

# URBANFOREST CONNECTIONS

webinar series

## The Power of Tree Canopy Data to Plan, Prioritize, and Inspire Stewardship

### Part I: Research Foundations

Wednesday, October 14, 2015 | 1:00 – 2:15pm ET

### TRANSCRIPT

*Jill Johnson:* We're going to dive right into today's topic, the power of tree canopy data to plan, prioritize, and inspire stewardship. This is a two-part mini-series. Today's session, part one, will focus on the research foundations. We'll hear from three speakers: Tom Jacobs, with the Mid-America Regional Council, Morgan Grove, with the US Forest Service, and Dexter Locke, from Clark University. If you have questions during the presentation today, feel free to type them into the group chat and questions pod, down at the bottom of the screen. Then we'll have a brief question-and-answer session for all of the speakers at the end of the webinar.

Our first speaker today, Tom Jacobs, has lead environmental policy and planning efforts for the Mid-America Regional Council, which is Kansas City's regional and Metropolitan planning organization, since 2001. His work focuses on building strong community partnerships and integrative planning platforms to help catalyze multi-benefit cross-sector sustainability-oriented outcomes. Thanks for being with us today Tom, and I'll turn it over to you.

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*Tom Jacobs:* Great, thank you. It is a real pleasure to get to share some of our work with everybody. I think my job in this session is to share a case study from what we've done in Kansas City, in terms of developing an urban tree canopy assessment, or regional forestry assessment, and then trying to implement our different policy and planning and design and management recommendations across our metropolitan area in a variety of different ways.

I'll be happy to share a story with you: The Mid-America Regional Council undertook this effort in a way that's a little different from many of the others that are found around the country. Often times urban tree canopy exercises are led by cities that are then

operationalized through different kinds of city operations. In contrast, MARC is a collaboration of nine counties and 119 cities in a bi-state area. Our work is always intended to build different kinds of partnerships and collaborations to advance different kinds of efforts, in this case urban forestry.

My thesis about our project is: we have a lot of trees, and trying to figure out how to conduct more sustainable urban forest management, for us, has worked best in trying to integrate it into a variety of regional and local planning efforts. I will draw that out as I move forward in my presentation.

In our grant, we received funds from the US Forest Service in partnership with the Kansas Forest Service and the Missouri Department of Conservation. What we intended to do, and what we did, was to conduct a regional forestry assessment and then to use that information to formulate a regional policy and planning framework. Trying to figure out: what do we do with this information to support the outcomes we would like to achieve? As part of that effort we conducted a lot of community education work, and since we completed our assessment a couple years back, we've moved forward into an implementation phase that I will share with you as I move forward.

It's really interesting, all of our work included a very extensive stakeholder participation process and the kinds of comments we received are shown on the slide. People love this stuff, of course they do, everybody loves trees. And I love the final bullet, "Let's take the elevator to the top!". There are so many metaphors out there for how do you aspire towards greater outcomes and succeed at ever higher levels. There is a lot of support for what we're trying to do. People understand urban forestry and trees to be like apple pie and motherhood; something everyone likes. But it turns out to be pretty hard to take it to the next level and implement things. We worked very hard at the policy level and the planning level to try and take our findings and recommendations forward.

This map shows the final outcome of our study, or one of them. We have a ton of trees! We have a quarter of a billion trees with an average of 18.6% canopy coverage. One of the interesting things is, when we broke down our canopy coverage by land use type there was enormous variability. All the residential areas tend to be well treed, we have an average canopy coverage in excess of 40%, whereas in our commercial and transportation and institutional areas, the number was closer to 10%. So think about big box stores or large institutional landscapes or transportation corridors. That gave us some guidance about where we want to focus our efforts.

This was our first stab at trying to do ecosystem service valuation. In our community, our quarter of a billion trees provide upwards of \$320 million a year of benefits relative to air quality, carbon storage, energy conservation, and carbon sequestration. The air quality piece turns out to be a huge driver for us, as are the other factors.

We have a lot of trees. What do we do with it? I've mentioned this question of integration: there is a lot of work we do as a regional planning agency on energy

conservation, air quality, stormwater, transportation, and even neighborhood-level revitalization efforts, and there are incredible opportunities to begin to tie our findings into efforts in each of these respective areas. It is interesting to think: if we want to increase our canopy coverage, how do we maximize different co-benefits relative to reducing urban heat islands and conserving energy, reducing ground-level ozone or improving stormwater quality through more green infrastructure at different geographic scales? How do we think about transportation corridors using Complete and Green Streets concepts?

The context for all of our work in our region is this plan. It's called Metro Green and is a plan first developed in 1991. It's a greenway and green infrastructure plan calling for the development of 1,144 miles of trails and greenways that would serve multiple purposes from flood risk reduction to water quality improvement, to alternative transportation, to creating development amenities in communities, and social connectivity. Of this, the system is about one-third built out: we've made a lot of progress. These corridors that drain, these are tributaries to the Kansas and Missouri Rivers, really contain about 40% of our forest. That is one of our key areas to focus on. It is the basis for policymaking that enables us to link green infrastructure and forestry with other community and economic development kinds of concerns.

So we have a ton of trees, a quarter of a billion trees: What do we do to protect them and to increase canopy coverage? So, as we thought about our policy and planning framework, we started with the general approach of saying: ok, we have a good forest in our region, but how can we do better? How can we link forestry to the full range of regional planning efforts we have underway in our community and agency? Transportation historically has been the most significant, but there are other areas related to housing, energy efficiency, and air quality that provide a strong basis for leverage and connection.

Finally, flexible local implementation is really important for us. We have a lot of different communities all engaged at different levels with different capacities, different levels of political support, different ecological contexts. We recognize the need to come up with different solutions that are flexible to meet the different needs and priorities in different communities.

Two overarching concepts that are important: we talked a lot about urban forestry, but there was a general understanding among our stakeholders that we needed to frame urban forestry within an overarching concept of green infrastructure and that green infrastructure itself is an integral element of community infrastructure. Second, we need to build upon a long history of local commitment to trees and we need to do that in flexible ways. When I looked at the Arbor Day Foundation website, there were 34 communities that were Tree City USA. Everybody's very proud, they have the signs up in their yard. But as I indicated earlier, we really want to raise the bar.

Our policy framework was bifurcated, there's a regional piece and a local piece. At the regional level, which is the one that I tend to focus on the most, there were two pieces.

First we wanted to set a canopy coverage goal for the region. It was a tricky thing to do. We set an aspirational goal because at our agency we don't have operational control over these kinds of issues, so we wanted to try and encourage folks to do more, and the goal-setting process was helpful in that regard. On the regional planning side we have a long-range transportation plan that is informed by regional land-use planning, we have a regional green infrastructure plan, we have regional air quality plans, and quite a bit of activity in watershed planning.

There were opportunities to link forestry to all of these elements as I described. We had received a HUD sustainable communities grant a few years ago focused on redevelopment and targeted activity centers and corridors that looked at: how do we take advantage of existing infrastructure and use smart growth ideas to spur sustainable redevelopment? And of course, forestry fits hand in glove with all of that. We've tried to link this to all the work going on in that area. Our regional canopy coverage goal is a 10% increase, but as I indicated, really a lot of the action is in areas where there's much less canopy, along our transportation corridors, along some of our big box commercial areas. It lends itself to specific kinds of planning conversations, and in that realm. On the other side, maybe it's more about education and incentives. If we were to increase our canopy coverage by 10%, we would get a huge return from that investment in terms of increased level of ecosystem services. The air quality and carbon sequestration benefits are called out on this slide.

One of the things that's interesting to me in Kansas City is, while we would have to plant a huge number of trees in order to achieve that goal we have a lot of land we could use for that purpose. If we have some 40,000 acres of transportation rights of way, just along the K-DOT and MO-DOT corridors, if we were to use 25% of that land we could accomplish our goal. We have some 225,000 riparian acres in our Metro Green corridors, if we were to take advantage of those areas where forests have been fragmented, we could meet our goals. We have huge areas of parking lots in our region, some hundred square miles. Those are places we could effectively turn parking lots into parks or forests. While I haven't had the ability to do this yet, there are a lot of institutional properties, hospitals, schools and other places in the landscape that lend themselves to forestry kinds of endeavors.

That is the regional piece. On the regional side, we're trying to integrate forestry into all these threads of work. On the local side we are trying to come up with a practical, flexible implementation strategy. We divided the kinds of work into four categories that included policy and planning, design, operations and maintenance, and education and engagement. This matrix shows a few illustrations of things that could be done at the regional and local scale. I want to walk you through the local side, the right-hand column of this framework. If we're thinking about policy and planning, all of our communities have tree ordinances or tree replacement ordinances. We found a lot of opportunities to enhance those so they become more effective in achieving very specific, locally-defined policy goals related to managing and maintaining or restoring urban forest. To that end, we had workshops where we looked at model ordinances

and looked at ways to try and improve the ordinances in ways that were useful to them.

On the urban design side, I mentioned Metro Green, our regional plan, which has been adopted by every local jurisdiction in our Metro area. There are opportunities at the local level to look at stream corridors and other natural areas of interest, and think about how to manage the forest in those contexts. One of the specific areas of opportunity for us has been in the realm of storm water management. Like many communities, we adopted best management practices to protect water quality. When we think about sustainable site design, protecting existing vegetation, urban forestry... those concepts fit hand in glove inside of that. We have worked hard to highlight those opportunities so that those in the storm water planning and comprehensive planning communities could consider and include those opportunities in their work. On the operations and maintenance side, this is one of the real rubs. Many of our communities lack the resources to take care of the forest they have. There are huge opportunities to create partnerships, with volunteer organizations and community-based groups, to try and share the work. On the regional side, we have hypothesized that there's a huge opportunity for workforce development and job creation for forestry, and green infrastructure more broadly, to grow plants and care for them, and to manage those landscapes.

That takes me to the final area of education and engagement where there are opportunities to engage our communities and our citizens, residents, and businesses in terms of helping understand opportunities for planting and management, and to plant more trees and take care of them. One of the groups I would like to highlight is the Heartland Tree Alliance, a nonprofit that was born out of an ice storm a decade ago that took a huge toll on our community. This alliance of utilities and communities and a variety of organizations came together through this nonprofit organization, and they teach classes and recruit volunteers to plant and manage trees in a way that has been enormously successful.

As I indicated, we try to take advantage of local best practices and highlight those and create opportunities for our communities to learn from each other. There are a variety of case studies we highlighted. It always works best when we start from there is already capacity and interest. Kansas City, Missouri has done quite a lot of work on its tree ordinance. Overland Park, Kansas has very detailed design standards for both its urban forest and stormwater practices. Liberty, Missouri has a wonderful partnership with its school district and other community organizations that are engaged in taking care of the urban forest. The City of Raymore has a recently developed tree protection plan that is very comprehensive. The Heartland Tree Alliance has a very high level of volunteerism and works with communities throughout the metro area. Johnson County, Kansas Parks and Recreation passed a biodiversity policy for management of their public land. This certainly relates to and strengthens the urban forestry work they are engaged in.

At the beginning of my presentation I neglected to mention all of the partners involved. Our funding came from the US Forest Service in partnership with the Kansas Forest Service and Missouri Department of Conservation. The Davey Resource Group conducted all of the fieldwork for us, David Nowak and his team at the Forest Service Research Station in Syracuse did all the modeling. We worked closely with the Heartland Tree Alliance and other community organizations to move forward on implementation measures.

I will wind up my presentation there. This is my contact information and it will be shared again later in the presentation. All the project materials are available at our website, at [www.marc.org](http://www.marc.org). I will be happy to answer any questions at the end of the session.

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*Jill Johnson:* Thank you Tom; that was a great presentation. Now that we have had a chance to settle in and hear that first presentation, let's take a minute to learn a little bit more about who is listening in on the webinar today. I will post a few questions on the screen and we ask you all take a minute to respond to them quickly so we can get back to our next presentation.

The first question is: where do you work? I will give you a couple of seconds to fill that out. We'll close the poll in 3... 2... 1... great. Our next question is: what is your profession? We'll close that poll in 3... 2... 1... The third question is: where are you from? We'll close that poll in 3... 2... 1... Our last question is: how many participants are listening in at your location today? We'll close that poll in 3... 2... 1... Thank you.

We will move on to our next speakers, Morgan Grove and Dexter Locke. Morgan Grove is a social ecologist and team leader for the US Forest Service Baltimore Urban Field Station and has led the urban tree canopy development team since 2006. Dexter is a PhD student in the Graduate School of Geography at Clark University where he focuses on urban forestry and urban ecology. I will turn it over to you now, Morgan.

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*Morgan Grove:* Thank you. It is a wonderful opportunity to speak with you today. Today we will be speaking about how to increase urban tree canopy and the tools we've developed for that kind of business approach. It's also a way to think about – to think outside the tree pit. I'll make this presentation on behalf of the other people or part of the Forest Service Urban Tree Canopy development team, which includes Dexter, who will also be speaking, Mike Galvin, and Jarlath O'Neil-Dunne. In terms of what we will speak about today, one of which is how have the urban tree canopy tools been developed? How did UTC begin? What does it mean to think outside the tree pit? What are the UTC tools? Dexter will offer concluding thoughts.

How have the UTC tools been developed? They have been developed through our work at the Forest Service Baltimore Field Station. In doing so, we've been developing these tools in a way that works with our local partners, with Baltimore City, with different public agencies, nonprofits, private business, and community groups in the city and surrounding counties. It has been dynamic: as we help solve one question, one problem, new ideas and questions arise, then we work to solve those. The work becomes cumulative, and that will be evident in the way we talk about the tools today. How we work to do one thing, and it leads to the development of a new set of tools.

The business model for this wider application, we pilot these tools in one place, we test out the pilot in other places, and we get to an enterprise approach where it's good to go, it's battle-tested and we feel comfortable and confident with how it's going to work. To give you an idea of that progression: when we first did the urban tree canopy assessment for Baltimore City, it took us nine months to do. When we then applied it to Annapolis, it took about three months to do. Later when Jarlath did the work in New York City, it took five days. And then we felt good, that we had gotten to the enterprise level.

Now a little bit about how UTC began. It starts with our research work doing in Baltimore. One of the things we discovered through our work was that urban riparian areas are not effective for removing nitrogen from the water, which is typically how rural riparian areas work. Urban riparian areas are actually a source of nitrogen that flows into the streams. This was problematic in the Chesapeake Bay program because they had established a goal of planting 200 miles of riparian areas with trees in the Chesapeake Bay watershed by 2020. We realized that the urban areas were not going to be useful for meeting that policy goal, in fact by planting trees in those urban areas we may be increasing the contribution of nitrogen into the streams. As we developed this research, the Maryland DNR Forest Service said: if you're so smart, and if planting urban riparian areas isn't useful for achieving the goals, then what would be the approach?

What we said was, in realizing that the reason the nitrogen was getting into the streams was because urban riparian areas had become disconnected... We realized we have to look to other parts of the city that were connected to intercept water through evapotranspiration. The policy should reflect the fact that in urban areas, all forest patches – all those tree pits, front yards and back yards – they are connected, and any kind of goal to achieve the policies of the Chesapeake Bay Program should focus on an overall urban tree canopy goal. With that in mind, they asked us to do an urban tree canopy assessment.

So what does it mean to think outside the tree pit? This equation is a basic equation for thinking inside the tree pit. In order to achieve an urban tree canopy goal you have what already exists, what you plant, what grows through protection and maintenance, and trying to minimize your losses. What we're learning is that a great deal of achieving a canopy goal has to look at trying to reduce your losses. But it also has to look at where you have existing places to plant trees. This is a typical kind of equation

we have to keep in mind when we are thinking inside the tree pit. We discovered there is much more that exists outside this tree pit.

What did we find outside the tree pit as we are doing our urban tree canopy work? First, one concern is what is the majority of owners that we can achieve significant and multiple benefits? There may be untapped resources that can contribute to the conservation of the existing canopy cover as well as planting new trees. What we started to learn is, within the context of the Chesapeake Bay policy context, is first of all, we establish these canopy goals, second policy changes and Chesapeake Bay policies are about more than just planting of trees, it is also looking at what is your net change, whether it's negative or positive and you can lose trees and a lot of ways: disease, failure of maintenance, development. In the context of the Chesapeake Bay, all of those possible losses are going to count against what the cities are doing.

From a practical perspective of thinking outside the tree pit, it is very limited in terms of what the city can do over the majority of landowners. What we discovered is that the majority of landowners are private residential owners and there is very little policy control over them. Second, the trees are essential for achieving many benefits and we need to be able to figure out how to include those benefits and to recruit those stakeholders. Finally, the stakeholders may come with additional resources. They may have resources that are greater than what the city arborist has in their budget and we need to figure out how to leverage and tap into those resources.

Here's the set of tools we have developed so far. First is urban tree canopy assessment, second is how to prioritize where to plan trees, third is market analysis, and fourth is change analysis. This gives some indication of what we're doing in terms of UTC assessment: on the far left is what remotely sensed images looks like, on the far right is what it looks like with national landcover database of tree canopy, and in the middle is what we are able to do with high resolution landcover mapping. This landcover mapping is done through a combination of the national agricultural imagery program data that is collected for every state every three years and LiDAR data, which helps us assess the heights of the vegetation and deal with issues of shade where trees might be hiding from our four-band imagery but we find with LiDAR. There are things here to note: with the NLCD database, you are only able to find trees in large forest patches. With the approach in the middle, we are able to pick out where trees are, and we can start to integrate this with other databases such as parcel level databases that are critical for integrating with municipal data systems. I would like to note that our job is getting to the point where it's done, in terms of UTC assessment. What I mean is that I think municipalities will no longer need to acquire these assessments. They will start to become available a state-by-state basis. This is the case for Chesapeake Bay where the entire watershed will be mapped. We are increasingly seeing this happening on a state-by-state basis.

The real trick is to think about: how do we take these UTC assessments and start to think about different ways we can use them? Most of the canopy cover is on private residential land, and that's where most of the land is to be able to plant trees. When we

did the first assessment for Baltimore, it became clear that there was no way to achieve the urban canopy goal by planting in all the rights of ways, in the parks. They couldn't achieve it by planting on just the public land. What we see here in Philadelphia, is that residential is the big player. Working with the residential land owners with whom we have no direct authority is going to be critical for achieving UTC goals and the benefits that we seek.

The second tool we have developed is UTC prioritization. We have here on the left is a prioritization map for the city of Baltimore. It was achieved by a stakeholder process where we conducted a survey, people could vote for the different types of benefits they saw. We used a model where people could vote early and often, everyone got 10 votes that they could cast for a single very important benefit or among a number of different benefits. On the right-hand side is a pie chart that shows how that voting went with a lot of people voting for different types of activities that address of water issues, urban heat island. And wanting to do these activities were there is a lot of existing community support and organization in order to get the trees planted. One of the benefits of the prioritization, was that rather than trying to force everyone to agree on the priorities, we relaxed that, let everyone vote, and if people didn't agree on what were the priorities, we started to see they agreed on the places and we could move on in terms of thinking about what can we do in these places in order to increase canopy cover.

When we think about those places, we have to think about: how do we build coalitions? How do we get stakeholders involved? We can look at common interests and start to build those coalitions and look at different site types. When we agree upon those places, they are made of a private residential areas, street trees, parks, schoolyards. And as part of our survey, we asked: where do they work? Through the combination of interest and site types, we could move to specific places and build coalitions where you may be interested in planting trees in the streets, I handle the residential areas, we need to find someone to work in the schools so we can develop a comprehensive approach to put together all different types of sites along with the interests in order to be able to advance tree planting in any one of those high priority areas. This part of the activity of prioritization is critical, as a social phenomenon. We developed the tools for data analysis but also for the social practice and how to engage those stakeholders. With that, I will turn it over to Dexter.

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*Dexter Locke:* Thanks. Morgan talked about the rationale and the reasons why the urban tree canopy tools were developed. He focused on the first two I will talk about the second two. Specifically market analyses, which is the third component. Some research also in Baltimore, looked at the existing tree canopy and market segments. Market segmentation data are frequently use a different types of marketing around consumer goods. These data take census information, demographic characteristics, etc. and they add information about magazines, credit card expenditures, the types of cars people buy... all of this is linked to an address. There are a lot of attributes about

who is living where and what they are buying. A market segmentation database takes those demographic variables and consumer expenditures, does a cluster analysis, and produces categories. These categories are predictive and indicative of the types of things people buy. In a rural forestry context you can think about someone who owns 150 acres of woodland, do they subscribe to Guns & Ammo because they are interested in hunting or Audubon magazine because they are interested in wildlife conservation? These types of data would be helpful for understanding prioritization in urban forestry. Specifically the idea was that that people in different market segments might have different amounts of tree canopy and different amounts of opportunity for tree canopy. What you see here are block groups in Baltimore: the colors correspond to different market segments and the height corresponds to the amount of existing tree canopy. Research in 2006-7 linked the ideas of consumer behavior, lifestyles and market segmentation, and tree canopy.

As we saw before, different people have different priorities and goals. Through the voting process, we have the map on the left. As an example, of trees planted in the fall of 2013. We looked at which organization did the planting: some organizations, like Parks and People, plant on high to low priority areas but Tree Baltimore only plants high priority areas. Different organizations work in different areas because they have different programs, and that is okay. The purpose of this slide is to show that different organizations work in different places with respect to priorities.

What does this have to do with market segments? Here is another example from NYC where there is a lot of literature that says more affluent areas are correlated with higher tree canopy. And while that may be true, what this slide shows... at the top are two block groups of New York City with similar median household income, and on the bottom. But you see a stark difference from left to right. While there may be a general trend showing environmental injustice in tree canopy, it is more complex. The geo-demographic data which capture consumer spending more than just income, other demographic characteristics like whether the household is married, how many people live there, age, there are many variables.

So there are differences in private forest owners, the "new" urban forest landowner, and there are differences among decider groups at parks departments and offices of sustainability, planning, and transportation. The market analysis is designed to bridge those groups. People have different motivation and capacity. [Indiscernible] We started to look again at Baltimore, at a different market segmentation. The map is on the left and a quantitative distribution is shown on the right. There are different market segments. Previous research shows different amounts of the tree canopy and different levels of opportunity.

Here, we take the same segment and look at previous to existing canopy. We can subdivide landcover. Planting trees where there used to be concrete is more expensive but has more benefits. Planting trees where there's already soil would be less expensive but provide fewer benefits. I will show a few of these graphs and take the time to explain them.

On the left, we have odds ratio. And odds ratio of one means the participation in different planting programs is perfectly equitably distributed with respect to the number of households in those market segments. So if 10% of the population was classified in a certain class and they receive 10% of the trees, then they would have an odds ratio of one. If 20% in a class receives 10% of the stuff (free trees), they would have an odds ratio of 0.5. If 20% of the population receives 40% of the stuff, they would have an odds ratio of 2. These dots correspond to different tree programs and rain barrels across market segments.

These market segments are stratified from low income on the left to high income on the right. What we see is that the highest income areas have the most tree canopy, shown on the green horizontal line, and the least opportunities for additional tree canopy, shown on the black dotted lines. However, the participation is really high, 500% under a completely equitably distributed scenario, odds ratio > 5. What we found is that participation in the tree planting programs was different from what was intended. That was an example from Baltimore. We've done peer-reviewed research in Washington DC and Baltimore on tree give away programs. Organizations are interested in understanding who is participating, where are free trees going, and which market segments are outreach strategies resonating or not? The point is we can parse by time, 2009-13, participation is more equitably distributed and rose over time.

Another point I want to make is we can go back and say what happens with high participation in upscale avenues in 2009. What happened? People who administer those programs, why were they successful and why are they less successful at other times? This is to show that it varies with existing and possible tree canopy. We have also done the same research in Philadelphia and you can see participation over time, odds ratios are very close to one.

We're doing the research now in Washington DC and Baltimore and Philadelphia, New York. We started to realize that [indiscernible] there are three types of variables occurring. We have the message, what is being communicated about benefits of trees, the messenger, how is it being communicated (print, media, urban foresters, word of mouth), and the market segments. [indiscernible] The programs we have analyzed tend to fit into the top... [indiscernible] We propose is that maybe different messages are more effective with different market segments and there may be different messengers that are better able to communicate or convince different populations of the values of urban trees.

With a new phase of research: we need to understand the right mix of market, message, and messenger that is most effective. How can we pre-identify that? [Indiscernible] For example, telling renters that trees increase property values is a combination of renters as the market, the message that trees increase property values, and messengers such as urban forestry organization website. This might not be effective with renters but very effective with owners. [indiscernible]

This is a graph from Baltimore; there are three things going on. Priorities of high-medium-low on the bottom. Vertically, we have the different market segments I have been talking about. The colors correspond to the amounts of possible planting area. The area outlined in that red dotted line presents a mix of areas where existing programs are working where there is lots of available space. For example, it may not make sense to work in a low priority area just because there is a lot of available space. The areas inside the red box present a mix of where current outreach is working and you have lots of opportunities and the areas are high-priority. We can do with decision-making stakeholders and geo-demographic statement and identify the possible planting areas. This is showing three UTC tools we have developed in one graphic.

The fourth tool, we're looking at change analysis in DC. The amount of change, whether it occurs in lots of small patches or a large patch. Who the owner of these changing landscapes are and how are they are related to different social economic and environmental factors. This is summary from data DC where we found the lowest income areas had the least amount of tree canopy, but also lost the most in both area and percent of area.

Just to summarize, we have developed those tools to assess how much tree canopy have and how much you could have. We developed the prioritization tools as a way to implement and to prioritize goal settings and to increase engagement across stakeholders. Then we realized, just because people have a high priority area, they aren't necessarily working there. We need to understand the motivation of private residential land owners so have developed the market analysis tool to understand where current programs are working and where they are not working. Finally, we are looking at how the urban forest is changing over time. Please feel free to contact me with any further questions, thanks for listening.

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*Jill Johnson:* Thank you, Morgan and Dexter. We do have a couple of minutes for questions for all of our speakers which includes Tom, Morgan, and Dexter. Just a reminder, if you would like to ask a question, please type it into the group chat and questions pod located at the bottom of your screen. We have a couple and they are directed to Dexter. The first is: have you ever looked at where long-term renters live? This has been discussed as a way to identify who might feel displaced with green-based gentrification.

*Dexter Locke:* That question comes up a lot and we still don't have a good solution. It's hard to identify long-term renters, but I agree the category of owner and renter are too broad. You have people who are renting temporarily, like students at colleges and universities, they are there for two or three years and then moving upward economically, they are mobile people. And then there are people who rent because they cannot afford to own. Even the category of renter needs more attention and further parsing. That's something we're looking at further; I don't have a good answer for that yet. Maybe Morgan has something to add.

*Morgan Grove:* No, I really don't. I think it highlights the need to work with other parts of the city government to come up with strategies and policy instruments that would keep people from being displaced. Such as if they have been there for some period of time that their taxes don't go up or if they've been renting some kind of stabilization. It points to working with other groups beyond just what has been our traditional forestry people.

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*Jill Johnson:* The next question is also for Dexter and Morgan. Has there been a general breakdown in cost of what it means to maintain existing canopy or the cost increase canopy by 1%, 5%, or 20%.

*Morgan Grove:* I think it depends on the program you use and where you are planting. You need certain diameter trees were street trees versus parks and how you plant those trees. I think the costs vary and the costs of effectively reaching groups that may be difficult to reach may also involve other costs. I don't think there's anything standard for that.

*Jill Johnson:* Great, thank you. Another one for Morgan and Dexter. But first, Dexter, did you anything else to add?

*Dexter Locke:* I wanted to suggest, for example, there are areas inside the clover-leaf freeway on-ramp, off-ramp situations that are often mowed and by not mowing, trees will grow back because of natural generation. There can be a cost savings because you're not paying to mow and you're getting the ecosystem services of trees. It doesn't have to be a cost, it can actually be a cost savings.

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*Jill Johnson:* Interesting. That's great. The other one is also for the last two speakers: what is the demographic called scholars and patriots?

*Dexter Locke:* These areas are typically characterized with military, hence the patriots, and colleges and universities. A thing that links them is that a large percentage of the population is between the ages of 18 and 25, and the type of housing. Barracks in the case of military and dormitories in the case of students.

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*Jill Johnson:* I see a few people typing but we don't have other questions yet. I'm going to give it a few seconds for people to finish typing their questions so we can get those read aloud. Funders always request: How much would it cost increase the tree canopy? New York City has planted 1 million trees to increase their canopy, has anyone there put together a cost breakdown of what that increase means?

*Tom Jacobs:* We have not in Kansas City. One of the things we try to say, and it seems important, is that it costs less to conserve trees than to plant new ones. There's a lot of planning strategies and outreach and education and management strategies that can help you get there. It seems like a silly thing to say but an important place to start. It would be difficult to price something like this out. Planting street trees can be much more expensive than planting in a park. It is enormously variable and would depend on the land use context.

[ Link from chat pod: Million Tree initiative report: <http://www.deeproot.com/blog/blog-entries/1-million-trees-vision-or-nightmare> ]

*Jill Johnson:* That makes sense. Morgan or Dexter, do you have anything to add to that?

*Dexter Locke:* I think that underscores the point Morgan made with the equation. Reaching the canopy goal is a factor of the existing canopy, planting, minimizing losses, regeneration, as well as planting.

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*Jill Johnson:* Another question. You mention that UTC data will become more readily available state by state, will that be open source data?

*Morgan Grove:* In some cases yes, and in some cases no. For example, it is available for the entire state of California now. We have some questions about data quality, but certainly for the state of Maryland, Washington DC, Pennsylvania, they are part of the Chesapeake Bay Program, and all those data are available for free. I think we'll get to point where NLCD data is available for free, where UTC data are available for free, and we will be able to do change analysis.

*Dexter Locke:* In the chat box I provided a link to the University of Vermont website that has 70 free high-resolution land cover data as well as the associated UTC assessment reports that summarize the data and meaningful geography like watersheds, etc.

*Morgan Grove:* I would just like to add though, that just as we pay a lot of attention to forest inventory and analysis (FIA) data for the US, we will have to pay a lot of attention to the quality of UTC data as we start to do change analysis.

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*Jill Johnson:* Another question. The PRIZM lifestyle classification system is interesting. What indicators are used to come up with them? From your other answer, it seems like a combination of social and physical characteristics.

*Dexter Locke:* They take census data, socioeconomic and demographic variables, and augment them with geo-referenced credit card expenditures, magazine subscriptions, cars, etc. They don't explicitly include built environmental features, although many of those social characteristics co-vary with the demographic characteristics, so they are implicitly included. There have also been people creating their own classifications to explicitly include environmental and built environmental things like tree canopy, housing density, architectural types, and other types of classifications for different types of analyses. The existing ones were predominantly driven by the needs to classify areas for consumer goods. Subsequent analyses have built different classifications for different purposes, including those kinds of variables as well.

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*Jill Johnson:* What do you suggest for drought-stricken places such as California, Nevada, Arizona where the natural state has few canopy type trees?

*Dexter Locke:* I would suggest looking at Diane Pitaki's research, particularly on the evapotranspiration rates of different trees. She's trying to hone in on the types of shade trees that uses the least amount of water.

[ Link from the chat pod: <http://bioweb.biology.utah.edu/pataki/pataki.html> ]

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*Jill Johnson:* Does anyone have tree canopy cover percentages for other global, international cities or do you know where to find this information? That is probably for any of the speakers, if you happen to know about other cities internationally that have canopy cover data.

*Morgan Grove:* On the assumption that Canada is not part of the US, we have data for Canada. I think that is as close as we get to international at the moment. Weiqi Zhou has done similar types of work for Beijing, so we do have that.

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*Jill Johnson:* There are no more questions in the queue. I do see a few more comments coming in, but if anyone has a question, this is your last chance to ask it of our speakers otherwise we will wrap up. We're getting lots of great links in the chat box, available for international canopy studies.

[ Links from the chat pod:

An interesting study out of Toronto from last year states "For every dollar spent on annual maintenance, Toronto's urban forest returns anywhere from \$1.35– \$3.20 worth of benefits and cost savings each year."

<https://www.td.com/document/PDF/economics/special/UrbanForests.pdf>

Weiqi Zhou does work in China

<https://scholar.google.com/citations?user=uUuTev4AAAAJ&hl=en> ]

With that, I think we will wrap up for today, thank you Tom, Morgan, and Dexter for sharing your expertise with us and thank you for to those on the line for participating. If you are seeking ISA CEU credits, please write down the code for today's webinar, it is US-15-009 and send that in using their form. You can download the form on this pod or from our webpage. If you are interested in receiving a certificate of participation to submit to other continuing education programs, please type your full name and email address in the group chat down at the bottom and we will be sure to send you a certificate.

Please join us for our next webinar on October 28. It will be the second part of the special mini-series on the power of tree canopy data. We will hear from Jarlath O'Neil Dunne, Ian Hannou, and Earl Eutsler, who will illustrate how urban tree canopy assessments can inform strategic decision-making at the neighborhood level as well as the state and regional scales.

Is also worth mentioning that we have written a synthesis report on urban tree canopy assessment to help serve as a guide for urban managers looking for general information, common approaches, and key tips for conducting UTC assessments and analyses.

The report is in press and will be out this fall. Before you sign off, let us know how we are doing, tell us how you would rate today's webinar and provide your comments or suggestions by responding to the poll up on the screen now. You should see a total of two polls up there right now. Please take a minute to do that and thank you and have a great rest of the day.

[ Event concluded ]

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