BioBlitz Results

Hills of Gold

May 16th and 17th 2015

RESULTS FROM THE 2015 HILLS OF GOLD BIODIVERSITY SURVEY
JOHNSON COUNTY, INDIANA

Compiled from the Science Team Reports
Assembled by Don Ruch (Indiana Academy of Science)

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RESULTS OF THE 2015 HILLS OF GOLD BIODIVERSITY SURVEY JOHNSON COUNTY, INDIANA

The 2015 biodiversity survey, also known as a BioBlitz, was held within the Hills of Gold Core Conservation Area as identified by the Central Indiana land Trust, Inc. (CILTI), Johnson County, Indiana (Fig. 1). The Hills of Gold area is where the last ice sheet from the Wisconsinan Glaciation met the Brown County Hills. Within the site one can find exposed bedrock capped with glacial till, flat bottom streambeds with shale with chunks of granite strewn about and an interesting mix of plants for the Brown County Hills as the soil is richer and less acidic than unglaciated hills to the south. See the 2015 BioBlitz Hills of Gold Geology Report for more details.

Covering 693 acres, nearly all wooded, the BioBlitz area included the Laura Hare Preserve at Blossom Hollow to the west, Glacier's End Nature Preserve to the northeast, and a conservation easement connecting the two (Fig 2). Because these areas have always been in private property, very little was known about them until recently. Because CILTI prides itself on a science-based approach to conservation, its partnering with the Indiana Academy of Science for BioBlitz will give them much data to use in land management and future land protection efforts in the Hills of Gold Conservation Area.

The first biodiversity survey in the Hills of Gold Conservation Area was conducted on 16th and 17th May 2015. The BioBlitz attracted over 66 scientists, naturalists, students, and others volunteering their time and expertise to make the event an overwhelming success. Food and lodging for the participants were provided through the generous support of the Central Indiana Land Trust, Inc. and the Indiana Academy of Science.

The 13 taxonomic teams reported 548 taxa. Here is a summary of the results.

Team	Team Leader	Number of Taxa and Notes
Bats	Joy O'Keefe	Two bats, both endangered; one pregnant adult female Indiana bat and one adult male Northern long-eared bat
Beetles	Jeff Holland	17 taxa, 16 species, none of special interest; due to rainy conditions, the list compiled represents a miniscule fraction of the species of the Hills of Gold Area
Birds	Kirk Roth	86 species; 17 migrant species
Fish	Brant Fisher	Three species from one family; no state/federal endangered or special concern species
Freshwater Mussels	Brant Fisher	Evidence (weathered dead shell material) of one species, Paper Pondshell; low diversity expected

Team	Team Leader	Number of Taxa and Notes
Herpetofauna	Bob Brodman	22 species: 16 amphibians and six reptiles; one species of special concern in Indiana; one special protected species in Indiana; four pond-breeding species represent Johnson County records
Moths, etc.	Carl A. Strang	26 taxa total: 20 moth species, two singing insect taxa, and four additional arthropods taxa; none unexpected or particularly uncommon; all moths and singing insects appear to represent county records due to little attention given to Johnson County in the past
Mammals	John Whitaker Jr.	14 taxa. Eight species of mammals were trapped. Four are relatively common, but the other four are relatively uncommon. Of the latter four, the woodland vole and southern bog lemming are found throughout much of the state. The pygmy shrew and smoky shrew are found only in forest in the unglaciated hill country of south central Indiana. In addition we had evidence of six other species. They were not caught in traps, but we had evidence of the eastern mole (numerous burrows), gray squirrel (several observed), chipmunk (two observed), southern flying squirrel (a dead one observed by staff), coyote (feces observed), and the white-tailed deer (numerous tracks).
Mushrooms	Steve Russell	34 fungal taxa: 31 mushrooms, two plant pathogens, one slime mold; do to the dry weather conditions prior to the bioblitz, the majority of mushrooms were wood rot fungi
Non-vascular Plants	Linda Cole	30 species; species recorded illustrates a healthy biodiversity of a mature mesic woodland environment; probably all represent Johnson County records
Snail-killing Flies	William Murphy	Five species from the subfamily Tetanocerini; two Johnson County records, *Dictya expansa* and *Sepedon pusilla*, the latter rare in Indiana
Spiders	Marc Milne	39 taxa, 33 species; five new distribution records for Indiana; two undescribed species; assemblage of spiders here is diverse, understudied, and unique
Vascular Plants	Donald Ruch	269 species; one state endangered, 4 on the state watch list; 113 potential Johnson Co. records; 31 sedges, 13 ferns, and three orchids

To obtain a complete picture of the biodiversity found in the Hill of Gold Conservation Area, long-term seasonal surveys are necessary. Even so, this two-day survey has provided a "snapshot in time" and has revealed the significant species richness and the inherent value of this area.

The participants express their appreciation to the Division of Nature Preserves, and especially Roger Hedge, for providing a permit allowing the event to occur.

Figure 1. Location of Johnson County within Indiana (left) and the Hills of Gold Bioblitz Area within Johnson County.

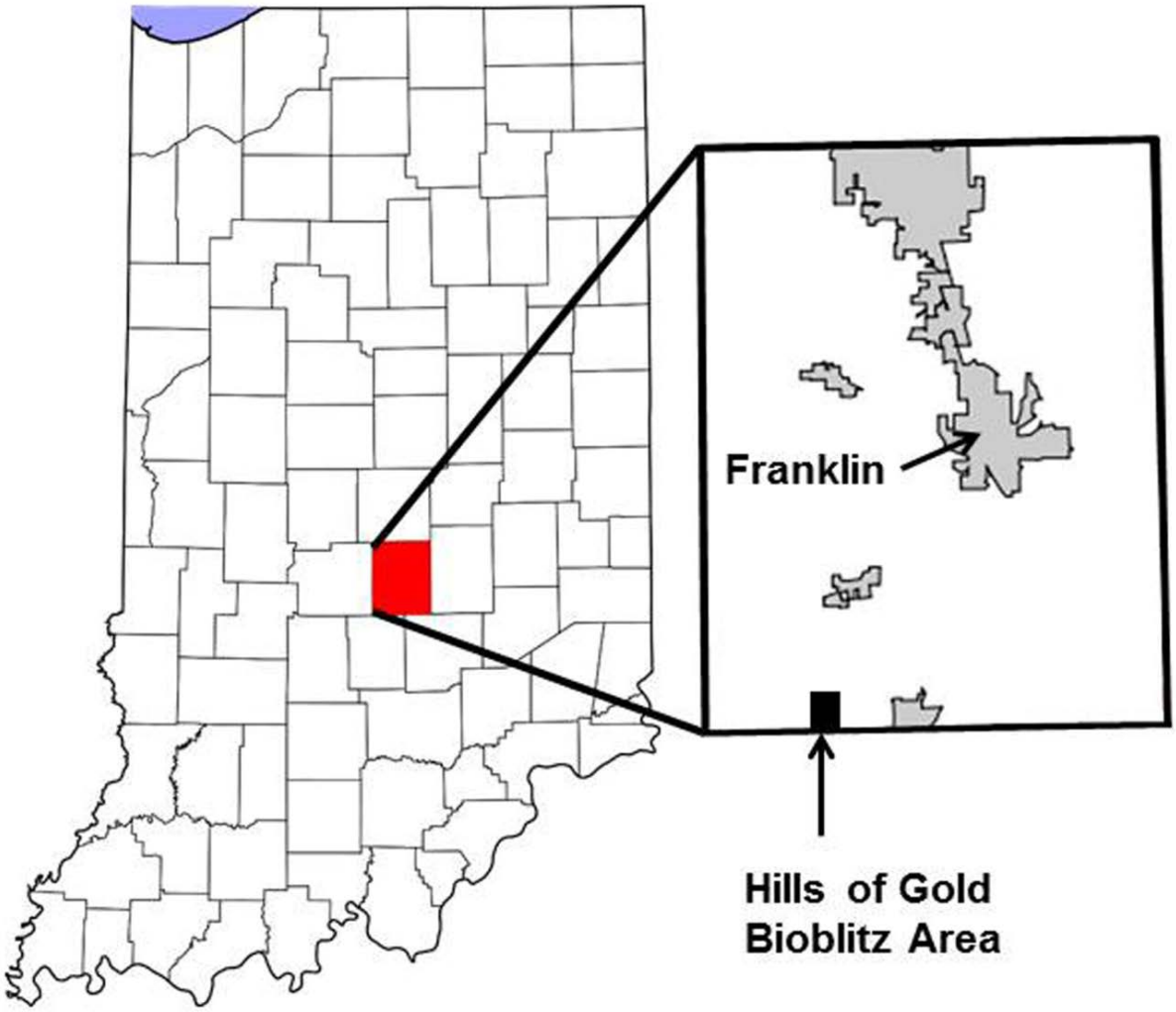
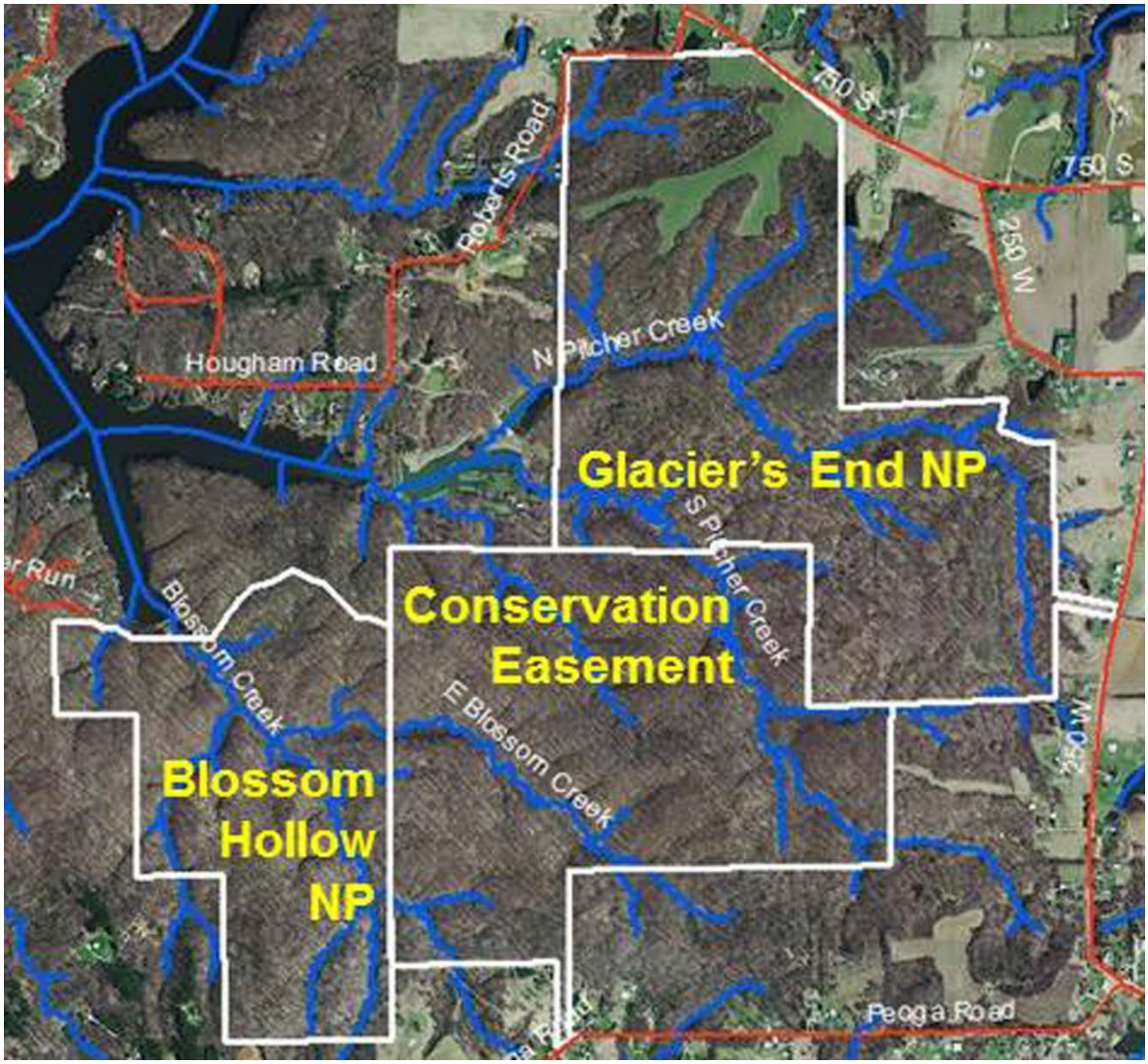


Figure 2. Covering 693 acres, nearly all wooded, the BioBlitz area included Blossom Hollow Nature Preserve to the west, Glacier's End Nature Preserve to the northeast, and a conservation easement connecting the two (Fig 2).



The History Hills of Gold Conservation Area

By Ann Deutch and Cliff Chapman

The area identified as Hills of Gold is part of the Brown County Hills extending northward into Johnson County. In fact, they extend farther north than can be easily recognized today, since the northern extension is completely covered by glacial till. Indiana has experienced several ice ages over the millennia, but the last one, the Wisconsinan glaciation, is what significantly molded the landscape associated in the 21st Century. Thus, the northernmost Brown County Hills around Trafalgar in southern Johnson County are buried under Wisconsinan till.

Those last ice sheets that covered much of Indiana extended south of the Hills of Gold area to the east and the west, but the Brown County Hills of Central Indiana acted like a cleave that parted the massive ice sheet. The northern boundary of Glacier's End Nature Preserve is quite literally where the ice stopped.

But that doesn't mean this area is without glacial influence. Loess from a pre-Wisconsin glacial period is still found on some of the ridge tops. Plus, being at the edge of a glacier makes for a dynamic history. While there is exposed Mississippian shale in the creek valleys, glacial erratics, found as chunks of granite and quartzite, are strewn throughout the area. Weathering has created a mix of soils in the area with glacially influenced soils in some places but not in others. This creates a mixture of soils with different pHs supporting different plant communities melding together as what appears to be a canopy of homogeneous forest "from the air". In reality, the ecological communities represent this mixture of soil types at this geologic boundary, this meeting of north and south.

Hills of Gold gets its name from one of the other glacial erratics found there previously. Gold and diamonds are sometimes found in this line across Indiana where the glaciers stopped. Gold was found as small flakes in areas just like Blossom Hollow and Glacier's End Nature Preserves in the 19th Century and is probably present in very small quantities today.

The portion of the Hills of Gold Conservation Area studied in the 2015 bioblitz is protected as a result of the Central Indiana Land Trust (CILTI) and two families. One hundred and thirty-three years after the first Europeans settled near the Bioblitz area in 1825, three Hougham brothers began to purchase land with a dream of developing a lake and residential area in the Blossom and Pitcher Creek drainage. Robert (Bob) Hougham, the son of one of those brothers, continued purchasing and holding land for this purpose. In 1957, Dr. Russell Lamb joined forces with Bob Hougham to develop a larger lake encompassing more of the Pitcher Creek and Indian Creek valley. In addition to purchasing additional land, the two developers entered into agreements to enable the dam building with several local families, including the Pitchers after whom Pitcher Creek is named.

The area's first dam was built in 1962 across Callon Hollow, to the west of the bioblitz area. The expense of building this dam precluded work on the main dam, so that preliminary 37 acre lake was sold to Earlham College for a Biological Station. Bob Hougham and Russell Lamb were then able to recruit

financial supporters, form a corporation and build the dam for Lamb Lake in 1966. About 300 families now own homes around and near the lake, said to be the largest privately owned lake in the state.

Much of shoreline of Lamb Lake has since been developed into a residential area. The bioblitz area, south and east of the lake, was reserved by the lake-builders for future development. However, over time, the Hougham and Lamb families recognized the value of undeveloped and protected land and both families were drawn to natural areas and realized the singular beauty and natural value of the lands they each owned. It was these hundreds of acres of forest that caught the attention of the CILTI.

As it turned out, timing was on the side of conservation as the owners were conservation minded and the Land Trust had developed a new conservation plan and was eager implement it. Furthermore, the Bicentennial Nature Trust was established by the state that made acquisition, and subsequent protection of some of this land, easier and faster than otherwise possible.

Formed in 1990, the Central Indiana Land Trust, Inc. works to protect the region's best remaining natural areas. Working as a volunteer driven organization, CILTI protected several sites through gifts of land until 1998 when it purchased Burnett Woods Nature Preserve in Hendricks County by writing its first grant to the Indiana Heritage Trust and pooling dozens of small donations. Hiring its first Executive Director in 2001, CILTI began purchasing land on a regular basis, first concentrating on lands along the White River north of Indianapolis utilizing temporary funds specific to that purpose. Using Indiana Heritage Trust funds as the lead gifts, several other land protection projects were successful. However, the board of directors felt efforts were following a shot-gun approach and the Land Trust needed to focus their effort.

A strategic conservation plan was undertaken in 2008 to identify where the best remaining natural areas were as well as investigate where rare and endangered species of plants and animals could still be found. Rather than seeking to protect individuals of species, the Land Trust adopted a plan that sought to protect sustainable populations of species.

The Hills of Gold is one of the targeted areas identified in the strategic conservation plan. Early field work revealed large populations of rare birds, such as worm-eating warbler, hooded warbler, and some sightings of cerulean warbler. Beyond those rare birds, forest interior species like red-eyed vireo, Acadian flycatcher, ovenbird, and wood thrush were found in high numbers. This indicated the area was large enough to support these populations as there were few to no brown-headed cowbirds observed. Additionally, yearling, juvenile and adult Eastern box turtles were found commonplace through the area, another good sign of a functioning ecosystem with minimal edge effects.

The field work just described was done in 2008 and 2009 while the strategic conservation plan was being created. It was finished and adopted by the CILTI Board of Directors as a path forward in summer of 2009.

At the same time, Bob Hougham's sons and their families were searching for a way to protect a large portion of their forest holdings into the future. The family attended a CILTI-sponsored workshop on Conservation Easements and within a year, they entered into discussion with CILTI about the details of an

easement and the appropriate management of the forest. By December 2009, the first project in the Hills of Gold, the 246 acre Bob's Woods Conservation Easement, was closed. Bob's Woods Conservation Easement will be managed in perpetuity in three sections, one area allowing ordinary timber management, the second area allowing selected tree cuts on a long rotation, and the third area prohibiting timbering and formally recognizing "the rights of nature to exist". The Hougham family embarked on forest management under these criteria and has continued to enjoy firewood production, as well as the satisfaction of reducing invasive plant populations and formally monitoring both birds and box turtles. The formal Conservation Easement has also been helpful to the family by providing legal "teeth" for protecting the land from vehicular trespass with the assistance of DNR Conservation Officers.

While working on the Bob's Woods Conservation Easement, the Land Trust staff was introduced to the other family that owned land in the Hills of Gold south of Lamb Lake and began building a relationship with them. The first walk-thru of their land was done in November of 2009. During 2010 discussion concerning options for conservation of the area continued. In 2011, CILTI signed a purchase agreement for 109 acres that became the Laura Hare Preserve at Blossom Hollow; the deal was closed in 2012.

Although negotiations continued with that family for land east of the Bob's Woods Conservation Easement, CILTI also continued conversation with the first family who owned land south of Blossom Hollow. CILTI's plan made this area one of 13 priority areas in Central Indiana; there were two families with land in the area willing to sell, but there just wasn't enough cash available. Fundraising for the conservation of nearly 700 acres would have taken many years and been challenging.

With Indiana's Bicentennial on the horizon, outgoing Governor Mitch Daniels decided to make a conservation impact by allocating $20,000,000 into a newly created Bicentennial Nature Trust in 2013. The Lilly Endowment added another $10,000,000. The idea was to celebrate the Bicentennial by protecting important natural areas, parks, and trails as a gift to future generations.

CILTI jumped at the opportunity but faced raising more money than it ever had in its history, not just in the Hills of Gold, but in some other critical areas needing protection. Overall organizational priorities were adjusted to make sure adequate time could be spent raising matching dollars to the new Bicentennial Nature Trust (it was a one to one match for acquisition).

The owners, of what is now called Glacier's End Nature Preserve, signed a purchase agreement for 203 acres in 2014. Later, the owners of 40 acres south of Blossom Hollow (same owners as Bob's Woods Conservation Easement) signed a purchase agreement with CILTI. In 2015 CILTI completed its largest fundraising campaign in its history and closed on the 203 acres at Glacier's End. Soon afterward, the same owners signed a purchase agreement on an additional 97 acres to add to Glacier's End. In early 2016, CILTI closed on the 40 acre addition to the Laura Hare Preserve at Blossom Hollow, then later on the 97 acre addition to Glacier's End Nature Preserve protecting a contiguous 695 acres with a total project value of $2,399,000.

During the bioblitz, most of this land was still in private ownership. CILTI wasn't working with two willing sellers, but rather, two partners who were just as interested in the results of the research.

CILTI's scientific approach to land conservation goes beyond just choosing what land to protect. Having an inventory of resources is essential for land management decisions. For example, deciding where to put trails, determining areas to prioritize for invasive species control, or identifying areas where more buffer land is needed to further protect a conserved species, are all based on data. Thus, the timing seemed perfect to collect as much data as possible during the two days of the bioblitz, while the land was still being acquired and management plans had not yet begun.

In conclusion, the Hills of Gold Conservation Area is one of 13 locations that the Central Indiana Land Trust is committed to protecting for future generations. These places called "Core Conservation Areas" represent the best slice of Central Indiana from a "natural perspective". Some protect forest interior habitat, like what is found in the Hills of Gold, others protect emergent marsh, old growth forest, tall grass prairie, groundwater wetlands, endangered species habitat, and/or unique geological features. Once protected, it is our belief that we will have captured the essence of Central Indiana.

CENTRAL
INDIANA
LAND TRUST
Preserving the Heartland

Geology Report
Prepared for the Central Indiana Land Trust Inc. (CILTI)
For the 2015 Hills of Gold Biodiversity Survey

by
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Introduction

This report will describe the geology underlying the Central Indiana Land Trust Incorporated (CILTI) Blossom Hollow and Glacier's End Nature Preserves (Nature Preserves). The geology discussion includes the structure and stratigraphy of the bedrock, the overlying unconsolidated sediment, and the soils developed in these geologic materials.

The Nature Preserves are located in southern Johnson County and within the southeastern watershed of Lamb Lake (Figures 1 & 2) (Indiana Spatial Data Portal, 2015). This BioBlitz study area is on sedimentary rock made of lithified river-carried deposits capped with unconsolidated ice-carried deposits overlain by wind-carried deposits. The unconsolidated deposits have undergone significant erosion.

Climate

This BioBlitz area is about 39.3 degrees north of the present equator on earth, about 700 miles from the nearest present day ocean edge and about 900 feet above the present average sea level. This current position permits four seasons in the study area. This latitude and distance from the ocean causes extreme seasons where both wet/dry and wintertime freezing conditions occur opposite of summertime heat. Local air temperatures are not dampened by the seawater thermal mass and vary from plus 120 F to minus 20 F. Seasonal interactions of the air gases deposit 44.83 inches (more than 1 meter) of water on the average each year. Most of this water is shed by the steep slopes in this study area. There is little water available as the surface water runs off and the local poorly-jointed shale/siltstone bedrock is not a very productive groundwater aquifer. For further information see Clark 1980, Fenelon et al. 1994, Uhl 1966.

Topography

This BioBlitz area is composed of canyons of eroding siltstone/shale, with the glacial debris capped siltstone ridges being cut with deep, and steep sided minor streams. In the focus area, Blossom Hollow, the deep shaded valley of Blossom Creek is cutting more than 100 feet below the rounded ridge tops. Work continues on mapping the actual contours of this remote area. An examination of the approximated topographic contours of the 1950's USGS Topographic Quadrangles, shows that the earlier contours do not superimpose the current IndianaMap topographic contours. Both of the earlier attempts to interpret and represent the complex land surface have small scale features that disagree with each other and the LIDAR

images now available. Blossom Hollow is an excellent example of the changes in technology that drive data revisions. For further information see Beacon 2015, IndianaMap 2015.

The existing nature preserve is 160 acres of glacial debris capped ridges made of eroded, jointed, siltstone, cut from the southeast to the northwest by Blossom Creek. It is labeled as "Blossom Hollow" on the USGS topographic sheet. Tributary branches feed the trunk stream almost perpendicular to main channel. The valleys are following the bedrock natural, regional, stress related, joint patterns (that were determined by IGS, Curtis Ault, in 1989). The eastern facing valley walls are generally the steepest. Several theories have been used to explain the differential steepness. One is that the sunshine during the warmest part of the day only hits the western exposed faces, causing more erosion, and thereby lower angle slopes on the western exposed valley walls. Another possible explanation is that the bedrock sediments were deposited from a westward flowing drainage system and decline westward, causing the eastside valley exposures to be made up of bedding planes that are sloping toward the open channels. In this case, the west side valley bedrock canyon wall exposures would be made up of bedding planes that slope away from the open channel, causing them to be more resistant to erosion, and therefore able to maintain a steeper slope.

Drainage

The 44.84 inches of precipitation that falls in an average year (NOAA 2015) has to go somewhere. It falls on the steep slopes and because of the tight nature of these siltstones and shales of the Borden Group bedrock, most of water quickly flows off into the narrow valleys. There is very little groundwater recharge. There are small, locally recharged, joint controlled, groundwater springs, where the streams have cut across and drain one of the siltstone channels. Some of the siltstones outcrop under a part of the glacial debris that caps the ridgetops.

The valley's surface waters are drained by the previously unnamed streams that, in order to document our BioBlitz observations locations more accurately, we are calling "Blossom Creek" and "Pitcher Creek", with upper tributaries reaches named "East Blossom Creek", "Upper Blossom Creek", "West Blossom Creek", "North Pitcher Creek" and "South Pitcher Creek". These two headwater streams flow into "Lamb Lake" an impoundment of Indian Creek.

Indian Creek is a named tributary to the West Fork of White River, which is part of the Wabash to Ohio to Mississippi to Gulf of Mexico system drainage. The regional surface water drainage divide is only a couple of miles east. The precipitation that falls at nearby Prince's Lakes flows eastward in Nineveh Creek to Driftwood to the East Fork of White River and then to the shared larger river system to the Gulf of Mexico. For more information the reader is referred to Clark 1980, Department of Interior 1974, Uhl 1966.

Bedrock

Indiana is underlain by sedimentary rocks ranging in age from Ordovician through Pennsylvanian ages which are estimated to range from 300 to 500 million years old (Fig. 3A). The Ordovician aged rocks are the oldest and the Pennsylvanian age of rocks are the youngest. The sedimentary rocks include

limestones, sandstones, siltstones, shale, and coal. The sedimentary rocks are folded over a structural feature called the Cincinnati Arch. The Cincinnati Arch is oriented from northwest to southeast across the state of Indiana (Fig. 3A). A simplified arch (Fig. 3B) shows how the bedrock layers can be folded over a central core and, following later erosion, shows how the older bedrock layers are exposed in the center of the arch and younger bedrock layers are exposed further from the center of the arch. An eroded arch is present in Indiana. The Nature Preserves are located on the western limb of the Cincinnati Arch. The bedrock layers dip approximately 30 to 50 feet per mile to the southwest (Fig. 3C) toward the Illinois Basin. The bedrock layers in the center of the Illinois Basin are over 20,000 feet thick. Midwestern geology is characterized by a series arches and basins (Fig. 3C).

The Nature Preserves are underlain by sedimentary rocks of the Borden Group which is primarily siltstone and shale with a few crinoid limestone beds and sandstone beds (Fig. 4) (Indiana Geological Survey 1987). The exposed Borden Group weathered color varies from grayish yellow to reddish brown. The Borden Group bedrock is grayish to grayish green where freshly exposed and unweathered.

The Borden Group rocks are generally unsuitable for use as construction aggregates. In other areas, these clay-rich, shaley rocks are used for brickmaking where the clay content is suitable. The bedrock is excavated, ground into clay sized particles, extruded into bricks and fired to make several colors of weather resistant construction brick. Because of the high clay content, multiple lakes and ponds are constructed within ten miles of the Blossom Hollow study; these tight clay- shales can be shaped and compacted into man-made lake basins that hold water. All of the lakes in the area are man-made and many are surrounded by permanent and seasonal homes.

This Borden Group bedrock is a very popular, central Indiana, rustic building stone. In the areas, where the grain size is large enough and quartz and the correct iron compounds are present, the Borden Group bedrock makes the “Brown County” sandstone. Exposed ledges of the sandstone are pulled from the hillsides and put through a heavy frame with a blade pushed by a power driven hydraulic ram. This product is called split-faced rubble stone. “Brown County” sandstone is mined and sold along the outcrop from southern Johnson County to the Ohio River. Many homes and commercial buildings in Johnson and adjacent Brown County are built or faced with Brown County sandstone. The side-water clay-rich deposits are the brick shales and the faster moving main channel quartz-rich siltstone deposits are the building stones.

The Borden Group was deposited by a very large, Mississippi River-size, westward flowing (modern alignments) ancient river. On this site, the bedrock is part of a westward advancing delta. The ancient delta’s materials are as thick as 800 feet, but only about 150 feet are exposed here. The Borden Group is eroded away only 10 miles east of Blossom Hollow. It is unknown how far eastward the ancient river deposits once extended. These Borden Group delta deposits extend westward, under Indiana and Illinois, about 280 miles. This is the distance from Vicksburg, Mississippi to Port Sulphur, Louisiana, on the present day Mississippi River delta, into the Gulf of Mexico. The very large and complex braided stream delta deposits are mostly unmapped, except for the most general features. For more information the reader is

referred to the "Compendium of Paleozoic Rock-Unit Stratigraphy in Indiana-A Revision", Indiana Geological Survey 1986; Willman et al. 1975, Handbook of Illinois Stratigraphy, Illinois State Geological Survey.

Following formation of the bedrock, streams and rivers began eroding a drainage network into the bedrock layers. Figure 5 show an elevation contour map of the bedrock surface (Indiana Geological Survey 1982). Several large river systems dissected Indiana into a series of ridges and valleys. One of the more interesting is the large valley located in northern Indiana called the Lafayette (Teays) Bedrock Valley system (Bruns & Steen 2003). The Lafayette (Teays) Bedrock Valley is the former course of the Ohio River until it was relocated by glacial ice.

Unconsolidated Sediment

Across the bedrock topography described above, continental ice sheets advanced from north to south. There have been at least four (4) glacial advances into the Midwest separated by interglacial periods. The most recent glacial advance is referred to as the Wisconsin glaciation.

The maximum extent of the Wisconsin glacial sediments is shown by the green line on Fig. 6 (Indiana Geological Survey 1989) and has been dated to approximately 20,000 years old. The Wisconsin glacial ice would have extended to the northern boundary of the Glacier's End Nature Preserve. The next oldest glaciation is referred to as the Illinoian glaciation and has been dated to approximately 140,000 years old (Wood et al. 2010). Since the older glacial deposits are eroded and discontinuous, it is difficult to know whether the glacial deposits are Illinoian-aged or from earlier glaciations. Hence, those glacial deposits are labelled as pre-Wisconsin. The maximum extent of the pre-Wisconsin glacial sediments is shown by the red line on Fig. 6 (Indiana Geological Survey 1988).

Glacial sediments can include:

1. Till which is an unsorted mixture of grain sizes including clay, silt, sand, gravel, and boulders deposited directly from glacial ice (i.e., like a dirty snow bank);
2. Outwash which is sand and gravel deposited by meltwater streams and rivers;
3. Lacustrine sediment which is silt and clay deposited in a lake or other quiet-water environment; or
4. Loess which is silt blown by the winds out of river valleys and deposited onto the surrounding landscapes. The loess commonly caps the other glacial sediment.

The surficial geology map shows that loam to sandy loam till is mapped underlying the Glacier's End Nature Preserve (Fig. 7), while siltstone and shale are mapped underlying the Blossom Hollow Nature Preserve. Glacial till likely extended across the Nature Preserves but has been eroded and removed. The erosion has exposed the older bedrock topography. There are may be erosional remnants of till located on the ridge tops. Loam till is mapped north of the Wisconsin glacial limit and north of the Nature Preserves. The loam till is the younger glacial sediment that has undergone less erosion and buries the underlying bedrock topography.

Glacial erratics (i.e., a geology term for a rock that is not from the local area) were observed in the valley bottom of Blossom Hollow. The glacial erratics included granite and quartzite boulders (Fig. 8). The nearest bedrock outcrops of these rock types are located in southern Canada. Erratics are one of the primary lines of evidence to prove that glaciation occurred.

Gold and diamonds are interesting glacial erratics eroded from the older glacial sediment. There are huge open pit gold and diamond mines "up-ice" in Canada. In 2013, mines in Canada produced over two million ounces of gold and about 15 million carats of diamonds. The largest (reported to officials) diamond found in Indiana is the "Stanley Diamond" which weighted 4.8 carats before it was cut. Indiana gold is found as small flakes and grains in fine, black sand. Both the diamonds and gold are heavier than the most of the other transported materials, so these are deposited with other heavy minerals in the weathered, rounded cracks and holes on the bedrock surfaces, like those in Blossom and Pitcher Creeks.

Other minerals/metals are also present. One IUPUI study, now in 2015, is tracking zircon in the ice transported materials. Elsewhere, Iron and copper nuggets have been found in this same age ice transported materials.

Soils

The soil survey map shows the soils developed in the bedrock and unconsolidated sediment (Fig. 9). The soil survey was derived from a United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) web service. (A USDA-NRCS Custom Soil Resource Report is included in the Hills of Gold Bioblitz folder on the Indiana Academy of Science website. It contains detailed information on soil names and properties.)

There are basically three major soils associations in the immediate area of Blossom Hollow: Hilltop glacial loess and the underlying weather till or outwash (Parke), hilltop with the loess washed off, on weathered till (Hickory), side-slope weathered bedrock (Muskingum and Wellston), and creek-bottom alluvial deposits (Eel and Shoals).

Parke series

The Parke series consists of deep, gently sloping and moderately sloping, well drained soils that formed in loess and the underlying weathered till or outwash. These soils are on ridgetops and knolls. The native vegetation is hardwood trees.

In a representative profile, the surface layer is dark grayish brown silt loam about 4 inches thick. The sub-surface layer is brown silt loam 5 inches thick. The subsoil is 53 inches thick. In the upper 4 inches the subsoil is yellowish brown, friable silt loam; in the next 23 inches it is strong brown friable loam. The underlying material, to a depth of 95 inches, is reddish brown, friable heavy loam.

The available water capacity is high and permeability is moderate. The organic-matter content of the surface layer is moderate.

Hickory series

The Hickory series consists of deep strongly sloping to very steep, well drained soils that formed in a thin layer of silt and the underlying weathered glacial till. These soils are on strongly dissected uplands. The native vegetation is hardwood trees.

In a representative profile, the surface layer is very dark grayish brown and dark grayish brown silt loam about 6 inches thick. The subsurface layer is brown, friable silt loam 7 inches thick. The subsoil is 50 inches thick. In the upper 7 inches it is yellowish brown, firm light clay loam; in the next 23 inches it is strong brown, firm clay loam; and in the lower 20 inches it is brownish yellow, firm light clay loam. The underlying material, to a depth of 73 inches, is olive brown loam.

The available water capacity is high and permeability is moderate. The organic-matter content of the surface layer is moderate.

Muskingum series

The Muskingum series consists of moderately deep, steep and very steep, well drained soils that formed in residuum weathered from interbedded sandstone, siltstone, and shale. These soils are on side slopes of strongly dissected uplands.

In a representative profile, the surface layer is dark grayish brown silt loam about 4 inches thick. The sub-surface layer is light yellowish brown silt loam 6 inches thick. The subsoil is 15 inches thick. In the upper 9 inches the subsoil is yellowish brown, friable silt loam, and in the lower 6 inches it is yellowish brown, friable channery silt loam. The underlying material, which extends to a depth of 34 inches, is dark yellowish brown channery silt loam. Below this is fractured sandstone and shale bedrock.

The available water capacity is moderate and permeability is moderate. The organic-matter content of the surface layer is moderate.

Eel series

The Eel series consists of deep, nearly level, moderately well drained soils that formed in loamy alluvium. These soils are on flood plains of rivers and creeks. The native vegetation is hardwood trees.

In a representative profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The underlying material is brown friable silt loam in the upper 9 inches; in the next 9 inches it is brown, mottled, friable loam; and in the next 14 inches it is brown, mottled, friable silt loam. Below this, to a depth of 60 inches, the underlying material is dark grayish brown, mottled, and stratified loam and sandy loam.

The available water capacity is high and permeability is moderate. The organic matter content of the surface layer is moderate. These soils have a seasonal high water table about 3 to 6 feet below the surface during some part of the year.

Eel soils are of moderate extent. They are well suited to farming, but crops are subject to damage from flooding.

Shoals series

The Shoals series consists of deep, nearly level, somewhat poorly drained soils that formed in loamy alluvium. These soils are on flood plains of rivers and creeks. The native vegetation is hardwood trees.

In a representative profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The underlying material is grayish brown, mottled, friable silt loam in the upper 5 inches; in the next 12 inches it is pale brown, mottled, friable silt loam; and to a depth of 35 inches it is grayish brown, mottled, friable loam. Below this, to a depth of about 60 inches, it is yellowish brown, mottled, stratified silt loam, loam and sandy loam.

The available water capacity is high and permeability is moderate. The organic-matter content of the surface layer is moderate. These soils have a seasonal high water table about 1 to 3 feet below the surface during some part of the year.

Shoals soils are of minor extent in Johnson County. When adequately drained, they are well suited to farming, but crops are subject to damage from flooding.

Wellston series

The Wellston series consists of deep, moderately sloping, well drained soils that formed in loess and the underlying residuum of acid sandstone, shale, and siltstone. These soils are on ridgetops and on upper side slopes and point slopes of strongly dissected bedrock areas in the uplands. The native vegetation is hardwood trees.

In a representative profile, the surface layer is brown silt loam about 8 inches thick. The subsoil is about 30 inches thick. The upper 8 inches is strong brown, friable and firm silt loam; in the next 11 inches it is strong brown and brown, firm silty clay loam; and in the lower 11 inches it is strong brown, firm silt loam. The underlying material, to a depth of 52 inches, it is brownish yellow, silt loam. Below this is fractured sandstone.

The available water capacity is high and permeability is moderate. The organic-matter content of the surface layer is moderate Wellston soils are of minor extent in Johnson County. When erosion is adequately controlled, they are well suited to farming.

See attached USDA map. For more information the reader is referred to Strum (1979) and Noble (1990).

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Indiana Geological Survey. 1988. PRE-WISCONSIN_GLACIAL_LIMIT_IN: Southern extent of glaciation in Indiana (Indiana Geological Survey, 1:500,000, Line Shapefile), < http://maps.indiana.edu/>, accessed 26 April 2015.
The mapping conducted was based on the best available information. The glacial limit in southern Indiana has been the subject of study and refinement for many years. Among the most important early attempts at delineating the limit through field mapping were those of G. F. Wright, who presented a map of the glacial limit in 1884 and slightly refined the line in 1890. Frank Leverett (1896) contributed to the understanding of the glacial limit through a long career of mapping the Pleistocene deposits of Indiana and adjacent states. Malott summed up previous mapping efforts in 1926; at that time, the outer (older) glacial limit in Indiana became defined sufficiently to establish a standard that held for many years without much change. The pre-Wisconsin glacial limit in some areas of Indiana is discontinuous and is defined primarily by scattered patches of till and erratics, as shown by Thornbury (1937). Most of this work was summarized and improved upon by H. H. Gray in: Gray, H. H., 1988, Map of southern Indiana showing geomorphic features relevant to ice marginal relict drainage, in Gray, H. H., 1989, Relict drainageways associated with the glacial boundary in southern Indiana: Indiana Geological Survey Special Report 45, 9 p.

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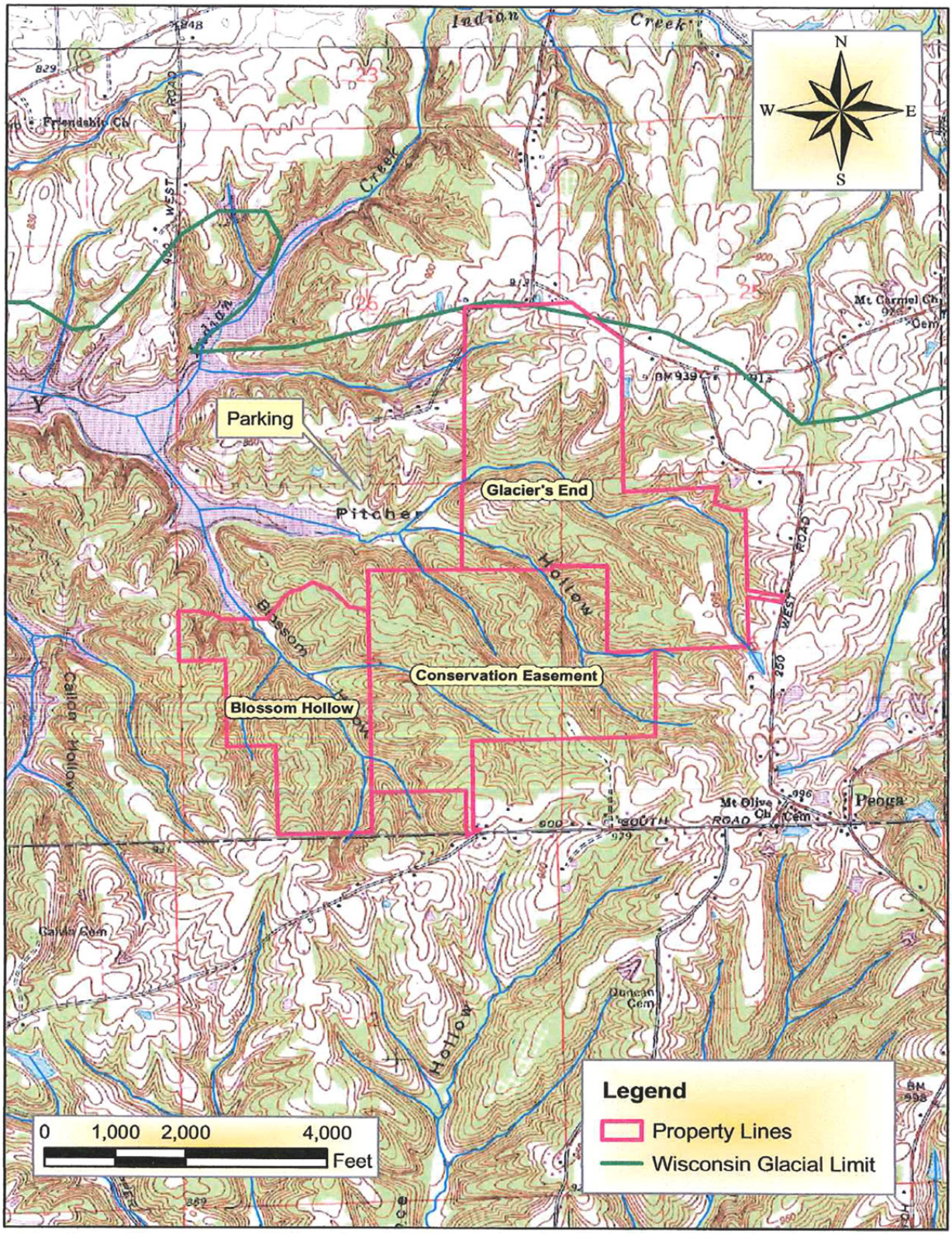


Figure 1. Map showing the CILTI Nature Preserves on Bean Blossom (1994) and Trafalgar (1993) US Geological Survey quadrangles (Scale: 1:24,000).

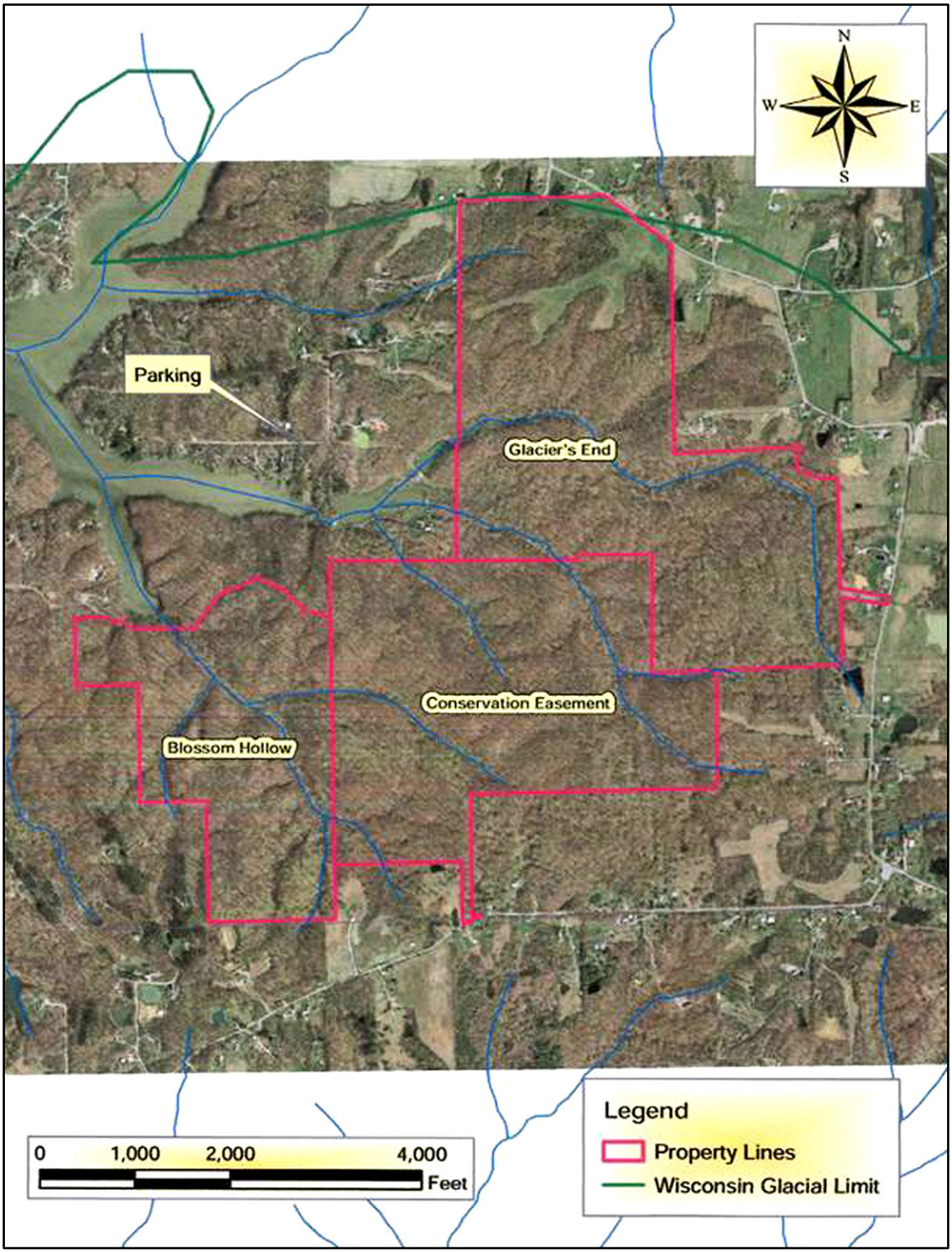


Figure 2. 2011 Orthophotographs showing the CILTI Nature Preserves. [2011-2013 Indiana Orthophotography (RGBI), LiDAR and Elevation (Indiana Spatial Data Portal <<http://gis.iu.edu/index.php>>, accessed April 26, 2014)]. (Scale: 1:18,000).

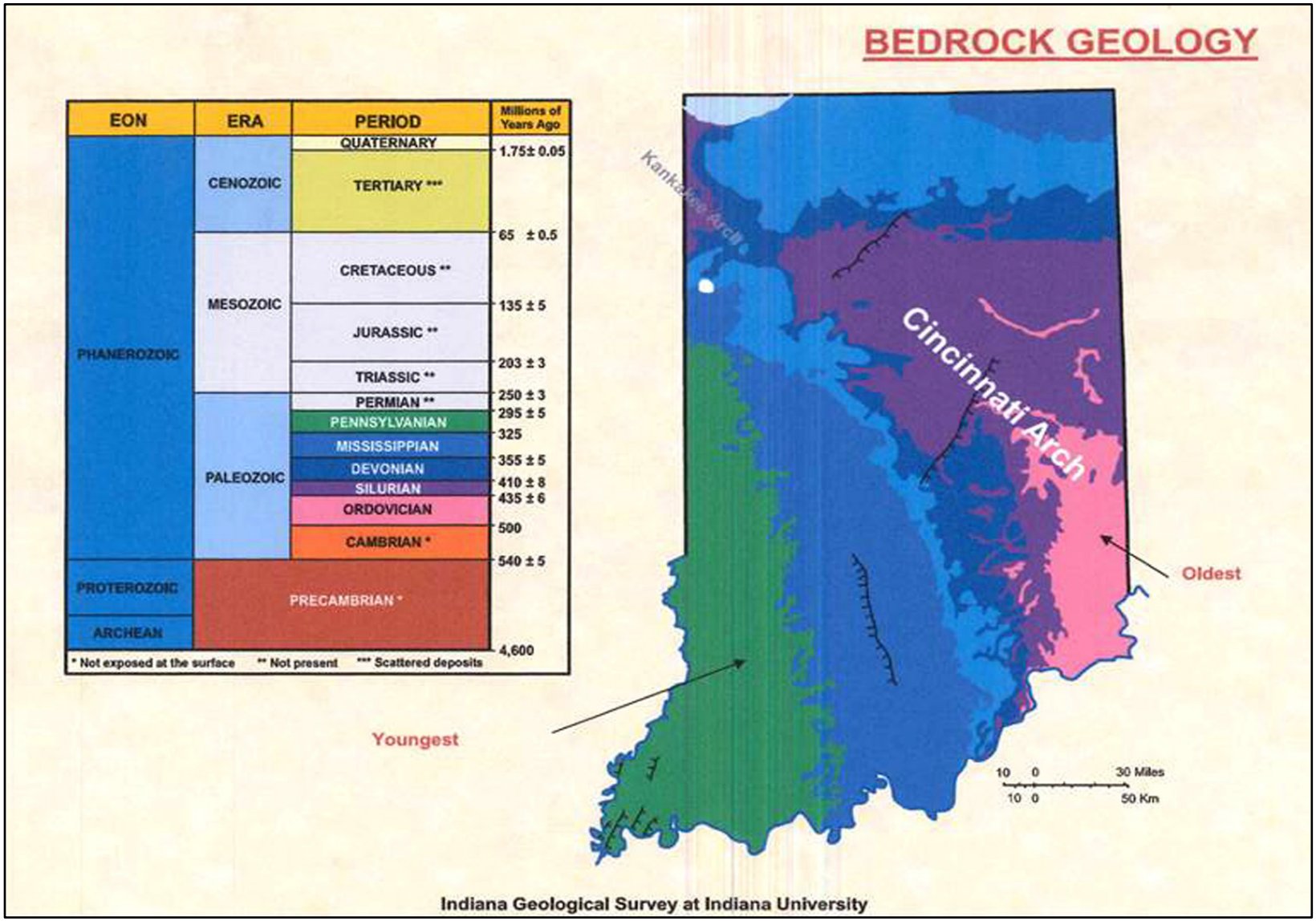


Figure 3A. Bedrock geology of Indiana (Thompson, 2015).

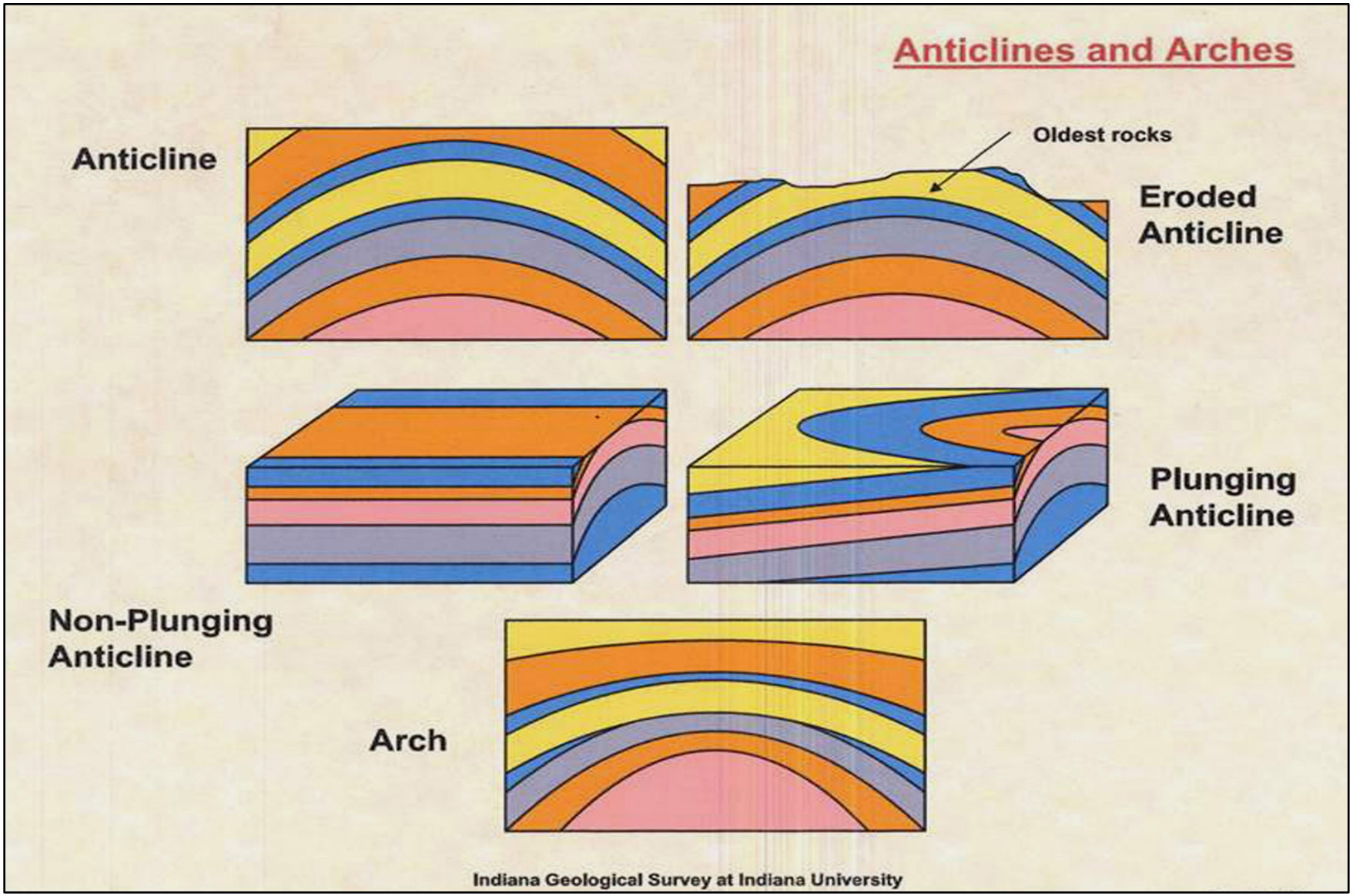


Figure 3B. Anticlines and arches (Thompson, 2015).

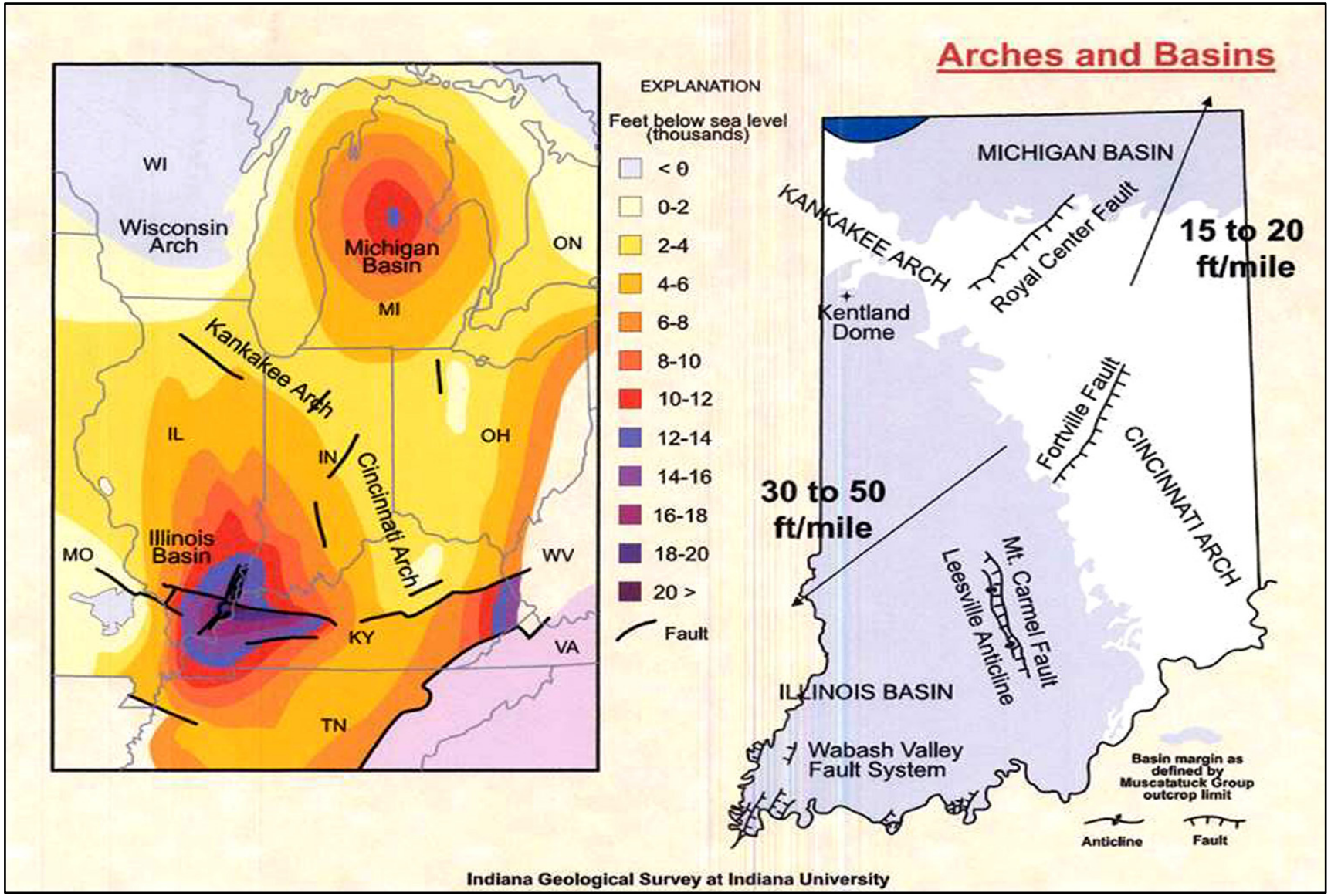


Figure 3C. Arches and basins (Thompson, 2015).

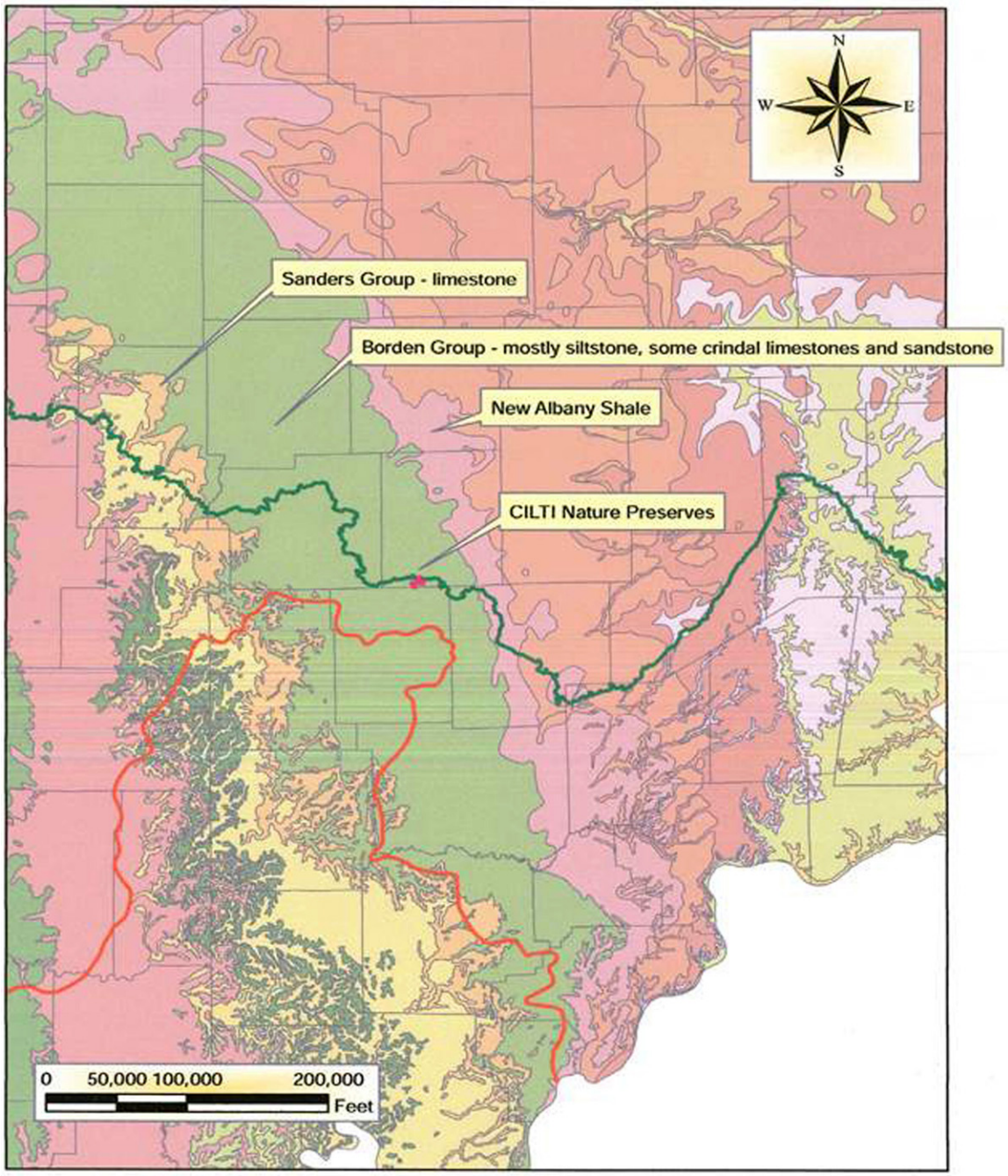


Figure 4. Map showing the CILTI Nature Preserves relative to bedrock stratigraphy. (Scale: 1:1,200,000).

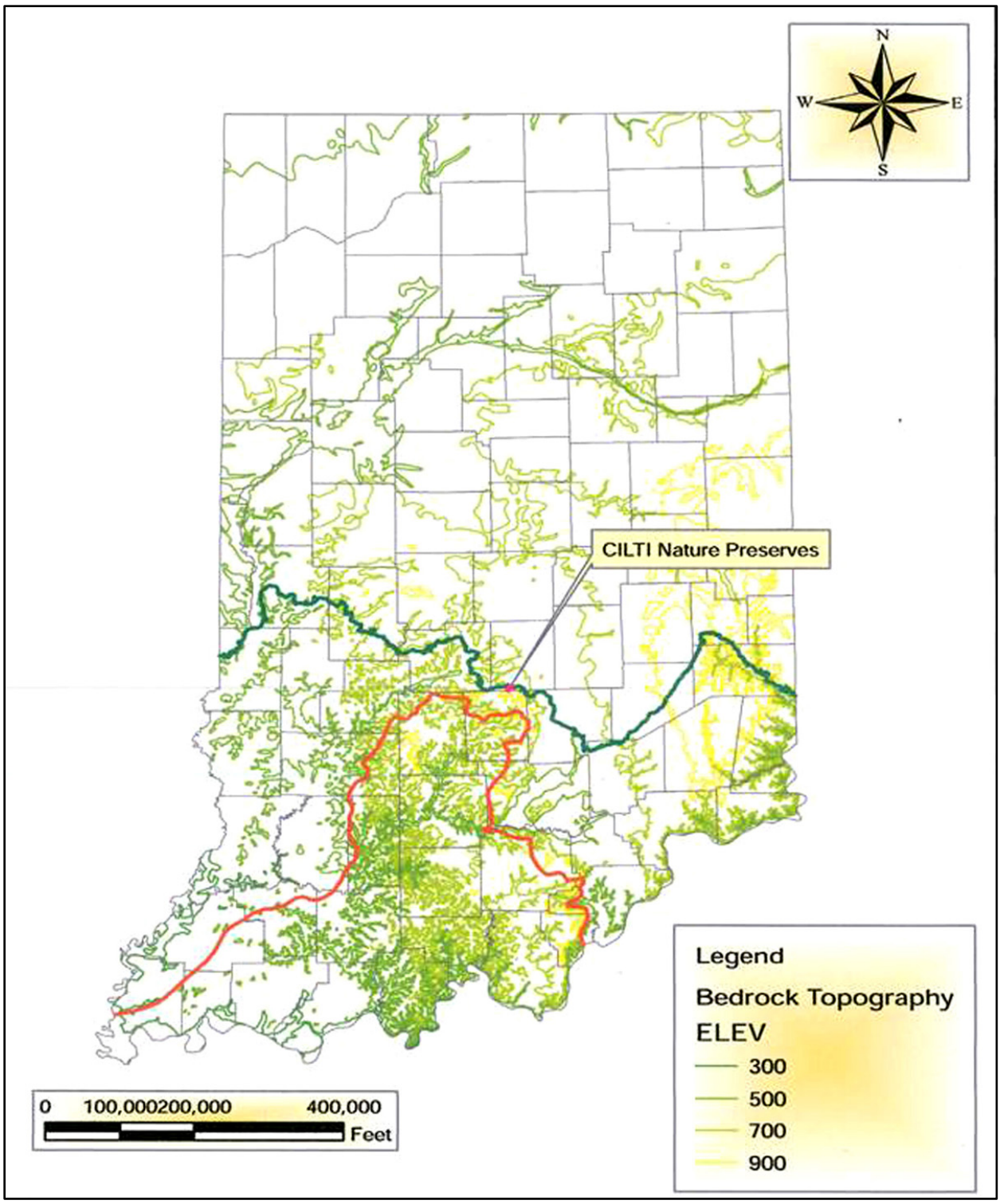


Figure 5. Map showing he CILTI nature Preserves relative to bedrock topography. (Scale: 1:2,400,000)

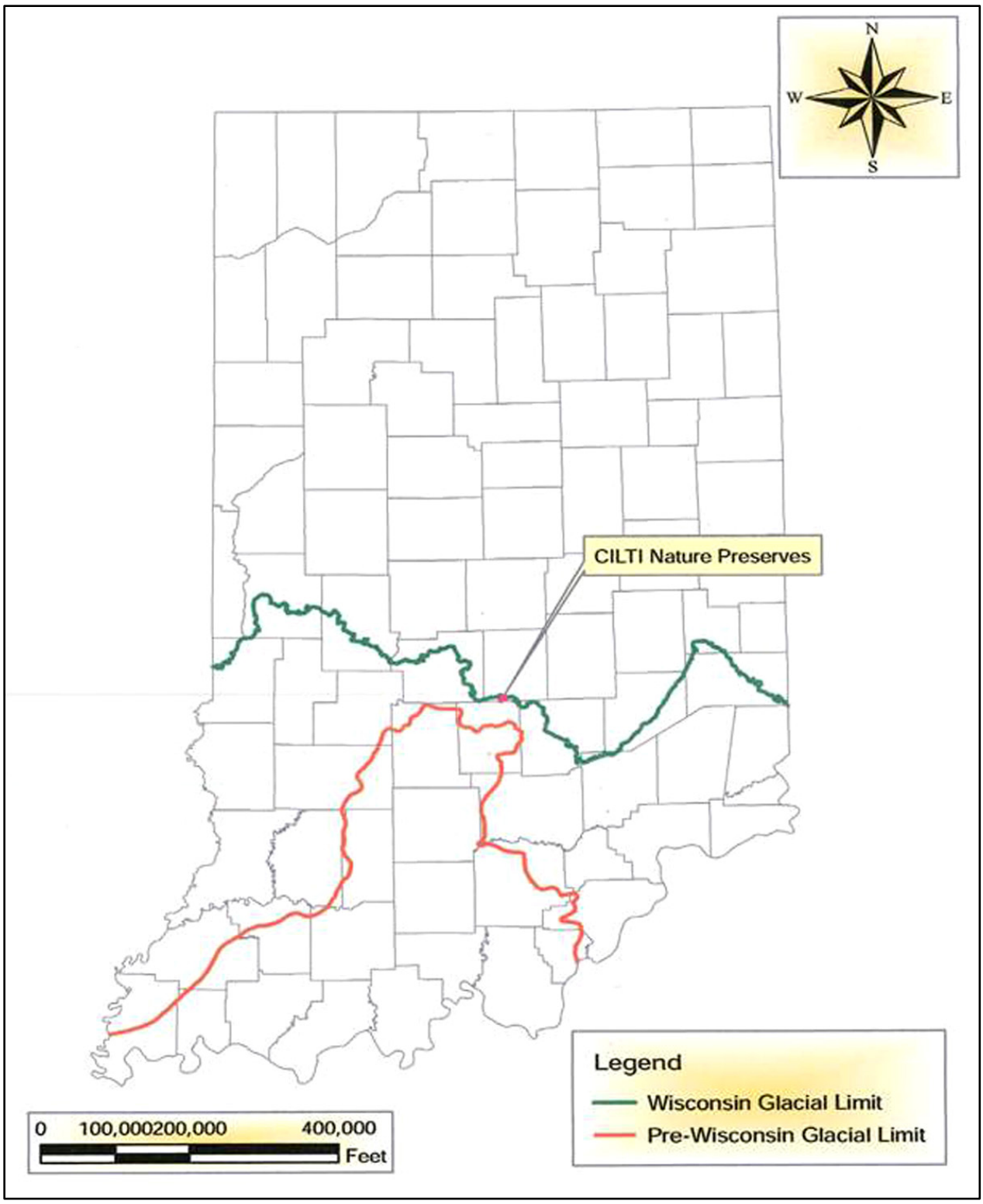


Figure 6. Map showing the CILTI Nature Preserves relative to glacial limits. (Scale: 1:2,400,000).

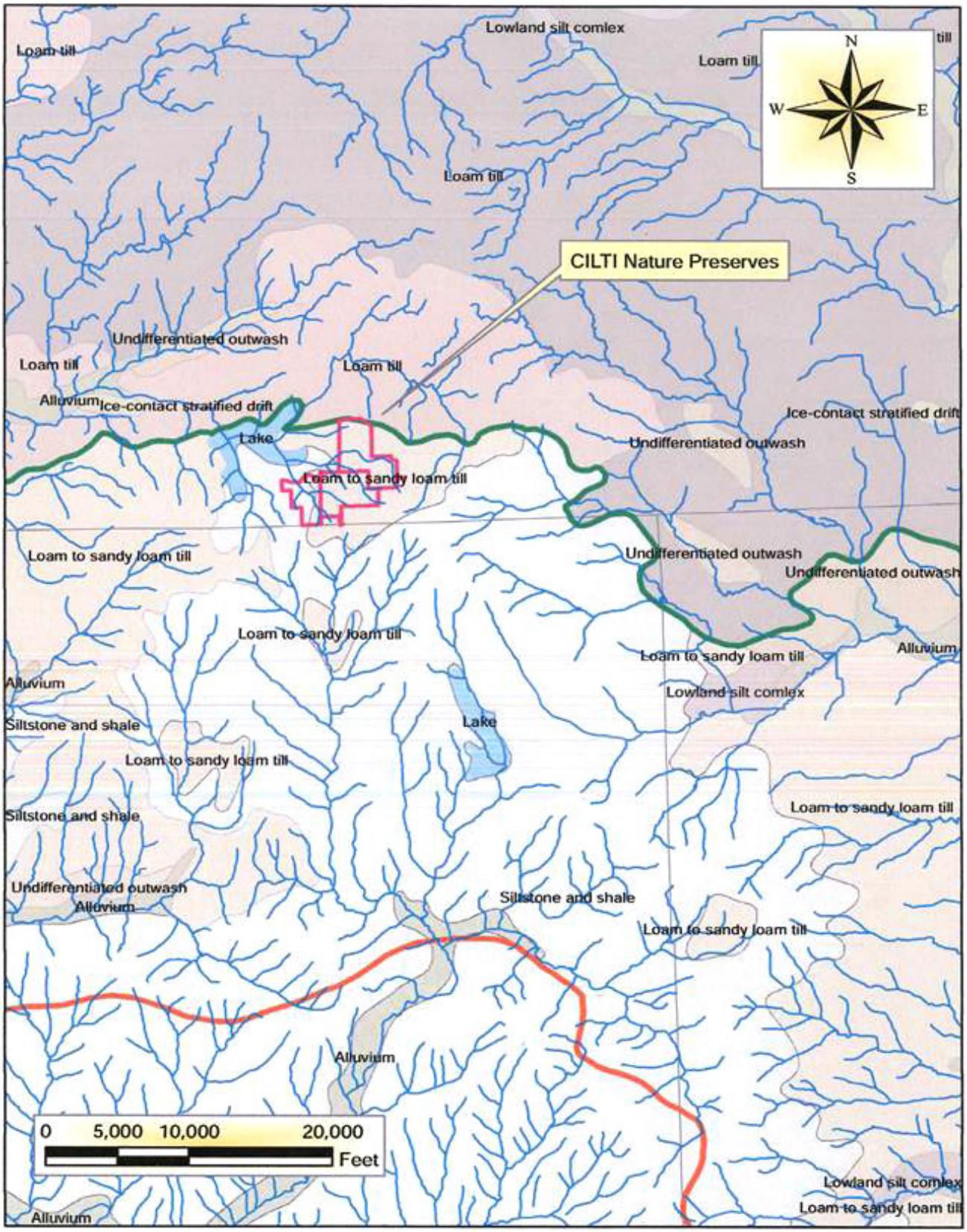


Figure 7. Map showing the CILTI Nature Preserves relative to surficial geology. (Scale: 1:120,000).

Figure 8.—Photograph of a granite boulder that is a glacial erratic in valley of Blossom Hollow Nature Preserve. The granite boulder is the reddish boulder that the shovel is leaning on.

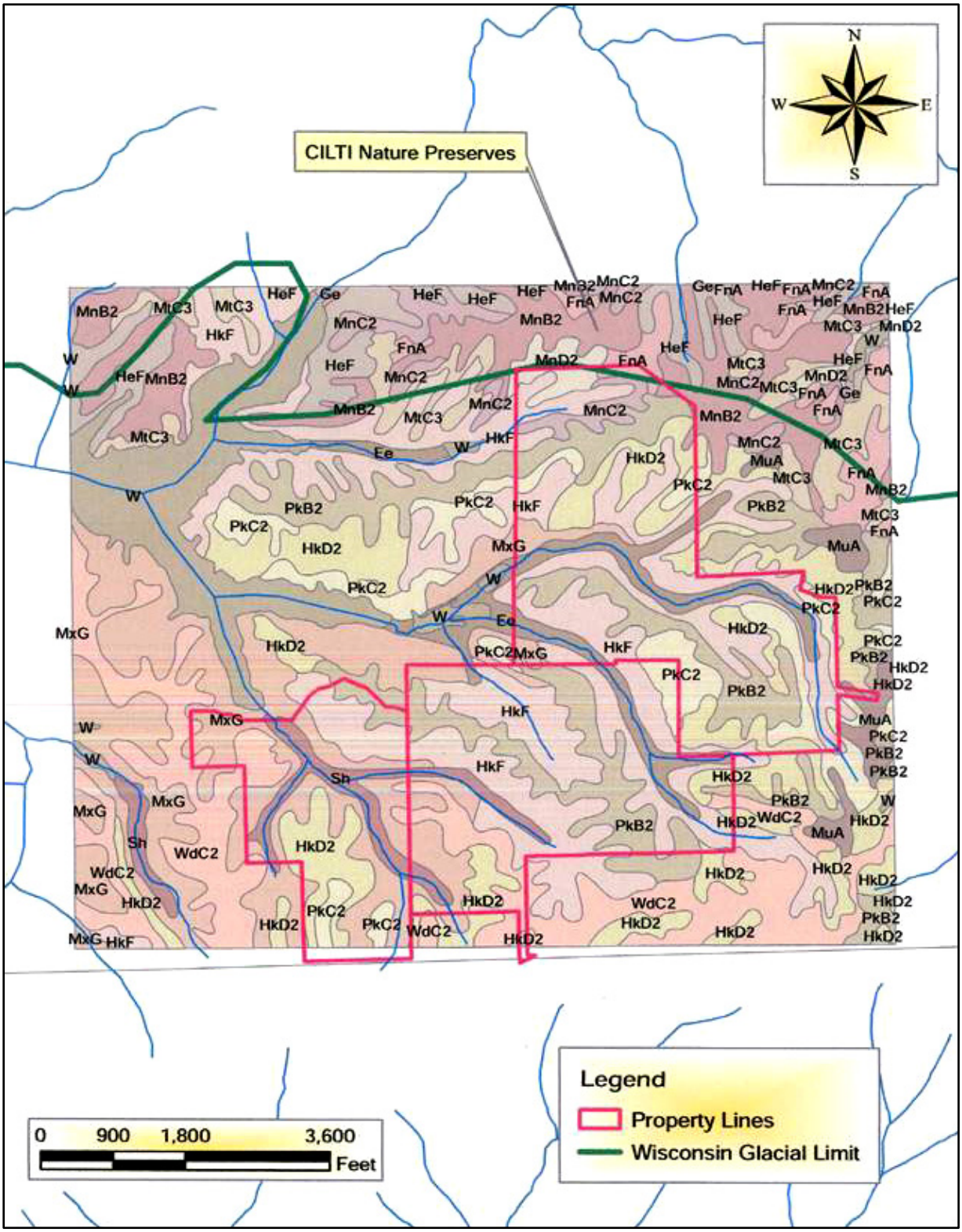
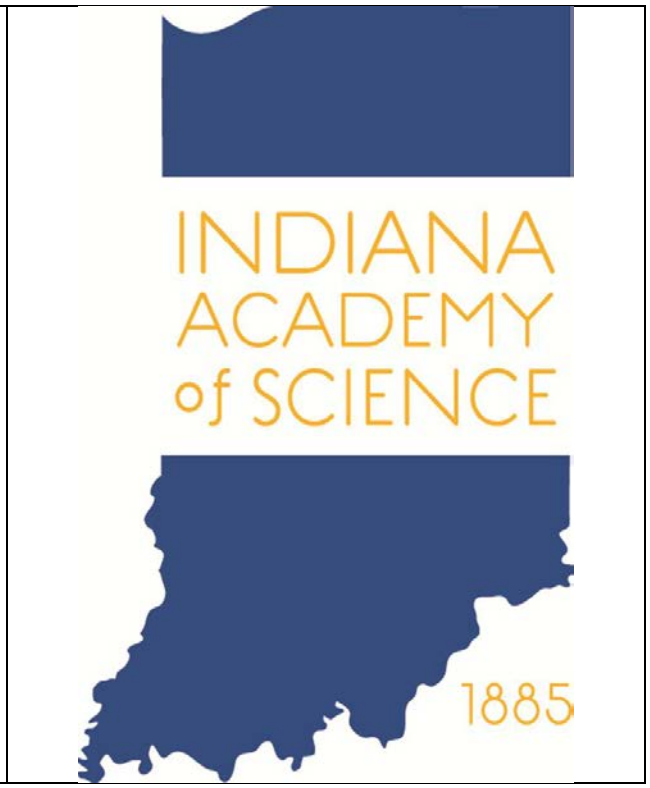


Figure 9. Map showing the CILTI Nature Preserves relative to the USDA NRCS soil survey. Refer to the Custom Soil Resource Report for an explanation of soil names and properties. (Scale: 1:21,600).

Results of the Hills of Gold Biodiversity Survey

16th – 17th May 2015



List of bat species (2 species) observed during the Hills of Gold Biodiversity Survey, May 17th -18th 2015.

Team Leader: Joy O'Keefe

Team Members: Caitlyn Gorden, Jordan Holmes, Julia Hoeh, Nick Bollerud, Tim Divoll, Scott Bergeson, Taryn Upmann Grunwald

Table 1: Bats

Scientific name	Common Name	Demographics	Number
Myotis septentrionalis	Northern long-eared bat	Adult male, non-reproductive	1
Myotis sodalis	Indiana bat	Adult female, pregnant	1

Surveying Methodology and Effort

Scouting for net sites: 2 hours × 2 people = 4 person-hours

Setting up nets: 3 hours × 8 people = 24 person-hours

Conducting mistnet survey: 5 hours × 8 people = 40 person-hours

Total = 68 person-hours

Voucher Specimens

None

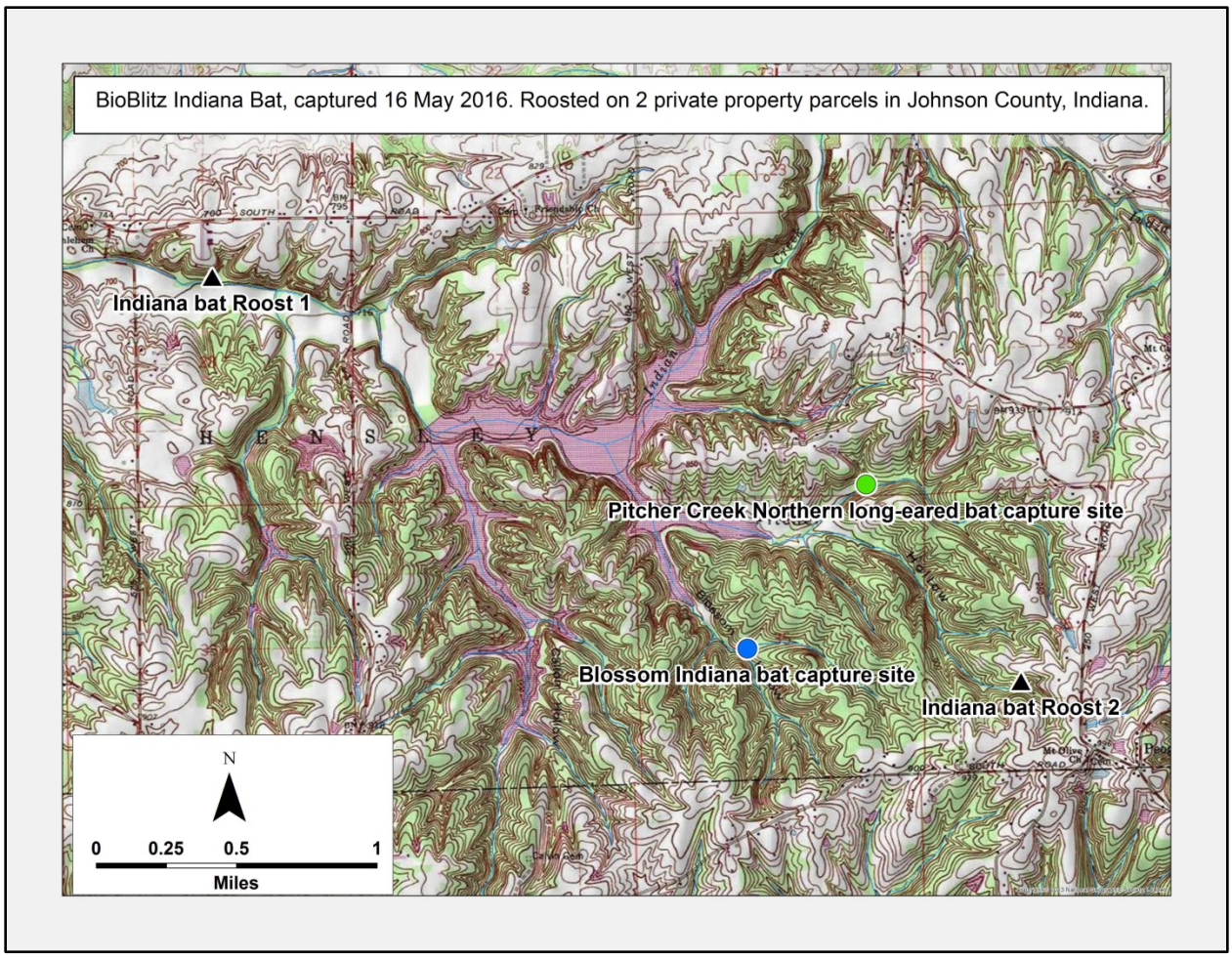
Summary Overview

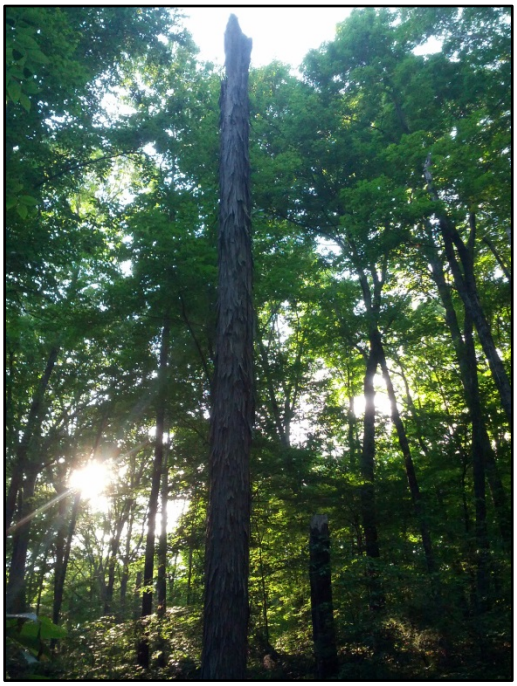
Eight biologists from the Center for Bat Research, Outreach, and Conservation sampled for bats. Two sites were established in Blossom Hollow Nature Preserve, one on Upper Pitcher Creek and the other in Blossom Hollow (see map below). At each site, we deployed two double-high mistnet sets and one single high mistnet. It rained steadily for most of the day leading up to a few hours before dusk. Nets were open for ~4 hours, beginning at dusk and were checked for bats every 10 minutes. Captured bats were banded with a unique aluminum forearm band and sex, age, reproductive condition, forearm length (mm), mass (g), and wing damage score for assessing effects of white-nose syndrome (WNS; scores range from 0 to 3) was recorded. A 0.38 gram radio transmitter was attached to an Indiana bat, using non-toxic surgical glue to adhere the transmitter to the skin between the bat's scapulae.

One male northern long-eared bat (*Myotis septentrionalis*; band BRR A4244) was captured, with a healthy weight (7 grams) and no significant wing damage (score = 0), at the Upper Pitcher Creek site.

The northern long-eared bat was recently listed as a federally threatened species due to large-scale population declines from the WNS epidemic. One pregnant adult female Indiana bat (*Myotis sodalis*; INB 1700) was captured at the Blossom Hollow site. Interestingly, she was captured in our single high net on a small drainage flowing into the larger creek bed that had very little water at the time of sampling. The Indiana bat is a federally endangered species and also has experienced significant population declines as a result of WNS. This bat was a healthy weight (8.5 g), but had significant wing damage due to WNS (score = 2). We radio-tracked the Indiana bat to two roost trees over the days following the BioBlitz. We first located her roosting in a large diameter (79.4 cm) cottonwood (*Populus deltoides*) snag in a small woodland opening on private land ~30 m from Indian Creek, 3.7 km northwest of the capture site. We observed 5 bats exiting this roost on 17 May and 3 bats on 18 May. Due to the size and decay state of the tree, we believe it could house a larger colony of Indiana bats later in the maternity season. The Indiana bat disappeared for a few days and then was relocated in a large (60 cm diameter) shagbark hickory (*Carya ovata*) with a snapped off top (see figure below); this tree was on private land 1.5 km southeast of the capture site. We observed 24 bats exiting from this tree on 23 May.

Due to the inclement weather during the day leading up to our mistnetting effort, it is not surprising that we only captured two bats across the two net sites. It is remarkable that both captures were federally protected species, however. This brief bat blitz also produced data on two maternity roosts for the federally protected Indiana bat. Bats used the large cottonwood roost on at least two days and a significant number of bats used the shagbark hickory that was closer to the net site. We recommend additional mistnetting and radio telemetry work in this area of Johnson County to gain a better understanding of the local bat community and this specific Indiana bat maternity colony.





Top figure: illustrates the location of the two mistnet sites during the bioblitz on the night of 16 May 2015.

Bottom figure: the large (60 cm diameter) shagbark hickory (*Carya ovata*) with a snapped off top serving as a maternity roost for the federally protected Indiana bat.

List of beetle species (17 taxa, 16 species) observed during the Hills of Gold Biodiversity Survey, May 17th -18th 2015.

Team Leader: Jeffrey D. Holland

Team Members: R. Michael Brattain, Gareth Powell, Robert Behring

Table 2: Beetle (Coleoptera) species.

I. Glacier's End Nature Preserve – North Pitcher Creek

Family	Species	Common Name
Brentidae	*Arrhenodes minutus* (Drury)	Oak timberworm
Cantharidae	*Atalantycha bilineata* (Say)	Two-lined leather-wing
Cantharidae	*Cantharis* sp.	A soldier beetle
Chrysomelidae	*Capraita circumdata* (Randall)	A flea beetle
Histeridae	*Platysoma leconti* Marseul	A clown beetle
Nitidulidae	*Brassicogethes aeneus* (Fabricius)	Common pollen beetle
Silvanidae	*Uleiota dubia* (Fabricius)	A silvanid flat bark beetle

II. Conservation Easment

Family	Species	Common Name
Carabidae	*Calosoma scrutator* Fabricius	Fiery searcher
Cerambycidae	*Analeptura lineola* (Say)	A longhorned beetle
Cerambycidae	*Euderces picipes* (Fabricius)	A longhorned beetle
Cerambycidae	*Saperda discoidea* Fabricius	Hickory saperda
Chrysomelidae	*Capraita circumdata* (Randall)	A flea beetle
Coccinellidae	*Coleomegilla maculata* (DeGeer)	Spotted lady beetle
Curculionidae	*Conotrachelus anaglypticus* (Say)	Cambium curculio
Melandryidae	*Spilotus quadripustulatus* (Melsheimer)	A false darkling beetle
Stenotrachelidae	*Cephaloon lepturides* Newman	False leptura beetle
Tenebrionidae	*Alobates pensylvanica* (DeGeer)	False mealworm beetle

Voucher Specimens

Representatives of all species collected have been accessioned into the Purdue Entomological Research Collection in the Department of Entomology, Purdue University, West Lafayette, Indiana.

Surveying Methodology and Effort

Beetles were collected through the day by sweep-netting vegetation, examining flowers, and hand collecting under rocks and bark. Approximately 30 person-hours were spent in these efforts. This was not effective because of the rainy weather. In the evening on the Saturday of the survey, we used a 1000 W metal halide light, a 175 W mercury vapor light, and two small UV lights to attract and catch beetles on a ridge in the hardwood forests of the conservation easement. This yielded a similarly low number of species because of the constant conditions of drizzle to light rain. Ten person-hours were spent collecting at the lights.

Summary Overview

A very low number and diversity of beetles were caught, undoubtedly because of the rainy conditions. No species of special interest were caught. While some specimens were winnowed from the saturated vegetation or found under bark, the list compiled represents a miniscule fraction of the species that actually are present at the Hills of Gold site.

Beetle collecting on Saturday night. (Photo by John Taylor)

Beetle collecting on Saturday night. (Photo by John Taylor)

Beetle collecting on Saturday night. (Photo by John Taylor)

List of bird species (86 species) observed during the Hills of Gold Biodiversity Survey, May 17th - 18th 2015.

Team Leader: Kirk Roth

Team Members: Tom Houghman, Karl Werner, David Benson, Rosemarie Jeffrey, Tamara Thweatt

Table 3: Bird species. The count of bird species observed during the Hills of Gold Bioblitz. Counts are given for the three main areas and also birds detected incidentally on adjacent property. Frequency of detection of each species within Johnson County during May is given, based upon eBird (2015) checklists (n = 204) from 2004–2014. Migrant species are denoted with an asterisk after the common name, although individuals of other species may also have been migrants. LH = Laura Hare Nature Preserve; GE = Glacier's End Nature Preserve; CE = Conservation Easement; NP = Nearby Property; eBird = eBird frequency for Johnson County.

Species Name	Common Name	LH	GE	CE	NP	eBird
Branta canadensis	Canada Goose		3		1	0.41
Aix sponsa	Wood Duck				7	0.07
Ardea herodia	Great Blue Heron				1	0.29
Cathartes aura	Turkey Vulture		1			0.30
Buteo lineatus	Red-shouldered Hawk	1	1			0.02
Buteo jamaicensis	Red-tailed Hawk		1			0.15
Zenaida macroura	Mourning Dove	1	1			0.49
Coccyzus americanus	Yellow-billed Cuckoo	4	5	2		0.13
Coccyzus erythropthalmus	Black-billed Cuckoo				1	0.03
Strix varia	Barred Owl	1	2		1	0.02
Chordeiles minor	Common Nighthawk	1				0.03
Chaetura pelagica	Chimney Swift				1	0.25
Archilochus colubris	Ruby-throated Hummingbird	2	2	1		0.14
Melanerpes erythrocephalus	Red-headed Woodpecker			1		0.09
Melanerpes carolinus	Red-bellied Woodpecker	3	6	7		0.42
Picoides pubescens	Downy Woodpecker	3	1			0.34
Picoides villosus	Hairy Woodpecker		1			0.02
Colaptes auratus	Northern Flicker		1			0.21
Drycopus pileatus	Pileated Woodpecker	3	6	5		0.11
Contopus virens	Eastern Wood-Pewee	8	14	12	1	0.26
Empidonax flaviventris	Yellow-bellied Flycatcher*	1				0.00

Species Name	Common Name	LH	GE	CE	NP	eBird
Empidonax virescens	Acadian Flycatcher	10	22	13		0.17
Empidonax minimus	Least Flycatcher*	1				0.09
Sayornis phoebe	Eastern Phoebe				1	0.29
Myiarchus crinitus	Great Crested Flycatcher	3	3	2		0.35
Vireo griseus	White-eyed Vireo		1		2	0.31
Vireo flavifrons	Yellow-throated Vireo		3	4		0.07
Vireo gilvus	Warbling Vireo	1				0.37
Vireo olivaceus	Red-eyed Vireo	8	32	39	2	0.39
Cyanocitta cristata	Blue Jay	3	7	6		0.44
Corvus bracyrhynchos	American Crow	3	14	5	2	0.39
Stegidopteryx serripennis	Northern Rough-winged Swallow				3	0.15
Tachycineta bicolor	Tree Swallow				3	0.26
Hirundo rustica	Barn Swallow		12		2	0.24
Poecile carolinensis	Carolina Chickadee	3	4	3		0.44
Baeolophus bicolor	Tufted Titmouse	8	13	7		0.38
Sitta carolinensis	White-breasted Nuthatch	2	2			0.24
Thryoyhorus ludovicianus	Carolina Wren	1	4			0.31
Polioptila caerulea	Blue-gray Gnatcatcher	5	11	3	1	0.38
Catharus fuscescens	Veery*	3	4			0.02
Catharus minimus	Gray-cheeked Thrush*	5	2	1		0.01
Catharus ustulatus	Swainson's Thrush*	7	12	8		0.10
Hylocichla mustelina	Wood Thrush	5	11	22	1	0.34
Turdus migratorius	American Robin		4	2		0.70
Dumetella carolinensis	Gray Catbird	5	2			0.56
Toxostoma rufum	Brown Thrasher		1			0.27
Sturnus vulgaris	European Starling		5		1	0.46
Seiurus aurocapilla	Ovenbird	8	20	11		0.04
Helmintheros vermivorum	Worm-eating Warbler	3	7	10		0.02
Parkesia motacilla	Louisiana Waterthrush	1	3	3		0.02
Mniotilta varia	Black-and-white Warbler		2	1		0.08
Oreothlypis peregrina	Tennessee Warbler*	15	33	18	2	0.17
Oreothlypis celata	Orange-crowned Warbler*				1	0.00
Oreothlypis ruficapilla	Nashville Warbler*		2		1	0.19
Oporornis agilis	Connecticut Warbler*	1		1		0.00
Geothlypis philadelphia	Mourning Warbler*		1			0.02

Species Name	**Common Name**	**LH**	**GE**	**CE**	**NP**	**eBird**
Geothlypis formosus	Kentucky Warbler	1	8	9		0.04
Geothlypis trichas	Common Yellowthroat	2	2			0.35
Setophaga citrina	Hooded Warbler		7	4		0.01
Setophaga ruticilla	American Redstart	4	8			0.17
Setophaga tigrina	Cape May Warbler*	2				0.02
Setophaga cerulea	Cerulean Warbler		2			0.05
Setophaga americana	Northern Parula		3		1	0.33
Setophaga magnolia	Magnolia Warbler*		1		1	0.09
Setophaga fusca	Blackburnian Warbler*	1	1	1		0.04
Setophaga petechia	Yellow Warbler				2	0.32
Setophaga pensylvanica	Chestnut-sided Warbler*		1			0.08
Setophaga striata	Blackpoll Warbler*	6	15	1		0.05
Setophaga coronata	Yellow-rumped Warbler*	1	1			0.12
Setophaga dominica	Yellow-throated Warbler	1	2			0.21
Setophaga discolor	Prairie Warbler		2			0.12
Setophaga virens	Black-throated Green Warbler		2			0.09
Carduellina canadensis	Canada Warbler*		1			0.01
Pipilio erythropthalmus	Eastern Towhee	2	8		2	0.37
Spizella passerina	Chipping Sparrow		3		1	0.25
Spizella pusilla	Field Sparrow		1			0.31
Melospiza melodia	Song Sparrow	1				0.48
Piranga olivacea	Scarlet Tanager	6	12	13		0.22
Cardinalis cardinalis	Northern Cardinal	3	4	5	2	0.61
Pheucticus ludovicianus	Rose-breasted Grosbeak*		1	2		0.21
Passerina cyanea	Indigo Bunting		8		1	0.37
Agelaius phoenieus	Red-winged Blackbird			1	3	0.47
Quiscalus quiscula	Common Grackle				1	0.31
Molothrus ater	Brown-headed Cowbird		4	1	1	0.41
Icterus galbula	Baltimore Oriole		2		2	0.38
Spinus tristis	American Goldfinch	1	1		2	0.48
	Number of Species	46	67	34	32	
	Number of Individuals	160	382	224	54	
	Research-Hours	6.75	13	5	1.5	

Surveying Methodology and Effort

Three groups spent approximately 26.25 research hours searching for birds during the bioblitz (see bottom line of the table above). Birds were identified by sight and sound only.

Summary Overview

A total of 86 species were detected, although ten of these were outside the property boundaries, especially on the trail leading toward the Laura Hare Preserve from its parking lot. Several of these species were associated with the large lake adjacent to the trail, such as Canada Goose, Wood Duck, and Great Blue Heron.

The Glacier's End property had the most species (67) and most individual birds (382) detected, but also had the most acreage and most time spent by researchers. One hundred and sixty individual birds of 46 species were detected on the Laura Hare Preserve, while in the Conservation Easement 224 individuals of only 34 species were detected. Note that only an additional 1.75 research-hours effort was spent at Laura Hare. The differences in diversity and individual bird counts could be influenced by habitat type – the Laura Hare property had more edge habitat to promote diversity, while the Easement had a larger tract of forest. This view is supported by the differences in detected birds for each area. The Laura Hare property had several species of successional, generalist, or edge specialist species which were not detected in the Easement, including Red-shouldered Hawk, Mourning Dove, Least Flycatcher, Warbling Vireo, Eastern Towhee, Song Sparrow, and American Goldfinch (Castrale et al. 1998). The Conservation Easement had much higher numbers of several mature forest specialists compared to the Laura Hare Preserve, such as Red-eyed Vireo (39 vs. 8), Wood Thrush (22 vs. 5), Worm-eating Warbler (10 vs. 3), Kentucky Warbler (9 vs. 1), and Scarlet Tanager (13 vs. 6).

Data from eBird (2015) were used to compare bioblitz detection rates to detections reported by birders in Johnson County in May from 2004–2014 (n = 204). Several birds detected during the bioblitz were reported on only 3% or less of eBird checklists. Some of these instances may be due to detection opportunity. For example, nocturnal species such as Barred Owl and Common Nighthawk were rarely reported by eBird. Orange-crowned Warbler, Connecticut Warbler, and Yellow-bellied Flycatcher were all unrepresented in the eBird dataset, but these are all notably secretive migrants which may easily escape detection during less intense field surveys.

However, several species were noted in relative abundance compared to eBird reports. The areas investigated during the Hills of Gold Bioblitz may contain habitat particularly suited to species which prefer the lower vegetative strata of mature forests, such as thrushes and low-nesting warblers. Migrant thrushes were well represented during the bioblitz, with at least seven individuals of Veery, eight individuals of Gray-cheeked Thrush, and 27 of Swainson's Thrush. These species were reported in 2%,

1%, and 10% of eBird checklists, respectively. Ground-nesting wood warbler species also were relatively abundant in comparison to eBird reports, with at least 39 Ovenbirds, 20 Worm-eating Warblers, seven Louisiana Waterthrushes, and 18 Kentucky Warblers reported during the bioblitz. These species were reported in 4%, 2%, 2%, and 4% of eBird checklists, respectively. Hooded Warblers generally nest within a meter or two of the ground, and there were 11 reported during the bioblitz, as compared to 1% of eBird reports. The properties treated in the bioblitz may provide an ample research opportunity to investigate low-strata vegetation cover with relation to these species presence and/or nesting success. Ground nesting bird species generally show more nesting success in forested habitat than shrubby or open areas (Martin 1993), so increased numbers of these species may be a reflection of the higher relative forested habitat in the study area, compared to what birders regularly encounter in the rest of the county. The Laura Hare and Glacier's End properties may be of local conservation importance for these species and management efforts could take these species into account. For example, studies in the Midwest have found ground disturbing activities, such as prescribed burns (Artman 2000) and nearby clear cutting (Manolis et al. 2002), decrease the population levels of such species as Worm-eating Warbler, Hooded Warbler, and Ovenbird. Tree nesting songbirds such as American Robin and Eastern Wood-pewee experienced an increase in population following prescribed burns in Southern Ohio (Artman 2000), while ground nesting birds showed less nesting activity.

Unsurprisingly, open-country birds were not well represented in the bioblitz in comparison to eBird reports. For example, only two Mourning Doves were detected in the duration of the bioblitz, although the species is reported on 49% of ebird checklists in the county. Northern Flicker, Eastern Phoebe, Warbling Vireo, Brown Thrasher, Common Yellowthroat, Song Sparrow, Common Grackle, American Goldfinch, and other species (see Table) are examples of species which had few detections during the bioblitz, but have high detection rates in eBird. Some bird species went completely undetected during the bioblitz, but have high eBird detection rates, including House Wren (44% of eBird checklists), Mallard (40% of eBird checklists), House Sparrow(34% of eBird checklists), Killdeer (27% of eBird checklists), Eastern Meadowlark (21% of eBird checklists), and Eastern Kingbird (20% of eBird checklists).

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Top Figure: Eastern Towhee (*Pipilio erythrophtalmus*).

Left Figure: Scarlet Tanager (*Piranga olivacea*).

List of fish species (3 species) observed during the Hills of Gold Biodiversity Survey, May 17th -18th 2015.

Team Leader: Brant Fisher

Team Members: JoAnne Davis

Table 4: Fish species. All species collected are in the Class Actinopterygii, Order Perciformes, and Family Centrarchidae.

Scientific Name	Common Name
Lepomis cyanellus	Green Sunfish
Lepomis macrochirus	Bluegill
Micropterus salmoides	Largemouth Bass

Surveying Methodology and Effort

Seining was used to sample the fish diversity present on Hills of Gold properties. Collected fish were identified in the field and returned to the area in which they were collected. The three sites sampled were North Pitcher Creek near the west boundary of Glacier's End Nature P, a pond just south of the intersection of Roberts Road and CR 300W, and Blossom Creek near the north boundary of Blossom Hollow (Laura Hare) Nature Preserve.

Summary Overview

Only three species of fish representing one family were recorded from the Glacier's End and Blossom Hollow Nature Preserves. No state/federal endangered or special concern fish species were collected. The three species, Green Sunfish (*Lepomis cyanellus*), Bluegill (*Lepomis macrochirus*), and Largemouth Bass (*Micropterus salmoides*), are common statewide, highly tolerant of a wide range of environmental conditions, and can be found in a variety of aquatic habitats. Green Sunfish was the only fish species collected from the two lotic sites sampled (North Pitcher Creek and Blossom Creek). These streams are intermittent and likely completely dry up each year. The pond sampled at the northern boundary of Glacier's End Nature Preserve contained the two most common pond species (Bluegill and Largemouth Bass) found statewide and was likely stocked with these two species at some point after its construction.

Green Sunfish (*Lepomis cyanellus*). (Photo by Brant Fisher)

List of freshwater mussel species (1 species) observed during the Hills of Gold Biodiversity Survey, May 17th -18th 2015.

Team Leader: Brant Fisher

Team Members: JoAnne Davis

Table 5: Freshwater mussel species. The species observed is in the Order Unionoida, Family Unionidae.

Scientific Name	**Common Name**
Utterbackia imbecillis	Paper Pondshell

Surveying Methodology and Effort

Freshwater mussels were sampled using haphazard sampling techniques. Sections of streams and ponds located on the Hills of Gold properties were visually searched for live freshwater mussels and shell material. The three sites sampled were North Pitcher Creek near the west boundary of Glacier's End Nature P, a pond just south of the intersection of Roberts Road and CR 300W, and Blossom Creek near the north boundary of Blossom Hollow (Laura Hare) Nature Preserve.

Summary Overview

Evidence of only one species, Paper Pondshell (*Utterbackia imbecillis*), of freshwater mussel was found from the three locations sampled. No state/federal endangered or special concern freshwater mussel species were collected. Paper Pondshell is one of the most tolerant species of freshwater mussels in the state, and can be found statewide in a variety of aquatic habitats. Only weathered dead shell material was collected and only from the pond at the northern boundary of Glacier's End Nature Preserve; it may not still be living at the location. The low freshwater mussel diversity found is not a surprise considering the intermittent nature of the streams sampled.

List of herpetofauna species (22 species, 16 amphibians and six reptiles) observed during the Hills of Gold Biodiversity Survey, May 17th -18th 2015.

Team Leader: Bob Brodman

Team Members: Michael Finkler, Dantra Finkler, Heather Milbtrath, Nick Asher, Elizabeth Kunk, John Faukner, Payton Kellendburger, Allyson Roller, Jessica Nagel, Jim Horton, John Taylor

Table 6: Herpetofauna species.

Common Name	Scientific Name	Adults	Larvae	Calls	Location
Salamanders					
Jefferson Salamander	*Ambystoma jeffersonianum*	1	30		pond/woods
Spotted Salamander	*Ambystoma maculatum*		10		pond
Redbacked Salamander	*Plethodon cinereus*	7			woods
Northern Zigzag Salamander	*Plethodon dorsalis*	2			woods
Slimy Salamander	*Plethodon glutinosus*	18			woods
Southern Two-lined Salamander	*Eurycea cirrigera*	14			streamside
Longtailed Salamander	*Eurycea longicauda*	23			streamside
Frogs					
Wood Frog	*Lithobates sylvaticus*	1	10		pond/woods
Green Frog	*Lithobates clamitans*	9	20	3	pond
Bullfrog	*Lithobates catesbeianus*	2		3	pond
American Toad	*Anaxyrus americanus*	13			woods
Fowler's Toad	*Anaxyrus fowleri*	8			woods
Blanchard's Cricket Frog	*Acris blanchardi*	7			pond
Spring Peeper	*Pseudacris crucifer*			12	pond
Upland Chorus Frog	*Pseudacris feriarum*		70		pond
Cope's Gray Treefrog	*Hyla chrysoscelis*			12	pond
Turtles					
Eastern Box Turtle	*Terrepene carloina*	3			pond
Painted Turtle	*Chrysemys picta*	2			pond

Common Name	Scientific Name	Adults	Larvae	Calls	Location
Snakes					
Northern Watersnake	*Nerdodia sipedon*	2			stream
Eastern Gartersnake	*Thamnophis sirtalis*	1			woods
Eastern Milksnake	*Lampropeltis triangulum*	1			woods
Gray Ratsnake	*Pantherophis spiloides*	1			woods

Surveying Methodology and Effort

Amphibian and reptiles were surveyed by a combination of methods. Terrestrial and wetland habitats were sampled by visual searches and sample cover objects. Calling frogs were identified, and wetlands were sampled for larvae by use of dip nets. Turtles and larval amphibian were also sampled by use of 10 turtle traps and 21 minnow traps in ponds. The complete effort totaled approximately 90 person-hours and 31 trap-days.

Voucher Specimens

Voucher specimens of *Lithobates sylvaticus* were deposited at the Indiana State Museum. Voucher specimens for *Ambystoma jeffersonianum* (SJCZC A401), *A. maculatum* (SJCZC A402) and *Hyla chrysoscelis* (SJCZC A403) were deposited in the Saint Joseph's College zoological collection in Rensselaer, Indiana. All other species were documented and vouchered by images and retained by Robert Brodman.

Summary Overview

The herp team found a total of 284 herps of 22 species, including ten reptiles representing six species and 275 amphibians representing sixteen species. *Acris blanchardi* is a species of special concern in Indiana having declined throughout the northern half of its geographic range during the last two to three decades. *Acris blanchardi* was common at the pond in the northwest part of Glacier's End. *Terrepene carolina* is a special protected species in Indiana and some were found in Blossom Hollow and the southern part of Glacier's End. Many of the amphibians including *Eurycea longicauda, E. cirrigera,* and *Plethodon glutinosis,* were very common under cover objects. Four pond-breeding species (*Ambystoma jeffersonianum, A. maculatum, Lithobates sylvaticus,* and *Hyla chrysosclis*) represent new Johnson County records.

The herp team in action. (Photo by Bob Brodman)

More of the herp team in action. (Photo by Bob Brodman)

Top: Jefferson Salamander, *Ambystoma jeffersonianum*.

Middle: Southern Two-lined Salamander, *Eurycea cirrigera*.

Bottom: Longtailed Salamander, *Eurycea longicauda*. (All photos by Bob Brodman)

Top: Wood Frog, *Lithobates sylvaticus*. (Photo by Bob Brodman)

Bottom: Eastern Box Turtle, *Terrepene carloina*. (Photo by John Taylor)

Eastern Milksnake (*Lampropeltis triangulum*). (Photo by John Taylor)

List of mammal species (14 taxa) observed during the Hills of Gold Biodiversity Survey, May 17th - 18th 2015.

Team Leader: John Whitaker Jr.

Team Members: Angela Chamberlain

Table 7: Mammal species.

Scientific Name	Common Name	Number
Mammal Trapped:		
Blarina brevicauda	Northern Short-tailed Shrew	10
Microtus ochrogaster	Prairie Vole	10
Sorex hoyi	Pygmy Shrew	3
Peromyscus leucopus	White-footed Mouse	2
Microtus pinetorum	Woodland Vole	1
Sorex fumeus	Smoky Shrew	1
Sorex cinereus	Masked Shrew	1
Synaptomys cooperi	Bog Lemming	1
Total:		**29**
Other Mammals :		
Scalopus aquaticus	Eastern Mole	Burrows
Sciurus carolinensis	Gray Squirrel	Observed
Tamias striatus	Chipmunk	Observed
Glaucomys volans	Southern Flying Squirrel	Dead sample
Canis latrans	Coyote	Feces
Odocoileus virginianus	White-tailed Deer	Tracks

Summary Overview

The area trapped was primarily forested. The most common small mammals in such habitats in Indiana are the short-tailed shrew and the white footed mouse, which were taken. Much less common in these habitats are the pygmy shrew, the smoky shrew, and the woodland vole. Our primary goal was to capture these latter three species. Also, another rare species was caught, the bog lemming, which is most common in various grasslands, which is where we caught it. In two other grasslands we caught the masked shrew and the prairie vole.

Eight species of mammals were trapped. Four are relatively common, but the other four are relatively uncommon. Of the latter four, the woodland vole and southern bog lemming are found throughout much of the state. The pygmy shrew and smoky shrew are found only in forest in the unglaciated hill country of south central Indiana. In addition we had evidence of six other species. They

were not caught in traps, but we had evidence of the eastern mole (numerous burrows), gray squirrel (several observed), chipmunk (two observed), southern flying squirrel (a dead one observed by staff), coyote (feces observed), and the white-tailed deer (numerous tracks),

Peromyscus leucopus, White-footed Mouse. (Photo by Tim Carter)

List of moths (20 species), singing insects (2 taxa), and non-target organisms (4 taxa) observed during the Hills of Gold Biodiversity Survey, May 17th -18th 2015.

Team Leader: Carl A. Strang

Team Members: Members of the beetle team

Table 8: Moth, singing insects, and non-target arthropod species.

Family	Scientific Name	Common Name	Notes
Orthoptera (Singing Insects)			
Gryllidae	*Gryllus vernalis*	Northern wood cricket	Identified by analysis of song recording
Tettigoniidae	*Atlanticus* sp.	Shieldback	Nymph found at night. Is either *A. testaceus* or *A. monticola*. Collected.
Lepidoptera (Moths)			
Depresariidae	*Gonioterma mistrella*		One collected during the day
Tortricidae	*Clepsis melaleucanus*	Black-patched clepsis	Collected during the day
Crambidae	*Palpita magniferalis*	Splendid palpita	One photographed at light station
Geometridae	*Heterophleps refusaria*	Three-patched bigwing	One came to the light; photograph
	Heterophleps triguttaria	Three-spotted fillip	The moth most commonly flushed during the day, one collected; a few came to the light.
	Hydrelia inornata	Unadorned carpet	Commonly flushed at all elevations in the forest during the day, one photographed, one collected
	Lambdina fervidaria	Curve-lined looper moth	One came to the light; photographed & collected
	Probole amicaria	Friendly probole	All previously described species in this genus recently were combined; photographed & collected
	Protoboarmia porcelaria	Porcelain gray	4 individuals photographed at the light station, one collected
Lasiocampidae	*Malacosoma americana*	Eastern tent caterpillar	Late instar larvae common in the forest; photographed
Saturniidae	*Actias luna*	Luna moth	One photographed at light station

Family	Scientific Name	Common Name	Notes
Saturniidae	*Callosamia angulifera*	Tulip-tree silkmoth	Collected by the Purdue group
Notodontidae	*Gluphisia septentrionis*	Common gluphisia	One photographed at light station
Erebidae	*Hypena madefactalis*	Gray-edged snout	One collected at the light station
	Phoberia atomaris	Common oak moth	One caterpillar, photographed at night
	Zale helata	Brown-spotted zale	Considered a complex composed of several species; one came to the light, photographed
Noctuidae	*Agriopodes fallax*	Green marvel	Placed by some in genus *Acronicta*; two came to light station, one photographed and collected
	Colocasia flavicornis	Yellowhorn	Many came to the UV light; six individuals photographed
	Polygrammate hebraeicum	The Hebrew	One photographed at light station
	Protodeltote muscosula	Large mossy glyph	One photographed at the light station; older references place it in genus *Lithacodia*
Non-target Groups			
Corydalidae	*Chauliodes pectinicornis*	fish fly	One photographed at light station
Panorpidae	*Panorpa* sp.	scorpionfly	One photographed at the top of a ridge
Apidae	*Bombus impatiens*	Common eastern bumble bee	A queen seeking a nest site on a ridge top; photograph
Linyphiidae	*Frontinella communis*	Bowl and doily spider	One photographed in web in forest

Surveying Methodology and Effort

I started at the top of the ridge at the south end of the Glacier's End portion of the survey area, and followed the logging trail back down to bioblitz HQ, from 9:30 a.m. to 2:00 p.m. (4.5 person-hours), with frequent side excursions into the forest and along streams. I listened for singing insects, collected examples of moth species flushed into flight, and photographed other invertebrates along the way. I worked alone.

In the evening I set up a white sheet with a UV light, not far from the Purdue beetle team's lights on a forested ridge top in the central portion of Blossom Hollow, but facing a different downslope, to the

east. For approximately 3 hours I collected some moths, and photographed others. I also exchanged some specimens with the Purdue group.

Voucher Specimens

All collected specimens will be transferred to the Purdue University collection at the West Lafayette campus.

Summary Overview

Two species of singing insects, 20 species of moths, and four additional arthropod species were identified in this portion of the bioblitz study. All except one singing insect and one additional arthropod were identified to the species level; the remaining two species were identified to genus. None of the species were unexpected or particularly uncommon, though all the moths and singing insects appear to represent county records thanks to little attention given to Johnson County in the past.

The species observed and collected all are well within their range, and none are regarded as rare, threatened or endangered in general references or on the Indiana state lists. This brief survey did not allow many comments on local abundance. Northern wood crickets (*Gryllus vernalis*) were scattered thinly in the forest, in low areas not far from streams as well as high ridge areas. The survey area is just north of the established range boundary for the southern wood cricket (*G. fultoni*), but that species does not appear to have shifted north at this position. Though the northern wood cricket has been found in surrounding counties, this appears to be the first observation of the species in Johnson County. A shieldback katydid nymph collected by the Purdue team could be either the protean shieldback (*Atlanticus testaceus*) or the least shieldback (*A. monticola*). Neither species is listed for Johnson County in the database for the Singing Insects of North America website (**http://entomology.ifas.ufl.edu/walker/buzz/**), the comprehensive source which also was the reference for the wood cricket.

The most commonly observed moths in the forest during the day were the three-spotted fillip (*Heterophleps triguttaria*), a few of which also came to the light, and the unadorned carpet (*Hydrelia inornata*), one or two of which came to the light. The most common moth to come to the light was the yellowhorn (*Colocasia flavicornis*), as well as several individuals each of the porcelain gray (*Protoboarmia porcelaria*), and the friendly probole (*Probole amicaria*). Otherwise, all observed insects were represented by only one or two individuals, for the most part in the elevated portion of the forest as that was where the light station was located. According to the assembled records of Mississippi State University's Moth Photographer's Group website (**http://mothphotographersgroup.msstate.edu/**), all of the moth observations represent Johnson County records, but this is more a comment on the lack of attention to Johnson County in the past than it is on the distribution and abundance of these species.

List of mushrooms species (31 taxa, 29 species), other fungal species (2 species), and slime mold species (1 species) observed during the Hills of Gold Biodiversity Survey, May 17th -18th 2015.

Team Leader: Stephen Russell

Team Members: Wayne Ward, Don Ruch

Table 9: Fungi and fungal ally's species.

Common Name	Link	Common Name
Mushroom Species		
Armillaria tabescens	Link	Ringless Honey Mushroom
Crepidotus mollis		Soft Slipper
Exidia recisa	Link	Amber Jelly Roll
Ganoderman applanatum	Link	Artist's Conk
Gymnopus dryophilus		Russet Toughshank
Gymnopus subsulphereus		Yellow-gilled Gymnopus
Hymenopellis sp.	Link	-----
Irpex lacteus	Link	Milk-white Toothed Polypore
Kretzschmaria deusta		False Charcoal
Lycoperdon pyriforme		Pear-shaped Puffball
Mycena leaiana		Orange Mycena
Morchella esculenta		Yellow Morel
Neofavolus alveolaris	Link	Hexagonal-pored Polypore
Phellinus gilvus		Mustard-Yellow Polypore
Pleurotus pulmonarius		Oyster Mushrooms
Pluteus cervinus group	Link	Deer Mushroom
Polyporus arcularius	Link	Light Cap Black-foot
Polyporus squamosus		Dryad's Saddle
Psathyrellaceae	Link	-----
Rhizomarasmius pyrrocephalus		Hairy Long Stem Marasmius
Schizophyllum commune	Link	Split-Gill Fungus
Stereum complicatum		Orange Crust
Stereum ostrea	Link	False Turkey Tail
Trametes gibbosa		Elegant Polypore
Trametes hirsuta	Link	Turkey Tail
Trametes pubescens	Link	None
Trametes versicolor	Link	Turkey Tail

Truncospora ohiensis		Ohio bracket-fungus
Urnula craterium		Devil's Urn
Xeromphalina tenuipes	Link	None
Xylobolus frustulatus		Ceramic Parchment
Plant Pathogen Species		
Puccinia podophylli		Mayapple Rust
Rhytisma acerinum		Tar Spot of maple
Slime Molds		
Lycogala epidendrum		Wolf's Milk

Summary Overview

Do to the dry weather conditions prior to the bioblitz, the majority of mushrooms were lignicolous (wood rot) fungi, although a number of fleshy species were observed. A total of 34 fungal taxa were listed, including 31 species of mushrooms, two species of plant pathogenic fungi, and one slime mold. All species reported are common and widespread in Indiana. Of particular note is *Armillaria tabescens* (see below). This is the earliest documented report of this species in Indiana that I am aware.

Interestingly, *Lycogala epiderndrum*, a slime mold was found. Often mistaken for a fungus/mushroom, especially small puffballs, *L. epiderndrum* is a widespread species of plasmodial slime mold. The fruiting bodies, called aethalia, occur either scattered or in clusters on damp rotten wood, especially on large logs. I may fruit from June to November. The aethalia are small cushion-like globs ranging in color from pink to brown (depending on age). When immature, if the other wall (or peridium) is ruptured, they may excrete a pink paste. When mature, the color tends to become more brownish.

Species with the term "Link" next to them were genetically sequenced. To get more information about these specific fungi, go to the IAS webpage (http://www.indianaacademyofscience.org/), open the information about the Hills of Gold BioBlitz. Open the MSWord file listing the species collected at the bioblitz. To see the additional information, hold down the Ctrl key and click on the word link for the fungus you want. A new page will open.

Top: *Armillaria tabescens*, Ringless Honey Mushroom. (Photo by Stephen Russell)

Bottom: *Mycena leaiana*, Orange Mycena. (Photo by Stephen Russell)

Top: *Xylobolus frustulatus*, Ceramic Parchment. (Photo by Stephen Russell)

Bottom: *Trametes versicolor*, Turkey Tail. (Photo by Stephen Russell)

Top right: *Lycogala epiderndrum* (Wolf's Milk); Top center: *Puccinia podophylli* (Mayapple Rust); Top left: *Irpex lacteus* (Milk-white Toothed Polypore). (Photos by Stephen Russell)

Bottom right & center: *Xeromphalina tenuipes*, top of cap (right), bottom of cap (center); Bottom right: *Pleurotus pulmonarius* (Oyster Mushroom). (Photos by Stephen Russell)

List of non-vascular plant species (30 species) observed during the Hills of Gold Biodiversity Survey, May 17th -18th 2015.

Team Leader: Linda Cole

Team Members: Myron Cole, members of the plant team

Table 10A: Non-vascular plant species – Scientific Name, Common Name, Growth Form, and Abundance. (A = abundant; C = common; I = infrequent; R = rare)

Kingdom: Plantae, Phylum: Bryophyta (mosses)			
Scientific Name	**Common Name**	**Growth Form**	**Abundance**
Dicranum scoparium	Windswept Broom Moss	Acrocarps	C
Polytricum piliferum	Bristly Haircap Moss	Acrocarps	A
Atrichum angustatum	Slender Starburst Moss	Acrocarps	C
Atrichum altecristatum	Wavy Starburst Moss	Acrocarps	A
Weissia controversa	Pigtail Moss	Acrocarps	I
Drummondia prorepens	Trailblazer Moss	Acrocarps	C
Rosulabryum capillare	Cluster Moss	Acrocarps	I
Fissidens adianthoides	Maidenhair Pocket Moss	Acrocarps	I
Leukobryum glaucum	Pincushion Moss	Acrocarps	A
Plagiomnium cuspidatum	Baby Tooth Moss	Acrocarps	A
Plagiomnium ciliare	Saber Tooth Moss	Acrocarps	C
Hypnum imponens	Brocade Moss	Pleurocarps	I
Anomodon viticulosus	Greater Tongue Moss	Pleurocarps	C
Anomodon rostratus	Yellow Yarn Moss	Pleurocarps	C
Anomodon attenuatus	Poodle Moss	Pleurocarps	A
Anomodon tristus	Threadbare Moss	Pleurocarps	R
Bryhnia novae-angliae	Bonsai Moss	Pleurocarps	I
Platygyrium repens	Oil Spill Moss	Pleurocarps	C
Brachycethium rutabulum	Rough Foxtail Moss	Pleurocarps	C
Bryoandersonia illecebra	Worm Moss	Pleurocarps	A
Eurhynchiastrum pulchellum	Rug Moss	Pleurocarps	I
Campylophyllum hispidulum	Tiny Star Moss	Pleurocarps	I
Campyliadelphus chrysophyllus	Bristle Star Moss	Pleurocarps	C
Herzogiella striatella	Tassel Moss	Pleurocarps	R
Rhychostegium serrulatum	Beaked Comb Moss	Pleurocarps	I

Scientific Name	Common Name	Growth Form	Abundance
Entodon seductrix	Cord Glaze Moss	Pleurocarps	C
Anacamptodon splachnoides	Knothole Moss	Pleurocarps	I
Platydictya confervoides	Algal Rock Moss	Pleurocarps	R
Myurella sibirica	Verdigris Mousetail Moss	Pleurocarps	R
Thuidium delicatulum	Delicate Fern Moss	Pleurocarps	A

Table 10B: Non-vascular plant species – Habitat and Substrate.

Scientific Name	Habitat	Substrate
Dicranum scoparium	Mesic Ridgetop	Forest soil
Polytricum piliferum	Mesic Ridgetop	Forest soil
Atrichum angustatum	Mesic slopes, ridge top	Forest soil, base of tree
Atrichum altercristatum	Mesic slopes, ridge top	Forest soil, upturned roots of tree stump
Weissia controversa	Seep, mesic slope	Rotting log
Drummondia prorepens	Mesic Ridgetop	Bark of Oak trees
Rosulabryum capillare	Mesic bottom, streambed	Sandstone rock
Fissidens adianthoides	Damp bottoms of mesic slopes	Forest soil
Leukobryum glaucum	Ridge top	Forest soil
Plagiomnium cuspidatum	Mesic slopes	Forest soil
Plagiomnium ciliare	Mesic bottom	Upturned soil of tree root
Hypnum imponens	Mesic bottom	Rotting log
Anomodon viticulosus	Mesic slopes	Tree trunk
Anomodon rostratus	Mesic slopes and ridges	Tree trunk and base of trees
Anomodon attenuatus	Mesic slopes and ridges	Tree trunks and rotting logs
Anomodon tristus	Mesic slopes	Tree bark
Bryhnia novae-angliae	Seep	Soil over tree root
Platygyrium repens	Mesic bottom	Tree trunks and rotting logs
Brachycethium rutabulum	Mesic slopes	Forest soil
Bryoandersonia illecebra	Mesic slopes & ridges, bottoms	Forest soil, rock

Scientific Name	Habitat	Substrate
Eurhynchiastrum pulchellum	Mesic ridge opening	Forest soil
Campylophyllum hispidulum	Mesic slopes	Tree base
Campyliadelphus chrysophyllus	Mesic bottom	Humus, moist rock, streambed
Herzogiella striatella	Mesic slopes	Rotting log
Rhychostegium serrulatum	Mesic slopes, bottoms	Forest soil and cavity of old grape vine
Entodon seductrix	Mesic bottom	Rotting log
Anacamptodon splachnoides	Mesic bottom	Tree trunk
Platydictya confervoides	Mesic bottom	Wet rock in streambed
Myurella sibirica	Mesic slopes	Seepage, damp rotting log
Thuidium delicatulum	Mesic bottom	Rotting log, forest soil

Summary Overview

Our survey of mosses in the Blossom Hollow Nature Preserve illustrates the healthy biodiversity of a mature mesic woodland environment. We were fortunate to have had recent rains which provided excellent conditions for identifying these bryophytes in their most robust, hydrated state. This is especially important when assessing those that colonize on mature trees (live, dead and dying) and decaying logs, all of which provide for a healthy ecosystem as well as habitat for this often overlooked and undervalued group of pioneer plants. Our survey encompassed representative sampling from various substrates and habitats including sandstone rock, bark from living and dying trees, tree roots, rotting logs downed for various periods of time, forest soils of mesic stopes, ridges and bottoms, creek beds, and seeps. The survey revealed a very interesting and diverse population of mosses that would only be found in such an intact, mature forest. These mosses are like miniature forests within the greater forest helping to support many organisms that underpin the dynamics of our entire ecosystem. We must keep in mind that no survey of mosses in such an area is complete. Each time we step onto such a piece of land with the intention of expanding our knowledge, there will be more to be found. Some of the most interesting discoveries were *Platydictya confervoides* (Algal Rock Moss) found on wet sandstone with both gametophyte and sporophyte which usually grows on calcareous rock; a beautiful specimen of *Myurella sibirica* (Verdigris Mousetail Moss) which is a rare find for me; and *Rosulabryum capillare* (Cluster Moss) growing on wet rock was a new find to add to my list. In a sample from a wet rock out of a streambed, there appeared to be a *Selaginella* (Spike Moss, a vascular plant, not a bryophyte) growing

within a mat colonization of *Campyliadelphus chrysophyllus* (Bristle Star Moss) and *Rhynchostegium serrulatum* (Beaked Comb Moss). It was exciting to view this vascular ally of ferns for the first time.

Overall, an impressive amount of moss diversity was revealed from a three hour canvas of this area. Approximately six hours were logged in microscope identification of species that were too small to identify on site and for verification purposes. This inventory clearly indicates that there is much to see beyond the trees of the forest and many important dynamics on the smallest scale that require our continued investigation. I express my thanks to the students from Ball State University who were helpful and focused in collecting species for this survey.

All samples collected for the survey were returned to the environment.

List of snail-killing flies (Insecta: Diptera: Sciomyzidae) species (5 species) observed during the Hills of Gold Biodiversity Survey, May 17th -18th 2015.

Team Leader: William L. Murphy

Team Members: None

Table 11: Snail-killing flies (sciomyzid) species.

Scientific Name	Abundance
Dictya expansa Steyskal	Uncommon
Dictya texensis Curran	Common
Sepedon armipes Loew	Abundant
Sepedon fuscipennis Loew	Common
Sepedon pusilla Loew	Rare

Surveying Methodology and Effort

For collecting, a 14" fine-mesh sweep net was used, 4 hours on Friday, June 15 (the day before the event; rain was forecast, and a sweep net is useless in wet vegetation, so I collected in the dry afternoon and evening). The location: 39°21.850'N, 86°09.579'W.

Voucher Specimens

All specimens will be deposited in the U.S. National Museum of Natural History, Washington, DC.

Summary Overview

Fourteen snail-killing flies (Diptera: Sciomyzidae) of five species were recorded from the Hills of Gold Conservation Area (Table 11). All specimens were collected by use of a sweep net in Glacier's End, the northernmost part of the property, in full sunlight, from sedges and grasses surrounding a small, shallow woodland pond (39°21.850'N, 86°09.579'W). All five species are members of the sciomyzid subfamily Tetanocerini, the aquatic larvae of which are overt predators of aquatic and semi-aquatic snails in fens, marshes, and even roadside ditches. New for Johnson County were *Dictya expansa* and *Sepedon pusilla*, bringing to eight the number sciomyzid species known from Johnson County.

In Indiana, four of the species (*D. expansa, D. texensis, S. armipes*, and *S. fuscipennis*) are common and widespread, whereas *S. pusilla* is decidedly rare, being at both its northern and western limits. It ranges from Indiana east to the District of Columbia, south to Georgia, and west to Mississippi (Knutson et al., 1986). Previously it was known in Indiana from only four widely separated counties

(Clark, Parke, Tippecanoe, and Union). Of the 14 specimens of *S. pusilla* now known from the state, only five specimens have been collected since 1918, when noted dipterist John M. Aldrich collected extensively in Parke and Tippecanoe counties while living in Lafayette.

Except for *S. pusilla*, all species identified would be expected to be found in suitable habitat anywhere in Indiana. The specimens of *S. fuscipennis* were of the southern form (*S. f. fuscipennis* Loew), which in Indiana is found from approximately the latitude of Indianapolis south; no individuals were of the northern form (*S. f. nobilis* Orth) found from central Indiana north.

Although the Hills of Gold Conservation Area offers limited habitat for sciomyzid species with larvae that require still water, the mature woodlands undoubtedly contain *Euthycera arcuata* (Loew) and *Trypetoptera canadensis* (Macquart). The larvae of these two common and widespread species prey on land snails and are found throughout Indiana in forested habitats. In North America, *E. arcuata* has been found feeding within the land snails *Mesodon inflectus* (Say), *Stenotrema hirsutum* (Say), and *Ventridens ligera* (Say), while *T. canadensis* is known to feed on small pulmonate land snails (Foote & Keiper, 2004). Both species of sciomyzids are rarely collected by use of a sweep net. They are most often captured in Malaise traps, which were not used in this study.

The discovery of *S. pusilla*, a species of snail-killing fly rare in Indiana, adds to the value of the Hills of Gold Conservation Area as an important wildlife conservation area.

Literature Cited

Foote, B.A. & J.B. Keiper. 2004. The snail-killing flies of Ohio (Insecta: Diptera: Sciomyzidae). Kirtlandia 54:43–90.

Knutson, L., R.E. Orth, T.W. Fisher & W.L. Murphy. 1986. Catalog of Sciomyzidae (Diptera) of America North of Mexico. Entomography 4:1–53.

List of spider species (39 taxa, 33 species) observed during the Hills of Gold Biodiversity Survey, May 17th -18th 2015.

Team Leader: Marc Milne

Team Members: Tyler Ploss, Elizabeth Wells, Leah Milne

Table 12: Spider species. (For the entire raw data, see the separate Excel file.)

Family	Scientific Name	Common name	Abundance
Agelenidae	*Wadotes calcaratus*	Hackledmesh weaver	Common
Agelenidae	*Wadotes hybridus*	Hackledmesh weaver	Common
Araneidae	*Micrathena gracilis*	Spined Micrathena	Abundant
Atypidae	*Sphodros* sp.	Purse-web spider	Rare
Corinnidae	*Castianeira cingulata*	Twobanded antmimic	Common
Dictynidae	*Cicurina arcuata*	Meshweaver	Common
Dictynidae	*Cicurina minnesota*	Meshweaver	Rare
Dictynidae	*Dictyna minuta*	Meshweaver	Infrequent
Gnaphosidae	*Drassyllus aprilinus*	Stealthy ground spider	Common
Gnaphosidae	*Haplodrassus bicornis*	Stealthy ground spider	Common
Hahniidae	*Neoantistea agilis*	Hahniid spider	Abundant
Linyphiidae	*Agyneta* sp.	N/A	Undescribed species
Linyphiidae	*Agyneta evadens*	Sheetweb weaver	New to the state
Linyphiidae	*Agyneta parva*	Sheetweb weaver	New to the state
Linyphiidae	*Oreonetides* sp.	N/A	Undescribed species
Linyphiidae	*Ceratinops latus*	Dwarf spider	Common
Linyphiidae	*Mermessus maculatus*	Dwarf spider	Abundant
Linyphiidae	*Neriene radiata*	Filmy dome spider	Common
Linyphiidae	*Origanatus rostratus*	Dwarf spider	Common
Linyphiidae	*Pityohyphantes costatus*	Hammock spider	Common
Linyphiidae	*Styloctetor purpurescens*	Dwarf spider	New to the state
Linyphiidae	*Tenuiphantes sabulosus*	Dwarf spider	Common
Lycosidae	*Pirata alachuus*	Pirate wolf spider	Common
Lycosidae	*Pirata sedentarius*	Pirate wolf spider	Common
Lycosidae	*Schizocosa ocreata*	Wolf spider	Abundant
Phrurolithidae	*Phrurotimpus alarius*	Antmimic spider	Abundant
Phrurolithidae	*Scotinella redempta*	Antmimic spider	New to the state

Family	Scientific Name	Common name	Abundance
Pisauridae	*Pisaurina ?*	Nursery web spider	Abundant
Salticidae	*Maevia inclemens*	Dimorphic jumping spider	Common
Salticidae	*Marpissa lineata*	Jumping spider	Common
Salticidae	*Neon nelli*	Jumping spider	New to the state
Salticidae	*Pelegrina proterva*	Jumping spider	Common
Salticidae	*Phidippus whitmani*	Tawny jumping spider	Common
Salticidae	*Zygoballus rufipes*	Hammerjawed jumper	Infrequent
Tetragnathidae	*Leucauge venusta*	Orchard spider	Abundant
Theridiidae	?	Cobweb weaver	Abundant
Thomisidae	*Xysticus ferox*	Ground crab spider	Common
Thomisidae	*Xysticus fraternus*	Ground crab spider	Common
Uloboridae	?	Hackled orbweaver	Infrequent

Surveying Methodology and Effort (See raw data file, Trap Type)

"Berlese funnel" indicates that we collected handfuls of leaf litter from each location in the field and put them in plastic bags to take back to the lab. In the lab, each sample of leaf litter was then put into a Berlese funnel, a canvas funnel with metal meshes inside that prevent the leaf litter from falling through the funnel. At the bottom of the funnel sits a container full of preservative. A light is turned on at the top of the funnel and the organisms in the leaf litter, disliking light, move deeper into the funnel, eventually falling into the preservative. The spiders were then sorted from all other arthropods and organic debris and identified to species.

"Litter sifted" indicates that a litter sifter was used in the field to collect spiders. A litter sifter consists of a large canvas tube with a metal mesh inside the tube. Litter is placed into the sifter and through the use of two wooden handles, the entire tube is shaken by the user. The end of the tube rests upon a separate canvas sheet and the debris and arthropods fall onto the sheet by the shaking. Spiders are then collected by hand from the sheet and preserved so that they may be identified later in the lab.

"Hand collected" means that the spider was collected by hand in the field, preserved, and identified later in the lab.

Effort: 4 team members x 7 hours in the field = 28 person-hours.

Voucher Specimens

All vouchered specimens were sent to Indiana State University.

Special Interest Species

The following are noted as "New to the State" or "Undescribed Species" in Table 12 above.

Agyneta sp. – This is a small (~1.5 mm) sheet-web weaving spider in the family linyphiidae, subfamily linyphiinae. This species is similar to *A. allosubtilis*, but differs in the shape of the epigynum (the female reproductive structure). We have collected males and additional females of this undescribed species in other Indiana forests. To confirm its identity as an undescribed species, we will conduct SEM imaging of its genitalia and compare these images to known *Agyneta* species. Additionally, DNA extraction and CO1 sequencing will be conducted and compared to known *Agyneta* CO1 sequences in GenBank.

Agyneta evadens – This is a small (~1.5 mm) sheet-web weaving spider in the family linyphiidae. It is known to exist as close as Illinois and Ohio, but it has never been recorded from Indiana. This vouchered specimen represents the first record of its existence in the state.

Agyneta parva – This is a small (~1.5 mm) sheet-web weaving spider in the family linyphiidae. It is known to exist as close as Kentucky, but it has never been recorded from Indiana. This vouchered specimen represents the first record of its existence in the state.

Neon nelli – This is a small (~2.5 mm) jumping spider in the family salticidae. It is known to exist in states all around Indiana: Illinois, Ohio, Michigan, and Wisconsin. However, it has never been recorded from Indiana. This vouchered specimen represents the first record of its existence in the state.

Oreonetides sp. – This is a small (~2.3 mm) sheet-web weaving spider in the family linyphiidae, subfamily linyphiinae. We were unsure of this species designation, so we sent photographs to two linyphiid specialists: Michael Draney of U. Wisconsin-Green Bay and Don Buckle. After an examination of images, we came to the conclusion that this species does not match anything known in the literature and is an undescribed species. We will keep this species in our personal collection so that we may use it as a reference for future collecting.

Scotinella redempta – This is a medium-sized (~5 mm) ant-mimicking spider in the newly-created family, phrurolithidae. It is known to exist as close as Illinois, but not from Indiana. This vouchered specimen represents the first record of its existence in the state (although we have previously captured it from Morgan-Monroe State Forest).

Styloctetor purpurescens – This is a small (~1.4 mm) sheet-web weaving spider in the family linyphiidae, specifically in the subfamily, erigoninae. It is known to exist as close as Ohio, but it has never been recorded from Indiana. This vouchered specimen represents the first record of its existence in the state (although we have previously captured it from Morgan-Monroe State Forest).

Summary Overview

For the low amount of sampling conducted at the Hills of Gold Core Conservation Area (28 person-hours in one day), the spider diversity was relatively high. In total, 39 different taxa (33 species) of spider were found in 32 different genera from 15 different families. The number of seemingly-monotypic genera found likely indicates a vast under sampling of the area. The most diverse family was linyphiidae (11 species in 9 genera) and the most diverse genus was *Agyneta* (3 species; within linyphiidae). In addition to the high diversity relative to the sampling regime conducted, the number of rare species found in this sampling period was very high. The discovery of *A. evadens*, *A. parva*, *Styloctetor purpurescens*, *Scotinella redempta*, and *Neon nelli* at the Hills of Gold Core Conservation Area was unexpected since all of these species represented new distribution records for the state of Indiana. Moreover, our sampling of this area uncovered two undescribed species of linyphiid: *Oreonetides* sp. and *Agyneta* sp. Suffice it to say, the Hills of Gold Core Conservation Area holds an assemblage of spiders that is diverse, understudied, and very unique.

Left: Tyler Ploss and Elizabeth Wells are litter sifting for spiders. Right: Spider team hand picking specimen. (Photo by Marc Milne)

Purse web of *Sphodros* sp. (Photo by Marc Milne)

List of plant species (269 species) observed during the Hills of Gold Biodiversity Survey, May 17th - 18th 2015.

Team Leader: Donald Ruch

Team Members: Alice, Heikens, Elizabeth Hendershot, Spencer Wesche, Ahmed Hubini, Megan Crecelius (Smith), John Taylor, Cheryl Shearer, Kevin Tungesvick, Paul Rothrock, Ben Hess, Kaitlin Hillier, Kem Badger, Willy De Smet, Jacob Hougham, Tabatha Ramsey, Josh Netherton

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Table 13A: Plant species listed by scientific and common names. Non-native plants are in all capital letters. SE = state endangered; WL = state watch list; # = potential Johnson County record.

Scientific Name	Authority	Common Name
Acer negundo	L.	Boxelder
# *Acer rubrum*	L.	Red Maple
Acer saccharum	Marshall	Sugar Maple
# *Actaea pachypoda*	Elliott	White Baneberry
# *Adiantum pedatum*	L.	Northern Maidenhair Fern
Agastache nepetoides	(L.) Kuntze	Yellow Giant-hyssop
Ageratina altissima var. *altissima*	(L.) King & H.E. Robins.	White Snakeroot
# *Agrimonia parviflora*	Aiton	Southern Agrimony
# *Agrimonia pubescens*	Wallr.	Downy Agrimony
ALLIARIA PETIOLATA	(Bieb.) Cavara & Grande	Garlic Mustard
# *Allium tricoccum*	Aiton	Ramps, Wild Leek
# *ALLIUM VINEALE*	L.	Wild Garlic
# *Amelanchier arborea*	(F.Michx.) Fernald	Downy Serviceberry
# *Amphicarpaea bracteata*	(L.) Fernald	Hog-peanut
Anemone acutiloba	(DC.) G. Lawson	Sharp-lobed Hepatica
# *Antennaria plantaginifolia*	(L.) Hook.	Plantain-leaved Pussy-toes
Aplectrum hyemale	(Muhl. ex Willd.) Torr.	Puttyroot Orchid
Apocynum cannabinum	L.	Indian Hemp
Arabis laevigata	(Muhl. ex Willd.) Poir.	Smooth Rockcress

# *Aralia racemosa*	L.	American spikenard
Arisaema dracontium	(L.) Schott	Green Dragon
Arisaema triphyllum	L.	Jack-in-the-Pulpit
# *Aristolochia serpentaria*	L.	Virginia Snakeroot
# *Aruncus dioicus*	(Walter) Fernald	Goat's-beard
Asarum canadense	L.	Wild Ginger
Asclepias quadrifolia	Jacq.	Four-leaved Milkweed
Asimina triloba	(L.) Dunal	Pawpaw
# *Asplenium platyneuron*	(L.) Britton, Sterns & Poggenb.	Ebony Spleenwort
# *Athyrium felix-femina*	(L.) Roth	Common Lady-fern
BARBAREA VULGARIS	R. Br.	Yellow Rocket
# *BERBERIS THUNBERGII*	DC.	Japanese Barberry
Blephilia hirsuta	(Pursh) Benth.	Hairy Wood-mint
# *Botrypus virginianus*	(L.) Michx.	Rattlesnake Fern
# *Brachyelytrum erectum*	(Schreb.) P. Beauv.	Long-awned Wood Grass
Campanula americana	L.	Tall Bellflower
# *Cardamine angustata*	O.E. Schulz	Slender Toothwort
Cardamine concatenata	(Michx.) O. Schwarz.	Cutleaf Toothwort
Cardamine douglassii	Britton	Purple Cress
Cardamine pensylvanica	Muhl. ex Willd.	Pennsylvania Bittercress
# *Carex albicans*	Willd. ex Spreng.	Blunt-scaled Oak Sedge
Carex albursina	E. Sheld.	Blunt-scaled Wood Sedge
# *Carex amphibola*	Steud.	Gray Sedge
# *Carex blanda*	Dewey	Common Wood Sedge
# *Carex careyana*	Dewey	Carey’s Wood Sedge
# *Carex cephalophora*	Willd.	Short-headed Bracted Sedge
# *Carex communis*	L.H. Bailey	Common Beech Sedge
# *Carex cumberlandensis*	Naczi Kral & Bryson	Cumberland Sedge
# *Carex digitalis*	Willd.	Narrow-leaved Wood Sedge
# *Carex gracilescens*	Steud.	Slender Wood Sedge
Carex gracillima	Schwein.	Purple-sheathed Graceful Sedge
Carex grisea	Wahlenb.	Wood Gray Sedge
# *Carex hirsutella*	Mack.	Hairy Green Sedge
# *Carex hirtifolia*	Mack.	Hairy Wood Sedge
# *Carex hitchcockiana*	Dewey	Hairy Gray Sedge

Carex jamesii	Schwein.	Grass Sedge
Carex laxiculmis	Schwein.	Weak-stemmed Wood Sedge
Carex laxiflora	Lam.	Beech Wood Sedge
# *Carex oligocarpa*	Willd.	Few-fruited Gray Sedge
# *Carex picta*	Steud.	Boott’s Sedge
Carex rosea	Schkuhr	Curly-styled Wood Sedge
# *Carex sparganioides*	Willd.	Loose-headed Bracted Sedge
Carex swanii	(Fernald) Mack.	Downy Green Sedge
# *Carex timida* — **SE**	Naczi & B.A. Ford	Timid Sedge
# *Carex tribuloides var. tribuloides*	Wahlenb.	Awl-fruited Oval Sedge
# *Carex virescens*	Willd.	Slender Green Sedge
Carex vulpinoidea var. *vulpinoidea*	Michx.	Brown Fox Sedge
# *Carex willdenowii*	Schkuhr ex Willdenow	Willdenow's Sedge
Carpinus caroliniana ssp. *virginiana*	Walter; (Marshall) Furlow	Musclewood
Carya cordiformis	(Wangenh.) K. Koch	Bitternut Hickory
Carya glabra	Mill.	Pignut Hickory
# *Carya ovata*	(Mill.) K. Koch	Shagbark hickory
Celtis occidentalis	L.	Common Hackberry
CERASTIUM FONTANUM ssp. *VULGARE*	Baumg.; (Hartm.) Greuther & Burdet	Mouse-ear Chickweed
Cercis canadensis	L.	Eastern Redbud
# *Cinna arundinacea*	L.	Wood-reed
Circaea lutetiana ssp. *canadensis*	L.; (L.) Asch. & Magnus	Enchanter's-nightshade
# *Cirsium altissimum*	(L.) Hill	Tall Thistle
Claytonia virginica var. *virginica*	L.	Virginia Spring Beauty
# *Collinsonia canadensis*	L.	Richweed
# *Conopholis americana*	(L.) Wallr.	American cancer-root
Cornus alternifolia	L. f.	Alternate-leaved Dogwood
Cornus florida	L.	Flowering Dogwood
# *Corylus americana*	Marshall	American Hazelnut
# *Crataegus mollis*	Scheele	Downy Hawthorn
Crataegus punctata	Jacq.	Dotted Hawthorn
# *Cryptotaenia canadensis*	(L.) DC.	Honewort
# *Cynoglossum virginianum*	L.	Wild Comfrey
# *Cystopteris protrusa*	(Weath.) Blasdell	Lowland Fragile Fern
Danthonia spicata	(L.) P. Beauv. ex Roem. & Schult.	Poverty Oatgrass

# *Delphinium tricorne*	Michx.	Dwarf Larkspur
# *Deparia acrostichoides*	(Sw.) M. Kato	Silvery Spleenwort
Dicentra canadensis	(Goldie) Walp.	Squirrel Corn
Dicentra cucullaria	(L.) Bernh.	Dutchman's Breeches
# *Dichanthelium boscii*	(Poir.) Gould & C.A. Clark	Bosc's Panicgrass
Dichanthelium clandestinum	(L.) Gould	Deer-tongue Panicgrass
Dichanthelium latifolium	(L.) Harvill	Broadleaf Rosette Grass
Dioscorea villosa	L.	Wild Yam
# *Diplazium pycnocarpon*	(Spreng.) Broun	Glade Fern
ELAEAGNUS UMBELLATA var. *PARVIFOLIA*	Thunb.; (Wall. ex Royle) C.K. Schneid.	Autumn Olive
Elymus villosus var. *villosus*	Muhl. ex Willd.	Downy Wild-rye
Enemion biternatum	Raf.	False Rue-anemone
Epifagus virginiana	(L.) W.P.C. Barton	Beechdrops
Erigenia bulbosa	(Michx.) Nutt.	Harbinger of Spring
Erigeron philadelphicus var. *philadelphicus*	L.	Philadelphia Fleabane
Erythronium americanum	Ker Gawl.	Yellow Trout Lily
EUONYMUS ALATUS var. *ALATUS*	(Thunb.) Siebold	Burning Bush
# *Euonymus americanus* var. *americanum*	L.	American Strawberry-bush
Euonymus obovatus	Nutt.	running strawberry-bush
Eupatorium perfoliatum var. *perfoliatum*	L.	Common Boneset
Euthamia graminifolia	(L.) Nutt.	Common Flat-topped Goldenrod
# *Eutrochium maculatum* var. *maculatum*	(L.) E.E. Lamont	Spotted Joe-Pye-weed
# *Eutrochium purpureum*	(L.) E.E. Lamont	Sweet-scented Joe-Pye-weed
Fagus grandifolia	Ehrh.	American Beech
Festuca subverticillata	(Pers.) E.B. Alexeev	Nodding Fescue
Fraxinus americana	L.	American or White Ash
# *Fraxinus pennsylvanica*	Marshall	Green Ash
Fraxinus quadrangulata	Michx.	Blue Ash
# *Galearis spectabilis*	(L.) Raf.	Showy Orchid
Galium aparine	L.	Cleavers
Galium circaezans var. *circaezans*	Michx.	Licorice Bedstraw
Galium concinnum	Torr. & A. Gray	Shining Bedstraw
# *Galium lanceolatum*	(Torr.) Torr.	Lance-leaved Wild-licorice

Galium triflorum	Michx.	Fragrant Bedstraw
Geranium maculatum	L.	Wild Geranium
Geum canadense var. *canadense*	Jacq.	White Avens
Glyceria striata	(Lam.) Hitchc.	Fowl- manna Grass
# *Goodyera pubescens*	(Willd.) R. Br.	Downy Rattlesnake-plantain
# *Hamamelis virginiana*	L.	American Witchhazel
# *Helianthus decapetalus*	L.	Thin-leaved Sunflower
Heuchera americana var. *americana*	L.	American alumroot
# *Huperzia lucidula* — **WL**	(Michx.) Trevis.	Shining Clubmoss
Hybanthus concolor	(T.F. Forst.) Spreng.	Eastern Green Violet
# *Hydrangea arborescens*	L.	Wild Hydrangea
# *Hydrastis canadensis* — **WL**	L.	Goldenseal
Hydrophyllum appendiculatum	Michx.	Great Waterleaf
# *Hydrophyllum canadense*	L.	Bluntleaf Waterleaf
# *Hydrophyllum macrophyllum*	Nutt.	Largeleaf Waterleaf
# *Hylodesmum glutinosum*	(Muhl. ex Willd.) H. Ohashi & R.R. Mill	Pointed-leaved Tick-trefoil
# *Hypericum punctatum*	Lam.	Spotted St. John's-wort
Impatiens capensis	Meerb.	Spotted Jewelweed
Juglans nigra	L.	Black Walnut
Juncus tenuis	Willd.	Path Rush
Juniperus virginiana var. *virginiana*	L.	Eastern Redcedar
Krigia biflora var. *biflora*	(Walter) S.F. Blake	Two-flowered Dwarf-dandelion
# *Lactuca floridana* var. *villosa*	(L.) Gaertn.; (Jacq.) Cronquist	Woodland Lettuce
# *Laportea canadensis*	(L.) Gaudich.	Woodnettle
Leersia virginica	Willd.	White Cutgrass
Lilium michiganense	Farw.	Michigan Lily
Lindera benzoin var. *benzoin*	(L.) Blume	Northern Spicebush
Liriodendron tulipfera	L.	Tulip Tree
# *Lobelia siphilitica* var. *siphilitica*	L.	Great Blue Lobelia
LONICERA JAPONICA	Thunb.	Japanese Honeysuckle
LONICERA MAACKII	(Rupr.) Maxim.	Amur Honeysuckle
Luzula echinata	(Small) J.F. Herm.	Spreading Woodrush
Maianthemum racemosum var. *racemosum*	(L.) Link	Feathery False Lily of the Valley
# *Medeola virginiana*	L.	Indian Cucumber-root

Menispermum canadense	L.	Common Moonseed
MICROSTEGIUM VIMINEUM	(Trin.) A. Camus	Japanese Stiltgrass
# *Mitchella repens*	L.	Partridgeberry
# *Monarda clinopodia*	L.	Basil Balm, White Bergamot
Morus rubra var. *rubra*	L.	Red Mulberry
# *Nabalus altissimus*	(L.) Hook.	Tall Rattlesnake-root
Nyssa sylvatica	Marshall	Blackgum
# *Obolaria virginica*	L.	Virginia Pennywort
# *Onoclea sensibilis*	L.	Sensitive Fern
# *Ophioglossum vulgatum*	L.	Southern Adders-tongue
# *ORNITHOGALUM NUTANS*	L.	Nodding Star-of-Bethlehem
# *Orobanche uniflora*	L.	One-flowered Broomrape
Osmorhiza claytonii	(Michx.) C.B. Clarke	Bland Sweet-cicely
# *Ostrya virginiana*	(Mill.) K. Koch	American Hophornbeam
# *Oxalis grandis*	Small	Great Yellow Woodsorrel
Oxalis stricta	L.	Common Yellow Woodsorrel
Oxalis violacea	L.	Violet Woodsorrel
# *Packera aurea*	(L.) Á. Löve & D. Löve	Golden Ragwort
Packera glabella	(Poir.) C. Jeffrey	Butterweed
Packera obovatus	(Muhl. ex Willd.) Weber & Á. Löve	Round-leaved Ragwort
# *Panax quinquefolius* — **WL**	L.	American Ginseng
# *Parthenocissus quinquefolia*	(L.) Planch.	Virginia creeper
# *PERSICARIA LONGISETA*	(Bruijn) Kitag.	Creeping Smartweed
# *Persicaria virginiana*	(L.) Gaertn.	Jumpseed
Phacelia bipinnatifida	Michx.	Fernleaf Phacelia
# *Phegopteris hexagonoptera*	(Michx.) Fée	Broad Beech Fern
Phlox divaricata ssp. *divaricata*	L.	Woodland Phlox
# *Phryma leptostachya*	L.	American Lopseed
Phytolacca americana var. *americana*	L.	Pokeweed
Pilea pumila var. *pumila*	(L.) A. Gray	Green-fruited Clearweed
Plantago rugelii var. *rugelii*	Decne.	Blackseed Plantain
Platanus occidentalis	L.	American Sycamore
POA COMPRESSA	L.	Canada Bluegrass
POA PRATENSIS ssp. *PRATENSIS*	L.	Kentucky Bluegrass
Poa sylvestris	A. Gray	Woodland Bluegrass

Podophyllum peltatum	L.	Mayapple
Polemonium reptans var. *reptans*	L.	Greek Valerian
# *Polygonatum biflorum* var. *biflorum*	(Walter) Elliott	Small Solomon's-seal
Polystichum acrostichoides	(Michx.) Schott	Christmas Fern
Populus grandidentata	Michx.	Bigtooth Aspen
Potentilla simplex	Michx.	Common Cinquefoil
Prunella vulgaris ssp. *lanceolata*	L.; (W. Bartram) Hultén	Common Selfheal
Prunus serotina var. *serotina*	Ehrh.	Wild Black Cherry
# *Pycnanthemum virginianum*	(L.) Durieu & Jacks. ex Fernald & B. Robinson	Virginia Mountain-mint
Quercus alba	L.	White Oak
Quercus muhlenbergii	Engelm.	Chinquapin Oak
Quercus rubra var. *rubra*	L.	Northern Red Oak
# *Quercus velutina*	Lam.	Black Oak
Ranunculus abortivus	L.	Kidney-leaved Crowfoot
Ranunculus recurvatus var. *recurvatus*	Poir.	Hooked Crowfoot
# *Rhus copallinum* var. *latifolia*	L.; Engl.	Winged Sumac
Ribes cynosbati	L.	Prickly Gooseberry
Robinia pseudoacacia	L.	Black Locust
ROSA MULTIFLORA	Thunb.	Multiflora Rose
# *Rubus allegheniensis*	Porter	Common Blackberry
# *Rubus flagellaris*	Willd.	Common Dewberry
Rubus occidentalis	L.	Wild Black Raspberry
# *Rubus pensilvanicus*	Poir.	Pennsylvania Blackberry
Sambucus canadensis	L.	American Black Elderberry
Sanguinaria canadensis	L.	Bloodroot
# *Sanicula odorata*	(Raf.) Pryer & Phillippe	Clustered Snakeroot
# *Sanicula trifoliata*	E.P. Bicknell	Large-fruited Snakeroot
Sassafras albidum	(Nutt.) Nees	Sassafras
# *SCHEDONORUS ARUNDINACEUS*	(Huds.) P. Beauv.	Tall Fescue
Scirpus atrovirens	Willd.	Dark-green Bulrush
# *Scirpus georgianus*	Harper	Georgia Bulrush
Scrophularia marilandica	L.	Carpenter's Square
Sedum ternatum	Michx.	Woodland Stonecrop
Silene stellata	(L.) W.T. Aiton	Starry Campion
Silene virginica var. *virginica*	L.	Fire Pink

Smilax hispida	Raf.	Bristly Greenbrier
# *Smilax rotundifolia*	L.	Common Greenbrier
Solidago caesia var. *caesia*	L.	Blue-stemmed Goldenrod
# *Solidago canadensis*	L.	Canada Goldenrod
Solidago flexicaulis	L.	Zig-zag Goldenrod
Solidago gigantea	Aiton	Late Goldenrod
Solidago juncea	Aiton	Early Goldenrod
# *Solidago ulmifolia* var. *ulmifolia*	Muhl. ex Willd.	Elm-leaved Goldenrod
Stachys tenuifolia	Pursh	Hispid Hedgenettle
Staphlea trifoliata	L.	American Bladdernut
STELLARIA MEDIA var. *MEDIA*	(L.) Vill.	Common Chickweed
Stellaria pubera	Michx.	Star Chickweed
Stylophorum diphyllum	(Michx.) Nutt.	Wood Poppy
Symphyotrichum cordifolium	(L.) G.L. Nesom Show	Common Blue Wood Aster
# *Symphyotrichum lanceolatum* var. *lanceolatum*	(Willd.) G.L. Nesom	White Panicle Aster
# *Symphyotrichum lateriflorum var. lateriflorum*	(L.) Á. Löve & D. Löve	Calico Aster
Symphyotrichum pilosum var. *pilosum*	(Willd.) G.L. Nesom	Hairy White Old-field Aster
# *Symphyotrichum shortii*	(Lindl.) G.L. Nesom	Short's Aster
TARAXACUM OFFICINALE ssp. *OFFICINALE*	(L.) Weber ex F.H. Wigg.	Common Dandelion
Thalictrum dioicum	L.	Early Meadow-rue
Thalictrum thalictoides	(L.) A.J. Eames & B. Boivin	Rue-anemone
Thaspium barbinode	(Michx.) Nutt.	Hairy-jointed Meadow-parsnip
# *Thelypteris noveboracensis*	(L.) Nieuwl.	New York Fern
Tilia americana var. *americana*	L.	American Basswood
Toxicodendron radicans ssp. *negundo*	(L.) Kuntze; (Greene) Gillis	Eastern Poison Ivy
Tradescantia subaspera var. *subaspera*	Ker Gawl.	Zigzag Spiderwort
Tradescantia virginiana	L.	Virginia Spiderwort
Trillium flexipes	Raf.	Bent Trillium
Trillium recurvatum	Beck	Prairie or Recurved Trillium
# *Typha latifolia*	L.	Broadleaf Cattail
# *Ulmus americana*	L.	American Elm
Ulmus rubra	Muhl.	Slippery Elm
Uvularia grandiflora	Sm.	Large-flowered Bellwort

# *Vaccinium pallidum*	Aiton	Blue Ridge Blueberry
Valeriana pauciflora	Michx.	Largeflower Valerian
# *Verbesina alternifolia*	(L.) Britton ex Kearney	Wingstem
Viburnum acerifolium	L.	Maple-leaved Viburnum
Viburnum prunifolium	L.	Blackhaw
Viola palmata	L.	Three-lobed Violet
# *Viola pubescens* — **WL**	Aiton	Downy Yellow Violet
Viola sororia	Willd.	Common Blue Violet
Viola striata	Aiton	Striped or Pale Violet
# *Vitis aestivalis*	Michx.	Summer Grape

End of Table 13A.

Table 13B: Location and abundance of plant species at the Hills of Gold BioBlitz.

LOCATION
RT: ridgetop
SW: slope woods
BW: bottom woods
PE: pond edge

ABUNDANCE
R = rare
I = infrequent
C = common
A = abundant

	Blossum Hollow Nature Preserve	**Easement Property**	**Glacier's End Nature Preserve**
Scientific Name	**Location — AB**	**Location — AB**	**Location — AB**
Acer negundo			BW— I
Acer rubrum	SW — C	SW — C	RT,BW,PE — C
Acer saccharum	BW,SW, RT — A	SW,BW — A	RT,SW,BW — A
Actaea pachypoda	BW — I	SW,BW — I	SW — I
Adiantum pedatum	BW — C	SW,BW — C	BW — I
Agastache nepetoides			BW — I
Ageratina altissima var. *altissima*	SW, BW — C	SW,BW — C	RT — C
Agrimonia parviflora			PE — I
Agrimonia pubescens	SW — I	SW — I	SW,BW — C
Alliaria petiolata	BW — I	BW — R	BW — I
Allium tricoccum	BW — C		
Allium vineale			RT — R
Amelanchier arborea	SW/RT — R	RT — R	
Amphicarpaea bracteata	SW, BW — C	RT,SW — C	RT,BW — C
Antennaria plantaginifolia			RT — I

Aplectrum hyemale	B — I	BW,SW — I	RT — I
Apocynum cannabinum			RT,BW,PE — I
Arabis laevigata	BW — I	SW,BW — C	BW — I
Aralia racemosa		SW — R	
Arisaema dracontium	BW — I	BW,SW — I	SW,BW — C
Arisaema triphyllum	SW, BW — C	SW,BW — C	RT,SW,BW — A
Aristolochia serpentaria	SW — I		SW — I
Aruncus dioicus		SW — R	
Asarum canadense	BW — C	BW — C	SW,BW — I
Asclepias quadrifolia	SW, BW — I	RT — I	RT,BW — I
Asimina triloba	BW — C	SW,BW — C	RT,SW,BW — C
Asplenium platyneuron	BW — I	BW — R	SW,BW — I
Athyrium felix-femina	SW — R		
Barbarea vulgaris			BW,PE — I
Berberis thunbergii		SW — R	
Blephilia hirsuta		BW — I	
Botrypus virginianus	BW — I	SW,BW — C	SW — C
Brachyelytrum erectum	BW — I	BW — I	RT — I
Campanula americana		SW — I	BW — R
Cardamine angustata	SW — I		
Cardamine concatenata	BW, SW — A	SW,BW — I	RT,SW,BW — C
Cardamine douglassii	BW — I	BW — I	BW — I
Cardamine pensylvanica	BW — I		
Carex albicans	RT — I	RT — I	RT,SW — C
Carex albursina	SW — I	SW — I	SW,BW — I
Carex amphibola	SW, BW — I		RT,SW,BW — C
Carex blanda	SW, BW — C	RT — C	RT,BW — C
Carex careyana		BW — I	
Carex cephalophora	SW — I	SW — I	SW,BW — I
Carex communis		RT,SW — C	SW — I
Carex cumberlandensis	BW — R		BW — I
Carex digitalis		SW — I	RT,SW — I
Carex gracilescens			BW — I
Carex gracillima	BW — I		BW — I
Carex grisea	BW — I		BW — R
Carex hirsutella	RT, SW — I		RT — I

Carex hirtifolia		BW,SW — I	
Carex hitchcockiana			BW — R
Carex jamesii	BW — I		BW — C
Carex laxiculmis		SW — I	BW — I
Carex laxiflora	SW — I	SW — C	RT,BW — C
Carex oligocarpa		SW — I	BW — R
Carex picta	RT, SW —I	RT — I	RT,SW,BW — C
Carex rosea	SW — I	RT — I	SW,BW — C
Carex sparganioides	BW — I		BW — I
Carex swanii		SW — C	RT — R
Carex timida			RT — I
Carex tribuloides var. tribuloides			PE — I
Carex virescens	BW — I		SW,BW — I
Carex vulpinoidea var. *vulpinoidea*			BW — R
Carex willdenowii		RT — I	RT — I
Carpinus caroliniana ssp. *virginiana*	BW — I	SW,BW — C	RT,BW — I
Carya cordiformis	SW, BW — I		SW,BW — I
Carya glabra	SW, BW — I		
Carya ovata	SW, BW — C	SW,RT — C	RT,BW — C
Celtis occidentalis	BW — I	BW — I	BW — I
Cerastium fontanum ssp. *vulgare*			PE — R
Cercis canadensis	SW — R	SW — I	RT,SW,PE — C
Cinna arundinacea			BW,PE — I
Circaea lutetiana ssp. *canadensis*	BW, SW — C	BW,SW — C	SW — C
Cirsium altissimum		RT — R	
Claytonia virginica var. *virginica*	SW, LW — A	BW — I	
Collinsonia canadensis	SW — I	BW,SW — I	SW — I
Conopholis americana	BW — I	SW — C	
Cornus alternifolia	BW — R		
Cornus florida	SW — I	SW,RT — C	SW — I
Corylus americana	Entrance Path — R		SW — R
Crataegus mollis	SW — R	SW — R	
Crataegus punctata			SW — R
Cryptotaenia canadensis	SW, BW — C	SW,BW — C	BW — I
Cynoglossum virginianum	SW, BW — C	SW — I	RT,SW — I

Cystopteris protrusa	BW — A	BW — I	BW — C
Danthonia spicata		RT — I	RT — I
Delphinium tricorne	BW — I	BW — I	
Deparia acrostichoides	SW — C	SW — C	
Hylodesmum glutinosum		RT — I	BW — R
Dicentra canadensis	BW — C	SW — C	
Dicentra cucullaria	BW — C	SW — I	BW — I
Dichanthelium boscii			RT — I
Dichanthelium clandestinum	BW — I		BW — I
Dichanthelium latifolium	BW — I		
Dioscorea villosa	BW — R	BW — R	SW — I
Diplazium pycnocarpon	BW — I		
Elaeagnus umbellata var. *parvifolia*			BW — I
Elymus villosus var. *villosus*	BW — I	RT — R	BW — I
Enemion biternatum	BW — I		BW — I
Epifagus virginiana	SW, BW — I	SW — I	SW — R
Erigenia bulbosa	BW — C	BW — C	BW — I
Erigeron philadelphicus var. *philadelphicus*	SW — I		RT — I
Erythronium americanum	BW — C	SW — I	
Euonymus alatus var. *alatus*	BW — R	SW — R	
Euonymus americanus var. *americanum*			BW — R
Euonymus obovatus	SW, BW — I	SW,BW — C	BW — R
Eutrochium maculatum var. *maculatum*			PE — R
Eupatorium perfoliatum var. *perfoliatum*			PE — I
Eutrochium purpureum			BW — R
Fagus grandifolia	BW, SW — C	SW,BW — C	RT,SW,BW — C
Festuca subverticillata	BW — C	BW — I	RT,SW,BW — C
Fraxinus americana	SW — I	SW — I	RT — C
Fraxinus pennsylvanica	BW — I		BW — I
Fraxinus quadrangulata	BW, SW — I	BW,SW — I	BW — R
Galearis spectabilis	SW — R		
Galium aparine	BW — C	BW — C	RT,SW — I
Galium circaezans var. *circaezans*	BW, SW — C	SW — C	RT,SW — C
Galium concinnum	BW, SW — A	SW,RT — C	RT,BW — C

Galium lanceolatum		SW — I	
Galium triflorum		SW,BW — C	RT,BW — C
Geranium maculatum	BW — I	SW,BW — I	BW — I
Geum canadense var. *canadense*		SW — I	BW — C
Glyceria striata	BW — I	BW — I	PE — C
Goodyera pubescens	SW — R		
Hamamelis virginiana	SW,BW — I	SW — I	SW — I
Helianthus decapetalus		RT — I	BW — I
Anemone acutiloba	SW/BW — R		
Heuchera americana var. *americana*		SW — I	RT,SW,BW — I
Huperzia lucidula		RT — I	
Hybanthus concolor	SW — R	SW — R	
Hydrangea arborescens	SW — I	SW — C	SW — I
Hydrastis canadensis	SW, BW — I	SW — I	
Hydrophyllum appendiculatum	BW — I		
Hydrophyllum canadense	BW — C	BW — C	SW,BW — C
Hydrophyllum macrophyllum		SW — I	BW — I
Hypericum punctatum		RT — I	
Impatiens capensis	SW, BW — A	BW — C	RT,BW,PE — C
Juglans nigra	BW — I	BW — C	BW,PE — I
Juncus tenuis			RT,SW — C
Juniperus virginiana var. *virginiana*	RT — R	RT — R	RT — I
Krigia biflora var. *biflora*	SW — I	RT — C	SW — R
Lactuca floridana var. *villosa*	BW — I		
Laportea canadensis	BW — C	BW — A	SW,BW — C
Leersia virginica	BW, SW — C	BW — C	RT,BW — C
Lilium michiganense			BW — R
Lindera benzoin var. *benzoin*	BW — C	SW,BW — A	RT,BW — A
Liriodendron tulipfera	SW, BW — I	SW,BW — C	SW — I
Lobelia siphilitica var. *siphilitica*	BW — I	BW — R	
Lonicera japonica			RT,PE — C
Lonicera maackii	RT, BW — I	RT — R	BW,PE — C
Luzula echinata	SW, RT — I	RT — I	SW — R
Maianthemum racemosum var. *racemosum*	BW, SW — I	SW,BW — C	SW — R
Medeola virginiana		RT — I	

Menispermum canadense	SW, BW — I	SW — I	RT,BW — I
Microstegium vimineum	BW — C	BW — C	SW,BW — C
Mitchella repens	SW — R		
Monarda clinopodia	BW — C	RT — C	
Morus rubra var. *rubra*	SW — R		
Nyssa sylvatica	BW, SW — I	BW,SW — C	
Obolaria virginica		RT — I	
Onoclea sensibilis	BW — I	BW — I	RT,BW,PE — I
Ophioglossum vulgatum	RT, SW — I	RT — R	
Ornithogalum nutans	BW — R		BW — R
Orobanche uniflora			BW — R
Osmorhiza claytonii	BW, SW — C	BW,SW — C	RT,BW — C
Ostrya virginiana	SW, RT — I	RT,SW — I	
Oxalis grandis	SW, BW — I	SW — C	BW — I
Oxalis stricta	RT, SW — I	RT — I	RT — I
Oxalis violacea	SW, BW — I	BW,SW — I	BW — R
Packera aurea		SW — R	
Packera glabella	BW — R	SW — R	RT,PE — R
Packera obovatus	BW, SW — C	SW — I	BW — C
Panax quinquefolius	SW — I	SW — C	
Parthenocissus quinquefolia	SW, BW, RT — C	SW — C	RT,BW — C
Persicaria longiseta		RT — R	
Phacelia bipinnatifida	BW — C	SW,SW — C	BW — I
Phegopteris hexagonoptera	BW — R	SW — I	
Phlox divaricata ssp. *divaricata*	SW, BW — C	SW,BW — C	RT — C
Phryma leptostachya	SW, BW — I		
Phytolacca americana var. *americana*		BW — I	
Pilea pumila var. *pumila*	BW — C		SW,BW — C
Plantago rugelii var. *rugelii*	RT — I	R — RT	
Platanus occidentalis	BW — C	BW — C	BW,PE — C
Poa compressa	RT — I		RT,PE — I
Poa pratensis ssp. *pratensis*			PE — I
Poa sylvestris	BW, SW — I	BW,SW — I	RT,BW — I
Podophyllum peltatum	BW, SW — A	SW,BW — C	RT,SW,BW — A
Polemonium reptans var. *reptans*			RT,BW — C

Polygonatum biflorum var. *biflorum*	BW — C	SW — C	RT,BW — I
Persicaria virginiana	SW, LW — C	SW,BW — I	BW — I
Polystichum acrostichoides	BW, SW — A	SW — A	RT,BW — C
Populus grandidentata	RT — I	RT — I	
Potentilla simplex	BW — I	SW — C	RT — C
Nabalus altissimus	SW, BW — C	RT,SW — A	RT,BW — C
Prunella vulgaris ssp. *lanceolata*	RT — I	RT — C	RT — I
Prunus serotina var. *serotina*	SW, BW — I	SW — C	
Pycnanthemum virginianum			PE — R
Quercus alba	SW, RT — C	SW,RT — C	RT,SW,BW — C
Quercus muhlenbergii	SW — I	SW — R	SW,BW — I
Quercus rubra var. *rubra*	SW, RT — C	SW — C	RT,SW — I
Quercus velutina	RT — I	RT — C	RT — I
Ranunculus abortivus	BW — I		BW — I
Ranunculus recurvatus var. *recurvatus*	BW — I	BW,SW — I	SW,BW,PE — C
Rhus copallinum var. *latifolia*		RT — R	
Ribes cynosbati	BW, SW — I	RT — I	SW — I
Robinia pseudoacacia	SW — R		SW,BW — I
Rosa multiflora	SW, LW — C	SW,RT,BW — C	RT,BW,PE — C
Rubus allegheniensis	SW, RT — C	SW,RT — C	
Rubus flagellaris			RT — I
Rubus occidentalis	BW — I		BW — I
Rubus pensilvanicus			RT,SW,BW — C
Sambucus canadensis	BW — I		
Sanguinaria canadensis	BW, SW — C	SW,BW — C	SW — C
Sanicula odorata	SW — C		SW — C
Sanicula trifoliata		SW — I	RT,BW — I
Sassafras albidum	SW, RT — C	SW,RT — A	RT,SW — C
Schedonorus arundinaceus			BW,PE — R
Scirpus atrovirens			PE — I
Scirpus georgianus			BW — R
Scrophularia marilandica		SW — R	
Sedum ternatum			SW — R
Silene stellata	BW — R		BW — I
Silene virginica var. *virginica*	BW — C	SW — C	BW — I

Smilax hispida	RT, SW — I	RT — I	RT,SW — I
Smilax rotundifolia	BW, SW — C	SW,BW — C	RT,SW — C
Solidago caesia var. *caesia*	RT, SW — C	RT,SW — C	SW,BW — C
Solidago canadensis			BW,PE — I
Solidago flexicaulis	BW — I	BW — I	SW — I
Solidago gigantea			BW — C
Euthamia graminifolia			RT,PE — I
Solidago juncea			SW — R
Solidago ulmifolia var. *ulmifolia*		RT — I	
Stachys tenuifolia		BW — I	
Staphlea trifoliata		BW — I	BW — R
Stellaria media var. *media*	BW — R		
Stellaria pubera	SW, BW — C	SW — C	BW — I
Stylophorum diphyllum	BW — I	SW — C	BW — I
Symphyotrichum cordifolium	SW, BW — C	SW,BW — C	RT,BW — C
Symphyotrichum lanceolatum var. *lanceolatum*			BW,PE — I
Symphyotrichum lateriflorum var. lateriflorum	BW — I		BW,PE — I
Symphyotrichum pilosum var. *pilosum*			BW — R
Symphyotrichum shortii	RT, SW — I	SW,RT — I	RT,BW — I
Taraxacum officinale ssp. *officinale*			PE — R
Thalictrum dioicum		RT — R	
Thalictrum thalictoides	SW, BW — I	SW,BW — C	SW — I
Thaspium barbinode	BW — I		
Thelypteris noveboracensis		SW,BW — I	BW — I
Tilia americana var. *americana*	BW, SW — I	SW,BW — I	RT,BW — I
Toxicodendron radicans ssp. *negundo*	BW, SW, RT — C	SW,BW — C	RT — C
Tradescantia subaspera var. *subaspera*	BW — I		BW — I
Tradescantia virginiana	BW — I		
Trillium flexipes	SW, BW — I	SW — I	
Trillium recurvatum	SW, BW — C	SW — I	SW,BW — C
Typha latifolia			PE — R
Ulmus americana	BW, SW — C	SW,BW — C	RT,SW,BW — I
Ulmus rubra	BW — I		BW — I
Uvularia grandiflora	BW — R		

Vaccinium pallidum		RT — R	
Valeriana pauciflora		BW — I	BW — R
Verbesina alternifolia			BW — C
Viburnum acerifolium	RT, SW — C	SW,RT — C	RT,SW — C
Viburnum prunifolium	BW, SW — I	SW — I	BW — R
Viola palmata	BW — R	RT — I	BW — I
Viola pubescens	BW — C	SW — I	BW — C
Viola sororia	BW — A	SW,BW — C	RT,SW,BW — C
Viola striata	BW — I	BW — C	
Vitis aestivalis	BW — I	SW — I	BW — I

End of Table 13B.

Table 13C: Plant species listed by family.

LYCOPODIOPHYTA

Huperiziaceae
Huperzia lucidula

POLYPODIOPHYTA

Athyriaceae
Athyrium felix-femina
Deparia acrostichoides
Diplazium pycnocarpon

Aspleniaceae
Asplenium platyneuron

Dryopteridaceae
Cystopteris protrusa
Polystichum acrostichoides

Onocleaceae
Onoclea sensibilis

Ophioglossaceae
Botrypus virginianus
Ophioglossum vulgatum

Pteridaceae
Adiantum pedatum

Thelypteridaceae
Phegopteris hexagonoptera
Thelypteris noveboracensis

PINOPHYTA

Cupressaceae
Juniperus virginiana

MAGNOLIOPSIDA

Adoxaceae
Sambucus canadensis
Viburnum acerifolium
Viburnum prunifolium

Amaryllidaceae
Allium tricoccum
Allium vineale

Anacardiaceae
Rhus copallinum var. *latifolia*
Toxicodendron radicans ssp. *negundo*

Annonaceae
Asimina triloba

Apiaceae
Cryptotaenia canadensis
Erigenia bulbosa
Osmorhiza claytonii
Sanicula trifoliata
Sanicula odorata
Thaspium barbinode

Apocynaceae
Apocynum cannabinum
Asclepias quadrifolia

Araceae
Arisaema dracontium
Arisaema triphyllum

Araliaceae
Aralia racemosa
Panax quinquefolius

Aristolochiaceae
Aristolochia serpentaria
Asarum canadense

Asparagaceae
Maianthemum racemosum
Ornithogalum nutans
Polygonatum biflorum var. *biflorum*

Asteraceae
Ageratina altissima
Antennaria plantaginifolia
Cirsium altissimum
Erigeron philadelphicus
Eupatorium perfoliatum
Eutrochium maculatum
Euthamia graminifolia
Eutrochium purpureum
Helianthus decapetalus
Krigia biflora
Lactuca floridana var. *villosa*
Nabalus latissimus
Packera aurea
Packera glabella
Packera obovatus
Solidago caesia
Solidago canadensis
Solidago flexicaulis

Solidago gigantea
Solidago juncea
Solidago ulmifolia
Symphyotrichum cordifolium
Symphyotrichum lanceolatum
Symphyotrichum lateriflorum
Symphyotrichum pilosum
Symphyotrichum shortii
Taraxacum officinale
Verbesina alternifolia

Balsaminaceae
Impatiens capensis

Berberidaceae
Berberis thunbergii
Podophyllum peltatum

Betulaceae
Carpinus caroliniana ssp. *virginiana*
Corylus americana
Ostrya virginiana

Boranginaceae
Cynoglossum virginianum
Hydrophyllum appendiculatum
Hydrophyllum canadense
Hydrophyllum macrophyllum
Phacelia bipinnatifida

Brassicaceae
Alliaria petiolata
Arabis laevigata
Barbarea vulgaris
Cardamine angustata
Cardamine concatenata
Cardamine douglassii
Cardamine pensylvanica

Campanulaceae
Campanula americana
Lobelia siphilitica

Cannabaceae
Celtis occidentalis

Caprifoliaceae
Lonicera japonica
Lonicera maackii
Valeriana pauciflora

Caryophyllaceae
Cerastium fontanum ssp. *vulgare*
Stellaria media
Stellaria pubera
Silene stellata
Silene virginica

Celastraceae
Euonymus alatus
Euonymus americanus
Euonymus obovatus

Colchicaceae
Uvularia grandiflora

Commelinaceae
Tradescantia subaspera
Tradescantia virginiana

Cornaceae
Cornus alternifolia
Cornus florida
Nyssa sylvatica

Crassulaceae
Sedum ternatum

Cyperaceae
Carex gracilescens
Carex albicans
Carex albursina
Carex amphibola
Carex blanda
Carex careyana
Carex cephalophora
Carex communis
Carex cumberlandensis
Carex digitalis
Carex gracillima
Carex grisea
Carex hirsutella
Carex hirtifolia
Carex hitchcockiana
Carex jamesii
Carex laxiculmis
Carex laxiflora
Carex lurida
Carex oligocarpa
Carex picta
Carex rosea
Carex sparganioides
Carex swanii
Carex timida
Carex tribuloides
Carex virescens
Carex vulpinoidea
Carex willdenowii
Scirpus atrovirens
Scirpus georgianus

Dioscoreaceae
Dioscorea villosa

Elaeagnaceae
Elaeagnus umbellata var. *parvifolia*

Ericaceae
Vaccinium pallidum

Fabaceae
Amphicarpaea bracteata
Cercis canadensis
Hylodesmum glutinosum
Robinia pseudoacacia

Fagaceae
Fagus grandifolia
Quercus alba
Quercus muhlenbergii
Quercus rubra
Quercus velutina

Fumariaceae
Dicentra canadensis
Dicentra cucullaria

Gentianaceae
Obolaria virginica

Geraniaceae
Geranium maculatum

Grossulariaceae
Ribes cynosbati

Hamamelidaceae
Hamamelis virginiana

Hydrangeaceae
Hydrangea arborescens

Hypericaceae
Hypericum punctatum

Juglandaceae
Carya cordiformis
Carya glabra
Carya ovata
Juglans nigra

Juncaceae
Juncus tenuis
Luzula echinata

Lamiaceae
Agastache nepetoides
Blephilia hirsuta
Collinsonia canadensis
Monarda clinopodia
Prunella vulgaris
Pycnanthemum virginianum
Stachys tenuifolia

Lauraceae
Lindera benzoin
Sassafras albidum

Liliaceae
Erythronium americanum
Lilium michiganense
Medeola virginiana

Magnoliaceae
Liriodendron tulipfera

Melanthiaceae
Trillium flexipes
Trillium recurvatum

Menispermaceae
Menispermum canadense

Montiaceae
Claytonia virginica

Moraceae
Morus rubra

Oleaceae
Fraxinus americana
Fraxinus pennsylvanica
Fraxinus quadrangulata

Onagraceae
Circaea lutetiana ssp. *canadensis*

Orchidaceae
Aplectrum hyemale
Galearis spectabilis
Goodyera pubescens

Orobanchaceae
Conopholis americana
Epifagus virginiana
Orobanche uniflora

Oxalidaceae
Oxalis grandis
Oxalis stricta
Oxalis violacea

Papaveraceae
Stylophorum diphyllum
Sanguinaria canadensis

Phrymaceae
Phryma leptostachya

Phytolaccaceae
Phytolacca americana

Plantaginaceae
Plantago rugelii

Platanaceae
Platanus occidentalis

Poaceae
Brachyelytrum erectum
Cinna arundinacea
Danthonia spicata
Dichanthelium boscii
Dichanthelium clandestinum
Dichanthelium latifolium
Elymus villosus
Festuca subverticillata
Glyceria striata
Leersia virginica
Microstegium vimineum
Poa compressa
Poa pratensis
Poa sylvestris
Schedonorus arundinaceus

Polemoniaceae
Phlox divaricata
Polemonium reptans

Polygonaceae
Persicaria longiseta
Persicaria virginiana

Ranunculaceae
Actaea pachypoda
Anemone acutiloba
Delphinium tricorne
Enemion biternatum
Hydrastis canadensis
Ranunculus abortivus
Ranunculus recurvatus
Thalictrum dioicum
Thalictrum thalictoides

Rosaceae
Agrimonia parviflora
Agrimonia pubescens
Amelanchier arborea
Aruncus dioicus
Crataegus mollis
Crataegus punctata
Geum canadense
Potentilla simplex
Prunus serotina
Rosa multiflora
Rubus pensilvanicus
Rubus allegheniensis
Rubus flagellaris
Rubus occidentalis

Rubiaceae
Galium aparine
Galium circaezans
Galium concinnum
Galium lanceolatum
Galium triflorum
Mitchella repens

Salicaceae
Populus grandidentata

Sapindaceae
Acer negundo
Acer rubrum
Acer saccharum

Saxifragaceae
Heuchera americana

Scrophulariaceae
Scrophularia marilandica

Smilacaceae
Smilax hispida
Smilax rotundifolia

Staphyleaceae
Staphlea trifoliata

Tiliaceae
Tilia americana

Typhaceae
Typha latifolia

Ulmaceae
Ulmus americana
Ulmus rubra

Urticaceae
Laportea canadensis
Pilea pumila

Violaceae
Hybanthus concolor
Viola palmata
Viola pubescens
Viola sororia
Viola striata

Vitaceae
Parthenocissus quinquefolia
Vitis aestivalis

End of Table 13C.

Table 13D: Floristic quality data. # = number of; all plants = native + non-native species; FQI = floristic quality index; mean C = average Coefficient of Conservatism.

	All Site Combined	Blossom Hollow Nature Preserve	Easement Property	Glacier's End Nature Preserve
# native plants	**251**	**179**	**171**	**189**
# non-native plants	18	8	7	14
Number all plants	269	187	177	203
FQI native plants	**74.2**	**62.6**	**63.1**	**61.9**
FQI all plants	71.6	61.3	61.8	59.7
Mean C native plants	**4.7**	**4.7**	**4.8**	**4.5**
Mean C all plants	4.4	4.5	4.6	4.2

Interpretation of the Floristic Quality Index (FQI) and the Coefficient of Conservatism.

The Floristic Quality Index (FQI) for The Hills of Gold BioBlitz was determined using the program developed by the Conservation Design Forum in conjunction with Rothrock (2004). This program also calculates the mean Coefficient of Conservatism (mean C), and the mean Wetland Indicator Status (mean W). Additionally, it presents a detailed physiognomic analysis of the flora, both native and non-native species. For a detailed description of how the FQI is determined and an explanation of C-values, see Swink & Wilhelm (1994), Rothrock (2004), and Rothrock & Homoya (2005). Briefly, C-values, which range from zero to ten, are an index of the fidelity of an individual species to undisturbed plant communities characteristic of the region prior to European settlement. The higher the C-value the more conserved the species is to an undisturbed habitat. All exotics are given a C value of 0. The FQI is

determined by multiplying the mean C for all species present by the square root of the total number of species. (For native FQI and mean C, only the native species are used.) A FQI greater than 35 suggests that a site has remnant natural quality and contains some noteworthy remnants of natural heritage of the region (Rothrock & Homoya 2005, Swink & Wilhelm 1994). Areas registering in the 50s and higher are considered of paramount importance and should be conserved (Swink & Wilhelm 1994).

Table 13E: Physiognomic analysis of the vascular flora observed at (1) all sites combined, (2) Blossom Hollow Nature Preserve, (3) Easement Property, and (4) Glacier's End Nature Preserve, Johnson County, Indiana. A = annual; B = biennial; H = herbaceous; P = perennial; W = woody.

	All Three Sites Combined		Blossom Hollow Nature Preserve		Easement Property		Glacier's End Nature Preserve	
	# Native Species	# Non-native	# Native Species	# Non-native	# Native Species	# Non-native	# Native Species	# Non-native
# species	250	18	178	8	171	7	188	14
Tree	37	0	35	0	28	0	28	0
Shrub	18	5	12	3	11	4	13	3
W-Vine	6	1	6	0	6	0	6	1
H-Vine	2	0	2	0	2	0	2	0
P-Forbs	121	4	79	1	83	0	85	4
B-Forbs	5	2	4	1	3	1	3	2
A-Forbs	8	2	7	1	6	1	7	0
P-Grass	11	3	8	1	7	0	10	3
A-Grass	0	1	0	1	0	1	0	1
P-Sedge	29	0	14	0	14	0	27	0
A-Sedge	0	0	0	0	0	0	0	0
Fern	13	0	11	0	11	0	7	0

Summary Overview

At total of 269 taxa, 251 native and 18 non-native, all identified to at least species, were reported from the bioblitz area. From each of the three separate sites the following was reported: Blossom Hollow Nature Preserve (187 taxa, 179 native), the Easement Property (177 taxa, 171 native) and Glacier's End Nature preserve (201 taxa, 189 native) (Tables 13A & 13D). The distribution across the three sites and the relative abundance of each species is seen in Table 13B. Of the 269 species reported, 114 occurred in all three sites and 113 represent potential Johnson County records. According the February 12, 2016 list of Endangered, Threatened, Rare and Extirpated Plants of Indiana (Nature Preserves 2016), one species is listed as state endangered, *Carex timida*, and four species are listed on the state watch list, *Huperzia lucidula*, *Hydrastis canadensis*, *Panax quinquefolius*, and *Viola pubescens*. (State endangered means that the species has less than five occurrences in the state.)

The species are listed by family in Table 13C. The thirteen families with the most species were, in order, Cyperaceae (31), Asteraceae (28), Poaceae (15), Rosaceae (14), Ranunculaceae (nine), Brassicaceae and Lamiaceae (seven each), Apiaceae and Rubiaceae (six each), and the Boraginaceae, Caryophyllaceae, Fagaceae, and Violaceae (five each). These 13 families represent 53% of the 269 species reported.

A summary of the native plants for the three sites combined, the FQI was 74.2 and the mean C was 4.7 (Table 13D). These numbers clearly indicate that The Hills of Gold Core Conservation Area has "remnant natural quality and contains some noteworthy remnants of natural heritage of the region" (Swink & Wilhelm 1994). Clearly, this area should be considered of paramount importance and should be conserved. Floristic quality is also reflected in the species present. Within the Core Conservation Area, there were three species of orchid, i.e., *Aplectrum hyemale* (Putty-root Orchid), *Galearis spectabilis* (Showy Orchis), and *Goodyera pubescens* (Downy Rattlesnake Plantain). In addition, the present of ferns is an excellent indicator of the quality and lack of disturbance of a site. To this point, the Core Conservation Area of the bioblitz included twelve species of ferns and the fern ally *Huperzia lucidula* (Shining Clubmoss). Lastly, as noted from earlier, the Coefficient of Conservatism, or C-value, which range from zero to ten, is an index of the fidelity of an individual species to undisturbed plant communities characteristic of the region prior to European settlement. The higher the C-value the more conserved the species is to an undisturbed habitat. A close examination of the 251 native plants reported during the bioblitz reveals that 64 species (25.5%) have C e 7. Within this group there were 37 species with C = 7, 24 species with C = 8, three species with C = 9 (*Carex careyana*, *Carex timida*, and *Diplazium pycnocarpon*), and one species with C = 10 (*Cynoglossum virginianum*).

Lastly, a physiognomic analysis of the vascular flora observed in all sites combined (Table 13E) reveals that 67 species (25%) were woody (trees, shrubs and woody vines), 144 species (53.5%) were herbaceous (herbaceous vines and forbs), 45 species (16.7%) were graminoids (grasses and sedges), and 13 (4.8%) were ferns and their allies. Overall, these numbers represent the composition of a high quality woodland in southcentral Indiana. Fortunately, the future preservation of the Hills of Gold Core Conservation Ares is assured since it is under the guidance of the Central Indiana Land Trust, Inc. (CILTI).

Carex cumberlandensis, Cumberland Sedge, was at its northern range limit at the BioBlitz site. (Photo by Paul Rothrock)

Carex timida, Timid Sedge, is a state endangered species. (Photo by Paul Rothrock)

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Hills of Gold Biodiversity Survey 2015
Scientists, Naturalists, Students, Staff and Community Volunteers (66)

Aster, Nick	Herpetofauna
Autio, Robert	Geologist
Badger, Kem	Plants
Behring, Robert	Beetle
Benson, David	Birds
Bergeson, Scott	Bats
Bollerud, Nick	Bats
Brattain, R. Michael	Beetle
Brodman, Bob Brodman *	Herpetofauna
Cachules, Stacy	CILTI Staff
Chamberlain, Angela	Mammals
Chapman, Cliff	Coordinator
Cole, Linda *	Non-vascular Plants
Cole, Myron	Non-vascular Plants
Crecelius, Megan	Plants
Davis, JoAnne	Fish, Freshwater Mussels
De Smet, Willy	Plants
Deutch, Ann	Coordinator
Deutch, Tom	Coordinator
Divoll, Tim	Bats
Faukner, John	Herpetofauna
Finkler, Dantra	Herpetofauna
Finkler, Michael	Herpetofauna
Fisher, Brant *	Fish, Freshwater Mussels
Gorden, Caitlyn	Bats
Grunwald, Taryn Upmann	Bats
Heikens, Alice	Plants
Hendershot, Elizabeth	Plants
Hess, Ben	Plants
Hillier, Kaitlin	Plants
Hoeh, Julia	Bats
Holland, Jeffrey *	Beetle
Holmes, Jordan	Bats
Horton, Jim	Herpetofauna
Hougham, Jacob	Plants
Houghman, Tom	Birds
Hubini, Ahmed	Plants

Jeffrey, Rosemarie	Birds
Kellendburger, Payton	Herpetofauna
Kunk, Elizabeth	Herpetofauna
Milbtrath, Heather	Herpetofauna
Milne, Leah	Spiders
Milne, Marc *	Spiders
Murphy, William L. *	Snail-killing Flies
Nagel, Jessica	Herpetofauna
Netherton, Josh	Plants
Nowacki, James	Geologist
O'Keefe, Joy *	Bats
Ploss, Tyler	Spiders
Powell, Gareth	Beetle
Ramsey, Tabatha	Plants
Roller, Allyson	Herpetofauna
Roth, Kirk *	Birds
Rothrock, Paul	Plants
Ruch, Don *	Plants
Russell, Stephen *	Mushrooms/Fungi
Shearer, Cheryl	Plants
Strang, Carl A. *	Moth, Singing Insects, Others
Taylor, John	Plants
Thweatt, Tamara	Birds
Tungesvick, Kevin	Plants
Ward, Wayne	Mushrooms/Fungi
Wells, Elizabeth	Spiders
Werner, Karl	Birds
Wesche, Spencer	Plants
Whitaker, John, Jr. *	Mammals

* Denotes a team leader

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