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# Scientists and the city

western roundup - August 20, 2007 *by Petra Spiess*

## **Urban ecology studies in Phoenix teach lessons for the West's arid metropolises**

Behind a large, luminous lake stretches an emerald lawn fringed by tall date palms. Nearby, other expanses of green grass and bright tropical flowers surround stately homes, shaded by eucalyptus trees. It's hard to believe this is the Sonoran Desert, an area that receives only 7 inches of rain a year. Except for the fact that it's 103 degrees. In May. This lush landscape is located in Scottsdale, Ariz., a suburb of Phoenix, but you'd never guess it was anywhere near that famously arid metropolis.

A 15-minute drive into less affluent South Phoenix, however, makes the desert much more apparent. Lawns vanish, replaced with expanses of rock mulch and the occasional cactus. Open spaces here aren't filled with lakes and lawns and trees; they're dotted by creosote bushes and covered with dirt.

Socioeconomics determines a lot about our environment: what kind of housing we live in, how far we have to commute to work, the quality of our children's schools. In cities like Phoenix, however, it also determines how hot you're going to be: Researchers at the Central Arizona-Phoenix Long Term Ecological Research project at Arizona State University have found that wealthier neighborhoods are cooler - literally. Affluent neighborhoods, such as those in Scottsdale, can be as much as 13 degrees Fahrenheit cooler than poorer neighborhoods. In an area that routinely reaches hellish triple digits in the summer, every degree counts.

Research like this is part of the relatively new field of urban ecology, the study of how urbanization affects interactions between the living and non-living components of a city. Thanks to a grant from the National Science Foundation, Phoenix - the fifth-largest city in the nation and still growing like mad amid a fragile desert ecosystem - is one of urban ecology's busiest study sites. Researchers here are discovering insights about urban ecology that they hope will apply to other cities in the West, and to arid urban areas around the globe. "I think

we're providing a new range of information for people making decisions," says Charles Redman, co-director of the project, "all the way from the individual house owner to homeowners' associations to town planners."

**Traditionally, ecologists have focused** on areas far from human influence. But by next year, for the first time in human history, more people will live in cities than not. Ecologists increasingly recognize that they have scant understanding of how urban systems influence larger ecological processes, such as climate change, or how the seemingly mundane actions of residents - such as their choice of landscaping - affect the surrounding environment. For instance, the Phoenix researchers found that native birds prefer drought-tolerant trees while alien bird species prefer water-dependent trees. So xeriscaping not only saves water and money, it also creates habitat for native desert birds within the city.

The researchers' project uses all of metropolitan Phoenix, population 1.5 million, as its laboratory. "This world we live in is becoming increasingly influenced, if not dominated, by the activities of people," says Redman. "If we are going to work to make this world sustainable well into the future, then we have to understand how humans at all different levels of intensity influence their surroundings and each other."

Conducting field research in high-density areas presents some unique problems. Ecologists usually choose random locations to collect information on whatever they're studying - but when your study site is a major city, those random plots can wind up in some weird places. "It's led us to some interesting, if not perverse locations," Redman says. The program's researchers have found themselves in the middle of Sky Harbor Airport and on freeways, for example, trying to take soil samples through several inches of asphalt.

**Because of the nature of the ecosystem** it's investigating, the project must include another area of study that traditionally has had little to do with ecology: sociology. "We aren't going to change human interaction with the environment if we don't understand how people see the environment and how they value aspects of it," Redman says.

Human actions drive ecological processes, which in turn have strong effects on human health, comfort and resource use. Those effects often correlate to social factors, such as race or income. For instance, lush landscaping cools the surrounding environment - but it's expensive. "We

found this relationship across the Valley, that every \$10,000 increase in median household income lowers the temperature by a half degree F. People essentially buy cooler microclimates," says Sharon Harlan, an associate professor of sociology at Arizona State University who conducts research for the project.

Another study examined how socioeconomic factors and environmental pollution affected childhood asthma in Phoenix. Researchers found that children in a low-income Latino neighborhood had asthma at twice the national rate; asthma hospitalizations were concentrated in areas with high minority populations. Many low-income minority neighborhoods in Phoenix and other Western cities are located near pollution sources, an environmental hazard that's often a legacy of past racism. "Sociologists have traditionally studied the social inequalities that arise from an urban society, in education, in jobs, but we are now starting to look at the environmental inequalities that arise from that," Harlan says.

**Humans also cause drastic inequalities** in animal populations. The two patterns common to most of the world's cities, says Eyal Shochat, a research associate with the project, "are an increase in population size and at the same time a decrease in species richness compared with the wildlands." For instance, even though birds are more abundant in the city, a handful of species are responsible for most of the urban bird population. One study found 27 different bird species living within Phoenix, but 42 in the surrounding desert. Similar patterns also occur in ground-dwelling insects, Shochat says. "It's very extreme. The proportion of wolf spiders increases from 8 percent in the desert to 80 percent in the city."

The creatures that dominate in the city often are exotic introductions, such as the European house sparrow. These invasive city slickers are better able to take advantage of the high food and water availability in urban areas, and they muscle out the natives. But though the urban birds are tough in their 'hoods, many can't hack it in the rougher wild desert. Urbanization of the desert has created what researchers refer to as a "pseudo-tropical bubble," an island of increased resources that buffers seasonal scarcity.

House sparrows, for example, go from the most populous bird in residential yards to 15th in the desert. Some city birds aren't found in the desert at all, like the peach-faced lovebird, an African import that escaped captivity and now has breeding populations in Phoenix.

Urbanization also reduces predation pressure, Shochat says, even though house cats are often blamed for bird genocide. "There are many native predators that are excluded from the city; at the same time, there are many more domestic predators. I believe the birds we see in the city are the ones who can cope with cats, and those who couldn't are extinct by now." So city-slicker birds aren't just good at exploiting the extra resources we leave around, they're also good at dodging our household bird killers. A few superstars, in fact, excel at both, crowding out other species that might otherwise do well in the city.

**Phoenix may be giving us a glimpse of the future** we've set ourselves up for: Many of the climate changes predicted to happen on a global scale are already occurring in the city. The conversion of lighter desert to dark heat-absorbing roads and buildings has raised average daily temperatures by about 5 degrees F across the entire city, as well as raising nighttime minimum temperatures and decreasing frost events. All that traffic necessitated by Phoenix's sprawling design has resulted in an atmospheric "bubble" of carbon dioxide over the metro area that's twice the global atmospheric mean concentration, as well as significantly elevated levels of atmospheric nitrogen deposition.

Urban ecology research in Phoenix can also give city planners across the arid West ideas for managing the needs of humans and wildlife. It can help planners learn how to obtain the cooling effect of landscaping (good) without excessive water use (bad). And it can help increase bird biodiversity in urban areas. "Many, many more species could basically live in urban habitat, but they don't do so because of competition," Shochat says. Although birds may not necessarily be on city planners' radar, their presence in urban areas is indicative of the larger quality-of-life issues urban ecology helps to explore.

Ten years ago, when the Phoenix urban ecology project was just embarking on its long-term mission, someone asked Redman what he would consider a success for such a venture. His answer: "If there were still birds singing in our city."

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