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INSIDE

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"Science affects the way we think together."
Lewis Thomas

Growing Quality of Life: Urban Trees, Birth Weight, and Crime

R. Mazza

A study in Portland, Oregon, found a relationship between tree cover within 50 meters of an expectant mother's house and a reduced risk of her baby being born underweight. Houses fronted by more street trees experienced lower crime rates than houses without street trees.

"The best time to plant a tree was 20 years ago. The next best time is now."
—Chinese proverb

Choosing a jogging route down a tree-lined street, walking the dog to a neighborhood park, or simply being entertained by the front-yard drama between squirrels and crows: urban trees and green spaces can enhance quality of life for a city-dweller in many ways. Trees also have a measurable economic value. The September 2010 issue of *Science Findings* featured a study in Portland, Oregon, by Geoffrey Donovan showing that a tree in front of a home increased that home's sale price by more than $7,000, and that it also increased the value of the homes around it.

But Donovan, an economist and research forester with the Pacific Northwest Research Station, says the value of urban trees goes beyond dollars and cents.

"Urban residents treasure their trees and green spaces. Each person might articulate a different reason for this, but most would agree that trees can make a neighborhood a more desirable place to live," he says.

Given this premise, Donovan set out to measure just how beneficial trees are to our health, our sense of well-being, and the safety of our homes. He and his collaborators designed two studies in Portland. The first looked for a connection between urban trees and birth outcomes. The second looked at the relationship between urban trees and crime.

IN SUMMARY

City dwellers can find many reasons to value neighborhood trees. Urban greenery provides relief from the built environment that many people find appealing. In fact, a previous study found that a tree in front of a home increased that home's sale price by more than $7,000. Two new studies explore the measurable effects that urban trees and green spaces have on human health and crime rates.

Geoffrey Donovan, an economist and research forester with the Pacific Northwest Research Station, used public health data, crime statistics, tax records, aerial photos, and other information in the two recent studies. He found that women who live in houses with more trees are less likely to have underweight babies. The study on crime revealed a more complex relationship. Larger trees, including trees located near the street, are associated with a lower incidence of property crimes. Larger numbers of smaller trees—especially trees planted near the home, which may provide a screen for burglars—are associated with higher crime.

Cities within the Portland, Oregon, metropolitan area are using this information as they rewrite street tree regulations. Likewise, local crime prevention programs and tree planting advocates are sharing the findings with urban residents.

Donovan's curiosity about possible associations between trees and community well-being was piqued while he was doing field work for the earlier study examining the effect of trees on house prices. As he walked through different neighborhoods, measuring trees, he was struck by the profound difference he felt around homes that had trees compared to those that did not. Although unquantifiable, the presence of trees simply gave a sense of well-being. "I started to think more about trees and their connection to quality-of-life issues," he says.

Donovan recalled a study that looked at trees and their effects on crime in and around public housing projects in Chicago. "But it raised questions for me," he says. "I wanted to approach it differently in studying Portland."

He also recalled a 1984 study that found that patients recovering from gallbladder removal surgery in a room with a view of a natural scene were discharged sooner and required less pain medication than those who recovered in a room with a view of a brick wall. Other studies showed that greenness was associated with lower obesity, morbidity, and mortality, and higher perceived general health.

Although these studies indicated a connection between trees and human health, Donovan thought more could be done. From an economic standpoint, planting trees may be one of the simplest, most inexpensive ways to enhance community well being. Tight budgets, however, mean that city planners and decisionmakers are looking for information that will help quantify the return on urban forestry investments. The two studies designed by Donovan and his colleagues begin to fill this need.

KEY FINDINGS

- Scientists found a positive association between urban trees and birth outcomes. Greater tree canopy cover within 50 meters of the mother's house was associated with a reduced risk of having an underweight baby. Proximity to private open space also appeared to reduce this risk. Past research has shown that exposure to the natural environment can reduce stress levels, so it may be that trees improve birth outcomes through stress reduction.
- Houses fronted with more street trees experienced lower crime rates, as did houses with large yard trees. These results hold for total-crime rates as well as specific property crimes such as vandalism and burglary. Trees may reduce crime by signaling that a neighborhood is well cared for.
- Yards that contained many small trees had higher crime rates, perhaps because small trees and shrubs can obstruct views, making it easier for criminals to hide. Other view-obstructing features, such as fences, were also associated with higher crime rates.

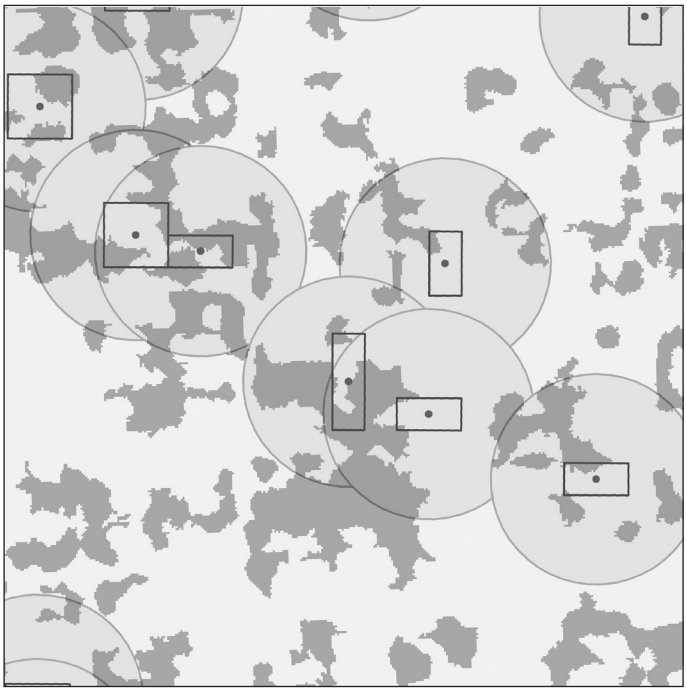
MORE TREES, BIGGER BABIES?

To learn more about the beneficial influences trees have on health, Donovan looked for something that was easy to quantify—something that had a fixed period of time associated with it and that had readily available data. Birth outcomes seemed the natural choice.

Other studies have shown that exposure to the natural environment lowers stress. "You can imagine how trees and stress-reduction might have an effect on a number of health issues," Donovan says. There was no research, however, on the relationship between trees (or any other part of the natural environment) and reproductive health.

He hypothesized that greater access to urban trees would reduce the incidence of preterm birth and underweight newborns (those below the 10th percentile for gestational age and

The researchers used aerial photos and ground-level verification to link tree canopy cover to houses.



Canopy data was then mapped in a way to allow analysis while protecting privacy.

gender). Both factors are major causes of neonatal and infant mortality and contribute to health problems in later life.

Donovan chose to study the effect of trees on birth outcomes because urban trees are an element of the natural environment that can be more readily modified than other natural amenities. It is easier to plant trees in a neighborhood, for example, than to increase the size of parks or other open spaces.

Birth outcomes are also easier to analyze than other kinds of health information. They're simpler than studying heart disease or other ailments that can have numerous causes and may not be detected until years after onset. Births are almost always recorded with very objective data: the size and the weight of the newborn. "And with pregnancy there is a definite beginning and end," he points out.

Donovan collaborated with epidemiologists Yvonne Michael from Drexel University in Philadelphia and Amy Sullivan with the Multnomah County, Oregon, Health Department. With their backgrounds in public health, they were able to help structure the study and compile a list of control variables. To protect privacy, the data were collected in two stages. First, Donovan and his field crew collected the house and neighborhood tree data. These were then sent to Sullivan who combined the data with information from birth certificates, but removed names, addresses, and any other personally identifiable information before returning them to the other scientists for analysis.

The researchers asked the Oregon Public Health Division for the addresses of every single live birth during 2006 and 2007. Donovan chose only addresses in which the mother lived in a detached single-family home. He got records of 5,696 homes overall. Of those, 348 were homes of mothers whose babies were born prematurely (the gestational period was less than 37 weeks), and 397 infants were below the 10th percentile for gestational age and gender. Thirty three of the births fell into both categories.

The next job was to link the statistics with the presence of trees. Using aerial imagery, Donovan was able to measure the amount of tree canopy within 50, 100, and 200 meters of the center of each mother's house.

He also was able to get information about the houses themselves—the number of bedrooms, the type of heating, the presence of air conditioning, the lot size and market value—as a way of gauging the relative affluence of residents. Donovan also gathered data on population density; street connectivity; and distance to parks, commercial districts, freeways, and public transit to measure each home's exposure to urban stress. He included these other factors as a way of assessing if tree canopy (or the lack of it) was independently related to the incidence of low birth weights and preterm births.

The answer was yes and no. He found that mothers who had more canopy cover within 50 meters of their home, or lived closer to private open space, were less likely to have an underweight baby. There was no significant correlation between trees and preterm births, however.

The correlation between canopy cover and birth weight bolsters the findings of previous studies that suggest stress increases the probability of underweight births and that exposure to natural environments reduces stress.

A subsequent study conducted in Barcelona, Spain, also supports this finding. The Spanish study looked at how green spaces affect birth outcomes among different socioeconomic groups. It concluded that green spaces made a positive difference among the poorest, least educated group. Why? Because this group spent more time close to home. If "home" was near a green space, birth outcomes were better.

R. Mazza

Babies whose mothers lived in homes near large trees were less likely to be born underweight.

Purpose of PNW Science Findings

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TREES AND CRIME

Previous studies looking for links between trees and crime have yielded mixed findings. Some studies found that trees and vegetation can increase the fear of crime; others showed that they reduced the fear or occurrence of crime. Donovan had some ideas as to why the studies contradicted each other. For example, there was little or no distinction between large trees and much smaller trees or bushes, or their placement on or near a property.

"Carefully distinguishing between different types of vegetation allowed us to untangle these competing influences," he says. He hypothesized that trees influence crime, and that the degree of their influence depends on their size and location.

Donovan constructed his study using input from Portland's Crime Prevention Program. He distinguished between trees in a house's yard and street trees in the parking strip between the sidewalk and the street. He made that distinction for two reasons. First, street trees are farther from a house than yard trees. Second, street trees typically do not block the view of a house from the sidewalk.

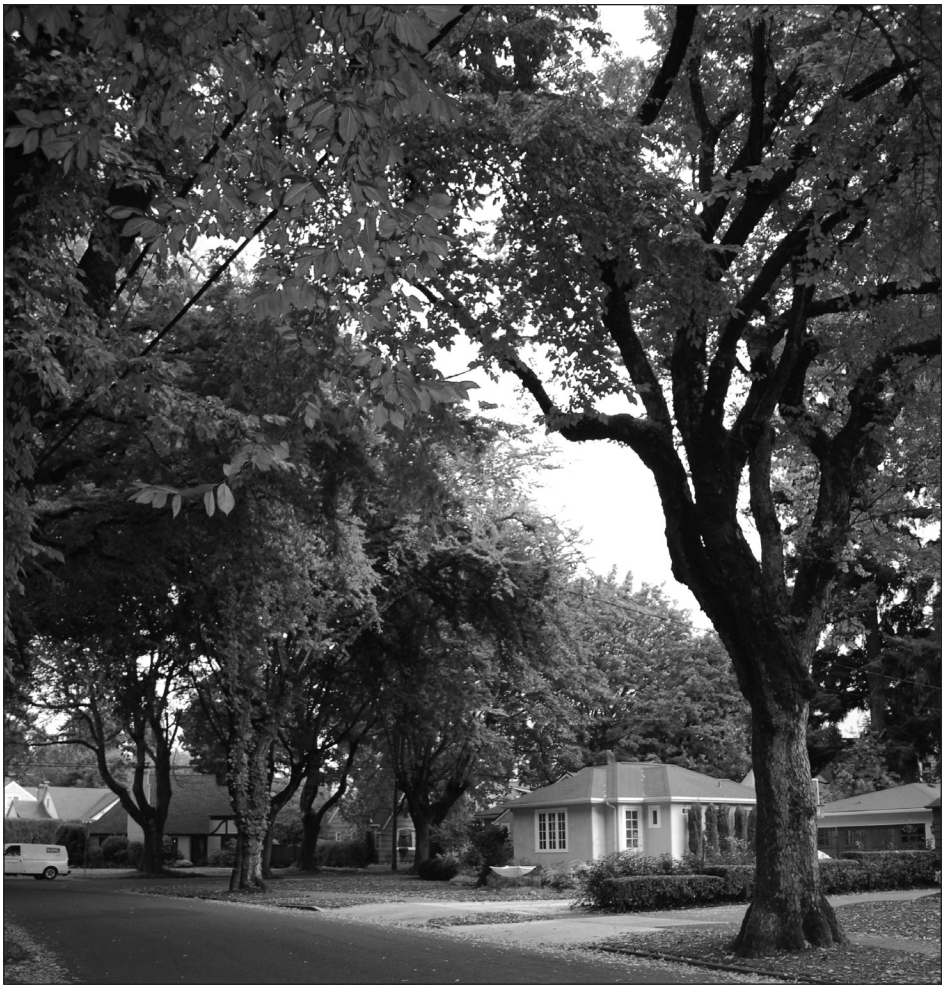
He confined his study to Portland's southeast precinct because of its high proportion of single-family homes, and obtained crime data for 2002 to 2007 from the Portland Police Bureau. As in the birth study, Donovan used aerial photographs to show the placement of trees in relation to the homes where crimes had occurred.

Donovan's research team also visited every house to note barriers in the front and back of each house. These were categorized as either low (less than three feet tall), high and solid (e.g., a rock wall or a solid wooden fence taller than three feet), or tall and see-through, such as a wrought-iron fence.

He found that the crown area of street trees fronting a house and the crown area on a house's lot were associated with decreased crime occurrence. But the number of trees on a lot was associated with increased crime.

One possible explanation is that more trees in a small area, like a yard, could lead to more crime by providing cover to criminals, Donovan surmises. A large number of trees might also mean that they're relatively small, so their crowns create a screen closer to the ground. Large trees don't present that problem because their crowns are higher.

There are other theories as to why mature trees are associated with less crime. One postulates that mature trees create a pleasant setting where people will want to congregate. Because they're a public attraction, criminals are less likely to break into nearby houses. It's too risky.



R. Mazza

Lower crime rates were found around houses with large street trees.

Another is the "broken window" theory that suggests that criminals are attracted to poorly maintained neighborhoods, because evidence of neglect—broken windows, for example—implies a lack of law enforcement. "If trees help a neighborhood appear well-maintained, they may deter crime," Donovan explains.

R. Mazza

Higher crime rates were found around houses with many small yard trees.

THE RIGHT TREE FOR THE RIGHT SPOT

These findings are already informing public policy and being used in educational outreach efforts. The City of Portland used these findings when it updated the city's tree ordinance. Tigard and Gresham, two other cities in the Portland metropolitan area, also are incorporating the information in their street-tree regulations. Friends of Trees, a nonprofit group that promotes the planting of trees in Oregon's two largest metropolitan areas, uses Donovan's findings in its educational literature, providing practical information to homeowners about how, where, and why to plant trees on their property.

R. Mazza

Friends of Trees, a nonprofit organization in Portland, is sharing this information with homeowners.

Stephanie Reynolds, manager of Portland's Crime Prevention Program, which offers guidelines on the planting of residential trees and shrubs, says these findings gave them a level of detail about the role of urban trees that they didn't have before.

Now she and her team members can give more detailed advice to homeowners about pruning and planting trees to reduce the possibility of crime. Pruning away the lower limbs of older trees, for example, opens the view between the house and the street. By carefully placing new plantings, a homeowner can avoid creating a visual barrier.

"In the past, we said trees made a place feel lived in and loved, and that neighborhoods with lots of trees are ones that people want to live in. But we had never differentiated between mature trees and young trees," says Reynolds. "Geoff's study added legitimacy and detail to those general principles. It added nuance to the kinds of recommendations we give."

"No town can fail of beauty, though its walks were gutters and its houses hovels, if venerable trees make magnificent colonnades along its streets."

—Henry Ward Beecher

R. Mazza

Through proper tree placement and maintenance, homeowners can find a balance between privacy and security.

FOR FURTHER READING

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LAND MANAGEMENT IMPLICATIONS

- Urban trees have a quantifiable effect on human health and crime rates. City planners, law enforcement, landscape designers, and neighborhood associations can use this information to create conditions that discourage criminal activity or improve human health.
- Understanding how tree placement and maintenance can discourage criminal activity helps homeowners find a balance between privacy and security.
- These studies illustrate ways in which nature can be integrated with built systems to create more livable urban communities.

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John Kirkland has been writing about science, higher education, and business for more than 20 years. He lives in Portland, Oregon.

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