Improving Heat Health Resilience through Urban Infrastructure Planning and Design

Webcast Transcript

August 19, 2015

Contents

Welcome and Introduction

Slide 1: Introduction Slide

Operator: This is Conference #91339917.

Operator: Good afternoon, my name is Anisis and I will be your conference operator today. At this time, I would like to welcome everyone to the Improving Heat Health Resilience through Urban Infrastructure Planning and Design Conference Call. All lines have been placed on mute to prevent any background noise. If you should need any assistance during the call, please press star zero and the operator will come back online to assist you.

I'll now turn today's conference over to Ms. Victoria Ludwig from EPA. Please go ahead.

Slide 2: Improving Heat Health Resilience through Urban Infrastructure Planning & Design

Victoria Ludwig: Thank you very much. Welcome, everyone. Thank you for joining us today for our webcast, the second in a series focusing on the connection between climate change, heat islands and public health. We will go for an hour and a half today. And before we begin, I'm going to ask Wendy Jaglom from ICF International to give us just a few quick logistic points.

Slide 3: How to Participate Today

Wendy Jaglom: Thanks, Victoria. So, on your screen, you can see an image of the GoToWebinar panel. You can open and close the control panel using the arrow in the red box highlighted in the upper left. Know that audio is only available by telephone using the information on the slide.

As noted by the operator, participants are on mute. However, we encourage you to please send in questions for the speakers using the GoToWebinar question pane. Simply enter your question into the box and hit "Send" to submit your questions. And we ask that you do – please indicate which speaker your question is intended for that way we'll know where to direct your question during the question-and-answer session at the end of the webcast.

Back to you, Victoria.

Slide 4: Climate Change, Heat Islands and Public Health

Victoria Ludwig: Thank you. As a quick reminder, this is as I said the second part of a two-part webcast series. In July, about a month ago, we had the first one. But the idea of the series is to focus on this connection between the three things but also to focus on two different aspects of that connection. The first one is what we talked about in the first webcast which is the idea that communicating on the connection between climate change, heat islands and public health is a great way to leverage public awareness of these issues. And also if the public health industry as well as the environmental agencies work together on this communication, it's much more effective.

The second one today is how to work in the long term to protect public health and protect heat health issues by working with urban design and infrastructure and the built environment solutions to cool the city as a way to protect people from heat health over the long term. The proceedings from the first webcast are ready and up on our website. You can see the URL at the bottom. In a couple of weeks, the proceedings from this webcast will be available at the same location.

Slide 5: Webcast Agenda

Victoria Ludwig: So today we have two great speakers. We're very happy to call this an international webcast. We have Pierre Gosselin from our lead country to the north who will be speaking. Some of you may have noticed if you signed up a couple of weeks before this that we had Health Canada on the agenda. They unfortunately because of federal – the upcoming federal election, they were unable to speak after all. In addition, we have Jason Vargo from the University of Wisconsin who is going to talk about research that he has done in this area. Then as Wendy said, we will have a Q&A session at the end about 20 minutes if possible.

Heat Islands, Public Health, and Urban Design: Connecting the Dots

Slide 6: Introduction Slide

Victoria Ludwig: And I'm going to start with an overview of what the heat island is, how it connects with public health and how urban design can help with both of these issues. I am a program manager with the U.S. EPA state and local climate and energy program. And I also manage within that program heat island reduction program.

Slide 7: What Causes Heat Islands?

Victoria Ludwig: So, some of you may know a heat island is an area of warmer temperature in the urban core. The temperatures are often warmer at both the surface and air level, in some cases, warmer than the surrounding areas. It's important to remember that a heat island can occur in a big city and in a small city and even in the suburbs. The exact dynamics of a heat island vary according to climate, demographics and the way the urban area is designed but the principle is the same. And the costs are often the same.

The top photograph, you can see the impermeable surfaces, the way that urban areas often have canyons, the lack of vegetation causes dry materials that store energy and therefore it makes the surrounding area warmer. Waste heat from cars and from air conditioning units and other mechanical items does also contribute to the heat island.

If, however, you have – you have permeable surfaces, you have vegetation, you're going to have less heat storage, more evapotranspiration which cools the air through moisture. You're going to have shade. You're going to have things that contribute to a lower temperature.

Slide 8: Climate Change and Heat Islands

Victoria Ludwig: How does climate change impact the heat island effect? The climate change contributes to higher temperatures as we know and so in our recent reports that EPA did called climate indicators in the U.S., our 2014 edition, we found that currently there are more unusually hot summer days happening in the last few decades. More importantly for the heat island is that we have more unusually hot summer nights. And this is a key aspect of the heat island is that often the temperature difference between the urban area and the surrounding areas is higher at night. And so, therefore, people do not have an opportunity to cool down and that contributes to serious health issues. And these data are backing that up as you can see.

In the future, climate models from the U.S. and from international communities are projecting that we see an increase in not just the frequency or the intensity of heat waves but also the duration, so all three things there. And in addition, when – so you have higher temperatures, you have increased heat wave. And then the heat island effect inside an urban area exacerbates the intensity of a heat wave. So, these things are very important as far as to how they contribute to each other.

Slide 9: Extreme Heat and Public Health

Victoria Ludwig: What does extreme heat means for public health? It's a very serious issue. In addition to asthma and other respiratory problems, people can get heat cramps, heat exhaustion, heat stroke, but also heat related mortality does happen. And what we found is that the National Weather Service has tracked that extreme heat is often the most deadly weather-related event in a given year. And some years it's the most deadly weather-related event more than hurricanes, more than earthquakes. So it's quite serious. And we're all familiar with the heat wave in Chicago and heat waves in Europe. Again, we found at EPA that nearly 8,000 Americans have suffered death from – have died from heat-related illnesses since 1979. That peaked in 2006 which was the second hottest year on record so far.

In the bubble on the right you can see a quote from – we had someone who worked on the Yale project in our first webinar who really focused on the fact that few Americans really realized how serious heat issues can be and how those are related to climate change and the heat island effect. So when they – when they do understand that link, they are more inclined to act on it but they really don't make that link right now, hence, the importance of the public health fields and the environmental fields – the importance of them working on this issue.

Slide 10: Who is the Most Vulnerable?

Victoria Ludwig: Obviously, there are certain types of people that are more vulnerable to the heat health illnesses, older adults, children, people in lower income stratus, folks who work outdoors, and people with compromised health both physical and mental. Also, there is air quality issues that come from – that high temperatures contribute to more ozone, ozone contributes to asthma. So, not just heat stroke and other things but chronic air quality illnesses.

Slide 11: Older Adults

Victoria Ludwig: I'm focusing on older adults because we have a program at EPA focusing on aging. So we have some stats that show that older adults account for the majority of deaths from extreme heat events. In 2014, for example, the number of deaths that we had, 85 percent of those folks were over age 65. Obviously with baby boomers, the population of older adults is growing and 81 percent of older Americans live in metropolitan areas. So as temperature increases as climate change gets worst, this group is just going to have more susceptibility to problems.

Slide 12: Infrastructure Planning can Increase Resilience

Victoria Ludwig: But not to give a bunch of depressing stats, we do have solutions and a lot is going on in the U.S. related to this. Short term, as we know, there are things that public health agencies are doing, cooling centers and making people aware of the risks of heat. But long term, working with urban planners, sustainability directors, public health officials, working together on cooling down the built environment is a great way to cool cities and prevent some of the negative effects that are going to come from future climate change and temperature increases.

Specifically, these are the five most common measures for reducing the heat island effect. Trees and vegetation which tends to be the most popular measure that U.S. cities have taken. In

addition, all of these things give health benefits but they also have co-benefits for improving air quality, reducing energy use, reducing greenhouse gases, and saving money on electricity. But trees do a little more, they have carbon storage benefits. Green roofs are popular now for reducing storm water runoff and cooling the storm water. And they obviously – sometimes are used for urban agriculture and multiple other benefits.

Cool roofs help to save energy. They cool the building. They cool the surrounding air. And as a consequence, it makes for more reliable energy supply which during a heat wave is really crucial. You don't want to lose power because that will affect the air conditioning.

Cool pavements which are permeable are a way to lower the air temperatures around the pavements. Also, it has been shown to have public safety benefits in terms of improving traction of cars and improving nighttime driving visibility. And smart growth which is the idea of having mixed uses in a – in a compact area promoting things like walkability and low development – low impact development. They usually come with more vegetation, less paved areas, et cetera. And that reduces the temperature in those areas as well.

Slides 13 and 14: EPA's Heat Island Program and Program Overview

Victoria Ludwig: So quickly, I'm going to talk about some resources that we have at EPA. As I mentioned, we have a heat island program which is part of our local climate and energy program. And we work with a variety of stakeholders, mainly local governments but also state governments and non-profit organizations and trade group to increase awareness of the heat island effect and increased understanding of programs and policies that can reduce the temperature in a city and can do that cost effectively and also bring multiple benefits.

Slide 15: Heat Island Program Resources

Victoria Ludwig: We have some of the standard resources, it's a great website which we're in the process of updating newsletter. We have – this is one of the examples of a webcast that we do. We have a database of information on what is happening in the U.S. around this issue. Our key resources are heat island compendium which goes into very good detail about each of the mitigation strategies that I talked about. It has more information on what's going on in the U.S. and also explains the scientific basis behind the causes and the impacts of heat – of the heat island effect.

Slide 16: EPA's State and Local Climate and Energy Program

Victoria Ludwig: Also, quickly I'll mention that the local climate and energy program has also a lot of great resources to not just heat island measures but programs that work around sustainability and climate change mitigation and adaptation. So I would encourage you to check out the website. Some of these go to the issue of how to implement programs, how to avoid common obstacles, how to design a program in a – in a model way. So I think no matter what you're doing in your – in your area, this will be very useful heat island or not.

Slide 17: Contact Information

Victoria Ludwig: So there's my contact information on my – the websites. And also, I would encourage you to sign up for the heat island newsletter as well as the local – the State and Local Climate and Energy newsletter. And there's the URL. We will be posting all these presentations so you can have reference to that later.

Thank you very much.

Poll Question #1

Wendy Jaglom: Great. So, before we move on to our next speaker, we wanted to ask a quick poll question of everyone in the audience. So on your screen, you should see the first poll question which is why is your community interested in reducing the heat island effect. And we ask that you choose up to two of the options. Are you interested in reducing the heat islands effect to improve public health, to reduce greenhouse gases, to save energy, to adapt to the impacts of climate change, or to improve overall community livability?

So we'll give everybody just a few seconds to select their responses. Again, we ask you to select up to two of the options.

We're going to give everyone just a few more seconds.

Great. I'm going to go ahead and share the results of this poll. So it looks like 63 percent are interested in improving public health – improving public health which is appropriate for today's webinar. Fifty-seven percent are interested in adapting to the impacts of climate change, 53 percent in improving overall community livability, 23 percent in reducing greenhouse gases and – so thank you very much for participating in the poll question. We'll do a couple more later in the webcast.

And I just wanted to remind everyone to please send in your questions for Victoria and the other speakers using the GoToWebinar question pane and please indicate which speaker your question is for.

And with that, back to you, Victoria.

Victoria Ludwig: Thanks, Wendy. Thanks for answering the poll questions again. Those are useful to us for helping us understand which resources are best and what are our – what our stakeholders need.

Urban Warming & Health

Slide 1: Introduction

Victoria Ludwig: Next we have Jason Vargo who is a scientist at the University of Wisconsin's Nelson Institute for Environmental Studies and he's also at the Global Health Institute. He has a background – a background in urban environmental planning and public health. He's focused in the impact of urban form and planning decisions on the environment and human health. He has had publications that cover topics such as the health effects of climate change in urban areas and the potential for mitigation of the heat island effect to save lives. So his presentation will be very appropriate to the topic.

Go ahead, Jason.

Maybe, Jason, you're on mute.

Dr. Jason Vargo: Can you hear me now?

Victoria Ludwig: Yes, we can hear you.

Dr. Jason Vargo: OK. I was just talking to myself there for about 10 seconds. But now, I think I have all of you. Thank you for having me, Victoria. And thank you for attending this webinar, all the registrants and attendees. I'm going to be talking today about one study in more detail that we did when I was a Ph.D. student at Georgia Tech. And this was conducted in the Urban Climate Lab at Georgia Tech. And then I'll talk a little bit about the new directions that research is going and hopefully think about how that helps guide local policy to mitigate the heat island and through public health.

Slide 2

Dr. Jason Vargo: So, I think many of you are familiar with the sort of transect that is used to describe the heat island. I just presented here because we'll be – I'll be using it to describe how we change the actual landscape. So when you see these different typologies like the rural, suburban, that are residential on the bottom. They have different sort of height, they have different densities, they have different ways that they reduced the natural heat occurring vegetation. And so we'll be thinking a bit about how we – what policies actually do to the landscape and then to see how that impacts to climate.

Slide 3: CULE

Dr. Jason Vargo: As I said, most of this work came out of a study that was – three years study funded by the Centers for Disease Control Prevention. And it was called CULE, the Climate, Urban, Land use, and Excess mortality study. And we – in that study, we looked at three metropolitan areas in particular, Atlanta, Philadelphia and Phoenix. This study was led by Dr. Brian Stone at Georgia Tech School of City and Regional Planning and the Urban Climate Lab there.

Slides 4 and 5

Dr. Jason Vargo: There are number of different ways that we can get from questions about different types of urbanization to the actual health impact that have mitigated by climate. In our study, we chose to look at the land cover of urban areas, how the land cover impacts temperature largely through the mechanisms that we described when talking about the urban heat island. And then finally, what are the health impacts?

So the health climate relationship that we are interested in looking at, we could have looked at vector-borne diseases or ozone production, we chose to look at temperature and heat illness. And specifically we looked at mortality related to temperature.

Slide 6

Dr. Jason Vargo: Most of this work appears in this article which you can dive in to a little deeper if you're interested.

Slide 7

Dr. Jason Vargo: Now, here's the transect again and I have presented to just sort of talk about what we did with the land covers so the urbanization part of that three phase, urbanization climate health model. We took the business as usual for these three metropolitan areas in the year 2050 and they began to think about what space we have to play with. What building space do we have to play with? What public space do we have to play with? What private land do we have to play with?

And through a number of different scenarios, we implemented policies somewhere related to particular green area ratios that were required on residential private lands or commercial private lands. Others mandated technologies like green roofs or surface whitening through high albedo coating. And so we made the urban landscape look something like what you see on the bottom, a variation of that. It could have been through tree planting or through albedo or a combination.

Slides 8, 9, 10 and 11: Existing Parking Lot, Retrofitted Parking Lot, Existing Streetscape, and Retrofitted Streetscape

Dr. Jason Vargo: Now in practice, this would look something like this. And our model, it's just a fraction of vegetation, a fraction of concrete, a fraction of high albedo concrete. But in practice, they actually look like this, it takes a dark asphalt parking lot and sort of moving it underground or perhaps covering it with high reflectivity pavement, adding some trees. And we think about what that does to the actual temperature in an urban area. Or take a streetscape that's been used as a vegetation and began to add trees. We were looking at the future metropolitan scenarios in the year 2050 so we presumed that we can plant these trees now and then in the next 35 years we would have some substantial canopy from those investments.

Slides 12 and 13: Extreme Heat and Excess Mortality

Dr. Jason Vargo: Now, so just to the last part about that heat health relationship. We looked at heat and health in two different ways. The first way that public health scientists understand the heat health relationship is through looking at summer temperatures and we can – we know that temperature and the mortality rate are related so at higher temperatures we see higher mortality. So this might look something like this where you see a dotted line like summer temperatures fluctuating over the course of several months and the number that's also fluctuating.

But we also wanted to look at sort of the extreme event. This is data from France and Paris. And you can see that during the 2003 event, a huge spike in temperature but were prolonged but also much higher than normal caused very, very large spikes in mortality. And so we wanted to capture this too. So it's not just the elevation of some of the temperatures on average, it's also the occurrence of this extreme event that Victoria already mentioned.

Slides 14 and 15: Health Impacts

Dr. Jason Vargo: Now to do that we used a couple of different health studies that have been referred to in the epidemia and logical literature as capturing this relationship between temperature and mortality – excess mortality. You can see that one of the studies uses mean daily apparent temperature and other one uses minimum daily temperature. So we wanted to get an idea about the impact on health of maybe these different temperature metrics particularly since the urban heat island is so important to influencing minimum temperatures over nighttime temperatures.

And then additionally, we looked at this study which quantified a percentage increase in the baseline mortality incidence for every heat wave day that metropolitan area experienced. So we can add on the impact – we could add together the impact of elevated summer temperatures on average and the occurrence of the heat wave days.

Slide 16: Atlanta

Dr. Jason Vargo: So these are some of the results and before I began to talk about what we found, let me just describe what I'm showing you. Each bar is a different scenario so if you see something like road albedo that means in Atlanta in this case, we changed the albedo of all the roads. Or building albedo, we made the building surfaces, the roof higher albedo than were measured in the business as usual. And then all albedo combined them, private greening was vegetation added on private land to the green area ratio of policy that I mentioned where we required 50 percent of commercial properties and 80 percent of residential properties to be vegetated. If they didn't meet that standard under the business as usual scenario, we force that. And then public greening within public lands and adding trees to parklands and vacant lands like that. All greening is obviously those two combined.

And then all strategies sort of combined the greening and the albedo, that's the blue bar. And when you compare that against the elevated mortality, that's expected in the year 2050 as compared to 2010 because of the warming over those 40 years, we found that all of the strategies implemented over the land in metropolitan area could offset almost that increase we see in there.

So to say that another way, if you look at Atlanta today or in 2010 and you thought about what the temperature might look in 2050, you might experience about 55 more deaths a year from higher temperatures. That's a combination of the heat waves and elevated summer temperatures. And when we implemented all the strategies, we found that we could offset just over 50 deaths a year for the Atlanta metropolitan area. So that would allow Atlanta to sort of cope with the impact of global climate change by taking local actions that can protect health.

Slide 17: Phoenix

Dr. Jason Vargo: In Phoenix, the numbers were not as comparable between the warming out to 2050 and the impact of all strategies. But importantly, this analysis allowed us to sort of look at the health benefits of different types of scenarios. As you can imagine, in Phoenix, greening scenarios are much more water insensitive and expensive and so they might not be as feasible. But it's important to realize that through the all albedo strategy, Phoenix can get almost the same benefit as albedo and green combined, that blue bar at the bottom.

So, it makes sense – it doesn't make sense for Phoenix to go out and invest in water intensive strategies like planting a lot of new vegetation. But they can really accomplish sort of the same local cooling health benefits by using reflective coating solely. And that I think is an important finding for policymakers there.

Slides 18 and 19: Health Impacts

Dr. Jason Vargo: The analysis allowed us to look down at sensor check level, began to think about which sensors track are benefiting more and less each urban area. This is what, for example, it looks like in Atlanta when we combined the average summer temperature reduction and the reduction in the number of heat waves we see. And in most cases, between zero and two that's avoided for all census tracks.

Slide 20: Median HH Income

Dr. Jason Vargo: The next thing that we started to look at was who's really benefiting from this strategy. We sort of implemented in a blanket way where we said we want the screen area ratio policy to be applied the whole of Atlanta. And then we want to see what the health impacts are. When we began to look at sort of which census tracks were winning more and losing more, it was very interesting to compare cities like Atlanta to Phoenix. In Atlanta, you see that the average avoided mortality rate which is basically how effective the strategies were in reducing deaths for these people. It was very effective for the poorest people in Atlanta. That's a very strategic investment for reducing the health risk to the people who are the most vulnerable or have the least adaptive capacities that sort of deal with the health threat.

In Phoenix, that trend was sort of reversed where we saw these urban heat island mitigation strategies really benefiting the tracks with median income with over 75,000. And so it sort of had this reverse effect but it wasn't benefiting the people who need it the most.

Slides 21 and 22: Race and Spatial Patterns

Dr. Jason Vargo: When we looked at race, again, you can see Atlanta and Phoenix sort of on opposite tracks. In Atlanta, the strategy has benefited majority non-white census tracks more than majority white census tracks. And in Phoenix, it was the opposite. And in large part, that has to do with the existing spatial patterns of income, race and we looked at age as well. But the way that those patterns exist in the two areas, in Phoenix, for example, you see the highest percent impervious in the urban core. The same in Philadelphia and Atlanta. The difference is that in Atlanta, we have a lot of impervious surface in the urban core, that's where you see the strategies having the greatest impact, lowering the temperature the most. But that's where the majority of non-white census tracks are in Atlanta and that not so much in Phoenix.

So the existing spatial patterns of race – sorry – income and age impact sort of the environmental justice implication of the strategy when they are flat regionally.

Slides 23 and 24: New Directions

Dr. Jason Vargo: So let me just quickly talk about a couple of the new directions that we're going. On this graph, you can sort of see a hypothetical situation where we looked at three different temperature health relationships. Medina-Ramone and Zanobetti are two that we used in that CULE study that I mentioned already. So, if temperature increase, we saw sort of a linear increase in the excess mortality. But we know from better epidemiology that really temperature health relationships follow a U-shape curve. So above – and this is represented by a curve like the Gasperini 2015 these are colleagues of the London School of Hygiene and Tropical Medicine who have produced these curves for more than 400 cities around the world.

And so they compare mortality to an ideal temperature where mortality is at the lowest it is. And below that temperature, you have cold related risks and above that temperature you have heat related risks. So we're getting much better as sort of approximating the relative risk of exposures at very high temperatures which you can see at the Gasperini, once you get up to 32 or 33 C for a metro area, the percentage increase in daily mortality that we can estimate with the new Gasperini function is much different and I think more accurate than we were previously doing with Medina-Ramone or Zanobetti. So the epidemiology is really improving and we're trying to use that to quantify the health impact of these strategies.

Slide 25: Block Level

Dr. Jason Vargo: Another thing we're doing is we're getting to look at very specific urban design level and using satellite imagery. So in this case, we're looking at a neighborhood in Chicago in a very hot day. We see the land surface temperatures in the neighborhood on the left about 7 degrees warmer than neighborhood on the right. Now, that's the land surface temperature, not air temperature.

But one interesting thing that we've begun to investigate but haven't really got in to deep yet is the number of buildings and sort of the design principle about putting garages behind houses. On the hot neighborhood block you see 39 houses and 71 buildings, 36 percent of the block is occupied by footprint. On the other side you see almost the same number of houses, 35 but far

fewer buildings. That's because many of these houses don't have detached garages the way that the neighborhood on the left does. And that in that block only about 22 percent of the block is occupied by building footprint. You can see much more tree canopy behind the home.

So that's an indication of maybe a local – very local urban design level design level policy that might be maintaining existing vegetation and really help lowering – helping to lower temperatures.

Slides 26 and 27: Madison UHI Network

Dr. Jason Vargo: Next in Madison, we have – we're looking to have some ambitious Ph.D. students like Jason Schatz to share this with me to setup and maintain a network of air temperature monitoring sensors around the Madison area. We have over 158 sensors that have been maintained for three summers now – or three years. Every 15 minutes they record temperature and humidity. This is what they look like. And I will say because I know there's lots of government agencies and officials listening in, some of the most important work that goes in to this project is negotiating the contracts for permission to put this up and maintain them. So that's really hard work. And anything that can be done to sort of make that easier will really help the surveillance of the urban heat island in your area.

Slides 28 and 29: Madison UHI Network and Intra-City Heat and Health

Dr. Jason Vargo: Also, good relationships with the researchers at the university who's doing that work is very important. What we've begun to do is sort of create surfaces for different months or days or summers and look at how those overlap with local level hospital admissions data. What we've found in preliminary research is that the zip code variations in temperature doesn't help explain a lot of the hospital admission. Rather the ambient sort of metropolitan level measurements of temperature that we already know are increasing and related to this – or indicative of these extreme heat events are really strong – the strongest indicators of the health impact.

So what that suggest to us is that while we're going to continue to sort of examine the local level differentials in the heat island and what impacts that they have on natural systems like this lake that you see in the Madison, really to start preparing for health impact of the heat island you don't need to – you don't need to wait for better information about the zip code level temperature or how different one part of the city is from another. We know that the urban heat island mitigation strategies can be implemented now, lower temperatures and save lives.

Slide 30: Heat Waves

Dr. Jason Vargo: All these – all of our research is trying to go towards improving the data that goes into quantifying the benefits of heat island mitigation. This is a work from the Royal Society in the U.K. in a report on resilience to extreme weather. They rate these different sort of strategies on their affordability but also effectiveness and give you an idea about the strength of the evidence and the overall positive or negative consequences.

One thing that public health officials are talking about a lot is especially with vegetation strategies in every heat island areas is the selection of species so as not to increase the amount of allergy-producing pollen and exacerbate asthma conditions in the city. So that would be an example of maybe a negative co-benefit or a disbenefit of vertical. It seems here that they haven't really captured that yet but it's interesting to begin to think about sort of how your city maybe is taking on these different strategies and who these strategies might work best for.

Obviously the most effective is the most expensive, air conditioning. So that's an important – that's an important consideration that go into these policies as and we think of the social impacts of mitigating heat waves.

Slide 31: Conclusions

Dr. Jason Vargo: So just to wrap up with some of the conclusions, the countermeasures that we thought in these metro areas effectively reduce temperatures and they reduced it to a degree where we could see the health benefit. So these countermeasures were found to offset half to almost the whole of increases in heat-related mortality that are expected in 2050 from global climate change.

If we keep pushing the quantified the health benefits more accurately but there's ample evidence already to support your local action. And that we're going to hear a lot about that from Pierre next.

Finally, to really make the convincing argument especially to private partners I believe and also in the public sector, the health benefits suburban heat island mitigation need to be combined with the other benefits. It's very encouraging to see the results of the poll and the – between the presentation to see that people are interested in the quality of life benefits the urban heat island thinking about representing those in combination with the health benefits, in combination with the environmental benefits, and the energy savings and et cetera.

So creating those more holistic representations of what the actual benefits of these vegetation or albedo strategies are, it is really an important piece of seeing the work done in place.

Slide 32: Climate Change Policy and Public Health

Dr. Jason Vargo: The last thing I'll mention is just that if you're interested in climate change and help, there are a couple of upcoming resources that I would point your attention to from the University of Wisconsin. The first is an online open free course that last for four weeks. You can find that in this web address, Climate Change Policy in Public Health. It's led by the director of the Global Health Institute, Dr. Jonathan Patz. And he's also the co-editor of a new book that was released this summer called "Climate Change and Public Health." It's intended to be an extensible textbook for a number of different fields and discipline. And I recommend that you check it out, it's available in Amazon.com.

Slide 33

Dr. Jason Vargo: With that, I'll just say thank you and I look forward to answering any questions.

Victoria Ludwig: Thank you, Jason. I think your research is really important, an important contribution to the field. And I think it will also – it helps public policymakers do the work that they need to do so keep doing that good work.

Victoria Ludwig: We're going to turn back to Wendy for the next audience participation question.

Poll Question #2

Victoria Ludwig: We're going to turn back to Wendy for the next audience participation question.

Wendy Jaglom: Great. So the next poll question is on your screen now. And the question is which of the following strategies does your community interested in integrating into infrastructure planning, trees and vegetation, green roofs, cool roofs, cool pavements, or none of the above? And for this question, you can select more than one response and we look forward to seeing your answers.

So, again, I'm just going to give everybody a few seconds to provide your responses.

OK, I'm going to go ahead and close the poll and share the results. All right, it looks like 91 percent of participants said they were interested in trees and vegetation and that's a clear winner. Fifty-three percent mentioned cool roofs and then 44 percent said green roofs and 44 percent said cool pavements. Only 3 percent said none of the above.

And with that, I'll pass it back to Victoria. And once again just to remind everyone to please send in your question to our speakers through the question pane.

Victoria Ludwig: Thanks, Wendy. Again, the answers to the poll questions are really helpful to us. And for me it's not surprising that trees and vegetation are number one. But the other ones, I can – I can see people are interested in those as well to a significant amount so that's great.

Urban Cool Islands for Public Health

Slide 1: Introduction

Victoria Ludwig: Moving on to our next presentation – I also forgot to mention at the beginning that we have two doctors presenting today. They're different types of doctors. Jason is a Ph.D. but we also have from Canada from the province of Quebec, Dr. Pierre Gosselin. He's an MD and an MPH. And he currently works at the Quebec Public Health Institute where he coordinates a joint research program between the institute and a national non-profit organization that focuses on climate change and health. He also works on the health component of the Quebec Action Plan on Climate Change. And he also is affiliated with a university and the institute – the National Institute for Scientific Research both in Quebec City. He was trained in family medicine and environmental health.

We look forward to your presentation, Pierre.

Dr. Pierre Gosselin: Oh, thank you very much and many thanks for this invitation. Do you hear me well?

Victoria Ludwig: Yes, we can.

Slide 2

Dr. Pierre Gosselin: OK, very good. So, this is about the urban cool islands so the kind of stop we want to do as Jason just mentioned for which is much evidence at this time. This is a story of what we did over the last six, seven years in this province, mostly around the Montreal area. And just to give you a glimpse on how public health authority can become leaders in the urban planning even though it's not – it's not really our normal job to do so but when nobody else is willing to take the leadership, it can – it can be interesting to do so – to go ahead and do things really.

Slides 3 and 4: Context

Dr. Pierre Gosselin: The context was quite coverable at that time in the sense that we had government wide program and action plan and plan to change. There was funding from a carbon tax which is possible to do here in Canada in some provinces. And after that we got some funding specifically for health adaptation about 5 million a year. And I think the heat island was one of our top priorities, that's classified under prevention in our mind because we – of course, the emergency preparedness for heat waves of course but other extremes that are related to climate change. And we also have a research program.

Slide 5: Steps in Implementation

Dr. Pierre Gosselin: The total budget of what I'm going to talk to you about for fighting and learning about how to reduce the impact of the urban heat island was 17 million over five years. And actually we got more than that sort of in terms of matching from our partners. What we did

is beginning with developing the scientific basis that developed some tools, we didn't know what work exactly in our context of the northern country with strong change is in temperature in winter and summer and lots of rain also. We wanted to evaluate on several aspects what we did. And I'll just conclude by what lessons that we learned and what we are currently doing after the first part of the business.

Slides 6 and 7: Scientific Basis: At Risk Populations

Dr. Pierre Gosselin: Scientific basis was already addressed by Jason and Victoria. Basically we wanted to focus on people most at risk. We thus prioritize from our point of view the most deprived areas. We've got a deprivation index that we used throughout that was developed here in this situation. These areas usually combined high exposure to heat because of the poor quality of their dwellings, more work constraints, you have to be there at your work at a given time. There are very few pools compared to other neighborhoods in the – in the same city. Few parks, no cottage to go to in the weekend, usually window air conditioning, not everyone instead of the central or wall air conditioning which is more effective.

Slide 8: Scientific Basis: What really works?

Dr. Pierre Gosselin: And of course we have statistics as with the public health system, statistics on each of their part – each and every census is tracked in terms of the level of chronic diseases. So we know where these high levels happened in a given city. And 100 percent of those deprived areas lived in your – in heat islands or within the 100 feet of them.

Slide 9: Scientific Basis: What are the best options?

Dr. Pierre Gosselin: So what we did basically is prepare our staff, what works what doesn't in those mitigation strategies that was published early on. We also did a lifecycle assessment because not much exists about that. We just a preliminary one for screening. While we discovered that in terms of negative, we didn't want to promote things that would have high levels of environmental impacts or that would increase production of greenhouse gases. And this assessment, led us to discover that the least impact is better management of rain water in the city, leave the rain in the soil instead of sending it to the waste water system. After that, if you can avoid extensive landscaping, of course, you avoid the trucks and the backhoes and all that stuff that produce greenhouse gases.

So plant trees or vines is much more preferable. And that green roofs have more negative impact because you need to bring lots of soil, you need to sometimes reinforce the roots. You need to import, in our case, we do have some plants that we can use here but we import some from Ontario or from Oregon or elsewhere. So all this contributes to negative impact compared to a high albedo membrane that you can put a white roof basically. So that's a kind of interesting stuff that one needs to know.

Slides 10 and 11: Tools

Dr. Pierre Gosselin: We also did a mapping – surface mapping of the urban heat island for the whole province. Here you see the island of Montreal in this region in this map. We've got about four million people in there. You can see where it's more intense. Every often it's where – some of those red areas where we have less – more deprived people.

So we've – all this was underway usable by potential partners. We also developed a vulnerability to – that was simply overlapping – it can overlap the areas with high deprivation level and the urban heat island and let's see more old people compared to the rest of the province. And it allowed us to focus on very deprived areas or all our projects that was a requirement. And it's been used since for many other purposes by project promoters and municipality. It's the second most popular download on the open government website. So that's the kind of orderly you can – you can see when you use that too. And you can pin point what is it below the urban heat island that causes it? What is it when it's not the urban heat island and here is he a part?

Slides 12 and 13: Pilot Projects: Open Call for Proposals

Dr. Pierre Gosselin: What we did after this was an open call for proposals with specific criteria. We have over 100 proposals. And we have a call for smaller project and a call for larger projects. In India we funded 44 projects. We required matching funds or for smaller projects in kind matching. And basically in India, we've got the two for one match. We got projects from NGOs, from municipalities, from public housing authorities, and also from consortiums formed of several of those many categories.

The project was evaluated – the proposals, sorry, were evaluated. And once funded followed by various specialists that we hired, you know, the Public Health Institute. So engineers are people landscaping our architecture. We had good people that help us from the private sector and universities. We wanted to have good projects. And the call was really very popular, it's been very good for our reputation as a Public Health Institute. Basically we did several types of projects including – including, sorry, parking.

Slides 14-22: Actual Projects: Greening; Actual Projects: Extensive Green Roofs; Actual Projects: White Roofs; Backstreets can be improved; Shade in Public Housing Settings; Parkings; Parkings can be Smaller; Public Housing for People Too; and Green Parking Standard

Dr. Pierre Gosselin: The urban agriculture was a kind of project that would promote. We did some as you can see that they were extensive. And all trees that would create too much negative environmental impacts. Some of them were for growing stuff at the convention center for instance that you see in downtown Montreal, right in the middle. White roofs were very popular too and we have back streets and other places where people can play and stay in the shade whenever possible. Especially we did an effort in public housing settings, we have several of them in those neighborhoods. And we wanted to transform those bland parking lots where nothing happens but for a building into place where people could live and feel good. And that's – you can see one here where we made things some larger in the parking and plants and reduce just ripping up asphalt is a good thing for fighting the urban heat island.

Here you see the transformation of a bland parking into a place where people can actually grow vegetables and have fun. And we did bring about standards for parking. We're transforming parking so it has been very popular and that can be used by – recommended by our Administration on Transport and by – adopted by several municipalities also as the basis for their normal investments in parking renovation.

Slides 23 and 24: Statistics: Total Value of 45 M$ and Evaluation of Projects

Dr. Pierre Gosselin: Those projects were in school yards or in public squares and parkings. They were also in kindergartens. And in one borough of Montreal we unplugged all the rain gutters and put them into the soils so that more water was staying put and could contribute to either evaporation and evapotranspiration after that. Those projects needed to have a communication plan, a maintenance plan for the next year, and all of these used participation methods to design the project collectively. So they were most of the time three meetings, kitchen meetings and little assemblies where people would choose between different options so that they could eventually feel appropriate the project for their specific housing situation.

Slide 25: Evaluations

Dr. Pierre Gosselin: The final evaluations we got, some of them were done through surveys for quality of life. And the basic – the bottom line is that most people found that their quality of life is much improved. Some of them told us that these were life changing projects. So we were very pleased there were comments about more shade that the places where nice and quieter, that the social activity is brought by the urban agriculture, and the fact that you had benches and small parks were interesting for exchanges between people would bring more critical activity. And in the end it was cooler too which is nice to note but this is important. We did – we used several methods numerical modeling – surface modeling. We used normalized satellite imaging and also micro meteorology done by the Environment Canada, one of our partners.

Slide 26: Thermal Improvement Performance

Dr. Pierre Gosselin: And here you can see one of the process where we had good improvement, that's the public housing project. And what we see that by working simultaneously on roofs, there are plenty of white roofs on the right. And planting more trees can bring more water there. And you see the improvements varying between reductions from 10 percent to 50 percent depending on the exact place where the action has been documented.

In some instances, it's close to zero. And in a few schoolyards where they have to change – they did last minute change in the choice of materials without letting us know. It even got worst. But most of the projects did improve significantly, the level of coolness of the parking area.

Slide 27: Side Effects

Dr. Pierre Gosselin: One of the most interesting site is that we contributed to creating a movement in the Montreal area where municipality is found and cities are offering grants, small grants, from worldwide groups, it's now even compulsory in some boroughs of Montreal. They

offer more trees. Now they have some interesting objectives for the – I believe it's something like the tree under the 75-year shifting – year of the foundation of Montreal and they want to plant a huge number of trees. So it's becoming more and more important. And more projects in the urban agriculture I've seen – I've seen like to.

Slide 28

Dr. Pierre Gosselin: Here we have a section of Montreal where it's been compulsory for the last four or five years to use white roofs. And you see it's going fast. It's just a normal cycle of roof replacement for flat – for flat roofs and it's going really rapidly.

Slide 29: Lessons Learned

Dr. Pierre Gosselin: What we learned from all this as a public health institution is that managing infrastructure projects, we had 44 if you remember, so we had all types of problems like contaminated soil and problems with the property of the – of the land and various – problems with availability of expertise, that kind of stuff is really tough to manage. So we decided we would simplify our life in the future.

One very rewarding aspect of that of using participatory methods is that it's really crucial to bring good ideas, to bring people to be part of the solution. The side of the projects is also a matter for impact, you need both sides of project. That's a lesson we have learned. And of course it can be immensely popular with politicians and managers and people living there.

Slides 30 and 31: Lessons Learned and Repeat and Avoid Mistakes

Dr. Pierre Gosselin: So what we decided, of course, we did a lot of dissemination of all those good news through various social media and website and conferences. And we decided for the next part of the climate change action plan which has began last year that we would have only two, one in Montreal and one in Quebec City. And that we have only one customer in each city which is a coalition of NGOs working with municipality, the private sector hospitals, various specialists, and the public. We went for large size projects, more ambitious ones. We now – I've included criteria in terms of biodiversity, for more thing physical exercise, more urban agriculture, besides the head avoidance and the evolution stuff that was there in the first project.

Altogether we did that because we realized that we need specialists in trees so that we plant now the trees that will be resistant to the climate in 30, 40 years from now. We realized that we would bring to the exercise health promotion people besides environmental health people. We realized that we're bringing more people with diverse interests. The people that are interested in flowers and the trees and the bees and everything like the song goes. They can contribute to this fighting the urban heat island.

So, also added the connectivity, the concept of connecting various existing parks which promote exercise, which promote exchanges, not to mention maintain biodiversities. And we also continue with the participatory methods but now we go online with the platform for

commitments. I want to plant a tree in my backyard and my front yard. I want to give money, I want to give a hand to those planting trees. And we continue to evaluate on this.

Slide 32

Dr. Pierre Gosselin: As a conclusion, I'll show you again the map of – this is the area of Montreal which I showed first. And our project at this stage will be in the blue circle which is connected between the Saint Lawrence River and other river on the top. And what you see is the existing remaining levels of biodiversity corridors on the island we want to put a little more active that we want to densify and that where our project will take place with partners from all over the economic and public NGO sector.

Slide 33

Dr. Pierre Gosselin: We do that there because it's a poorer area. If you go to the west of the island, it's more connected, more remaining biodiversity because it's the – these are where the flush neighborhoods are. Basically what we will do is make the existing parks and try to connect them with the people and of course the animals and the insects can connect between the different parts where the university still exists.

Slide 34: Thank You

Dr. Pierre Gosselin: That's about it and thank you.

Victoria Ludwig: Thank you, Pierre. I really commend you on the work that you're doing. Your program is really great and that it's comprehensive and well thought out. And I think it's going to be helpful for states and local governments here in the U.S. So, like I told Jason keep up the good work.

Poll Question #3

Victoria Ludwig: So we're going to do one last poll question before we go in to the Q&A. And one last reminder, please type in your questions into the chat box. You can do that even during the Q&A. We'll try to get to as many as we can. If not, we will post them – we will answer them later and post them on the website along with the proceedings.

So, Wendy, over to you.

Wendy Jaglom: Great. So the last poll question is which implementation step best characterizes your community's current efforts to reduce the heat island effect? And for this question we ask you to select just one of the answers. So, are you understanding the scientific basis and available tools? Are you implementing pilot projects? Are you implementing full scale projects? Are you evaluating projects and lessons – identifying lessons learned? Or have you not yet started?

So as of the previous questions, I'll give everyone just a few seconds to select your responses.

OK, I'm going to go ahead and close and share the results. And it looks like 40 percent are at the step of understanding the basic and available tools, 22 percent haven't started yet, 18 percent are implementing pilot projects, 11 percent are evaluating their projects and lessons learned, and 10 percent are implementing full scale projects.

So thanks again for participating in this poll question. And, again, as Victoria mentioned, please continue to send in your questions for speakers. We've got a fair amount of time for the Q&A sessions so we look forward to getting your questions answered.

Victoria Ludwig: Thanks, Wendy. And, again, your answers to the poll are really great for us to learn. And I would add that please let us know what you're doing. As I mentioned, we have a database of some programs in the U.S. as far as what's going on on the ground for heat island work but we know that there's a lot more going on. So, please take the time to send me an e-mail and let me know, it will be very useful to us.

Questions and Answers

Victoria Ludwig: So, thank you to Jason, Pierre and the audience. Great presentations and great sort of enlightening aspects to think about as far as this topic. So now we'll go into the Q&A question which Wendy will moderate for us.

Wendy Jaglom: Great. Thanks, Victoria. So the first question is for Jason. And the question is the graph showing the correlation between temperature and excess mortality seems to show a lag between the high temperature event and mortality. Could you please explain a bit more?

Dr. Jason Vargo: Yes. A number of studies have examined sort of the lag effect that temperature shows. We've been investigating that as well in the Madison area like I mentioned, the study we're doing with hospital admissions. The lag that we found for the zip code level temperature differences tend to be longer for lower temperatures and as the temperatures get higher like these extreme heat events, the lag is less. But it's sort of important to realize that the minimum temperature elevation that the heat island causes really is crucial for extending the time of exposure.

So that's, I think, one reason that you see the lag is that, sure, high temperatures for, let's say, an hour will really only impact the most vulnerable people. But if you have high temperatures for a week and especially in urban areas when you don't see the temperature go below, let's say, 85 degrees even at night for a week, the exposure to those high temperatures is much longer. And so you start to see more and more people as that exposure gets longer and longer and longer. More people susceptible or sort of manifest the heat illness outcomes – heat outcomes.

Wendy Jaglom: Great. Thank you, Jason. So the next question is I believe for Pierre. And the question is which component would show the most bang for the buck so that we could pilot a specific project to show a quick return on investment?

Dr. Pierre Gosselin: Well, there was one slide from Jason about that, that said try to avoid cutting the remaining forests that are in town. That's number one and that's in itself difficult. It takes a lot of organized groups to do that. The next thing would be, from my point of view, projects going for better management of water in town. I mean, if you've got land where that water can remain, it's really effective in operating the energy accumulated in the – in the – in the soil.

After that I would say, of course, parkings and cars in the sense that you can promote bicycle paths and walking paths in town. And that can be brought to public transit. And every time – every time you have one bus it's usually the equivalent of 50 cars so you can reduce the trees – not the trees but the size of the street. And these aren't difficult depending on what you define as a bus. There are some political bucks that are tough to implement. Others are easier. So it depends on the context. But of course it's beginning to be a serious problem. It's going to get only worst and eventually nothing can be solved only by air conditioning.

I mean, there are some real studies showing that heat actually increases when it's centralized. It increases the heat density by several degrees. And not to mention power outages and several problems that can be linked to that. There's no simple answer to that. I believe the combinations

are most effective, the projects having the combination of planting trees, ripping up asphalt, and white roofs, that kind of stuff done together in a – in a specific area.

Wendy Jaglom: Great. Thank you, Pierre. So the next question is for Victoria. And the question is can green roofs also help moderate temperature? Your short slide just mentioned it improves comfort and storm water management. By comfort did you need temperature? aesthetic?

Victoria Ludwig: Great question. And I forgot to mention that all of the mitigation strategies on the slide, green roofs, cool roofs, cool pavement, trees, and smart growth do reduce temperatures. Whether they reduce surface or air temperatures depends on the mitigation strategy and other factors. But they all do reduce temperature and in the – in the surrounding area around the buildings.

The additional benefits that I mentioned were sort of – some of the different ones that aren't as commonly thought of. But in addition to temperature increase, all of the mitigation strategies have been shown to also save on energy use which can often reduce cost and they have reduced air pollution, reduced greenhouse gases.

There are some studies on these aspects, temperature decreases and other things, so I'm happy to point you to some if you'll send me an e-mail. Thanks.

Wendy Jaglom: Great. Thank you, Victoria. So next we have another question for Jason. And the question is can you give a little more detail about the hot block, cool block slide? What's the actual temperature difference? Is it surface temperature or air temperature? Interested in a little bit more detail on that hot block, cool block comparison.

Dr. Jason Vargo: Yes. Like I said that's very preliminary and sort of an anecdote that we've uncovered from a larger part of my Ph.D. work. And so we're just beginning to sort of dive into that. But I will say that we were using the satellite imagery to sort of approximate temperatures. And so when I mentioned the sort of 7 degree difference between the two, that's a difference in land surface temperature which as I mentioned is not always well correlated with air temperature. And that's one benefit of the network in Madison that we have is that the sensors actually measure the air temperature which is the metric that determines your exposure and the metric that is used in all of the epidemiological studies so that it's the metric that we know is associated with the health impacts.

Wendy Jaglom: Great. Thank you. So next we have another question for Pierre. And the question is – or the participant wanted to know where they could find the complete life cycle assessment.

Dr. Pierre Gosselin: Well, if you – it's on the web on our institute website. Just type in Google, the title, the presentation will be made public, I believe, Victoria?

Victoria Ludwig: Yes. Yes, it will.

Dr. Pierre Gosselin: OK. So just type the full title and you will find it easily.

Wendy Jaglom: Great, thank you. We'll do another question for Jason. Do rooftop solar panels respond more like cool roofs or hot roofs where albedo is concerned?

Dr. Jason Vargo: That's not something that I know a lot about so let me start my rambling with that disclaimer. I would like to see – Victoria, have you uncovered anything in the – in the compendium of strategies that talks about that?

Victoria Ludwig: Yes, I was just thinking about that. When we know that – we haven't covered that in our compendium but I do know that several cities have – when they have incentive programs for cool roofs or even laws that require cool roofs, some of them do allow credit for putting solar panels on the roof, meaning they don't have to install – have a cool roof per se on that section. So I'd be happy to maybe talk to some of those groups and find out if they've – if they looked into in. It would seem to me to be a very technical question that would require some good academic research which – yes, we haven't done that at EPA.

Wendy Jaglom: Great, thanks. So I'm going to do another question for Pierre. And the question is does the rainwater harvesting help by promoting vegetation growth or is there some other impact?

Dr. Pierre Gosselin: Rainwater, what actually happens when it's in the soil after it gets there. When heat accumulates into soil, it can evaporate and then bring accumulated energy to the atmosphere. One of the things after this first step of evaporation, the water that has been incorporated into trees and vegetation in the next days, in the following days also evaporates but through the leaves of the trees. So it contributes also to evaporating some of the accumulated energy. So that's the way it works.

There are some cities in Europe that I know that during heat waves use that rainwater that they've put in reservoirs on the streets. It was basically sprinkled the streets to decrease – to evaporate the energy. So that is the way it works as a simple way of using basic physics.

Wendy Jaglom: Great, thank you. Next we're going to ask a question for Victoria. The question is how is the EPA State and Local Climate and Energy Program connecting with local public health departments, if at all?

Victoria Ludwig: Great question. I think we're connecting with them through this work that we've done to produce the webcast series. I think in general in the heat island realm, those two groups, environmental and EPA and the public health agencies have started to connect. They're connecting more and more. We do have relationships with the CDC, the American Public Health Association. With CDC, different parts of EPA have done research on the connection between climate change and health. And also with other groups like the American Public Health Association, we have – we work as partners and just understanding each other's work and helping to promote each other's work.

But in general I would say, we hope to do more collaboration with that realm. And I think this webcast series is a great way to kick that off.

Wendy Jaglom: Great, thanks. Now, we have a few questions for multiple speakers. So the first question is for both Jason and Pierre. And the question is what does the speaker out of Atlanta, Jason, think of the last speaker's thought on the negative co-benefits of green roofs? So I guess it's for Jason.

Dr. Jason Vargo: Pierre, can you just describe some of those negative co-benefits quickly?

Dr. Pierre Gosselin: Yes. Well, you have to read it – it's very dependent on where you are. What is your usual climate and what kind of stuff you need to do to improve your act regarding the urban heat island. What we did is for Montreal to take into account that context and see for each of these activities what was the impact in terms of production of greenhouse gases and the air pollutants that you will bring with your project. So you can imagine that developing a very intensive green roof on an existing building somewhere probably means that if you're in a densely inhabited neighborhood that you'll need a big truck bringing soil. You'll need to import from somewhere the trees or any vegetation that you want to put on your – on your roof.

And compared to that just planting a little tree has less impact to that's the kind of negative impact that you – that you can have from those green roofs. So that would not be my first choice. So, nonetheless, they are useful, they are effective and they bring greenery to the city. So if you're in a downtown area and building something new is going to be a very marginal negative impact compared to the rest of the building and in the long term it could probably be positive. So it depends on each every project but in general what I presented is if you are working on existing buildings in a densely inhabited area like a North American big city, it's more likely to be more negative to do a green roof instead of high albedo membranes.

Dr. Jason Vargo: I think that's very interesting because really when I've talked to people about dis-benefits of urban vegetation, I think I mentioned that in the presentation, we're often talking about sort of a suite of known health impacts related to vegetation in urban areas, be it aero-allergen production, asthma exacerbation, that type of thing. But also property losses, damages from falling trees or breaking trees or just people trying to keep trees longer maybe because of incentive programs than they should – that type of injury, those claims, I don't think are very well understood. This is the first time I've heard about the lifecycle assessment of what's required to actually build or even maintain an intensive green roof.

So I think all of this is very necessary to sort of really accurately represent the sort of cost and benefit of these strategies. As I mentioned in the presentation, I think that's what's needed to really make the strong case and the convincing case to public and private partners that are going to be influential in sort of transforming urban areas into green or cooler places. They are going to want sort of comprehensive assessments of both the ills and the wins for their local neighborhood, the block and the metropolitan areas.

So, I think it's great that someone is doing that work and thought about green roofs in such a comprehensive way.

Wendy Jaglom: Great. Thanks to both of you. So this is a question for all speakers. Can any of the presenters recommend model zoning ordinance provisions for increasing tree cover as a method for reducing the urban heat island effect?

Dr. Jason Vargo: I will…

Wendy Jaglom: Can anybody…

Dr. Jason Vargo: I mean…

Wendy Jaglom: Oh, go ahead.

Dr. Jason Vargo: I have one that I would talk about. I mentioned that the work CULE is led by Dr. Brian Stone. He has a book called, "Cities in the Coming Climate." And there's a lot of examples in that book at the local level and it goes from around the U.S. but also internationally. And I will say that in Atlanta we have a particularly strong tree ordinance. And so that type of legislation is maybe not as important for increasing or adding new canopy but very important for sort of protecting the canopy that you have which is even cheaper.

One thing that the ordinance does include is a recumbence fund so that trees that are taken down must store or sort of the money that property owners pay into the city's fund for new trees comes from – it's like a penalty for cutting down old trees. So in that way it's not only protects the existing vegetation but also sort of provides the mechanism to feed into the production of new urban greenery.

Wendy Jaglom: Great. And Pierre or Victoria, do you have anything to add about recommended model zoning ordinance provisions?

Victoria Ludwig: Well, I'll just say, I think I know of similar programs that Jason mentioned. As far as zoning per se, I don't know of any off the top of my head but there probably are some in the U.S. A lot of other places like Atlanta do have these ordinances with different aspects as Jason mentioned.

Dr. Pierre Gosselin: We're beginning to see – one of the ordinances in this province is that for any new development a part of the land is to be converted to parks on private land. So there is between 10 and 30 percent of the land that needs to be conserved in parks. When it's not possible, well the equivalent in terms of the value of the land is to be paid by the promoter to the municipality for development. So it's at least between 10 and 30 percent.

Wendy Jaglom: Great, thanks to everyone. And we're just about at time here so I think we're going to wrap up the Q&A session. But as we mentioned, the questions that we weren't able to get to during this Q&A session, we will have the speakers draft responses to and post the responses along with the other materials on EPA's website.

So with that, I'm going to pass it back to Victoria to wrap up.

Victoria Ludwig: Thanks, Wendy. Thanks to all of the attendees, especially those that stayed on the full hour and a half. I hope that you found this useful. And more importantly, I'd like to thank our expert speakers, Dr. Vargo and Dr. Gosselin. Without your work in the field on this, we wouldn't be able to do what we're doing at EPA so it's great to know what you're doing and to collaborate.

Please stay in touch with us, join our newsletters or send me an e-mail, look at our website. We always advertise the webcast in all of those places. And we will continue to do some in the future. Please let us know also what other topics you'd like to hear about as far as heat islands or climate change at the local level. We're always looking for good feedback.

And thanks to everyone. Have a good rest of your day.

Operator: That does conclude today's conference. You may now disconnect. Presenters, please remain on the line.

END