

UHI Mitigation – The Tucson Story

Slide 1: Title Slide

OK, great. Now, we're going to move a little bit west, a lot west actually in the country and hear what the City of Tucson is doing for the heat island effect. Our speaker on that will be Irene Ogata who is the City of Tucson's Urban Landscape Manager.

She's going to talk about what Tucson has been doing in terms of trying to mitigate the heat island and basically, an area that has scarce water resources. So it's a different perspective I think than Louisville. Maria has been involved in the urban heat island field for over 15 years. So Maria, you can start. Thank you.

Irene Ogata: Or Irene. Hello?

Victoria Ludwig: Irene

Irene Ogata: Yes, OK. So I'll go ahead and – thanks, Victoria for this opportunity to share one small story of how Tucson, that is a city in the far West and air is Southwest is tracking or tackling urban heat islands. So the story is Tucson is in the desert, the Sonoran desert to be specific.

Slide 2: The Story

Irene Ogata: So by definition of a desert, we're already in a climate that's hot and dry with less than 10 inches of rain. So this is about a glimpse into the future, what happens or what will happen if we do nothing today and what are the issues today that are tied to each other, and planting shade trees today can make a difference tomorrow.

When I first came to Tucson in the 70s, I have a home with an evaporative cooler and no air conditioning. So at night, I would cool the house by opening the windows and then, as the temperatures were dropping – the temperatures were dropping to about 60 to 70 degrees Fahrenheit.

Slide 3: It's Hot

Irene Ogata: Today, I do have air conditioning and at night, I don't really open the windows very much because the temperatures are in the 70s and 80s. So we know that it's hot in Tucson and actually in 2005, the record was 39 consecutive days over 100 degrees Fahrenheit. So if you look at the map on the right, it's a kinetic, a surface temperature in 2005 at 10:30 at night. The scale of the lower left is the temperature where yellow is the hottest and blue is the coolest.

And if you look at the lower left quadrant – lower right quadrant, this is the urban area of Tucson in the city and it's very easy to pick up the airport, the regional shopping center that has the

malls, expansive parking lot and large buildings, the Interstate I-10 and I-19, as well as the grid of roadways within the city because these are all yellow.

In contrast, you can see the Santa Cruz River in the upper right-hand corner, that's cooler and even though it's a dry riverbed, it does have ceric riparian vegetation so it is cooler. The Catalina Mountains on the right-hand corner has an elevation up to 9,000 feet and does have an Alpine biome so it's very cool.

But you also see in the lower left-hand quadrant some yellow and red, and this is really the bear earth desert and so, the desert is naturally hot. In 2000 – the 2013 assessment of climate change in the southwestern United States indicates that in the future, there will be less nighttime cooling and that the documentation since 1987 also indicates that heat and drought as the number one weather related cause of death in the United States. And in Arizona, we are the highest in the nation

Slide 4: It's Hot

Irene Ogata: These science assessments indicates cities will be getting hotter due to increased heat waves. I think some of these have been mentioned by both Victoria and Maria, increased energy consumption and these in turn, lead to increased stress on at risk population. So we do nothing in our urban Southwest heat islands, we'll be experiencing temperatures of 5 to 10 degrees higher by the end of this century, increased and more severe heat waves by a factor of two weeks.

Increasing temperatures will ripple into increase in air pollution. And we'll also have a decrease in rainfall within the urban areas but these rainfalls will be more intense, leading to greater flooding and damage due to aging infrastructure. That as Victoria said, there are actions we can take today and one of these is planting shade trees, and this is a practice being done by many cities.

Slide 5: Issues in the Southwest

Irene Ogata: Marie mentioned that they were doing it in Louisville, but here is the Southwest, planting trees also brings into play, our limited water resources. What do we know about water supply in Tucson? Tucson has two major sources of water, groundwater which is being depleted and also, being supplemented now by the surface water but our surface water comes from the Colorado River.

So it's pretty far away and it's coming via the central Arizona project, and there are early warning signs that this is a diminishing supply is there are no future increases in snowpacks in the Rocky Mountain. So for several decades now, Tucson water has this conservation ethic and it has included derogating large outdoor landscapes such as golf courses and ball fields with reclaimed water.

Ultimately, the goal is to create a cooler and more resilient community. So one strategy is to increase the urban force canopy but also continue the message of the need to practice water

efficiencies. So one approach by the city is to capture more local rainwater. In essence, a third bucket of water that can be used for outdoor landscaping.

Slide 6: Issues in the Southwest

Irene Ogata: The city is doing this by addressing rainwater in three smaller buckets. On the commercial side in 2008, the Mayor and Council passed a commercial water harvesting ordinance that required developers, commercial developers with 50 percent of the irrigation water needs for plants be supplied through rainwater harvesting.

On the residential side, Tucson water offers an incentive, a rebate of \$500-\$2000 for passive or active water harvesting on residential properties. And internally within the city, the Department of Transportation adopted a Green Street policy that requires all new and redeveloped roadway projects to incorporate as much green infrastructure as possible. And Victoria talked about the storm water benefits that this also provides.

Slide 7: Issues in the Southwest

Irene Ogata: The city has limited resources both in funding and staff, so what tools could we used to target tree planting to areas where they were needed the most? We had already done some select public rights of ways, tree inventories and quantify the value of public tree eco-services but this really didn't provide the information of what neighborhoods had the least percentage of tree canopy.

In essence, we had no private sector tree information. A few years ago, working with our Pima Association of Governments, that's our regional Council of governments, Josh Pope processed Aerial LiDAR Data and this now started to begin to provide that overall tree canopy data and we were now able to also link it to the City of Tucson's neighborhood.

Slide 8: Issues in the Southwest

Irene Ogata: Dr. Sharon Harlan at the Arizona State University was doing research on urban heat islands and intercity neighborhoods, and finding that lower income neighborhoods are hotter. The Arizona Public Health Services, a statewide agency utilizing the 2010 census block information mapped the disadvantaged neighborhoods with potential heat stress, vulnerable populations for both the City of Tucson and the city of Phoenix.

Slide 9: Data for UHI Toolbox

Irene Ogata: This census data includes information that we've already been talking about, the vulnerable populations. We know it's about the young and the old. So this data includes populations under age five, 65 and older, 65 and older who live alone and now, the lower income families that is incomes below poverty. In Tucson, you can see the four red high vulnerable census blocks that were mapped and now, we have this layer of information to add to our tools of information.

Slide 10: Planting Project

Irene Ogata: So the tools of information. Now we have several pieces of mapped information we can overlay. Again, in conjunction with the Pima Association of Governments. They put an interactive online map layering the information of this LiDAR canopy. The Arizona State health services map of vulnerable indexes, and then we were also able to acquire a surface temperature map from the University of Arizona as Dr. Eve Harper was doing her dissertation.

And we already have the City of Tucson's neighborhood designations. This tool is now available to non-profits, agencies, individuals, who may be interested in launching their own programs for applying for grants.

Information from this online tool helped to identify our vulnerable neighborhoods in the city. And in the fall of 2003, just last year, the mayor launched a tree planting campaign with the goal to be completed by the end of this year. The campaign invited businesses, individuals, schools and non-profits to participate.

Slide 11: Planting Project

Irene Ogata: A major partner with the City of Tucson is Trees for Tucson. They provide trees to homeowners at a very reduced rate. These trees are subsidized by Tucson Electric Power and Trico Electric Power. The goal is trees are planted to shade homes to help reduce electric consumption. Trees for Tucson has utilized this online mapping tool to also look at which neighborhoods they could target to reduce the urban heat islands, and they're pursuing this.

Other businesses and organizations that have contributed to funding the tree, planting trees is the Association of Realtors, along with the realty company itself and a car dealership. The city's transportation department has also partnered with TEP to remove trees under power lines. We often see those terrible directionally pruned powerline trees.

And so, TEP is removing them, and the city is replacing them with two trees that will not grow as tall and we are not planting them directly under the power lines. In essence, we're utilizing the practice of right tree in the right place, and water harvesting these trees as much as possible. This will greatly improve the coverage of the tree canopy without the directional pruning.

By connecting these issues of water and shade trees, the community gained tree canopy coverage without excessively dipping into the portable buckets of water. Outdoor shade trees are now utilizing rainwater harvesting on commercial and residential properties, and streets is implementing green infrastructure practices along public roadsides where there are tree plantings.

Slide 12: Planting Project

Irene Ogata: The green infrastructure practices in Pima County has been recognized by the EPA in their green infrastructure program and to date, the mayor's campaign has tallied over 9,600 trees, so we're well ahead of schedule. Developing these online tools, applying storm water

management and water harvesting education and outreach has been accomplished only through the involvement of a number of agencies and non-profits.

Slide 13: Acknowledgements

Irene Ogata: Without the assistance of the various individuals, these development of tools, planning of projects or implementation of practices would not have been possible. It has been because of the common interest of public, private, non-profit and individuals who have been interested in UHI mitigation, water resource reliability and social justice issues that the city is able to continue to improve existing programs and develop new initiatives.

Slide 14: Questions/Resources

Irene Ogata: Here are some additional resources and I guess our questions will be reserved until after David's presentation. Thank you.

Victoria Ludwig: Thank you, Irene, that was great. I think for those of us who are listening in from the East Coast, it's really interesting to hear your perspective coming from an area that has water resource scarcity issues and so – and you are doing a great job of addressing that.

It's a good example for others, similar communities and also, the aspect of bringing in social justice and environmental justice is an important issue that I think all communities are interested in. So it's great to hear your perspective on that as well.

Poll Question #3

Victoria Ludwig: Again, if you have questions for any of our speakers, continue to type them in to your screen. We'll answer them after David but before we get to David, I wanted to ask another poll question. If you could please tell us, which of the shade tree benefits mentioned by Tucson are the most important to your community?

Is it because you want to reduce storm water peak flows or because you want to filter air pollutant? Are you interested more in the transpiration to cool the air nearby? Are you interested in reducing the heat absorbed by dark surfaces, or are you interested in reducing building energy consumption? Please type in all that applies and we'll give the answers in a minute.

OK, thanks for voting. Here are the answers, 61 percent of you said you want to reduce storm water peak flows which at EPA, we know that that's an important issue right now for many communities. We – 29 percent want to filter air pollutants, 41 transpiration to cool the air, 58 to reduce the heat absorbed by dark surfaces and 38 to reduce the building energy consumption.

I think the lesson here is that shade trees have many, many benefits which is great. So pick your benefit there. Thanks for answering.