How I Got Religion on Trees

By Ann Drumm 5/14/13, anndrumm@swbell.net

Reviewed: *The City and the Coming Climate: Climate Change in the Places We Live* by Brian Stone, Jr. (Cambridge University Press, 2012)

Cities are heating up at *double* the rate of global climate change, with major implications for human health. Managing urban heat is just as important a response to climate change as reducing greenhouse gas (GHG) emissions, and the benefits will be felt much sooner. Cities should prioritize strategies that reduce both heat and GHG emissions, and trees are at the top of that priority list.

Those are some of the key messages in *The City and the Coming Climate: Climate Change in the Places We Live* by Brian Stone, Jr. Stone is an Associate Professor in the City and Regional Planning Program of the Georgia Institute of Technology and an expert in the urban heat island effect: land-use changes that are producing higher temperatures in cities than in the surrounding countryside.

Stone says the warming trends reported by climate science do not reflect the impact of the urban heat island. That's because scientists, in measuring global-scale temperature trends, statistically adjust temperature observations from urban monitors to address potential bias in temperature-trend analyses. The result of those adjustments is that "such analyses measure the degree to which the planet is warming *from greenhouse gases alone.*"

Most urban policy makers are preparing for an extent of warming (if they are preparing at all) equivalent to these global-scale projections based on GHG emissions. *This assumption profoundly underestimates the magnitude of warming that urban populations are confronting.* That's because warming in cities has two causes: GHG emissions and the urban heat island. Whatever warming trends are indicated from rising GHG, the urban heat island effect is going to render cities even hotter. His research indicates that "most large U.S. cities are not only warming faster than the planet as a whole, they are warming at *double* the rate of global climate change."

So how much hotter will cities get? Using his home city of Atlanta as an example, Stone predicts that the temperature on a typical July day might rise from 89°F to 96°F due to GHG alone (conservatively using the midpoint of the IPCC range of projections). But when you add the urban heat island effect, the temperature is likely to climb to 103°F. This is "alarming" because "Atlanta has exceeded 100°F on only five occasions since temperatures were first recorded in the 19th century – with all of these days occurring since 1980."

The implications for city dwellers are suggested by the 2003 European heat wave, in which 70,000 people died as a result of heat-induced illness. High temperatures stress the human body, especially when nighttime temperatures are too high to allow the body to recover from daytime exposure. Not only are the number of extreme heat days increasing, there is a "growing tendency for such days to cluster into heat waves...[I]t is the succession of extremely hot days, rather than the isolated intensity of heat itself, that results in the most heat-related deaths."

Air conditioning won't help us if the extreme heat causes power grids to fail. In 2003, a power line in Ohio, sagging from heat, came into contact with a tree branch, causing a cascading power outage that affected 55 million people. "It is the failure of infrastructure in the form of transportation and electrical power systems that can pose one of the most significant – and the least anticipated – threats of rising temperatures to urban populations." An even more significant threat is to the delivery of water, which is driven by a vast network of electrical pumps.

If human health and infrastructure are even more threatened by warming than previously understood, what action should cities take? Most cities are focusing on reducing GHG emissions through strategies like energy efficiency. Stone says they should focus as much energy on land surface changes: "[A]lthough only

reductions in carbon emissions coupled with an increase in carbon sequestration can ultimately reverse global climate change over the very long term, at the scale of cities, only land-based mitigation can yield measureable improvements during the period of our own and our children's lifetime."

He recommends "adaptive mitigation: climate-management activities designed to reduce the global greenhouse effect, through the control of gaseous and/or land-surface drivers, while producing regional climate-related benefits in the form of heat management, flood management, enhanced agricultural resilience, or other adaptive benefits." His main recommendations are for strategies that he calls **urban sunscreening**: a combination of "albedo [reflectivity] enhancement and vegetative strategies...that physically screen urban environments from the accumulation of heat through radiant reflection, shading, and evaporative cooling."

- **Plant lots of trees and protect the ones we have.** "[A]mong the full suite of conceivable approaches to cooling urban environments, none is more effective or less energy intensive than planting trees." Trees help reduce ambient temperatures (thereby reducing energy consumption and GHG emissions), absorb moisture, reduce flooding, improve air quality, and sequester carbon. In Atlanta, models have shown that a doubling of the region's forest cover *could reduce temperatures on the hottest days by more than 12°F.* "In a word, **urban trees greatly enhance climate resilience** – an attribute that will be regarded as increasingly invaluable in a warming world."
- **Plant green roofs.** "A study in Toronto found that the greening of just 5% of that city's area in the form of roof gardens lowered temperatures by almost 1°F – a surprisingly large benefit for the modification of a relatively small surface area." But for roofs in hot, arid climates he recommends:
- **Increase surface reflection with high albedo roofs:** "In Los Angeles, for example, the conversion of all flat or low sloping roofs to highly reflective materials could lower average summer afternoon temperatures by...almost 3°F." The combination of aggressive tree planting and roof conversions could reduce summer afternoon temperatures by more than 5°F. On this front, he says Austin has adopted the most ambitious policy in the U.S.

He recommends other strategies in addition to urban sunscreening:

- **Urban greenbelting:** Protection and regeneration of natural land covers in proximity to large cities is a key component of a regionally comprehensive approach to urban climate change management.
- **Carbon cooling strategies:** These are strategies to reduce both waste heat and GHG emissions. Since the most significant source of waste heat is vehicle traffic, he recommends much greater reliance on mass transit.

The population density which is a prerequisite for mass transit will also better enable the sunscreening and greenbelting strategies. Therefore, "urban densification must be the centerpiece of any serious climate management program undertaken at the metropolitan scale. Fundamentally what this means is that regional economic development strategies rooted in low-density, sprawling housing development at the urban periphery are wholly untenable in a warming world."

Locally, options to manage urban heat have been recommended by Houston Advanced Research Center[1] and included in the Vision North Texas[2] recommendations. Those recommendations should be revisited and perhaps urged more forcefully in light of Stone's research. Thought leaders, elected officials and the community should fully appreciate the need to prioritize actions that have a short-term heat management benefit as well as a long-term GHG mitigation benefit – starting with the trees.

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[1] http://www.visionnorthtexas.org/NTAF/Documents/Dallas_Urban_Heat_Island_Report.pdf
[2] http://www.visionnorthtexas.org/regional_summit/North_Texas_2050.pdf