Dear Students, Colleagues and Friends,

You're in a conversation about sustainability or climate change or something similar having to do with human relationships to and with nature. You see you are starting to make inroads with the other person. They're shifting their weight from one foot to the other. They're actually starting to lean forward a bit. And then they do it. They ask the question about . . .
metrics. Well, how much of a difference will it make if I:
Plant a tree
Care for a pollinator
Turn off the water when I brush my teeth
Shut the door if I'm just popping out to the mailbox

And on and on it goes. Metrics – or lack thereof - can very often make or break a conversation and the feeling that you or the person you're talking with, might actually adopt a different, more responsible behavior.

That's why I feel a little giddy whenever I'm able to discover and give an immediate definition and/or measurement of what kind and how much of a difference we ARE making when we do those "little" things. As it turns out, small stuff matters. Little things add up. Certainly, when you remember someone's birthday, say thank you or hold a door open you feel that warm flush that accompanies kindness whether given or received. That's a good thing. It's also a good thing if you shut that door, plant that native plant, turn off the water when you brush your teeth or plant a tree. So just how much of a good thing?

A few years ago one of the talks I would give when asked was called "*The Power of I*". The Power of I was all about metrics connected with those small things. But it's important to personalize small things by relating them to your audience. For instance, when I gave the talk in Nashville and mentioned that if we turned off the water when we brushed our teeth we could save up to 678,490,470 gallons per year. Audiences there could relate to that because it was *their* community. As growth has continued, in the region where I live now we could save more than double that amount.

Here's another. There's a commercial out now that prompts you to run your dishwasher, if you have one, every night. Yet in Kansas City, we could save roughly 1 billion gallons of water a year if <u>even half of</u> us ran our washing machines and dishwashers only when full. Imagine what we could accomplish if all of us added those small acts to our lives. In fact, when I gave The Power of I program I listed six small actions we could take and the total water we could save tallied to *4,411,839,252 gallons of water each year*. That amount would fill about 6,000 Olympic-sized swimming pools.

Kansas City, along with many regions in the country are likely to experience increasing flooding and drought as well as a greater heat island effect as we move further into climate change. Can we afford to just give away 4 billion gallons through behaviors we could change? (Actually, because of our size it would be closer to 8 billion.) The answer is - No.

Because of all this, you can imagine my delight when I read the following article about the metrics connected with planting trees and its effects on urban heat islands. So if you're interested in the small things – like planting a tree and cooling down your city – read on, and see what a difference you're making.

DAILY SCIENCE

First of its kind study quantifies how tree shade can cancel urban heat island effect

The presence of 20 additional mature trees in one neighborhood could lower the temperature by 1.39 degrees

By Sarah DeWeerdt

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On a 93.33 °F day in a certain part of Columbus, Ohio, trees currently planted in the neighborhood could lower the temperature by 3.48 °F if they were all fully grown, according to a new study. The presence of 20 additional mature trees in the neighborhood would make the temperature 1.39 °F lower still.

The research suggests that shade from trees and carefully sited buildings could go a long way to mitigate the urban heat island effect, the tendency for cities to be several degrees hotter than surrounding areas due to the heat-absorbing effects of pavement and building materials.

"While we of course intuitively know that shades make the thermal environment more comfortable, this research provides a means to measure this effect," says study team member **Jean-Michel Guldmann**, professor emeritus of city and regional planning at the Ohio State University in Columbus.

Guldmann and his collaborators, Yujin Park of Chung-Ang University in South Korea and Desheng Liu of Ohio State, created a 3D computer model of a 36-square-kilometer area of Columbus, Ohio. They combined this with information on land cover – grass, pavement, water, and so on – across the city. Then they calculated the shadows cast by the buildings and trees from 11 am to noon on Sept 14, 2015, and integrated this with 39,715 temperature data points gathered by a NASA satellite that passed over Columbus on exactly that date and time.

"The statistical analysis demonstrates and measures the differential effects of shadows over different structures and land covers," Guldmann explains. "For instance, a sun-exposed road will increase the local temperature, but any part that is shaded will help attenuate this effect. This also applies to grass and to the sun-exposed facades of buildings."

The researchers report their results in the journal *Computers, Environment & Urban Systems*.

Trees cool the city environment in two ways, they found: by casting shade, and by transpiration, or the evaporation of water from their canopies.

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Buildings increase the temperature of the immediate surroundings, and larger buildings increase the temperature more. But shade cast by buildings, especially on neighboring rooftops, has a significant cooling effect.

The researchers' model could help planners figure out the best places to add green spaces and plant trees in cities, and even how to design and situate buildings to maximize the shade they provide to other buildings and roads. "A general design principle is to maximize the extent of

shadows at ground level and on building walls by properly siting new buildings and new trees," Guldmann says.

As a test of this approach, the researchers simulated different tree configurations in a 7.4-square-kilometer part of the study area. This showed that the surface temperature on a 93.33 °F day would be 4.87 °F lower if the young trees in the neighborhood were fully grown and there were 20 additional mature trees in the neighborhood.

A previous study of 60 US cities found that summer temperatures are 2.4 °F higher in the urban areas than in rural areas nearby – so planting trees in the right spots can at least cancel out the average urban heat island effect.

"I believe that the Columbus-estimated models could be used for other cities, but some more research should probably be done to guarantee this transferability," Guldmann says. And, he argues, it should be feasible for many cities to undertake their own work along similar lines: "Most metropolitan areas and even mid-size cities are now well equipped in terms of geospatial tools and data, and therefore should be able to apply the procedures used in this research to create a 3D digital environment, generate shadows, and conduct statistical analyses."

Source: Park Y. *et al.* "**Impacts of tree and building shades on the urban heat island: Combining remote sensing, 3D digital city and spatial regression approaches**." *Computers, Environment and Urban Systems* 2021.

Image: **UBC art installation**

Margo

Margo Farnsworth
Screendoor Consulting
Screendoorconsulting.com
615.478.4889
Contributing author in *Wildness: Relations of People and Place*

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