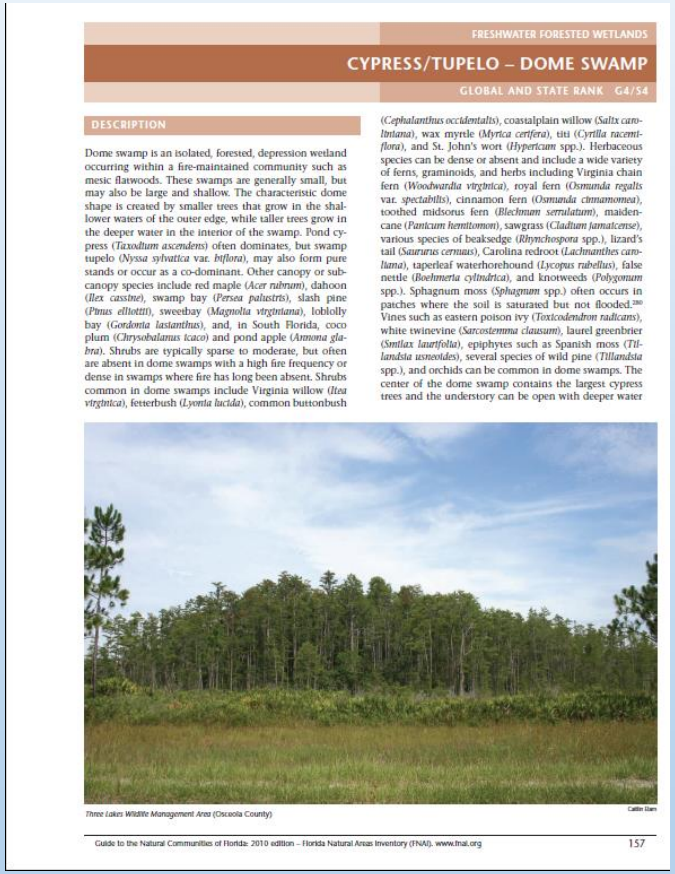






Resource available to students but used to create an abbreviated guide





FRESHWATER FORESTED WETLANDS

CYPRESS/TUPELO – DOME SWAMP

GLOBAL AND STATE RANK G4/S4

DESCRIPTION

Dome swamp is an isolated, forested, depression wetland occurring within a fire-maintained community such as mesic flatwoods. These swamps are generally small, but may also be large and shallow. The characteristic dome shape is created by smaller trees that grow in the shallower waters of the outer edge, while taller trees grow in the deeper water in the interior of the swamp. Pond cypress (*Taxodium ascendens*) often dominates, but swamp tupelo (*Nyssa sylvatica* var. *biflora*), may also form pure stands or occur as a co-dominant. Other canopy or subcanopy species include red maple (*Acer rubrum*), dahoon (*Ilex cassine*), swamp bay (*Persea palustris*), slash pine (*Pinus elliottii*), sweetbay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), and, in South Florida, coco plum (*Chrysobalanus icaco*) and pond apple (*Annona glabra*). Shrubs are typically sparse to moderate, but often are absent in dome swamps with a high fire frequency or dense in swamps where fire has long been absent. Shrubs common in dome swamps include Virginia willow (*Itea virginica*), fetterbush (*Lyonia lucida*), common buttonbush (*Cephalanthus occidentalis*), coastalplain willow (*Salix caroliniana*), wax myrtle (*Myrica cerifera*), titi (*Cyrilla racemiflora*), and St. John's wort (*Hypericum* spp.). Herbaceous species can be dense or absent and include a wide variety of ferns, graminoids, and herbs including Virginia chain fern (*Woodwardia virginica*), royal fern (*Osmunda regalis* var. *spectabilis*), cinnamon fern (*Osmunda cinnamomea*), toothed midsorus fern (*Blechnum serrulatum*), maidencane (*Panicum hemitomon*), sawgrass (*Cladium jamaicense*), various species of beaksedge (*Rhynchospora* spp.), lizard's tail (*Saururus cernuus*), Carolina redroot (*Lachnanthes caroliana*), taperleaf waterhorehound (*Lycopus rubellus*), false nettle (*Boehmeria cylindrica*), and knotweeds (*Polygonum* spp.). Sphagnum moss (*Sphagnum* spp.) often occurs in patches where the soil is saturated but not flooded.[280] Vines such as eastern poison ivy (*Toxicodendron radicans*), white swinevine (*Sarcostemma clausum*), laurel greenbrier (*Smilax laurifolia*), epiphytes such as Spanish moss (*Tillandsia usneoides*), several species of wild pine (*Tillandsia* spp.), and orchids can be common in dome swamps. The center of the dome swamp contains the largest cypress trees and the understory can be open with deeper water

Three Lakes Wildlife Management Area (Osceola County) Caitlin Barr

and floating and emergent species such as alligatorflag (*Thalia geniculata*), big floatingheart (*Nymphoides aquatica*), floating water spangles (*Salvinia minima*), duckweeds (*Lemna*, *Spirodela*, and/or *Landoltia*), and bulltongue arrowhead (*Sagittaria lancifolia*).

Dome swamps are most often found on flat terraces, where they develop when the overlying sand has slumped into a depression in the underlying limestone, creating a rounded depression connected to a shallow water table. In uplands with clay subsoils, dome swamps may occupy depressions over a perched water table. Soils in dome swamps are variable[70] but are most often composed of a layer of peat, which may be thin or absent at the periphery, becoming thicker toward the center of the dome.[280] This peat layer is generally underlain with acidic sands or marl and then limestone or a clay lens. In South Florida, dome swamps also occur on peat directly overlying limestone.[101] Common soil types include Bladen, Coxville, and Bayboro.

CHARACTERISTIC SET OF SPECIES

Pond cypress, swamp tupelo

RARE SPECIES

Dome swamps can host a suite of rare species, including pondspice (*Litsea aestivalis*), panhandle spiderlily (*Hymenocallis henryae*), and small-flowered meadowbeauty (*Rhexia parviflora*) in North Florida, and many-flowered catopsis (*Catopsis floribunda*) in South Florida. Dome swamps provide important habitat for many wildlife species,50 including several rare animals. They provide critical breeding habitat for flatwoods salamanders (*Ambystoma cingulatum* and *Ambystoma bishopi*) and are important roosting sites for wading birds such as white ibis (*Eudocimus albus*) and wood stork (*Mycteria americana*).

RANGE

Dome swamps are most common in Central Florida but occur throughout the state, except in the Florida Keys. Similar cypress swamps in shallow depressions also occur throughout the southeastern coastal plain.[93]

NATURAL PROCESSES

Dome swamps are often formed when poor surface drainage causes water to move downward and dissolve the limestone bedrock. These depressions then fill in with peat or marl.[88] Dome swamps derive much of their water through surficial runoff from surrounding uplands.[220] Water levels in dome swamps naturally fluctuate with seasonal rainfall changes.[167] They may also be connected directly to the aquifer, where groundwater influences the hydrological regime, especially during periods of drought.[167] Dome swamps can function as reservoirs that recharge the aquifer.[50,167] The normal hydroperiod for dome swamps is 180 to 270 days per year,[50] with water being deepest, and remaining longest, near the center of the dome creating a larger buildup of peat there. Ewel[106] suggests the most likely reason for the domed profile, where trees grow faster in the center of the dome swamp[108] is due to deeper peat and lower competition from other species.

Dome swamps experience a wide range of water level variation.[42,222] Prolonged dry periods as well as prolonged wet periods can have a significant effect on cypress regeneration. Although adult cypress trees are tolerant of extended inundation, their seeds cannot germinate under water and cypress seedlings may not survive if submerged.[222,422]

Fire is essential for maintaining the structure and the species composition of a dome swamp community.[107] Without periodic fires cypress may become less dominant as hardwood or bay canopy species increase and peat accumulates. Cypress have fairly thick, fire-resistant bark and are tolerant of light surface fires, but catastrophic fires burning into the peat can kill cypress trees, especially when fire has long been absent. The consumption of muck fuels from such a catastrophic wildfire can lower the ground surface and transform a dome swamp into a pond, wet prairie, or shrub bog. Fire frequency is generally greatest at the periphery of the dome and least in the interior, where long hydroperiods and deeper peat, and/or water, maintain high moisture levels.[222] The normal fire cycle might be as short as three to five years along the outer edge and as long as 100 to 150 years towards the center.[130] The domed profile of these swamps may be partly attributable to this frequent, peripheral fire regime. Fire in a long-unburned dome swamp may result in higher cypress mortality in the center of the dome where fire burns through a deeper layer of accumulated peat and kills the cypress roots.[107] Emergent marshes can develop in the center of such dome swamps.

Topographic microsites can be important areas for tree, shrub, and herbaceous seedling recruitment in dome swamps.[182] Raised mats of root fiber and peat form hummocks at the bases of trees and shrubs, on old tree stumps, or among cypress knees, often creating microsites for more diverse and mesic species to establish above the water surface.[280]

COMMUNITY VARIATIONS

Dome swamps are classically small (relative to other swamp types) and circular or elliptical in shape but can occur in any size or shape on the landscape, especially if the swamp is shallow. Dome swamps can completely surround, or appear as fringes, on the edge of basin or depression marshes. Some dome swamps have marsh vegetation or a small pond in their center, creating a "doughnut" appearance when viewed from above. Although most dome

Resource Guide Including Relevant Information for Tibet-Butler Nature Preserve

Tibet Butler Ecosystem Guide

HARDWOOD FORESTED UPLANDS – mesic or xeric forest dominated mainly by hardwood trees.

Xeric Hammock (G3/S3) – upland with deep sand substrate; xeric; primarily eastern Panhandle to central peninsula; rare or no fire; closed canopy of evergreen hardwoods; sand live oak, saw palmetto.

HIGH PINE AND SCRUB – hills with mesic or xeric woodlands or shrublands; canopy, if present, open and consisting of pine or a mixture of pine and deciduous hardwoods.

Scrub (G2/S2) – upland with deep sand substrate; xeric; statewide except extreme southern peninsula and Keys, mainly coastal in Panhandle; occasional or rare fire (usually 5-20 years); open or dense sl
canopy; sand pine and/or scrub oaks and/or Florida rosemary.
ROSEMARY SCRUB – on the driest ridge crests, particularly at the southern end of the La
Panhandle barrier islands; occasional or rare fire (10-40 years); dominated by Florida ros
bare sand visible between the shrubs.
SAND PINE SCRUB – on ridges throughout the state; rare fire (20-80 years); canopy of sa
of the three shrubby oaks, or less commonly, Florida rosemary.

PINE FLATWOODS AND DRY PRAIRIE – mesic or hydric pine woodland or mesic sh
subtrates, may have a hard pan that impedes drainage.

Wet Flatwoods (G4/S4) – flatland with sand substrate; seasonally inundated; s
peninsula and Keys; frequent fire (2-4 years for grassy wet flatwoods, 5-10 yea
closed to open pine canopy with grassy or shrubby understory; slash pine, pon
sweetbay, cabbage palm, wiregrass, toothache grass.
CUTTHROAT GRASS FLATWOODS – on and near the Lake Wales Ridge; frequen
pines over cutthroat grass and/or other hydrophytic herbs.
CABBAGE PALM FLATWOODS – on shelly sand or where limestone is near the s
peninsula; pine canopy over cabbage palm understory.

Mesic Flatwoods (G4/S4) – flatland with sand substrate; mesic; statewide except extreme southern peninsula and Keys; frequent fire (2-4 years); open pine canopy with a layer of low shrubs and herbs; longleaf pine and/or slash pine, saw palmetto, gallberry, dwarf live oak, wiregrass.

Scrubby Flatwoods (G2/S2?) – flatland with sand substrate; xeric-mesic; statewide except extreme southern peninsula and Keys; occasional fire (5-15 years); widely scattered pine canopy over saw palmetto and scrub oaks; longleaf pine, sand live oak, myrtle oak, Chapman's oak, saw palmetto, wiregrass.

FRESHWATER NON-FORESTED WETLANDS – herbaceous or shrubby palustrine communities in floodplains or depressions; canopy trees, if present, very sparse and often stunted.

MARSHES – long hydroperiod; dominated by grasses, sedges, broadleaf emergents, floating aquatics, or shrubs.

Basin Marsh (G4/S3) – basin with peat or sand substrate; seasonally inundated; statewic
occasional fire; largely herbaceous; maidencane, sawgrass, bulltongue arrowhead, picke
cordgrass, white water lily, coastalplain willow.
LAKE BOTTOM – marshes on former lake bottoms of "disappearing" lakes in northern Flo
between lake and marsh when the sinkholes draining them are plugged or re-opened; w
Lake Miccosukee and Paynes Prairie.

FRESHWATER FORESTED WETLANDS – floodplains or depressions dominated by hydrophytic tr

CYPRESS/TUPELO – dominated entirely by cypress or tupelo, or these species important in t
hydroperiod.

Dome Swamp (G4/S4) – small or large and shallow isolated depression in sand/marl/limest
peat accumulating toward center; occurring within a fire-maintained community; seasonall
statewide excluding Keys; occasional or rare fire; forested, canopy often tallest in center; po
tupelo.

Basin Swamp (G4/S3) – typically large basin wetland with peat substrate; seasonally inundated; still water or with water output; Panhandle to central peninsula; occasional or rare fire; forest of cypress/tupelo/mixed hardwoods; pond cypress, swamp tupelo.

HARDWOOD – dominated by a mix of hydrophytic hardwood trees; cypress or tupelo may be occasional or infrequent in the canopy; short hydroperiod.

Baygall (G4/S4) – slope or depression wetland with peat substrate; usually saturated and occasionally inundated; statewide excluding Keys; rare or no fire; closed canopy of evergreen trees; loblolly bay, sweetbay, swamp bay, titi, fetterbush.
BAY SWAMP – large or small peat filled depression; mainly eastern Panhandle to central peninsula; forested; dominated by bay species.

PONDS and LAKES (LACUSTRINE) – non-flowing wetlands of natural depressions lacking persistent emergent vegetation except around the perimeter.

Flatwoods/Prairie Lake (G4/S3) – generally shallow basin in flatlands with high water table; frequently with a broad littoral zone; still water or flow-through; sand or peat substrate; statewide except extreme southern peninsula and Keys; variable water chemistry, colored to clear, acidic to slightly alkaline, soft to moderately hard water with moderate mineral content (sodium, chloride, sulfate); oligo-mesotrophic to eutrophic.

Tibet-Butler Nature Preserve Field Assignment

Pre-trip materials include links to:

- Tibet-Butler Topographic Map
- Tibet-Butler Google Earth (GE) Maps and Soils
- *Native Plants Guide* with information about plants associated with the major ecosystems in central Florida.
- *Tibet-Butler Ecosystems Guide* with information about the major ecosystems in the preserve
- *Florida Soils* paper
- FNAI Natural Community Classification Guide

Tibet-Butler Nature Preserve Field Assignment

For this assignment, while on the field trip:

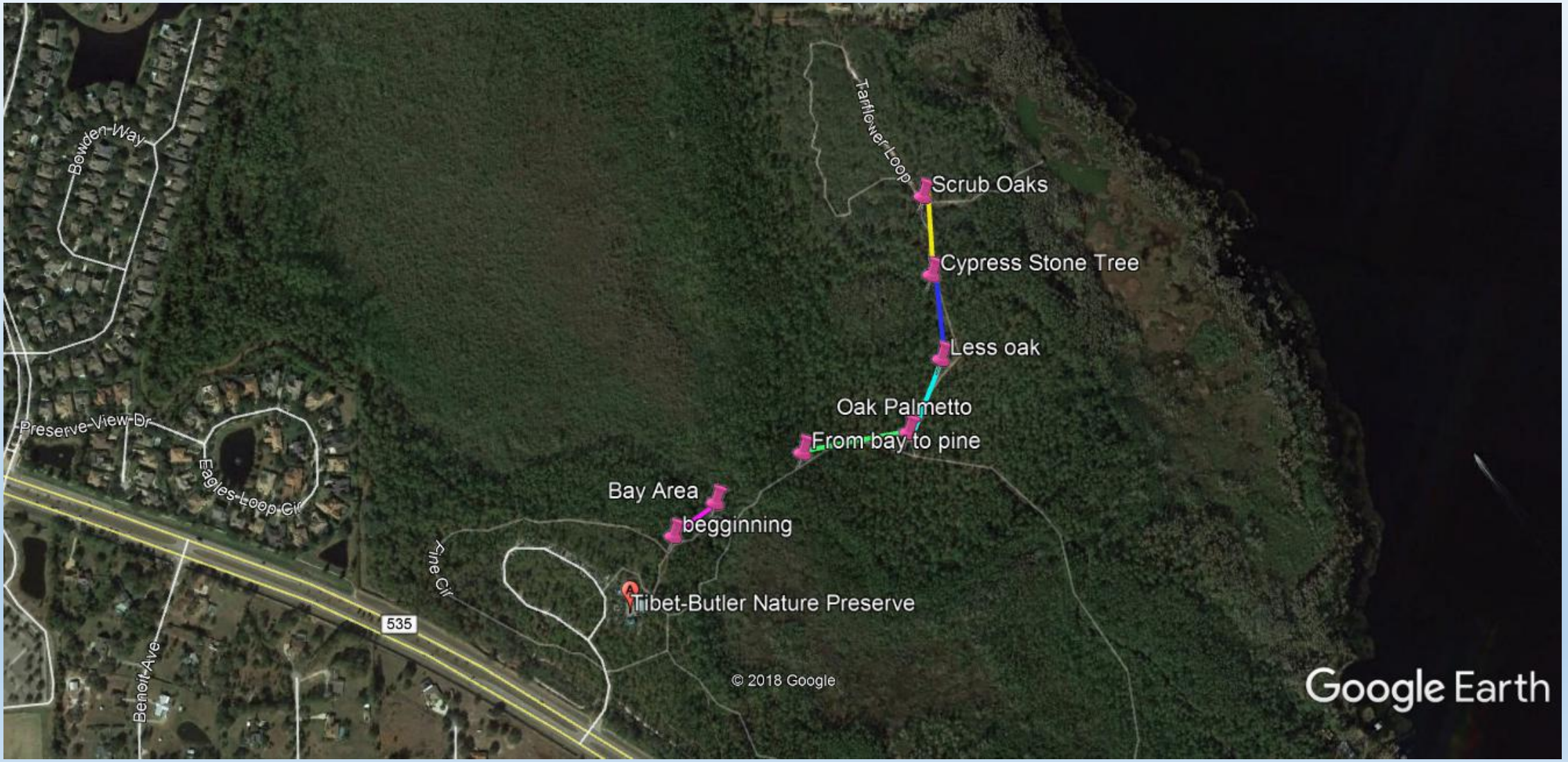
1. You will be taking notes and photos of the different types of vegetation and soils associated with the different ecosystems that we encounter.
2. You will be recording GPS waypoints at locations where you observe changes in vegetation and soil type.

Tibet-Butler Nature Preserve Field Assignment

At the end of the trip, you should:

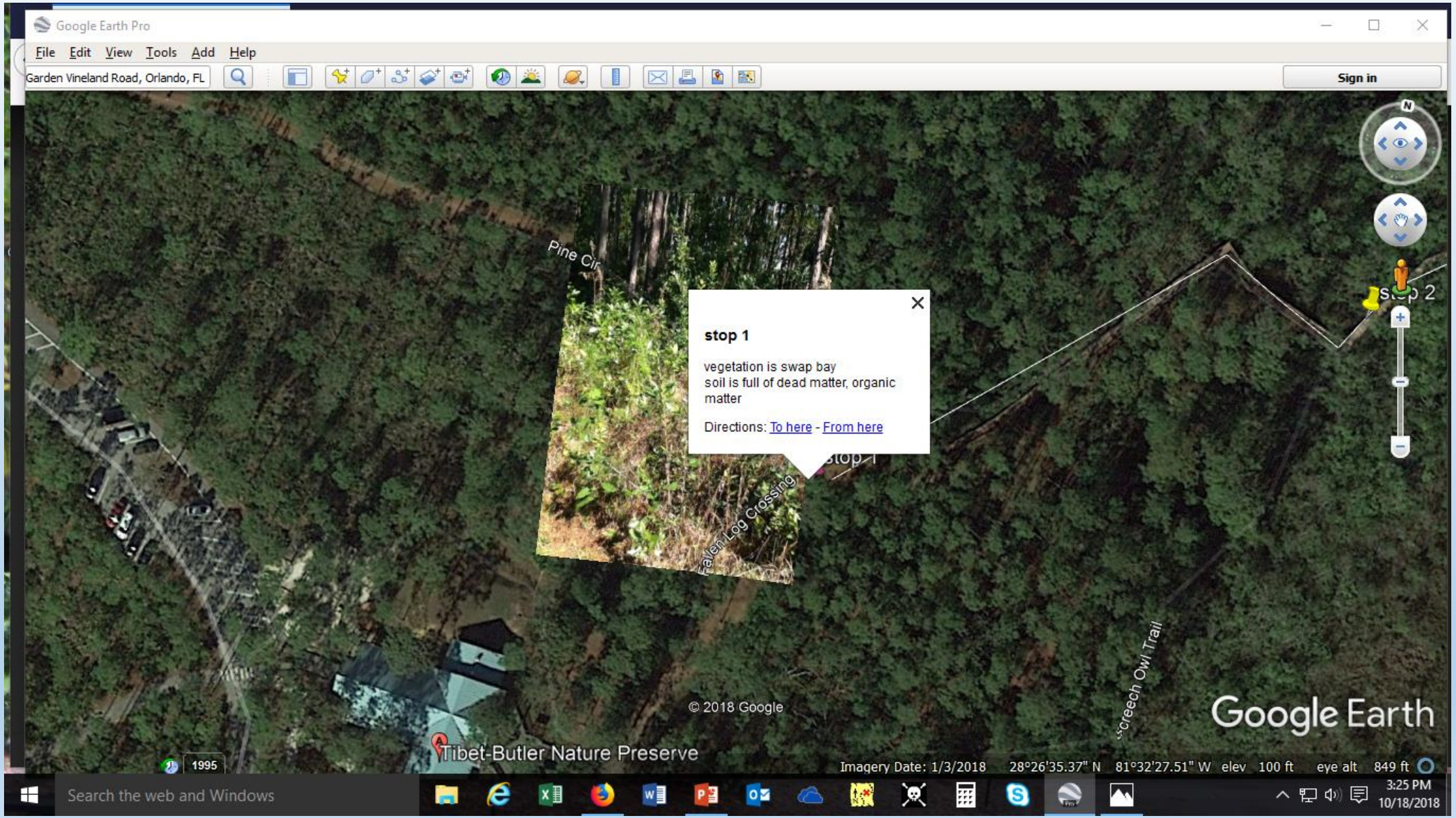
1. Have images demonstrating your observations.
2. Have annotations of these images that makes clear what is being shown.
3. Be able to use your observations to identify specific ecosystems.
4. Be able to determine where the changes in ecosystems occur.
5. Be able to summarize your evidence that led to your conclusion (in #4).
6. Have an annotated map denoting the different ecosystems.

Placemarks and colored paths used to map the different natural communities based on vegetation types.

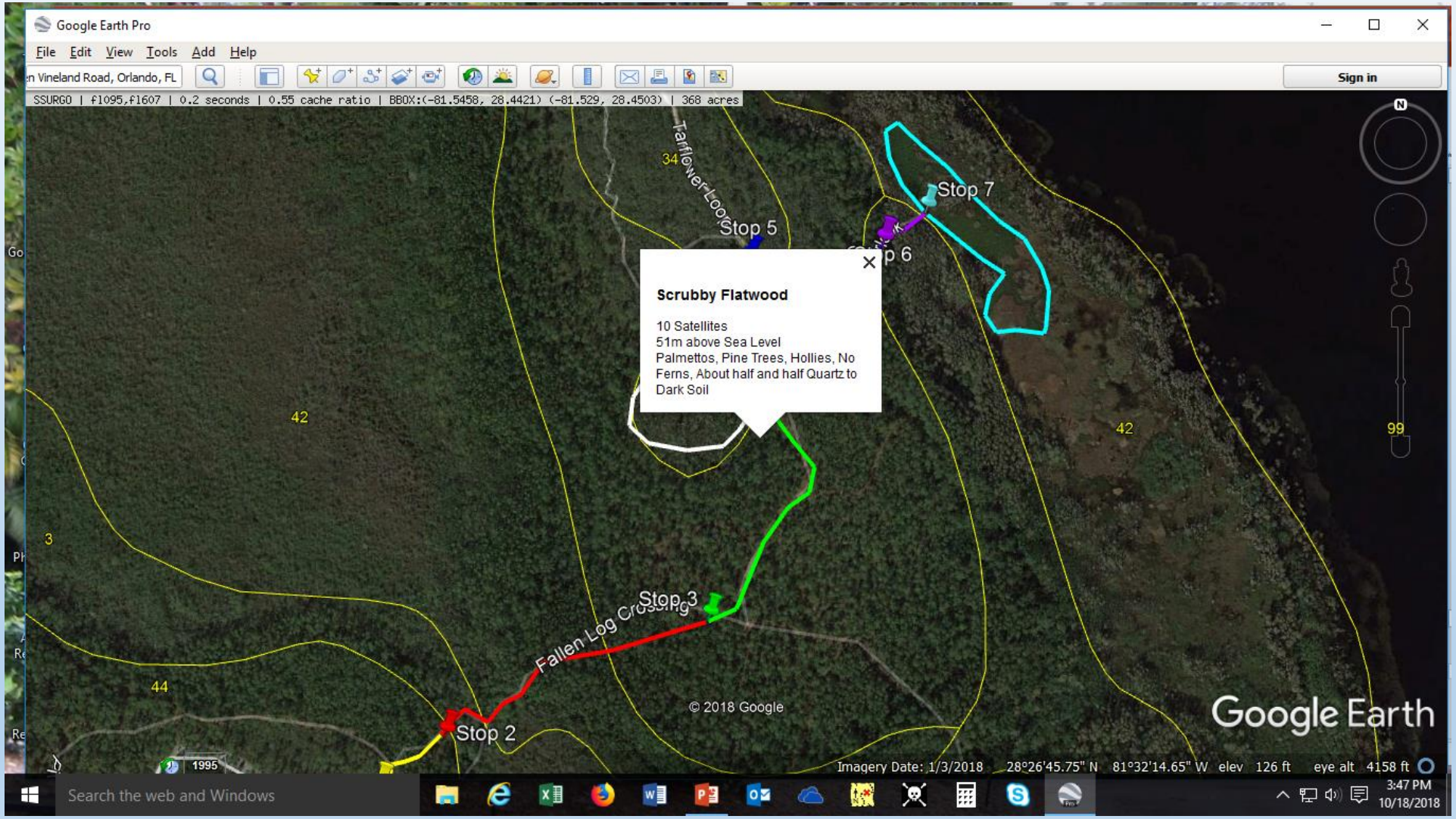


Photos of vegetation added as overlays and annotated to placemarks

Vegetation photo with annotation.



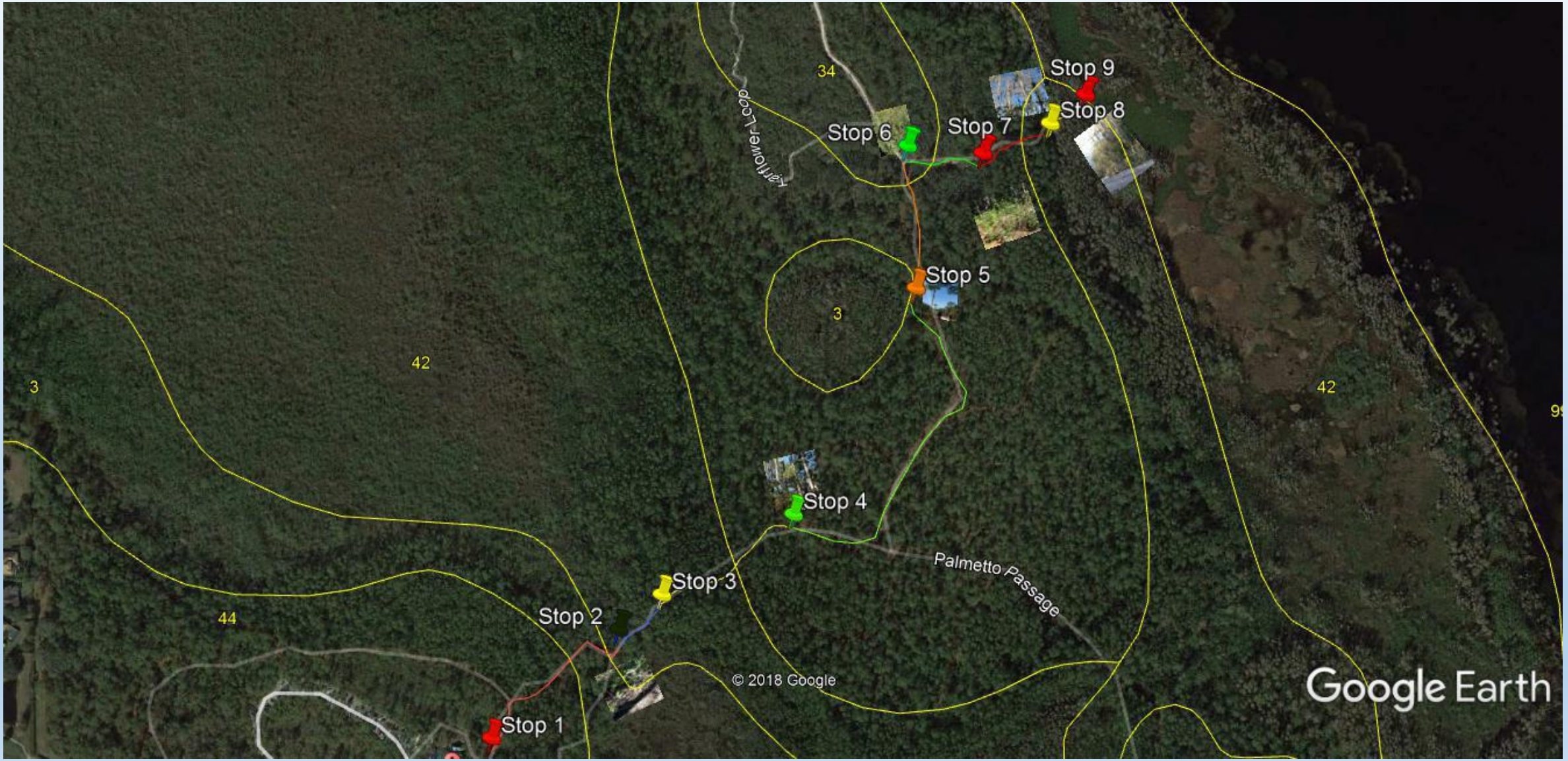
Vegetation, soil, and community information added to description box of placemarks



Examples of comparisons:

Students’ maps with SoilWeb.

Comparison of student mapping with SoilWeb mapping



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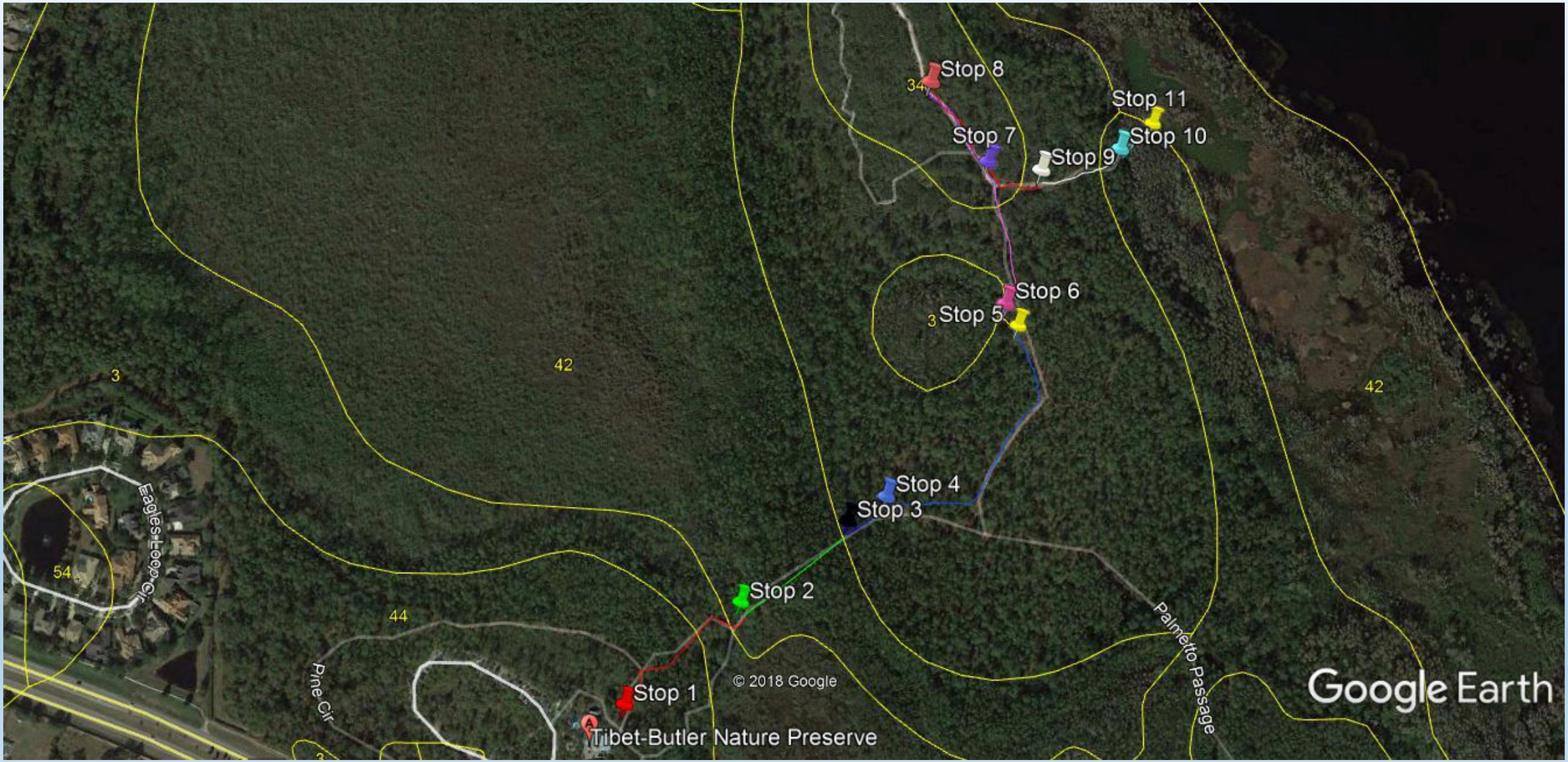

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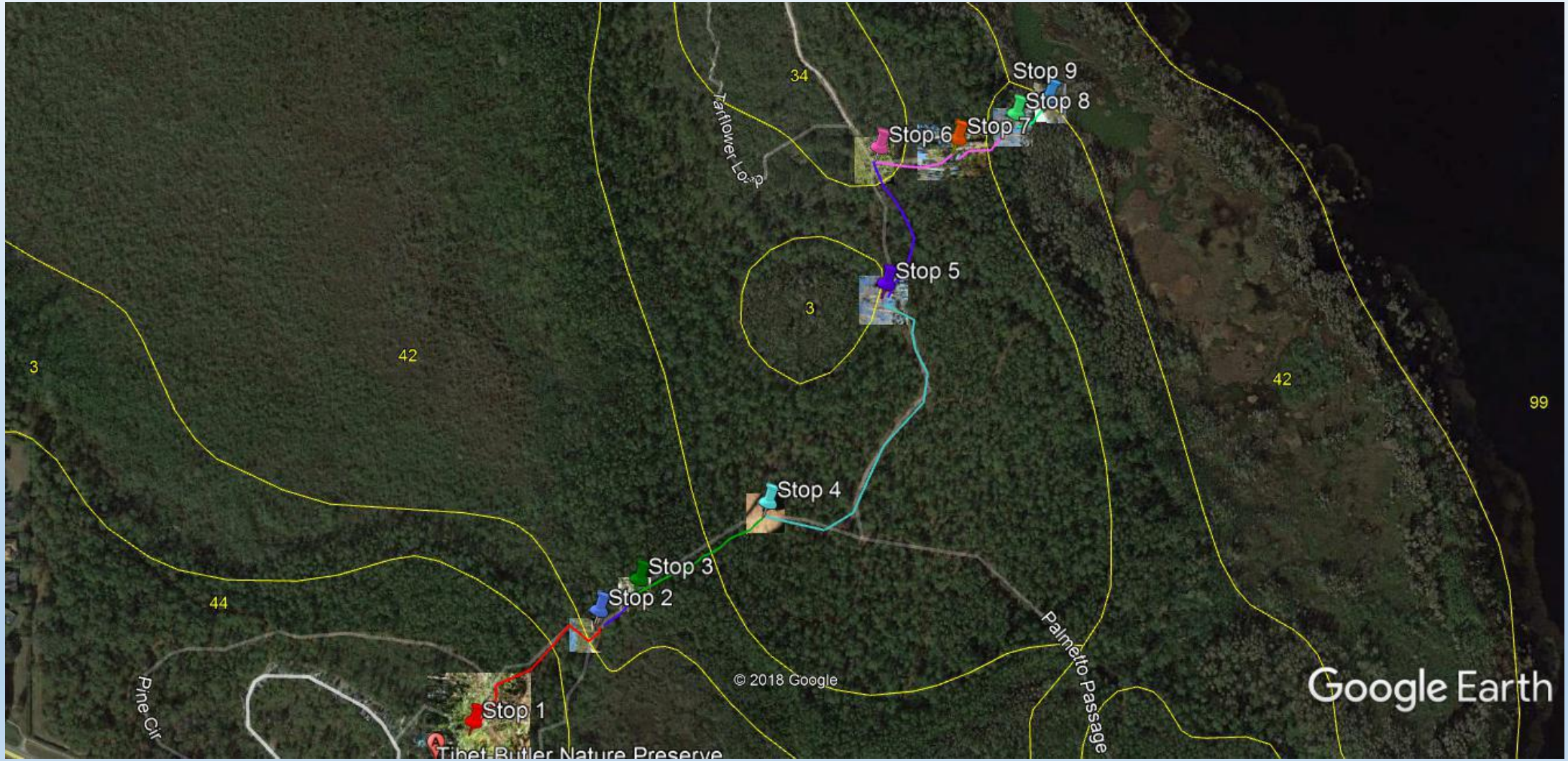

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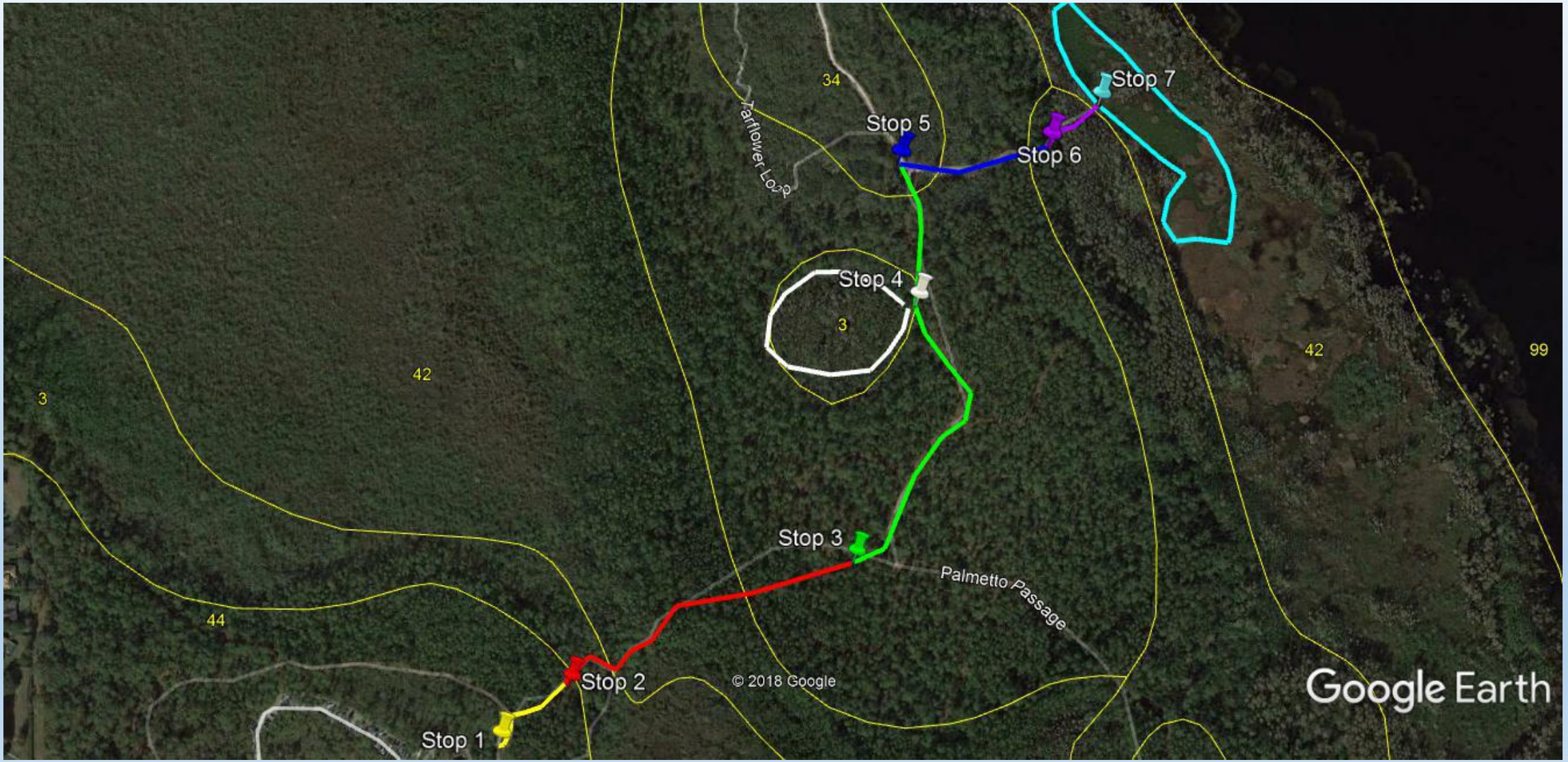

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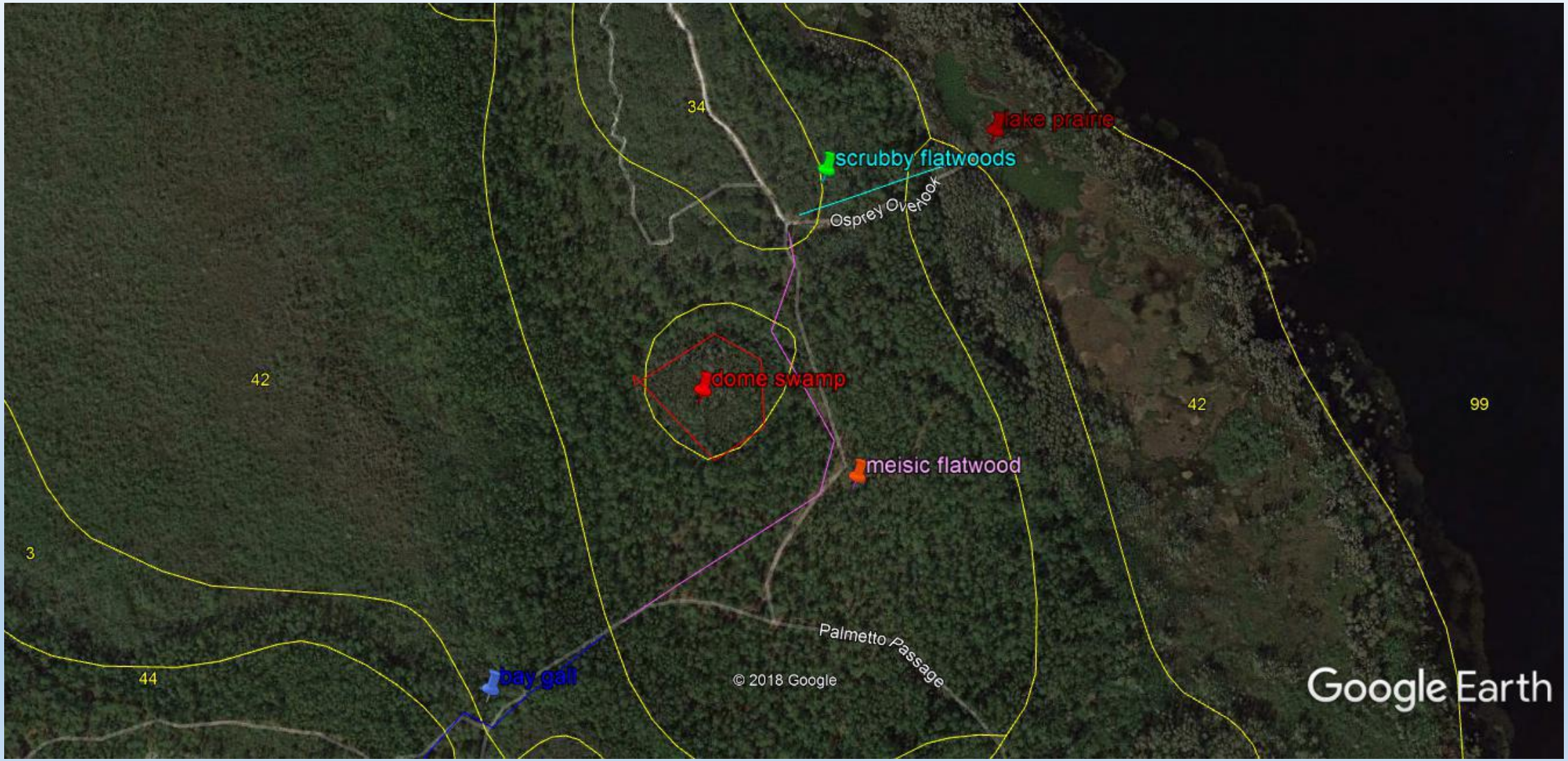

Changes in the trail can provide further lessons in observation

Bay or Cypress Swamp

Mesic Flatwoods

Scrub

Last Thoughts