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Trials of the urban ecologist

A group of scientists describe some of the obstacles encountered and insights gained while carrying out ecological research in and around the city of Indianapolis.

We are out with student interns from Butler University's Center for Urban Ecology (CUE) in a downtown Indianapolis neighborhood, listening carefully and scanning the area with binoculars, when a loud voice abruptly cuts through the early-morning calm from a nearby front porch. "What are you looking at?", and, after a pause, even louder, "BIRDS?" This is followed by flap, flap, flap, as our startled quarry fly off. Sigh. We wait for 20 or 30 minutes for the birds to settle again before resuming our observations. A typical urban ecology field experience.

For the first time in history, more than half of the world's human population lives in cities (UNFPA 2007). While constituting less than 3% of the Earth's surface (Grimm *et al.* 2008), urban regions are expected to triple in coverage area from 2000 to 2030 (Seto *et al.* 2012). Cities are understudied ecosystems where repeated human disturbance rarely allows ecological equilibriums to develop, and where the rules and paradigms developed through the study of wildland environments often don't apply. Urban ecosystems may be one of the final frontiers of ecological exploration. The complex coupling of human and non-human activities in urban areas requires a transition from the traditional approaches used to study ecology "in" cities to studying the ecology "of" cities, where humans are considered to be fully integrated components of the urban ecosystem.

Researchers at CUE have been exploring the ecology of Indianapolis, the 12th largest city in the US, for the past 10 years (Figure 1). Because we learned our trade in remote locations (eg the Rocky Mountains, Southern Appalachians, Vancouver Island) or those with few human inhabitants (eg Savannah River Site in South Carolina), we continually have to adjust our field techniques to adapt to the unique challenges of working in highly populated urban environments. There are distinctive urban perils: large dogs that threaten both researchers and focal biota, curious residents drawn to conspicuous sampling equipment, and unexpected habitat conversion by bulldozer, all of which disrupt experimental designs and provide daily reminders that our ecological evaluations are inextricably linked to human activities. During the past decade, we've conducted basic research in the city, working with neighborhood communities throughout Indianapolis and partnering with other urban institutions, all of which have presented challenges but also unanticipated rewards.

One way we've studied the city is to simply explore and monitor the spaces around us. We use the urban environment as a convenient field site, one located right outside Butler's back door and a mere 5 miles from the center of downtown Indianapolis. For example, as part of a series of



Figure 1. Marjorie Hennessy, Shelby Johnson (student), Rebecca Dolan, Sarah Strobl (student), and Travis Ryan (from left to right) take a break from their research.

demographic and movement pattern studies, we've been trapping and marking turtles in the Indianapolis Central Canal, which runs through the city (Figure 2). Early on, traps were often stolen or vandalized, and captured turtles were sometimes set free by well-meaning passersby. Nowadays, signs bearing the CUE logo explain the research, student assistants wearing CUE-logo t-shirts talk with interested folks walking along the canal's towpath, and articles in local neighborhood association newsletters recruit citizens to report sightings of turtle nests; these measures have led to reduced human interference with the traps. Data collected from the projects have formed the basis of the scientific evidence on turtle nesting preferences that influenced management of the canal; as a result, rather than implementing plans to stabilize the eroding banks of the canal with stone material known as riprap, the contractor overseeing canal-bank stabilization incorporated turtle basking habitat and used native plantings to help local turtle populations thrive. This was in direct response to public outcry over the original designs that neglected to accommodate the needs of their newly appreciated shelled friends. In this case, combining science with public awareness led to a transformative outcome.

Another way we've developed CUE projects is through cooperation with neighborhood organizations. For example, a near-eastside neighborhood was selected by the National Football League's Super Bowl organizing committee (in association with the 2012 Super Bowl, held that year in Indianapolis) to be a special focus for urban renewal, including the establishment of community gar-

dens and small parks landscaped with native plants. We worked with Butler faculty to quantify the expected increase in use of restored vacant urban lots by desirable wildlife. We monitored birds, arthropods, amphibians, reptiles, mammals, and plants in several neighborhood lots. Although the neighborhood was in need of revitalization, new construction was only beginning to take place. We met with the community development corporation to identify lots not intended for the designed plantings for use as control sites and established treatment sites on lots where the green infrastructure would be installed. On initial examination, things looked promising; the control sites were nearby and easy to access, and there was only a stray cat or two to contend with. A follow-up survey a few months later was a different story. At first we thought we were on the wrong street, but we quickly discovered that our control site had been excavated to form the basement of a new house. Additionally, it turned out that the local residents really liked plywood. We had left numerous sheets of it to weather and age in place, to mimic the natural downed wood that provides a haven for salamanders, toads, and other herpetofauna; unfortunately, the boards had disappeared, even though marked with CUE branding. So it goes in urban ecology research.

A third type of project involves partnering with organizations that work city-wide. For instance, as part of its efforts to beautify the city and make it more livable, a local non-profit organization, Keep Indianapolis Beautiful (KIB), selected interstate highway exits between the airport and downtown Indianapolis as sites for landscaping and art installations. Native vegetation was planted at the exits by 6000 employee volunteers during Eli Lilly and Company's annual Global Day of Service in 2010, replacing the standard mix of turf and weeds maintained by the Indiana Department of Transportation. CUE researchers agreed to follow the development of habitat at the exits, again through the monitoring of plants and our suite of animals. Communications between the highway department's mowing crews, landscape companies maintaining the native plants, and KIB proved challenging: areas sown with native plant seeds (to provide understory) that were not meant to be mowed were – you guessed it – consistently mowed. This complicated identifying plants and performing other sampling activities to evaluate the planting treatment impacts. Announced schedules for mowing turf were not followed, so that Sherman traps set for small mammal catch and release often looked as if they had been run over by a steamroller. In the city, even with the best intentions, the institutions that design public spaces often hire subcontractors or management companies who may not be in tune with the project team and have little incentive to modify their practices.

We've learned many lessons from these projects, from the practical – always carry a clipboard to exude authority – to the personal – gaining a deeper appreciation of what



Figure 2. Travis Ryan (right) demonstrates how to handle a snapping turtle for students and a passerby on the towpath that runs alongside the Indianapolis Central Canal.

it means to be teachers, as we share our research directly and indirectly with urban residents. We value formal communication of our science through journal articles and conference presentations, but increasingly we must recognize the importance of creatively extending communication through informal science outlets in the city to more fully engage with local people. Translating the science of ecology using the arts as well as design fields such as architecture and landscape architecture holds great promise for improving the dissemination of our findings among non-scientists. Another lesson involves an awareness of how quickly urban environments can change; the pace of change (eg abandoned lot one day, excavated basement the next) is quite different from that encountered when doing research in laboratories or wildlands. The mismatched rates of change between ecological and social systems re-emphasize the unique context that the urban ecosystem provides. Finally, urban ecology fieldwork has offered an opportunity to get “up close and personal” with places we've driven past a thousand times before getting out and really looking at what grows and lives there. If you're one of the 50+% who live in cities, you should give it a try.

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