

# Participant Questions from U.S. EPA Heat Island Webcast Assessing Your City's Heat Island: Considerations and Approaches

September 7, 2017

*Questions in bold were asked during the webcast.*

## Questions for All Speakers

- 1. What is the impact of covering e.g., parking lots with elevated solar panels? Could solar panel-covered bike lanes be a good strategy for cooling commuter routes and decreasing carbon emissions?**

**Dave Sailor:** This is something that we've been interested in ourselves here. Trees for shade offer a lot of benefits. But artificial shade can provide some benefits also, as anyone who's walked down a city street on the shady side to avoid the heat of the sun knows.

Using PV shading is actually something we thought about in terms of creating cool corridors for walking in and around the commercial districts and getting people from houses to bus stops and whatnot. It generally has a handful of benefits in terms of providing shading.

And remember the thermal environment felt by the person is a combination of the air temperature and the humidity, but also the net radiation that their body feels. So if they're shaded from the sun, that actually has a huge benefit in terms of thermal comfort.

One of the possible downsides that's very interesting is that even with the higher-performance panels, these tend to be very dark surfaces that generate on the order of 20 percent of the solar power that the intercept turns into electricity. And so, a lot of that heat from the sun actually goes into heating the panels.

The panels themselves don't have a lot of thermal mass, so the air flows over them. They convect some of that heat away, so it's kind of an interesting research question to really understand what is the net effect both on the pedestrians underneath, but also on the air temperature throughout the city by placing a lot of dark surfaces.

My personal feeling is that the net effect is likely a benefit, but you always need to consider some of the potential adverse consequences in doing a full evaluation. But definitely I think there is promise there.

- 2. For John and Kristin: Did either of you engage the public health/medical community in your planning? If so, in what ways were they involved and how did they contribute?**

**Kristin Baja:** Yes, absolutely. In fact, public health—the Health Department and the Office of Emergency Management—have both been key partners both in the development of our all-hazards plan or our DP3 plan, and also in implementing all of the actions that we have around heat and flooding. So they are two key partners in pretty much all the work we do.

The Public Health Department is in charge of our Code Red days, declaring our Code Red days, and using a lot of this information to identify areas for priority outreach—letting people know about shelters, areas where they can get ice and water, and resources in the event of a Code Red day; also for distribution of information, and that is kind of a two-way street.

It's been a great way also for the Health Department and our office to gather information from people and understand where we may have residents with more risk, those who have medical conditions, are elderly, or if we have children who sometimes are left home alone while their parents are at work.

Emergency management also has been a huge group that's been involved in a lot of this work, and both of them have been part of the individual preparedness work we've been doing, the community preparedness work that we've doing, and then also prioritizing the same sort of neighborhoods that we've been looking at for resiliency hubs and communication centers, and public outreach work on initiatives.

So it's certainly key to involve health and emergency management in any work around heat islands and air temperatures.

3. *For John and Kristin: What are the typical costs of building green urban canopies and the necessary irrigation infrastructure to maintain them? Perhaps on a per-tree or per 100 feet squared basis?*

**Kristin Baja:** I think that's a really specific question; I'd be happy to take down the contact information for whoever requested that information.

It's going to be different depending on different spaces and different projects, so I would be happy to talk with that person offline to give more estimates, but there is not a single number that I can say this is how much it costs per tree based on this space.

4. *For John and Kristin: Who "owns" the street trees adjacent to the street? The city or the adjacent landowner? And how does this impact maintenance?*

**John Bolduc:** In Cambridge, the city owns the trees within the public right of way and under state law we can also plant trees, I believe, within 20 feet of the public right of way. We have some interest in being able to work with private property owners to plant trees outside of that zone, but I think there are some legal issues we probably have to work through on that.

**Kristin Baja:** In Baltimore, we have the ability to plant trees with the permission of the property owners, or their willingness. We can do it without permission, but it doesn't happen very often. We try to build relationships and maintain positive relationships, so if somebody says they do not want a street tree, we don't put one in.

But we do have maintenance issues because of funding. And so, we do, again, try to use our tree keepers programs and some of the other programs on training people how to take care of the trees. And we try to utilize members of the neighborhood to plant the trees as well so that they're involved throughout the process and sort of take ownership of those trees.

**John Bolduc:** I would also add: one thing that the urban forest canopy mapping did was to help us understand that most of the tree canopy is on private property. And, therefore, if we're going to manage urban forest as a system, we have to do more in terms of working with private property owners.

**Kristin Baja:** The same is true in Baltimore as well.

5. *Have you done a cost-benefit analysis of the proposed mitigation method? Cool surfaces change the air temperature very little, and may be more expensive. Rather than cool the whole city so slightly, why not give some people air conditioners?*

In 2014, Lawrence Berkeley National Laboratory compared the economics of green, white, and black roofs using a 50-year life-cycle analysis. It showed that white roofs provide a 50-year net savings of \$25/m<sup>2</sup> (\$2.40/ft<sup>2</sup>). See <https://heatisland.lbl.gov/publications/economic-comparison-white-green-and> for more information. Reduced surface temperatures from cool roofs can lower air temperature. For example, a New York City simulation predicted near-surface air temperature reductions for various cool roof mitigation scenarios. The study assumed 50-percent adoption of cool roofs on available roof space and ran models to evaluate the resulting temperature changes. Averaged over all times of day, the model predicted a city-wide temperature reduction of 0.3°F (0.2°C). The city-wide, 3:00 p.m. average reduction was 0.6°F (0.3°C) and ranged from 0.7 to 1.4°F (0.4 - 0.8°C) in six specific study areas within the city. See Chapter 4: Cool Roofs from EPA's Heat Island Compendium for more information:

[https://www.epa.gov/sites/production/files/2017-05/documents/reducing\\_urban\\_heat\\_islands\\_ch\\_4.pdf](https://www.epa.gov/sites/production/files/2017-05/documents/reducing_urban_heat_islands_ch_4.pdf)

### Questions for David Sailor (Arizona State University)

1. *What do you think of the climate simulated data when comparing to measured data?*

That is a big question. And its phrasing sort of presupposes that measured data may be preferred. But as I said in my talk, your measurements are not as good as the sensors. They're always worse than the sensors because the sensors sort of view that upper limit of accuracy and then it's how the sensors are deployed and how they're maintained, and whether the environments that they're

deployed in are truly representative. You could do a heat islands study in my yard and come up with a very different result depending upon which sensors you choose to use.

On the flip side, a lot of modelers, and I fall in that category as well, tend to think of simulations as the gold standard because they have so much capability to simulate those what-if scenarios. And as long as they're suitably validated you can really go quite a long ways towards projecting possible huge outcomes for different scenarios.

A brief answer would be that you absolutely need both simulation and measurements to really plan out a future mitigation strategy for your city. Be careful about using both, certainly whether it's at the regional scale, mesoscale models, or even the micro-scale models like ENVI-Met: they have significant limitations that are often not really appreciated by the end users when it comes to predicting some of these effects, whether it's vegetation or high albedo surfaces et cetera, so both are very important, yes, in concert.

**2. *Are there rules of thumb for when adding vegetation is NOT a good idea for UHI mitigation?***

I don't know about rules of thumb, but there are certainly some considerations. If you're planting vegetation, you obviously need to have a budget to maintain that vegetation and that includes providing the necessary water for that vegetation to survive. So, water resources is a huge constraint as we think about using vegetation for heat mitigation.

Another thing is, depending upon how you deploy a vegetation canopy, it can have adverse consequences at the street level because you can actually create sort of a tent effect where you trap emissions from the surface below that tree canopy and can actually have adverse consequences such as making your local air quality worse.

So there are certainly some considerations. These are things that don't necessarily make you want to move away from using vegetation. It just requires you to be a little bit more thoughtful in your design of how you implement it.

**Questions for John Bolduc (Cambridge, MA – Cambridge Community Development Department)**

**1. *With the flash droughts Cambridge is increasingly seeing, are there more effective ways to prevent urban forest mortality? Do we need to change the way we plant and water street trees?***

That's a little outside my expertise. I'm not an arborist. The city has a pretty robust urban forestry program led by a master arborist. They have been updating their tree management standards for planting and have efforts to water trees and we've had drought issues especially the last few years.

But I think, from a planting perspective, in terms of trying to increase the tree canopy, I think it's both a function of trying to maintain what we already have, as well as adding to it. So our

planning has to take into account how we're going to maintain the canopy that we have and also replace it as it naturally dies off or as it becomes subject to storm damage, things like that.

### Questions for Kristin Baja (Baltimore, MD – Urban Sustainability Directors Network)

**1. *Is data from the sensors wirelessly uploaded? Can they be monitored in real time or are they recorded on the device?***

My understanding is that the data from the sensors is uploaded at Hopkins and used there. But the new ones that we're putting in, the new boxes are actually something that can be accessed directly from Hopkins because they require a Wi-Fi directly in the community.

From the iButtons, my understanding is that that it's something that we have connected and we take that data at the end of the monitoring period and then bring it into a space where it's then uploaded and analyzed.

But the new sensors actually do work off of Wi-Fi as the new boxes are going to be something that enable us to have daily data that we can look at more often.

**2. *What have you done to prevent sensor theft?***

To be honest with you, it's been mostly about engaging with members of the neighborhoods where the sensors are being concentrated and talking with our community-based organizations in those areas and our community leaders. There has been outreach with youth and kids within those neighborhood schools, as well as residents within those neighborhoods.

And so, it's been great to have people on board to support that process and that's been the main way. That's not to say we haven't lost a few here or there, but we certainly haven't lost as many as we could have, had we not had members of community really involved from the beginning of the process.