2016. Proceedings of the Indiana Academy of Science 125(2):126–136

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

Donald G. Ruch[1]: Department of Biology, Ball State University, Muncie, IN 47306 USA

Cliff Chapman: Executive Director, Central Indiana Land Trust, 1500 N. Delaware Street, Indianapolis, IN 46202 USA

Ann Deutch: 4001 W Hougham Road, Trafalgar, IN 46181 USA

Bob Brodman: Biology Department, St. Joseph's College, Rensselaer, IN 47978 USA

Linda Cole: Brown County Indiana Naturalist, 635 Oak Run Drive, Nashville, IN 47448 USA

Brant Fisher: Atterbury Fish and Wildlife Area, 7970 South Rowe Street, Edinburgh, IN 46124 USA

Jeffrey D. Holland: Department of Entomology, Purdue University, West Lafayette, IN 47907 USA

Marc Milne: Department of Biology, University of Indianapolis, Indianapolis, IN 46227 USA

Bill Murphy: 7835 Tufton Street, Fishers, IN 46038 USA

Joy O'Keefe: Department of Biology, Indiana State University, Terre Haute, IN 47809 USA

Kirk Roth: Corradino, LLC, 200 S. Meridian Street, Suite 330, Indianapolis, IN 46225 USA

Steve Russell: The Hoosier Mushroom Company, P.O. Box 3094, Bloomington, IN 47402 USA

Carl Strang: 3S126 Briarwood Drive, Warrenville, IL 60555 USA

John Whitaker Jr. and **Angie Chamberlain**: Department of Biology, Indiana State University, Terre Haute, IN 47809 USA

ABSTRACT. The Central Indiana Land Trust, Inc. (CILTI) and the Indiana Academy of Science (IAS) hosted a biodiversity survey or bioblitz within the Hills of Gold Conservation Area, Johnson County, Indiana, on 16th and 17th May 2015. The 280 ha (695 acres) bioblitz area incorporated 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. Over 65 scientists, naturalists, students, and other volunteers on 13 different taxonomic teams observed and reported 548 taxa during the event. The thirteen taxonomic teams included bats, beetles, birds, fish, freshwater mussels, herpetofauna, small mammals, moths and singing insects, mushrooms/fungi and slime molds, non-vascular plants (mosses), snail-killing flies, spiders, and vascular plants. Three state endangered species were reported, i.e., northern long-eared bat (*Myotis septentrionalis*), Indiana bat (*Myotis sodalis*), and the timid sedge (*Carex timida*). In addition, many state and Johnson County records were reported. This manuscript presents both a brief history of the Hills of Gold Conservation Area and a summary overview of the results. Detailed results are available on the IAS website.

Keywords: Bioblitz, biodiversity survey, Hills of Gold, Blossom Hollow Nature Preserve, Glacier's End Nature Preserve, state endangered, county records, CILTI

[1] *Corresponding author:* Donald G. Ruch, 765-285-8820 (phone) 765-285-8804 (fax), druch@bsu.edu.

INTRODUCTION

The Indiana Academy of Science's 2015 biodiversity survey or bioblitz was held within the Hills of Gold 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, and chunks of granite. In addition, because the soil of the glacial influenced area is richer and less acidic than unglaciated hills to the south, there is an interesting mix of plants. See the Geology Report by Robert Autio, LPG, Environmental Data & Consulting, LLC, and James Nowacki, LPG, Kayak Lake Tree Farms, for additional details (Hills of Gold Bioblitz Report 2016).

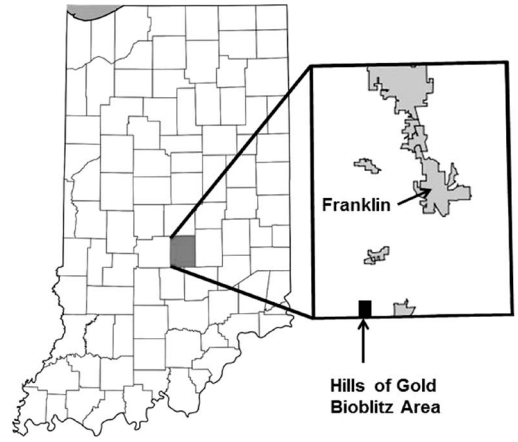

Figure 1.—Location of Johnson County within Indiana (left) and the Hills of Gold Bioblitz Area within Johnson County (right).

The 280 ha (695 acres) bioblitz area incorporated 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). These areas have always been in private property and, as a result, little historical information concerning the flora and fauna is available. CILTI prides itself on a science-based approach to conservation, and its partnering with the Indiana Academy of Science to sponsor the bioblitz has provided it with considerable data to use in land management and future land protection efforts in the Hills of Gold Conservation Area.

The biodiversity survey in the Hills of Gold Conservation Area was conducted on 16th and 17th May 2015. The event, with over 65 scientists, naturalists, students, and others volunteers, proved an overwhelming success and revealed the area's significant species richness and inherent natural value. This manuscript provides a brief history of the Hills of Gold Conservation Area and a summary of the biodiversity results. For additional details see the Hills of Gold Bioblitz Report (2016).

BRIEF HISTORY OF THE HILLS OF GOLD CONSERVATION AREA

The area known 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 covered by glacial till. Although Indiana has experienced several ice ages over the millennia, the last one, the Wisconsinan Glaciation, covered the northernmost Brown County Hills around Trafalgar in southern Johnson County. 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 acted as a cleave that parted the massive ice sheet. In fact, the northern boundary of Glacier's End Nature Preserve is where the ice stopped (Fig. 2).

But that doesn't mean this area is without glacial influence. Loess from a pre-Wisconsin glacial period is found on some ridge tops. While there is exposed Mississippian shale in the creek valleys, glacial erratics, in the form of granite and quartzite chunks, are strewn throughout the area. Weathering has created a mix of soils in the area, some places glacially influenced but others not. This mixture of soils with different pH's supports different plant communities melded together under what appears to be a canopy of homogeneous forest.

Hills of Gold gets its name from another of the glacial erratics once found here. Gold and diamonds are sometimes found in a 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 are probably present in minute 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, Inc. (CILTI) and two families. One hundred and

thirty-three years after the first Europeans settled near the area in 1825, three Hougham brothers began purchasing 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. The two developers also entered into agreements to enable the dam building with several local families, including the Pitchers after whom Pitcher Creek is named.

The 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 15 ha (37 acres) 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 the 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 CILTI.

The Central Indiana Land Trust, Inc., formed in 1990, seeks to protect the region's best remaining natural areas. This volunteer-driven organization 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. After 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. Also, through the use Indiana Heritage Trust funds as the lead gift, several other land protection projects were successful. However, the board of directors felt this "shot-gun" approach was problematic.

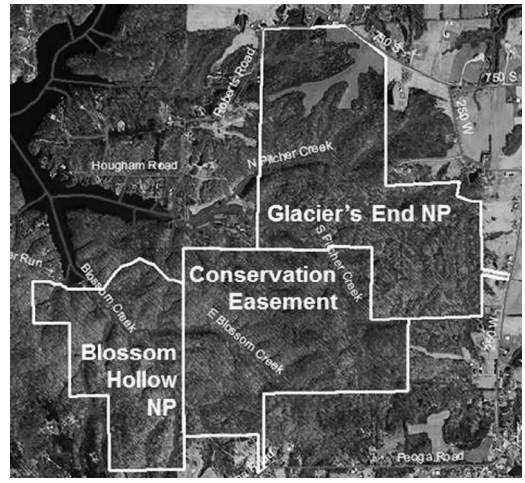

Figure 2.—The 280 ha bioblitz area included Blossom Hollow Nature Preserve to the west, Glacier's End Nature Preserve to the northeast, and a conservation easement connecting the two.

A 2008 strategic conservation plan sought to identify where the best remaining natural areas were as well as where rare and endangered species of plants and animals could still be found. The plan of the Land Trust sought to protect sustainable communities of species.

The Hills of Gold was one of the areas identified in the strategic conservation plan. Field work in 2008 and 2009 revealed large populations of rare birds, such as Worm-eating Warbler, Hooded Warbler, and sightings of the elusive Cerulean Warbler. Beyond those rare birds, forest interior species like Red-eyed Vireo, Acadian Flycatcher, Ovenbird, and Wood Thrush were found in high numbers. Additionally, yearling, juvenile and adult Eastern Box Turtles were found to be commonplace through the area, a sign of a functioning ecosystem with minimal edge effects. The field work was done while the strategic conservation plan was being created. It was finished and adopted by the CILTI Board of Directors in the 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 100 ha (246 acre) Bob's Woods Conservation Easement, was closed.

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-through of their land occurred in November of 2009, and in 2011, CILTI signed a purchase agreement for 44 ha (109 acres) that became the Laura Hare Preserve at Blossom Hollow; the deal was closed in 2012.

CILTI's plan had designated the Hills of Gold Area one of 13 priority areas in Central Indiana. Although negotiations continued with both families owning land in the area and willing to sell, there wasn't enough cash available. Fundraising for the conservation of 280 ha (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 (BNT) 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 adjusted its organizational priorities to leverage the one to one matching dollars of the BNT.

The owners of what is now called Glacier's End Nature Preserve signed a purchase agreement with CILTI for 82 ha (203 acres) in 2014 and an additional 39 ha in 2015. During the same period, the owners of 16 ha (40 acres) south of Blossom Hollow (same owners as Bob's Woods Conservation Easement) signed a purchase agreement with CILTI. By 2016 CILTI completed its largest fundraising campaign in its history and had completed five projects totaling $2,399,000 protecting 280 ha (695 acres) of contiguous habitat.

The 2015 bioblitz took place while most of this land was still in private ownership. This inventory of resources was timely in preparation for management decisions affecting the new preserve.

SUMMARY OF RESULTS AND METHODS

The Hills of Gold bioblitz attracted over 65 scientists, naturalists, students, and others volunteers. Thirteen taxonomic teams and their leaders reported 548 taxa (Table 1). To obtain a complete picture of the biodiversity found at Hills of Gold, long-term seasonal surveys are necessary. This two-day survey provided an initial "snapshot in time" and has revealed the remarkable species richness of this area. An overview of the results from the thirteen taxonomic teams follows. To view the complete results, visit the Indiana Academy of Science website at *http://www.indianaacademyofscience.org/*, lay the cursor over Events at the top of the page and then click BioBlitz Archive.

Bats.—Two survey sites were established in Blossom Hollow Nature Preserve, one on Upper Pitcher Creek and the other in Blossom Hollow. At each site, two double-high mistnet sets and one single high mistnet were deployed. Nets were open for $\sim$ 4 h, beginning at dusk and were checked for bats every 10 min. Captured bats were banded 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.

Because it rained steadily for most of the day leading up to a few hours before dusk, only two bats were captured. It is remarkable that both captures were federally protected species, however. One male northern long-eared bat (*Myotis septentrionalis*) 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*) was captured at the Blossom Hollow site. 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). Using a radio transmitter, the Indiana bat was tracked to two roost trees on nearby private lands over the week following the Bioblitz. She roosted in a large diameter (79.4 cm) cottonwood (*Populus deltoides*) snag (3–5 bats emerged) and a large diameter (60 cm) shagbark hickory (*Carya ovata*) with a snapped off top (24 bats emerged).

Beetles (Coleoptera).—Beetles were collected through the day by sweep-netting vegetation, examining flowers, and hand collecting under

Table 1.—Summary of the 548 taxa reported at the 2015 Hills of Gold Biodiversity Survey, Johnson County, Indiana.

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	Jeffrey 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
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
Mammals	John Whitaker Jr. and Angie Chamberlain	14 taxa. Eight species of mammals were trapped. Four are relatively common, but the other four are relatively uncommon. Of the latter, 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).
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
Mushrooms	Steve Russell	34 fungal taxa: 31 mushrooms, two plant pathogens, one slime mold; due 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; 23 potential Johnson County records, two potential state 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

rocks and bark. This was not effective because of the rainy weather. In the evening on Saturday of the survey, a 1000 W metal halide light, a 175 W mercury vapor light and two small UV lights were used 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.

A low number and diversity of beetles were captured (17 taxa, 16 species), 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. Representatives of all species collected have been accessioned into the Purdue Entomological Research Collection in the Department of Entomology, Purdue University, West Lafayette, Indiana.

Birds.—A total of 86 species, including 18 migrant species, were detected, although ten of these were outside the property boundaries, especially on the trail leading toward the Blossom Hollow 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.

Glacier's End Nature Preserve (GENP) had the most species (67) and most individual birds (382) detected, but also had the most acreage and most time spent by researchers. A total of 160 individual birds of 46 species was detected on Blossom Hollow Nature Preserve (BHNP), while in the Conservation Easement (CE) 224 individuals of only 34 species were detected. The differences in diversity and individual bird counts could be influenced by habitat type – the BHNP had more edge habitat to promote diversity, while the CE had a larger tract of forest. This view is supported by the differences in detected birds for each area. BHNP had several species of successional, generalist, or edge specialist species that were not detected in the CE, including Red-shouldered Hawk, Mourning Dove, Least Flycatcher, Warbling Vireo, Eastern Towhee, Song Sparrow, and American Goldfinch (Castrale et al. 1998). The CE had much higher numbers of several mature forest specialists compared to the BHNP, 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).

Twenty-five species occurred in all three sites, including Acadian Flycatcher, Eastern Wood-pewee, Ovenbird, Red-eyed Vireo, Scarlet Tanager, Tennessee Warbler, and Wood Thrush. The three species with the highest number of individuals were Red-eyed Vireo (81), Tennessee Warbler (68), and the Acadian Flycatcher (45).

Fish.—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 Preserve, a pond just south of the intersection of Roberts Road and CR 300W, and Blossom Creek near the north boundary of Blossom Hollow Nature Preserve.

Only three species of fish representing one family were recorded. 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 in a variety of aquatic habitats and are highly tolerant of a wide range of environmental conditions. 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) and were likely stocked after the pond's construction.

Freshwater mussels.—Freshwater mussels were sampled using haphazard sampling techniques. Sections of streams and pond located on the properties were visually searched for live freshwater mussels and shell material. Sampling occurred at the same three sites where fish were sampled.

Evidence of only one species of freshwater mussel, Paper Pondshell (*Utterbackia imbecillis*), was found. 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 expected considering the intermittent nature of the streams.

Figure 3.—The herp team in action. (Photo by Bob Brodman)

Herpetofauna.—Amphibians 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 (Fig. 3). Turtles and larval amphibians were also sampled by use of 10 turtle traps and 21 minnow traps in ponds.

The herpetofauna team found a total of 285 herps of 22 species, including ten reptiles representing six species and 275 amphibians representing 16 species. Blanchard's Cricket Frog (*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. Eastern Box Turtle (*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 Long-tailed Salamander (*Eurycea longicauda*), Southern Two-lined Salamander (*E. cirrigera*), and Slimy Salamander (*Plethodon glutinosis*), were common under cover objects. Four pond-breeding species (Jefferson Salamander (*Ambystoma jeffersonianum*), Spotted Salamander (*A. maculatum*), Wood Frog (*Lithobates sylvaticus*), and Cope's Gray Treefrog (*Hyla chrysosclis*) represent new Johnson County records.

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.

Mammals.—Eight species of mammals were trapped. Four are relatively common, but the other four are relatively uncommon. The common species included Masked Shrew (*Sorex cinereus*), Northern Short-tailed Shrew (*Blarina brevicauda*), Prairie Vole (*Microtus ochrogaster*), and the White-footed Mouse (*Peromyscus leucopus*). Of the four uncommon species, the Woodland Vole (*Microtus pinetorum*) and Southern Bog Lemming (*Synaptomys cooperi*) are occasional throughout much of the state. The Pygmy Shrew (*Sorex hoyi*) and Smoky Shrew (*Sorex fumeus*) are found only in forests in the unglaciated hill country of south central Indiana. In addition to these eight species, evidence of six other mammal species was found. Numerous burrows of the Eastern Mole (*Scalopus aquaticus*) were observed, several Gray Squirrels (*Sciurus carolinensis*) and two Chipmunks (*Tamias striatus*) were seen, and one dead Southern Flying Squirrel (*Glaucomys volans*) was seen by a staff member, feces from a Coyote (*Canis latrans*) was

observed, and numerous tracks of the White-tailed Deer (*Odocoileus virginianus*) were seen.

Moths, singing insects, and other non-target organisms.—During the day, a transect was walked from the top of the ridge at the southern end of Glacier's End back to the bioblitz headquarters on the north edge of the property. Frequent side excursions were made into the forest and along streams. Singing insects were identified from their songs, moth species flushed into flight were collected, and other invertebrates photographed. In the evening a white sheet with a UV light was set up near 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 $\sim$ 3 hours moths were collected and/or photographed, and some specimens were exchanged with the Purdue group.

Two taxa of singing insects, 20 species of moths, and four additional arthropod taxa were identified in this portion of the bioblitz study. All were identified to species except one singing insect and one additional arthropod; these taxa 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.

Species observed and/or collected are all well within their range, and none are regarded as rare, threatened, or endangered in general references or on the Indiana state lists. 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 location. 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.

The most commonly observed moths in the forest during the day were the Three-spotted Fillip (*Heterophleps triguttaria*) and the Unadorned Carpet (*Hydrelia inornata*). The most common moths to come to the light were 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, mostly in the elevated portion of the forest 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. All collected specimens were transferred to the Purdue University collection at the West Lafayette campus.

Mushrooms, fungi and slime molds.—Due 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 the mushroom *Armillaria tabescens*, as this may be the first documented report of this species in Indiana.

Interestingly, *Lycogala epiderndrum*, a slime mold known as Wolf's Milk, 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. It 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 outer wall (or peridium) is ruptured, they may excrete a pink paste. When mature, the color tends to become more brownish.

Non-vascular plants (mosses).—The survey of mosses in Blossom Hollow Nature Preserve revealed a healthy diversity characteristic of a mature mesic woodland environment. Further, the recent rains provided excellent conditions for identifying bryophytes in their most robust, hydrated state, especially important when assessing these overlooked pioneer plants that colonize mature trees (live, dead, and dying) and decaying logs. Our survey sampled 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 slopes, ridges and bottoms, creek beds, and seeps.

Overall, 30 bryophyte species were identified. According to the Flora of North America (FNA 2007) and Welch (1957), 23 species represent potential Johnson County records, and two, *Anomodon viticulosus* (Greater Tongue Moss) and *Weissia controversa* (Pigtail Moss), represent potential state records. Some of the interesting discoveries were both gametophytes and sporophytes of Algal Rock Moss (*Platydictya confervoides*) growing on wet sandstone rather than its usual calcareous rock; a beautiful specimen of the rare Verdigris Mousetail Moss (*Myurella sibirica*); and Cluster Moss (*Rosulabryum capillare*) growing on wet rock. In a sample from a wet rock out of a streambed, there appeared to be a *Selaginella* sp. (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). All samples collected for the survey were returned to the environment.

Snail-killing flies (Sciomyzidae).—Fourteen snail-killing flies (Diptera: Sciomyzidae) of five species were recorded from the Hills of Gold Conservation Area. 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. 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. 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 occur 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.

Spiders.—The surveying methodology included the use of Berlese funnels, litter sifting, and hand collecting. (For details of these methods, see the final bioblitz report on the IAS website.)

For the low amount of sampling conducted at the Hills of Gold 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 high. The discovery of *Agyneta evadens*, *A. parva*, *Styloctetor purpurescens*, *Scotinella redempta*, and *Neon nelli* 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. In summary, the Hills of Gold Conservation Area holds an assemblage of spiders that is diverse, understudied, and unique.

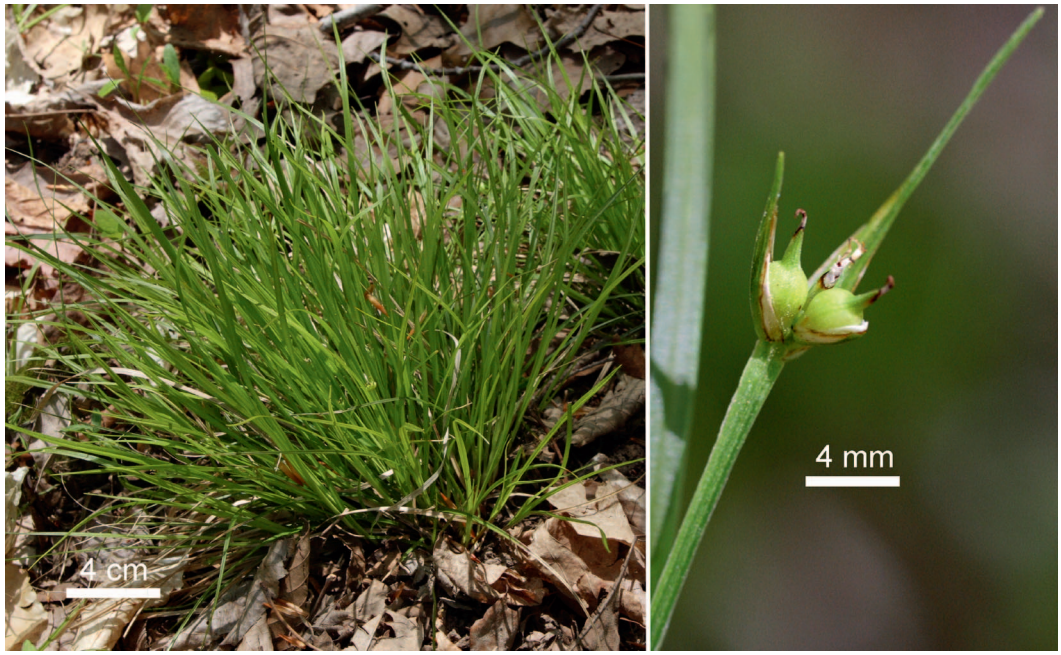

Figure 4.—*Carex timida*, timid sedge, is a state endangered species. (Photo by Paul Rothrock)

All vouchered specimens were sent to Indiana State University.

Vascular plants.—A total of 269 taxa, 251 native and 18 non-native, all identified to at least species, was 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 Conservation Easement Property (177 taxa, 171 native), and Glacier's End Nature preserve (201 taxa, 189 native). The distribution across the three sites and the relative abundance of each species was determined. (See final bioblitz report.) Of the 269 species reported, 114 occurred in all three sites and 113 represent potential Johnson County records. According to 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* (Fig. 4), 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 thirteen families with the most species were, in order, Cyperaceae (31), Asteraceae (28), Poaceae (15), Rosaceae (14), Ranunculaceae (9), Brassicaceae and Lamiaceae (7 each), Apiaceae and Rubiaceae (6 each), and the Boraginaceae, Caryophyllaceae, Fagaceae, and Violaceae (5 each). These 13 families represent 53% of the 269 species reported.

For the native plants from the three sites combined, the FQI (Floristic Quality Index) was 74.2 and the mean C (Coefficient of Conservatism) was 4.7. These numbers clearly indicate that The Hills of Gold 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 presence of ferns is an excellent indicator of the quality of 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, 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 revealed that 64 species (25.5%) have $C \geq 7$. 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 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 high quality woodland in south-central Indiana. Fortunately, the future preservation of the Hills of Gold Conservation Area is assured under the guidance of the Central Indiana Land Trust, Inc.

ACKNOWLEDGMENTS

Food and lodging for the participants was provided through the generous support of the Central Indiana Land Trust, Inc. and the Indiana Academy of Science. The participants express their appreciation to the Division of Nature Preserves, and especially Roger Hedge, for providing a permit allowing the event to occur. The bioblitz organizers express their sincere thanks to the participants who made the event a success.

LITERATURE CITED

Castrale, J.S., E.M. Hopkins & C.E. Keller. 1998. Atlas of Breeding Birds of Indiana. Indiana Department of Natural Resources, Indianapolis, Indiana. 388 pp.

FNA (Flora of North America) Editorial Committee, Eds. 2007. Flora of North America North of Mexico. Vol. 27: Bryophytes: Mosses, Part 1. Oxford University Press, New York, New York. 734 pp.

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

Hill of Gold Bioblitz Report. 2016. Results from the 2015 Hills of Gold Biodiversity Survey, Johnson County, Indiana. At: http://www.indianaacademyofscience.org/ (Accessed 14 December 2016).

Nature Preserves, IDNR. 2016. Endangered, Threatened, Rare and Extirpated Plants of Indiana. At: http://www.in.gov/dnr/naturepreserve/files/npetrplants.pdf (Accessed on 30 August 2016).

Swink, F. & G. Wilhelm. 1994. Plants of the Chicago Region, 4th edition. Indiana Academy of Science, Indianapolis, Indiana. 921 pp.

Welch, W.H. 1957. Mosses of Indiana. The Bookwalter Company, Indianapolis, Indiana. 478 pp.

Manuscript received 15 December 2016, revised 25 January 2017.