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RESULTS OF THE 2016 INDIANAPOLIS BIODIVERISTY SURVEY, MARION COUNTY, INDIANA

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ABSTRACT. Surprising biodiversity can be found in cities, but urban habitats are understudied. We report on a bioblitz conducted primarily within a 24-hr period on September 16 and 17, 2016 in Indianapolis, Indiana, USA. The event focused on stretches of three waterways and their associated riparian habitat: Fall Creek (20.6 ha; 51 acres), Pleasant Run (23.5 ha; 58 acres), and Pogue's Run (27.1 ha; 67 acres). Over 75 scientists, naturalists, students, and citizen volunteers comprised 14 different taxonomic teams. Five hundred ninety taxa were documented despite the rainy conditions. A brief summary of the methods and findings are presented here. Detailed maps of survey locations and inventory results are available on the Indiana Academy of Science website (https://www.indianaacademyofscience.org/).

Keywords: Bioblitz, Indianapolis, urban biodiversity, urban waterways, urban wildlife

INTRODUCTION

Cities can be home to surprisingly high levels of biodiversity (e.g., Aronson et al. 2014), yet biodiversity harbored in cities is understudied and few formal inventories have been conducted. We held a 24-hr biological survey, or bioblitz, in the city of Indianapolis, Indiana, USA to document flora and fauna present. Indianapolis, located in Marion County, is the 12th largest city in the United States. It is in the Central Till Plain natural region of Indiana (Homoya et al. 1985). Historically, the area currently covered by the city was 98% forested, the vast majority comprised of

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beech-maple association (Barr et al. 2002). Land conversion to row crop agriculture preceded urban expansion. Only 13% forest cover remained by the late 1900s (Barr et al. 2002).

Our urban bioblitz covered 72.2 ha (176 acres) along three waterways: Fall Creek, Pogue's Run (including Brookside Park and Spades Park), and Pleasant Run (including Garfield Park), and their mostly-vegetated riparian borders (Fig. 1). These areas were chosen primarily because they have been the focus of recent broad-based community efforts to re-establish these waterways as assets to their surrounding neighborhoods (Dolan et al. 2015). Part of that effort has been directed at ecological restoration along the creeks, primarily the removal of Amur honeysuckle (*Lonicera maackii* (Rupr.) Herder). This invasive shrub grows so prolifically that it blocks citizens' view of the waterways, while inhibiting growth of native plants (Gould & Gorchov 2000) and negatively impacting wildlife (Ingold & Carycroft 1983; Schmidt & Whelan 1999). In addition to providing the first time-limited semi-comprehensive inventory of flora and fauna in the city, the 2016 bioblitz data provide a baseline of some species that are present. This may aid in future studies that examine the response of flora and fauna to riparian restoration efforts. The waterways were also selected for study because they and their riparian borders may serve as corridors for wildlife.

BRIEF HISTORY OF THE WATERWAYS OF INDIANAPOLIS

The study areas on the creeks were located along parkways on city-owned land. The parkways were all part of the historic Kessler Plan of the early 1900s. This plan created a series of linear parks and associated roads, with the goal of improving water quality in the creeks, while providing greenspace and parks to city dwellers (Diebold 1994). The three creeks are tributaries of the White River, part of the Mississippi River system. All are impacted by typical factors affecting urban streams, including high loads of contaminants such as *E. coli* and agricultural chemicals from farming in areas north of the city (City of Indianapolis 2006). These problems are exacerbated by combined storm water and sanitary sewer lines with overflow outlets that feed directly into the creeks during heavy rains. Infrastructure improvements are currently underway that will greatly reduce the frequency of overflow events in the future.

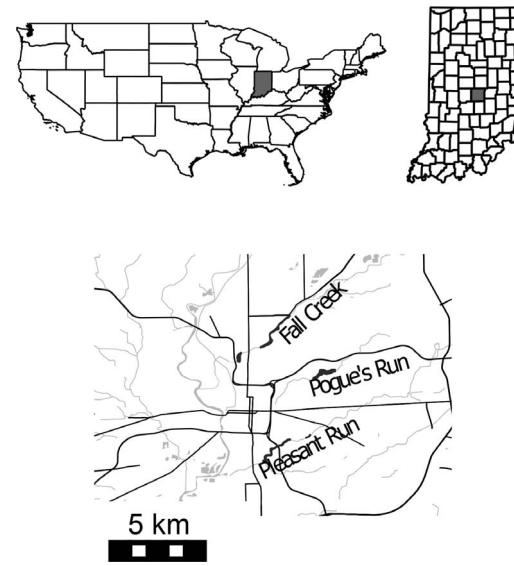


Figure 1.—Map of bioblitz locations within the city of Indianapolis with insets showing the locations of Marion County within Indiana and the State of Indiana within USA.

SUMMARY OF METHODS AND RESULTS

This bioblitz used the efforts of 50 taxonomic experts and students and 25 citizen volunteers to survey the diversity of 14 different taxonomic groups over a 24 hr period, from 5:00 P.M. on September 16 to 4:59 P.M. on September 17, 2016. Five hundred ninety different taxa (species or genera) were found (Table 1). All efforts were hampered by nearly 4 cm of rain that fell during the period. The complete lists of species and detailed site maps have been archived on the Indiana Academy of Science (IAS) website at https://www.indianaacademyofscience.org/resource-center/bioblitz-events-data. The event concluded with taxonomic teams reporting their preliminary results, followed by refreshments at a local brewery. A short video documenting the bioblitz can be viewed at: http://ourwaterways.org/indy-urban-bioblitz/ and through the IAS archive.

Bees.—Twenty species, approximately 5% of the Indiana bee fauna, representing all five common bee families in Indiana were collected during the survey. Bees were collected using passive (bowl trapping) and active (netting at flowers) sampling techniques. Three areas were sampled, Pogue's Run, Fall Creek, and Pleas-

Table 1.—Summary of the 590 taxa reported at the 2016 Indy Urban Bioblitz, Marion County, Indiana, USA.

Team	Leader	Taxa observed
Bees	Robert Jean	20 species; mostly common; only 1 non-native species; relatively intact native bee fauna
Beetles	Jeffrey Holland	16 taxa (species or genera); all common
Birds	Roger Hedge	58 species; state endangered osprey and 4 species of concern in Indiana
Butterflies	Kirk Roth	21 species
Dragonflies & damselflies	Tom Swinford	5 species
Fish	Brant Fisher	40 species, none state-listed; for 4 species, documentation of their most upstream tributary in the West Fork White River drainage
Freshwater mussels	Brant Fisher	23 species; only 5 native species; shell material of 2 federal/state endangered freshwater mussels and 3 state species of special concern; invasive zebra mussel and Asian clam present
Fungi/mushrooms	Nick Harby	33 taxa; all common
Herpetofauna	Michael Finkler	6 species (4 turtles, 1 anuran, 1 snake); all common
Mammals	Jeremy Sheets	17 taxa (5 bats, 12 terrestrial mammals); state listed evening bat and proposed for federal listing tricolored bat; *Myotis* sp. could be a federally listed one; mammals all common
Mosses & lichens	Bill McKnight	10 species (7 mosses, 3 lichens); all common
Singing insects	Carl Strang	31 species; mostly common; a katydid species at the northern edge of its distribution and one at its southern edge
Spiders	Marc Milne	37 species; all common; hampered by weather
Vascular plants	Paul Rothrock	275 species, none rare or endangered, 26% non-native and no high C-value species, but good diversity of trees

ant Run. Each area was sampled with a single transect of 30 bowls (ten white, ten fluorescent blue, and ten fluorescent yellow) for a total of 90 bowls across the Indianapolis Urban Bioblitz focal area. Bowls were separated by 5 m along each transect. Approximately 10 hr of net collecting was performed by the team on several flowering species at Pleasant Run. Net collections were not performed at Pogue's Run and Fall Creek due to the lack of floral availability. Overall floral diversity was very low and bee activity was modest.

Sweat bees in the family Halictidae represented a large portion of the species richness (10 spp.) and much of the bee abundance (41%). Only two bumble bee species were collected, *Bombus impatiens* and *B. griseocollis*, with the former being much more common and the latter represented by a single specimen. In general, most of the bees encountered were common species and expected in collections throughout the state. Interesting species include *Lasioglossum anomalum*, which is very small sweat bee often associated with prairies and grasslands and *Lasioglossum platyparium*, a cuckoo bee that parasitizes other bees. The European honey bee (*Apis mellifera*), the only non-native bee collected, was the most common bee species, representing over 18% of total specimens. At the same time, with only one introduced species (5% of total species collected), Indianapolis seems to have a relatively intact native bee fauna.

These collections provide baseline data of the bee species richness and relative abundance and demonstrate the importance of corridors for bee conservation and habitat. Further management to increase native wildflower diversity and reduce invasive plant species will likely enhance bee populations and thus local pollination and ecological services. Collections in these areas earlier in the year would likely add many species since solitary bees are highly seasonal and some social bee species are only active until mid-late August. Voucher specimens are housed in the Environmental Solutions & Innovations, Inc. (ESI) entomology collection in Indianapolis.

Beetles.—The beetle crew consisted of four people. They spent approximately 40 person-hours searching for beetles with sweepnets, beating sheets, and hand collecting. On Friday evening, a 1000 W metal halide light, a 175 W mercury vapor light, and a small UV light were run for three hr to attract beetles. Sixteen beetle species from 10 families were found. This extremely low number of species was the result of very heavy rains Friday evening. In addition, urban habitats contain lower diversity of habitats and vegetation than more natural settings. However, the small semi-natural areas along the waterways likely do contain hundreds of beetle species.

Three of the sixteen species of beetles were exotic species. All of these are well-established and well-known. The most diverse group of beetles collected was from the Carabidae, or the ground beetles. These are active running species whose activity was likely less impacted by the weather than the beetles that fly more often. The ground beetles were quite active at the lights, darting across the white sheets under the lights to seize prey insects that were attracted to the lights. Several beetle specimens were prepared for identification during the event to allow viewing by participants (Fig. 2). Beetle species were identified by JDH. Voucher specimens of all beetle species have been deposited in the Purdue Entomological Research Collection.

Birds.—Twelve participants surveyed birds using binoculars and occasional owl audio recordings and were divided equally among the three pre-selected sites. A fourth unit, the Pogue's Run Art and Nature Park, approximately 0.60 km northeast of Brookside Park and immediately south of I-70, was also surveyed because it offered a series of artificial wetlands consisting of open water, marsh, and shrub swamp that are not present in the other sites. Green heron and ruby-throated hummingbird were the only species recorded in this site. Habitats in the originally selected sites consisted primarily of city park lawn with scattered trees and riparian woodland in the midst of urban and residential neighborhoods. Despite the dismal weather (overcast and periodic rain), 942 individuals of 58 species were tallied in 48.75 person-hours.

Incidental observations were received from three additional participants who were focusing on other taxonomic groups. These observations included barred owl (*Strix varia*), peregrine falcon (*Falco peregrinus*), veery (*Catharus fuscescens*), American redstart (*Setophaga ruticilla*), chestnut-sided warbler (*Setophaga pensylvanica*), and black-throated green warbler (*Setophaga virens*). The peregrine falcon was seen near the intersection of Rural Street and I-70. The barred owl was recorded on the evening of 16 September in a nearby neighborhood outside the survey units. Pre-dawn owling on 17 September was met with intermittent rain, making it difficult to attract or hear any owls. In fact, none were recorded, aside from the single barred owl heard the previous evening.

State listed species that were recorded include the state endangered osprey (*Pandion haliaetus*) at Pleasant Run and state special concern red-shouldered hawk (*Buteo lineatus*) at Brookside Park, common nighthawk (*Chordeiles minor*) at Fall Creek, peregrine falcon (I-70 and Rural St.), and black-and-white warbler (*Mniotilta varia*) at Brookside Park (Division of Fish & Wildlife 2015). A couple of migrants that were somewhat unusual were recorded because of their relatively early and late seasonal occurrences, i.e., yellow-rumped warbler (*Setophaga coronata*) and Baltimore oriole (*Icterus galbula*) respectively (Brock 2006). The nomenclatural authority used for birds was Chesser et al. (2016).

Butterflies.—Butterfly observations during the bioblitz likely under-represent their actual diversity due to rainy conditions during the survey causing butterflies to be less active. Nevertheless, 224 individual butterflies of 21 species were detected. Two sulphurs (*Colias* sp.) that were unable to be identified to species also were seen. The most abundant species were the tawny-edged skipper (*Polites themistocles*) with 47 individuals detected and the pearl crescent (*Phyciodes tharos*) with 45 individuals detected. Both of these are common species of fields and edge habitats. Other well-represented species include cabbage white (*Pieris rapae*) with 33 individuals, Peck's skipper (*Polites peckius*) with 21 individuals, clouded sulphur (*Colias philodice*) with 16 individuals, and orange sulphur (*Colias eurytheme*) with 13 individuals. However, there were fewer observations of the larger species of butterfly, for example, only seven individual monarchs (*Danaus plexippus*) were found, and the single observation of a swallowtail was a black swallowtail (*Papilio polyxenes*) at the Fall Creek Trail.

The Garfield Park Gardens showed the most diversity (14 species) and abundance (67 individ-













Figure 2.—Beetle team leader Jeffrey Holland preparing specimens. Photo by Mark Kesling.

Figure 3.—Dragonfly wandering glider (*Pantala flavescens)* seen at Pogue's Run. Photo by Mark Kesling.

Figure 4.—Shorthead redhorse (*Moxostoma macrolepidotum*) from Fall Creek. This occurrence represents the most upstream tributary in the West Fork White River drainage in which the species has been found. Photo by Brant Fisher.

Figure 5.—Camera trap photo of red fox provided by Julia Angstmann.

Figure 6.—Spider team leader Marc Milne extracting spiders from litter sample. Photo by Mark Kesling.

Figure 7.—Plant Team leader Don Ruch, Adam Rickert of the Marion County Health Department, and students from Ball State University. Photo by Mark Kesling.

uals) with Brookside Park having similar butterfly numbers (12 species and 65 individuals). However, this may be an artifact of the sampling time—Garfield Park Gardens was sampled repeatedly during differing weather, while Brookside Park was searched after the rain had largely stopped and sun was beginning to warm the ground. As may be expected, Garfield Park Gardens has a diversity of nectar sources. Most of the butterflies at Brookside Park were found nectaring on red clover (*Trifolium pratense*) in patches of the meadow which had not been recently mowed.

Dragonflies and damselflies.—Five species of Odonata were documented during the bioblitz. Heavy precipitation throughout the sample period greatly diminished the ability to characterize the odonate fauna. Adult odonate flight activity is greatly curtailed under persistent storm conditions of rain, wind, and darkness. Benthic and vegetative sampling of larval stream odonates was next to impossible with dangerously flooded creeks. No ponds were sampled for larval odonates. Three sites were sampled: Garfield Park (Bean Creek and adjacent mowed and landscaped areas); Brookside Park (forest edge, mowed areas, stormwater retention basin, and some aquatic sampling of Pogue's Run), and Spades Park (prairie plantings adjacent to Pogue's Run).

At Garfield Park, *Aeshna umbrosa*, shadow darner, was observed making foraging patrols in a linear mowed area along Bean Creek. The same species was collected at Spades Park foraging in an open mowed lawn approximately 30 m from Pogue's Run near a prairie planting. *Aeshna umbrosa* is a species known for crepuscular activity and this may explain its presence on such a dark and dreary day.

In the large open retention pond area of Garfield Park, *Pantala flavescens*, wandering glider, was the most abundant dragonfly of the day (Fig. 3). Seven were observed flying in a loose swarm during a lull in the rainfall.

Four larval *Calopteryx maculata*, ebony jewelwing, were taken from Pogue's Run at Brookside Park. These large damselflies are tolerant of relatively impaired streams. One *Libellula luctuosa*, widow, was seen at Garfield Park. One *Ishnura verticalis*, eastern forktail, was observed in a small pond at the Children's Garden at Garfield Park Conservatory.

Fish.—A total of 40 species of fish was found from the six sites sampled in Pogue's Run (1 site), Pleasant Run (2 sites), and Fall Creek (3 sites). As might be expected, species diversity increased as drainage area increased. Ten species were collected from Pogue's Run, 22 from Pleasant Run, and 38 from Fall Creek. Two species not collected from Fall Creek but found elsewhere were white sucker (*Catostomus commersonii*) and blackside darter (*Percina maculata*). Six species were collected from all six sites sampled: central stoneroller (*Campostoma anomalum*), yellow bullhead (*Ameiurus natalis*), green sunfish (*Lepomis cyanellus*), bluegill (*L. macrochirus*), and largemouth bass (*Micropterus salmoides*). All six of these species are common statewide. Eleven other species were collected from five of the six sites sampled. Only five species were collected from a single site: bullhead minnow (*Pimephales vigilax*), golden redhorse (*Moxostoma erythrurum*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), and blackside darter. Even though seemingly rare during this survey, all are common statewide and are probably more common in the streams sampled than the survey indicated. No state listed fish species were collected from the three streams surveyed and the fish communities present are typical for tributaries of the Middle West Fork White River drainage. Interestingly, for four species, bullhead minnow, shorthead redhorse (*Moxostoma macrolepidotum*), spotted bass (*Micropterus punctulatus*), and dusky darter (*Percina sciera*), the Fall Creek drainage represents the most upstream tributary in the West Fork White River drainage in which they are found (Fig. 4).

Freshwater mussels.—Evidence of 21 native species of freshwater mussels and two nonnative mollusks was found from the six sites sampled in Pogue's Run (1 site), Pleasant Run (2 sites), and Fall Creek (3 sites). Similarly to the fish diversity, freshwater mussel diversity was greatest in Fall Creek, where evidence of 21 species was found. A few unidentifiable old shell fragments were found in Pogue's Run, while shell material of only one native species was found in Pleasant Run. Unfortunately, a once very diverse mussel community from Fall Creek in the stretch sampled is now relegated to only five live species: mucket (*Actinonaias ligamentina*), plain pocketbook (*Lampsilis cardium*), fatmucket (*L. siliquoidea*), fragile papershell (*Leptodea fragilis*), and lilliput (*Toxolasma parvum*). All are common statewide. Interestingly, the only known fish host

for reproduction of the fragile papershell is the freshwater drum (*Aplodinotus grunniens*), which was not collected during fish sampling, but is undoubtedly present in Fall Creek.

Two non-native mollusks, Asian clam (*Corbicula fluminea*) and zebra mussel (*Dreissena polymorpha*), were collected during the survey. Both are thriving in Fall Creek; Asian clam was also found live in Pogue's Run. The zebra mussel population in Fall Creek is a direct result of its inhabitation of Geist Reservoir further upstream in the watershed. Shell material of two federal and state endangered freshwater mussels (snuffbox (*Epioblasma triquetra*) and clubshell (*Pleurobema clava*)) and three state species of special concern (wavyrayed lampmussel (*Lampsilis fasciola*), kidneyshell (*Ptychobranchus fasciolaris*), and little spectaclecase (*Villosa lienosa*) was collected, but none are still found live in the Fall Creek drainage.

Fungi.—Thirty-three taxa were documented, 27 were identified to species. The fungi seen at the Garfield Park/Pleasant Run location were not unusual; one might expect to find any of these species in such a setting throughout Indiana. The antler form of *Ganoderma sessile* (Reishi) was encountered popping up in the lawn at one place in Garfield Park. The shelf-like form of *G. sessile* is normally more commonly seen in Indiana. The team did not survey Fall Creek or Pogue's Run.

Herpetofauna.—The amphibian and reptile group conducted surveys on the Fall Creek and Pogue's Run sites. Baited turtle traps were placed in Fall Creek at various locations along its west bank, and team members visually searched and sampled under cover objects in the riparian habitat, wooded, and woodland edge habitat at both sites. Anurans were identified by call. The combined effort at the two sites totaled approximately 38 person-hours and 14 trap-days.

In total, 11 reptiles and amphibians representing six species were observed. Six turtles representing three species were observed in Fall Creek (*Graptemys geographica*, *Sternotherus odoratus*, and *Trachemys scripta*). One species of turtle (*Chelydra serpentina*) and one species of anuran (*Lithobates clamitans*) were observed at Pogue's Run. In addition, members of another survey group observed one snake (*Nerodia sipedon*) at the Garfield Park site. All six species are common in central Indiana. Both the abundance and diversity of reptiles and amphibians observed during the bioblitz was less than expected. This likely was due, in part, to the cool, rainy weather and high water levels at the time of the survey which would have curbed basking behavior. It is likely that actual abundance is considerably higher, and that other common species of turtles, snakes, and anurans inhabit these sites. Indeed, the species observed likely represent less than half of the species inhabiting these sites.

Mammals.—Eight Anabat SD2 bat detectors (Titely Scientific) were placed along forested or riparian commuting and foraging flyways (four at Fall Creek, two at Pogue's Run, and two at Pleasant Run) for a single night. Ultrasonic microphones were placed on a ten foot pole and connected via cable to the waterproofed detector. The detectors were programmed to begin recording one half-hour before sunset and end one half-hour after sunrise. A total of eight detector nights were completed recording 14,880 audio files. The audio files were analyzed using BCID (version 2.7d, Bat Call Identification C. Ryan Allen, Bat Call Identification, Inc.), an automated acoustic identification software, which identified 90 bat passes and removed the bulk of audio files that where not produced by bats (99.4%). The identified bat passes were then visually analyzed in AnalookW (Titley Scientific) to confirm the identification of each bat pass. Based upon these audio files, four bat species were identified: big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), tricolored bat (*Perimyotis subflavus*), and evening bat (*Nycticeius humeralis*). Additionally, one genus (*Myotis*), and six unknowns (poor quality passes) were detected. There also were 16 recordings not made by bats (noise). The *Myotis*, evening and tricolored bat recordings are of interest. Two of the three potential *Myotis* are federally listed, the tricolored bat is being considered for federal listing, and the evening bat is state-endangered.

A total of ten species of mammals in addition to the bat species recorded were identified by sight or sign during daytime meander surveys: Virginia opossum (*Didelphis virginiana*), red squirrel (*Sciurus vulgaris*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), groundhog (*Marmota monax*), fox squirrel (*Sciurus niger*), eastern mole (*Scalopus aquaticus*), North American beaver (*Castor canadensis*), eastern cottontail (*Sylvilagus floridanus*), and human (*Homo sapiens*). Many mammal signs such as feces, prints, burrows, etc., determined presence only and could not differentiate

between individuals. Many small mammals such as shrews and rodents likely occur in relative abundance, but are difficult to observe without additional forms of sampling such as snap, pitfall, or Sherman trapping. Small carnivores (e.g., foxes and skunks) were absent from the survey likely due to their nocturnal behavior and secretive lifestyles.

Two additional mammal sightings (red fox and domestic cat) were provided by Travis Ryan using camera traps deployed in bioblitz survey areas as part of an ongoing study being conducted by Butler University faculty and staff (https://www.butler.edu/cue/IWW). Each camera was mounted on a tree at approximately breast height and a fatty acid scent lure (USDA Pocatello Supply) was affixed to another tree within 8–10 m of the camera's field of view. Cameras were set to capture images when triggered by motion at a rate of not more than one image every 30 s. To minimize disturbance of wildlife in the area, the cameras were mounted at least 48 hr prior to the start of the bioblitz and removed once the observation period ended. Cameras were placed at densities of approximately 3 per ha. All images captured were reviewed and wildlife during the bioblitz time period were identified to one of seven species: red fox (Fig. 5), raccoon, opossum, fox squirrel, groundhog, domestic cat (*Felis silvestris catus*), and human. Coyote, domestic dog (*Canis lupus familiaris*), gray squirrel (*Sciurus carolinensis*), and white-tailed deer (*Odocoileus virginianus*) where seen the day just before and just after the bioblitz.

Mosses and lichens.—Samples of mosses and lichens were collected by the plant team for later identification by Bill McKnight. Seven mosses and three lichens were documented. All are very common in central Indiana.

Singing insects.—Twenty-seven species of singing crickets, katydids, cicadas, and grasshoppers were found on the three sites combined. Four additional species outside those groups were photographed at the beetle team's light station following the opening night event. Most of the species observed are common and expected in these habitats. A few are worthy of additional notes.

Green-striped grasshopper (*Chortophaga viridifasciata*): This is primarily a spring to early summer species. It can have two seasonal generations in the south, and the one found at Brookside Park suggests that such may be the case as far north as Indianapolis.

Japanese burrowing cricket (*Velarifictorus micado*): The loud chirping series produced by this introduced species were the dominant singing insect sounds everywhere surveyed in Indianapolis. This Asian cricket has spread outward from its introduction site at Mobile, Alabama, often transported in landscape materials.

Agile meadow katydid (*Orchelimum agile*): This southern species was found recently at Buzzard's Roost Nature Center in Ohio, at a latitude slightly south of Indianapolis. Photographs and a sound recording taken in a little meadow area along Pleasant Run best fit this species.

Dusky-faced meadow katydid (*Orchelimum campestre*): A surprisingly dense population was heard in the small patches of cattails, grasses, and sedges in the end of the disc golf course at Brookside Park. Dusky-faced meadow katydids have become locally distributed in northern Indiana, apparently because they are intolerant of invasive species (hybrid cattails, reed canary grass, *Phragmites*, and purple loosestrife). The authors do not know their status in central and southern Indiana.

Spiders.—The Indianapolis bioblitz spider team was considerably hampered by the weather on the collection date. Throughout the day, the spider team attempted to collect spiders through intermittent rain showers—a difficult experience when depending on dry equipment for efficient collection (Fig. 6). After approximately 25 person-hours of sampling, only 37 species were found, most of which are considered common or abundant in Indiana. Most of the specimens were immatures that could not be identified to species.

We suspect that Indianapolis has much greater spider diversity than what was recorded during this event

Vascular plants.—The plant team consisted of three subteams of 4–5 members each. One subteam led by Ben Hess surveyed Pogue's Run, the second led by Don Ruch (Fig. 7) surveyed Garfield Park, and the third led by Paul Rothrock surveyed the Fall Creek site.

Pogue's Run had 202 species, of which 144 were native (Table 2). This richness of species, greater than either Garfield Park or Fall Creek, can be attributed to the broad range of habitats encountered. These included degraded upland forest and riparian corridor, man-made detention basin, prairie planting, and turf. Pogue's Run also had the highest mean C-value (see Swink & Wilhelm

Table 2.—Floristic metrics for three Indianapolis bioblitz sites. MC = mean C-value.

Site	Number of native species	Total number of species	Native MC	Total MC
Fall Creek	102	142	2.4	1.7
Garfield Park	75	129	2.1	1.2
Pogue's Run	144	202	3.1	2.2

(1994) for details on C-values and Floristic Quality Assessment) at 3.1 for native species, the result of tree plantings and a prairie planting. The former included *Magnolia macrophylla*, the latter included *Bouteloua curtipendula, Potentilla arguta, Silphium integrifolium, Solidago riddellii, Solidago rigida, Symphyotrichum laeve,* and *Zizia aurea*. Among likely spontaneously occurring species the most notable were trees such as *Cornus alternifolia, Fagus grandifolia,* and *Quercus schumardii*; shrubs included *Ribes americana*. No high C-value (i.e., C > 6) herbs were observed but *Silphium perfoliatum* was locally common. Other noteworthy species included *Scrophularia marilandica* as well as monocots such as *Maianthemum racemosum* and a variety of grasses. Some invasive or potentially invasive species were common, at least locally: *Acer platanoides, Euonymous fortunei, Lonicera japonica, Rhamnus cathartica, Rosa multiflora, Ulmus pumila,* and *Viburnum opulus*.

At Fall Creek two areas were particularly inspected for their species content—the southern end in vicinity of 30th Street and the northern end north of the Monon Trail. The area near 30th Street had a narrow riparian zone and steep degraded woods. Thanks to recent efforts, however, it was relatively free of invasive species and had lush stream-side vegetation. The northern area was a broader floodplain forest and had numerous characteristic species, but it also had an abundance of the invasive *Euonymous fortunei*. Overall 142 species were observed in the Fall Creek riparian corridor. Of these 102 were native (Table 2). The trees included *Acer negundo, A. saccharinum, Celtis occidentalis, Platanus occidentalis,* and *Populus deltoides*. Common herbs included *Calystegia silvatica, Cinna arundinacea, Impatiens capensis, Solidago gigantea,* and *Verbesina alternifolia. Fallopia scandens* was particularly abundant. Aside from *E. fortunei, Clematis terniflora* was a second invasive of concern. Mean C for the area was 2.4 (for native species) and reduced to 1.7 with the inclusion of non-native species. Not surprisingly, no native species had a C-value > 6.

Garfield Park and Pleasant Run had rather limited natural habitat. Pleasant Run was often at the base of a steep slope with a narrow woodland border. As one might expect, this site had the fewest native species (75 species). Of note, however, is the presence of 30 native tree species. Common hardwood species included *Acer saccharinum, Celtis occidentalis, Fraxinus americana,* and *Quercus rubra*. Among the infrequent trees were *Acer saccharum, Quercus muehlenbergii*, *Q. palustris, Liriodendron tulipifera, Tilia americana,* and *Ulmus rubra*. The native vine *Menispermum canadense* also was common. Collectively these tree species suggest that Garfield Park contains a significant urban forest.

In Garfield Park, the remaining native species were those characteristic of early successional habitats (e.g., *Ambrosia* spp. and *Symphyotrichum pilosum*). These also include a few from more hydric habitat (e.g., *Bidens frondosa*, *Symphyotrichum* spp., and *Vernonia gigantea*). Over 40% of species at Garfield Park were non-native. While most were innocuous, common or abundant problematic species included *Lonicera* spp., *Alliaria petiolata, Clematis terniflora,* and *Humulus japonicus*.

Overall plant summary: The three Indianapolis parks had a total of 275 vascular plants species of which 62 species (26%) were non-native. None of the species are on the state rare-threatened-endangered list and high C-value species were lacking. Nonetheless, a richness of species and of tree species was observed and, based upon their structure and density of vegetation, portions of the riparian zones provide valuable ecological services.

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