Florida League of Cities
Center for Municipal Research and Innovation

Research Article Journal | 2017 Edition

Through the **Partners in Municipal Research (PMR)** program, the **Center for Municipal Research & Innovation** serves as a link between Florida's public policy researchers and municipal governments, bridging the gap between academics and public policy makers and administrators. The PMR program currently has 36 participating researchers at 12 research institutes in the southeast region. One component of the Partners in Municipal Research program is a regular research column in the League's *Quality Cities* magazine from our research institute partners. The following is a compilation of those articles published in 2017.

Begun in 2011, the Florida League of Cities' Center for Municipal Research & Innovation is the primary source for local government research at the League. Through the center, Florida's city officials have access to municipal resources and data as well as a number of programs and publications, including two annual research symposiums, a statewide research forum for our research partners, regular research articles in the League's *Quality Cities* magazine and a quarterly e-newsletter.

The cornerstone of the center's research is the annual CityStats survey covering municipal operations, budgets, policies and services. The CityStats survey forms the basis for the online Find A Peer City database tool and the annual State of the Cities report. Contact Research Analyst Liane Schrader with the center for more information.

FLORIDA LEAGUE OF CITIES CENTER FOR MUNICIPAL RESEARCH AND INNOVATION
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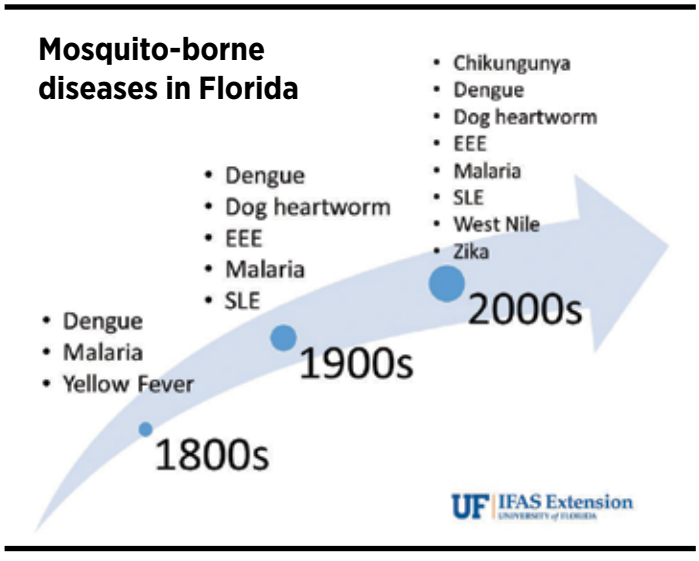
PUBLIC HEALTH

Zika in Florida

Over 1,200 cases reported in the Sunshine State

by Roxanne Connelly
University of Florida

Mosquitoes and mosquito-borne diseases have been a part of life in Florida for hundreds of years. Up until the 1800s, dengue, malaria and yellow fever were common throughout the state. In the 1900s, eastern equine encephalitis, St. Louis encephalitis and dog heartworm followed. More recently we have seen a return of dengue, along with new arrivals including West Nile, chikungunya and Zika viruses. However, the millions of Florida residents and tourists that live in or travel to our state enjoy a reduced threat from mosquitoes and the diseases they carry due to organized mosquito control efforts.



AEDES AEGYPTI AND ZIKA

There are at least 80 different mosquito species in Florida, and of those, about 10 are important when it comes to transmitting the pathogens that can cause disease in humans. *Aedes aegypti,* commonly known as the "yellow fever mosquito," is a major transmitter of the Zika virus in Florida.

The news in 2016 was initially about "imported" or travel-related Zika cases. Imported cases happen when someone is infected while outside of the United States and then returns to Florida, where they are diagnosed. A "locally acquired" case, or "local transmission," means that mosquitoes in Florida have acquired the virus and are responsible for the infection locally.

In addition to documenting imported cases in 2016, Florida was the first of the continental United States to experience local transmission of the Zika virus and most of the cases occurred in Miami. At the time this article was written, Florida had reported 1,011 travel-related cases and 256 that were locally acquired. Daily updates on Zika in Florida can be viewed at *floridahealth.gov/newsroom/all-articles.html.*

The mosquito species of concern, *Aedes aegypti,* is what is known as a "domestic species" or "container species" due to its preference for laying eggs in items that hold small amounts of water that are found around the home. Some common items include bird baths, vases, tires, buckets, bromeliad plants, clogged

roof gutters and cups. This mosquito prefers to feed on the blood of humans. The female mosquito utilizes nutrients in the blood to nourish her developing eggs, which are deposited on the inside walls of containers, not directly on the water surface. The eggs dry out for several days, and then hatch when the water level inside the container rises (due to rain, irrigation, etc.).

After the eggs hatch, the mosquitoes develop through the larval and pupal stages in the water, and then the adult emerges and begins its search for a mate and for food. The time for development from egg hatch to adult can be ~7 to 14 days, depending on the temperature. The warmer it is, the faster they will develop. *Aedes aegypti* mosquitoes do not fly far from the container where they live their aquatic life; they don't fly much over about 500 meters from their aquatic habitat.

Aedes aegypti is a tropical species that has been in Florida since the 1700s. It was once documented from every Florida county. Over time, the distribution has changed such that is rare to find it in the western Panhandle counties. Although, there is another "container" species that is found in every county and sometimes co-occurs with *Aedes aegypti,* that first showed up in Florida in the 1980s – the Asian Tiger mosquito, *Aedes albopictus*. This species was implicated in one outbreak of Zika in Gabon and may end up being an important vector in Florida, but the extent of its importance is not yet known.

Globally, human infections of Zika virus are a recent phenomenon and much is still unknown about the human health effects. However, Zika is the first mosquito-borne disease we have dealt with in Florida that can also be sexually transmitted and is the first associated with birth defects.

STOPPING ZIKA

What can cities do right now to work to prepare for local cases? Two of the most important local activities are reducing mosquito habitats (containers) and protecting people from mosquito bites.

It is important to consider where container mosquitoes live and how their numbers can be reduced. Work with your public works agencies now to establish best management practices for maintaining properties to include trash removal, tire disposal and shredding, and removal or modification of items that collect water. Talk to people about cleaning up their yards. Have waste amnesty days.

Educate your employees (especially outdoor workers) and residents about proper use of insect repellents and how to choose a repellent that is effective. The University of Florida provides information that compares some brands (visit *edis.ifas.ufl.edu/in419*). Avoid the use of gimmicky items like mosquito repellent bracelets and sonic devices advertised to scare mosquitoes away – they do not work and will not provide protection from mosquito bites.

The ability to stop Zika is in our hands. We are all going to have to be involved.

Roxanne Connelly, Ph.D., BCE, is a professor and state medical entomology extension specialist at the University of Florida, Florida Medical Entomology Laboratory. She is a past president of the Florida Mosquito Control Association and the American Mosquito Control Association. QC

A Front Line Response

Miami fights Zika through local partnerships

by Zerry Ihekwaba
City of Miami

Pre-2016, a Zika threat in an urbanized neighborhood, as in **Miami,** was not one of the usual suspects in emergency management and continuity of operations. Therefore, mounting an effective response during the emergency declaration and designation of a Zika zone had a daunting impact on the municipal budget, operations and competing demands. Success required an effective harnessing of local, state and federal resources, stakeholder networking and partnerships, as well as interdepartmental collaboration, to address the emerging public health challenge, as outlined below:

- **Ad-hoc Zika Task Force.** A task force was established and comprised of inspectors from Miami's Building, Fire, Code Enforcement, Public Works, Solid Waste, Parks, Neighborhood Enhancement Team, Police and other departments.
- **Targeted Outreach.** The city increased citizen participation, developed community partnerships and scheduled public meetings to coordinate outreach, educational programming and dissemination of information from the city, county, state and Centers for Disease Control and Prevention through visits, homeowners' associations, business improvement districts, community redevelopment agencies, print and electronic media, street bus shelters and ad panels, TV, web and social media; promoted recycling and visits to schools and parks to educate users, parents and children; and ensured public safety, emergency response, training and distribution of repellents to officers, outdoor workers, the homeless population and others.
- **Enhanced Services in Zika Zone.** Daily, code enforcement targeted slum and blight, overgrown lots, vacant properties, open dumpsters, outdoor storage, illegal dumping and removal of tires; operations staff addressed street sweeping, standing water, street drains, trash holes and landscape improvement with removal of plantings that hold water (e.g., bromeliads); inspected building sites, construction storage bins, open trenches and abandoned swimming pools; and applied larvicides in drains. Miami-Dade County handled mosquito control and spraying.
- **Resolved Operational Challenges.** Prompt communication was needed among agencies and to avoid conflict in public outreach by multiple entities through strategy sessions. Plans were made for large-scale rapid response to stormwater system cleaning and larvicide applications, and for absentee landlords, culture of illegal dumping, vacant properties with restricted access, outdoor storage of tires and containers, plantings and landscape that hold water; legislative restraints and due process rights' provisions in code enforcement were addressed.

With a readiness to bounce forth with controllable impact, the City of Miami mustered all of its resources to fight the Aedes aeqypti mosquito, and thus Zika, in its Wynwood and Little River neighborhoods.

Zerry Ihekwaba, Ph.D., P.E., is assistant city manager for the City of Miami. QC

CIVIC HEALTH

Community Civic Engagement

The heart of democratic government

by Racine Jacques
Lou Frey Institute

2015-16 was the first year of the partnership between the **University of Central Florida's Lou Frey Institute** and the **Florida Benchmarking Consortium (FBC)** to collect data intended to help FBC members to measure and monitor the civic health of their communities. The FBC is an intra-state local government performance measurement consortium with more than 40 members across Florida. It regularly publishes annual performance measures across 20 service areas ranging from animal services to water/wastewater services.

The newly created civic engagement data initiative included 41 indicators to measure the following six key aspects of community civic heath: citizen engagement; governmental action to create opportunities for citizen engagement; governmental action to create opportunities for youth engagement; social capital; community inclusiveness; and the strength of the community's citizen engagement infrastructure.

Community civic engagement is at the heart of democratic governance and it has consequences for the overall health and functioning of our communities. Aggregate data pooled from the Current Population Survey Civic Engagement, Voting, and Volunteering supplements show that Floridians are among the least involved in local politics and governance. The picture is quite similar with regard to community engagement. Florida ranks second to last in charitable giving (donating at least $25 to an organized charity) and 47th in volunteering.

Note the rankings shown on page 45. Against this backdrop, there is some variation in communities across the state. Metro level data suggests that some areas of Florida are doing better in some aspects of civic engagement than others, but this is still far from the best of national benchmarks.

All of this underscores the importance of the FBC civic engagement initiative – to document and understand what communities are doing and how we might learn from each other to establish best practices for civic engagement. The goal of the partnership between the Lou Frey Institute and the FBC is to dig deeper into these trends and measure the civic health of local jurisdictions.

First year results from this initiative were encouraging. Twenty-six FBC members were able to provide data for at least some of the measures, and a number of members reported that they were developing data capture procedures to support expanded reporting in the next cycle.

A number of FBC communities are making substantial efforts to engage their citizens. The **City of Clermont,** for example, reported 74 public events (or 23 per 10,000 citizens) held to gather citizen input or provide public education. Likewise, the **City of Pompano Beach** held 219 such events (or 20 per 10,000 citizens). Over half of reporting members indicated that they provided activities intended to cultivate future citizen involvement, ranging from citizens' academies to town hall meetings and educational outreach through print and other media.

About half of the reporting members indicated that they routinely conduct a citizen survey to solicit input and almost all reporting members have a website designed to support more efficient business contact with citizens, solicit citizen input or both. Results on actual citizen involvement were mixed. The number of volunteer hours reported, for example, ranged from a low of about 214 hours to just over 3,000 per 10,000 population.

Reports also included data drawn from national sources that have well-developed and regular reporting systems. A measure of the strength of the community civic engagement infrastructure, for example, is provided by the per 10,000 population number of nonprofits that offer citizens vehicles for community service and issue advocacy. Not surprisingly, **Tallahassee,** the state's capital, exceeded the statewide (29.3) and national (34.2) averages with 73.6 501(c)3s per 10,000 population. Almost two-thirds of reporting member communities were below the national average.

As this effort matures, it will support a detailed understanding of the civic culture of FBC member communities. If you are doing something innovative with community civic engagement, we would like to hear from you as we continue to build support for local civic participation.

Racine Jacques, Ph.D., is lead analyst at the Lou Frey Institute for Politics and Government at the University of Central Florida. She can be reached at *racine.jacques@ucf.edu*. QC

GO TO:

loufreyinstitute.org to learn more about the Lou Frey Institute's programs. Information on the Civic Health Index can be accessed at ***floridacivichealth.com.***

For more information on the Florida Benchmarking Consortium, including membership, visit ***flbenchmark.org*** or contact FBC Executive Director Susan Boyer at ***sboyer@flbenchmark.org.***

Florida's Civic Health

Where Are We?

44.8% vs NATIONAL 41.9%
Voted in 2014 Election

18.9% vs NATIONAL 23.7%
Volunteered

6.3% vs NATIONAL 8.2%
Attended a Public Meeting

9.6% vs NATIONAL 13.2%
Participated in a Community Organization

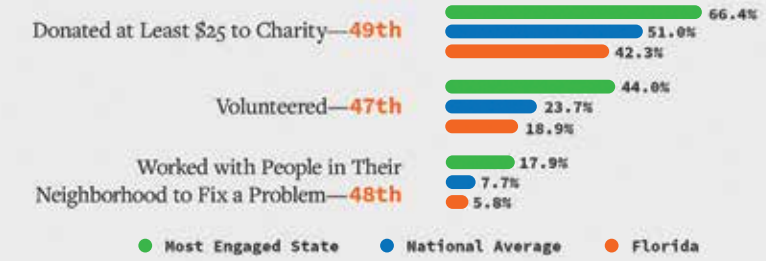
42.3% vs NATIONAL 51.0%
Donated at Least $25 to Charity

7.5% vs NATIONAL 10.3%
Contacted/Visted a Public Official

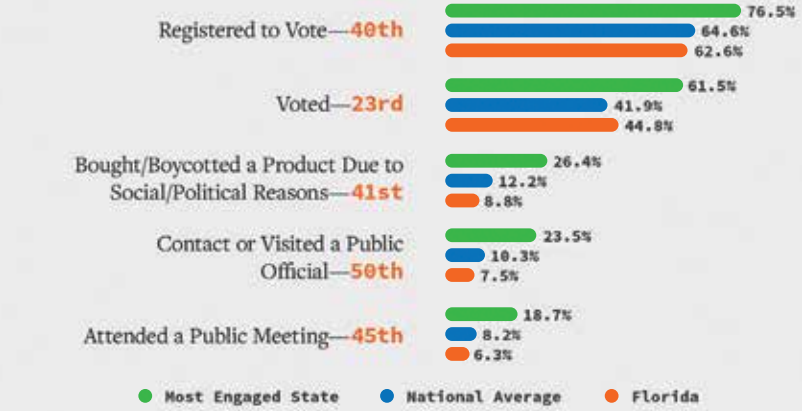
5.8% vs NATIONAL 7.7%
Worked with a Neighbor to Fix a Community Problem

8.8% vs NATIONAL 12.2%
Boycotted an Item for Social/Political Reasons

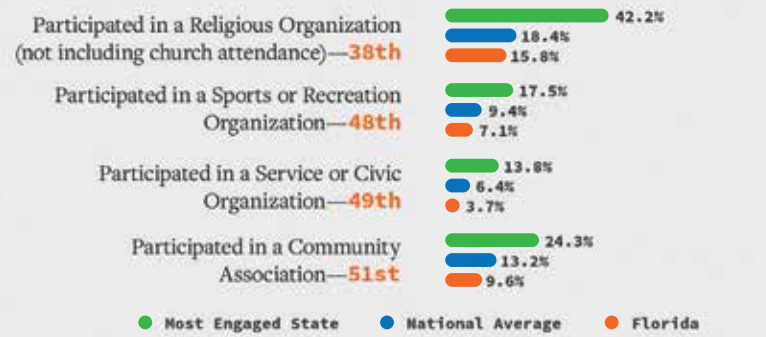
HOW WE RANK—VOLUNTARY ACTION



HOW WE RANK—POLITICAL PARTICIPATION



HOW WE RANK—COMMUNITY PARTICIPATION



LOU FREY INSTITUTE

The Lou Frey Institute promotes the development of enlightened, responsible, and actively engaged citizens. The Institute works to accomplish its mission: Through civic education programs that encourage thoughtful debate and discussion about current policy issues; Through experiential learning programs that encourage the development of civic and political skills; By working to help strengthen the civic education capacity of Florida's k-12 education system; and through research, policy analysis, and advocacy.

Sources: United States Department of Commerce, Bureau of Census, United States Department of Labor. Bureau of Labor Statistics, and Corporation for National and Community Service. Current Population Survey, September 2014: Volunteer Supplement; United States Department of Commerce. Bureau of Census, United States Department of Labor. Bureau of Labor Statistics, and Bureau of Census: Social, Economic, and Housing Statistics Division. Current Population Survey, November 2014: Voting and Registration Supplement

PLANNING

Sustainability in Local Governments

Governance is an important fourth pillar to sustainability efforts

by Haris Alibašić
University of West Florida

Sustainability is defined as a set of effective and efficient actions undertaken by organizations to address social issues, foster economic growth, reduce negative environmental consequences and improve overall governance. It is an integral part of organizations in both the private and public sectors. Sustainability provides cities with a multifaceted approach to improve their communities and operational efficiency.

My research focuses on the sustainability outcomes in local governments, measurements deployed and reporting mechanisms for sustainable outcomes. The following reviews the efforts of **Grand Rapids, Mich.,** which was a part of the research.

Figure 1: The City of Grand Rapids' Quadruple Bottom Line Pillars

While most cities with sustainability plans use the triple bottom line approach, which addresses economic, social and environmental issues, Grand Rapids implemented the quadruple bottom line, adding governance as its fourth pillar of sustainability measurement.

Grand Rapids has had a sustainability plan in place since 2005. Annual reports, which have been published since 2009, show that the city is meeting most of its sustainability targets, and it met or made progress to 99.1 percent of its annual sustainability targets in 2016.

The use of the quadruple bottom line to measure sustainability becomes linked to Grand Rapids' annual budget planning and transformation projects. Each year, the city reports sustainability efforts related to budgetary outcomes. While this approach to measuring sustainability outcomes is unique to Grand Rapids in the United States, a number of cities in Australia have adopted it. However, the Australian cities' approach differs from that of Grand Rapids' in sustainability planning and reporting.

The six overarching governance goals in the Grand Rapids sustainability plan are:

- Providing value to citizens at the lowest reasonable cost
- Offering policies and tools for effective and efficient management
- Sustaining an engaged and informed community
- Delivering open and inclusive government
- Affording an effective and efficient service industry
- Having a sustainable city workforce

Municipalities, and other levels of government, will continue to use a sustainability approach to addressing environmental, social, economic and governance issues.

The fourth pillar, governance, works with the other three pillars to ensure no sustainability efforts are neglected and that they align with social, environmental or economic sustainability. It is important to examine the often neglected areas of sustainability, which include fiscal resilience, community engagement, transparency, accountability and ethics.

This research indicates the breadth and depth of sustainability measurements when governance is fully evaluated as a pillar of sustainability; shows the importance of measuring, reporting and independently verifying results; and highlights the practical application of municipal sustainability to improve strategic planning.

Haris Alibašić, Ph.D., is an assistant professor at the University of West Florida. His research interests include sustainability, energy policy, climate resilience, and ethics and integrity. He has more than 20 years of experience in the public sector, including work for the United Nations Mission and the Office of High Representative in Bosnia and Herzegovina, and directing energy, sustainability and legislative affairs for local governments in Michigan. QC

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SUSTAINABILITY

Waste Matters

Recycling behavior improves with knowledge

by Stephen Neely, JoAnne Fiebe and Taryn Sabia
University of South Florida

As of 2013, nearly 72 percent of Florida's local governments operated recycling programs. While the environmental benefits of these programs are significant, many municipalities face mounting economic challenges due to low rates of participation, declining commodity prices and high levels of contamination (i.e. non-recyclable food products, yard waste and plastic bags).

To address these concerns, the **Hillsborough County Solid Waste Management Division (SWMD)** recently partnered with the **University of South Florida's Center for Community Design and Research** to conduct a study aimed at increasing participation rates and reducing contamination levels in recycled waste. The results of this study highlight a significant link between citizens' confidence in their own recycling knowledge and their recycling behaviors.

While the survey responses were specific to Hillsborough County, the analysis may assist municipalities in their efforts to improve the quantity and quality of recycled materials.

KEY FINDINGS

The 2016 survey was administered to single-family households in Hillsborough County, and a total of 1,570 usable responses were received[1]. As part of the survey, respondents were asked the following question: How confident are you that your household knows which materials should be recycled and which items should be placed in the trash?

Subsequent analysis revealed that this measure of confidence is significantly related to a number of important attitudinal and behavioral outcomes. This suggests that as individuals become more confident in their own recycling knowledge, they are more likely to recycle with greater frequency and produce less contamination in the process.

For example, those with higher levels of confidence are more likely to place a high priority on recycling (Table 1). Nearly 90 percent of respondents who identify themselves as "very confident" indicate that their household places a "high priority" on recycling, as opposed to only 41 percent of respondents who

Table 1.

Cross-Tabulation for Confidence and Priority±

	Percentage of Responses				
	Very Confident	Mostly Confident	Somewhat Confident	Not Very Confident	I Don't Think About It
How high of a priority is recycling in your household?					
High Priority	89.9	83.1	59.3	41.4	16.7
Medium Priority	8.8	15.9	33.2	37.9	16.7
Low Priority	1.3	0.9	7.2	20.7	16.7
Not a Priority	0.0	0.2	0.3	0.0	50.0
Total	**100**	**100**	**100**	**100**	**100**

Source: 2016 Hillsborough County Recycling Survey

± Percentages total to 100% by column (Confidence Level)

$X2 = 558.040$; $\phi = 0.596$; $p \leq 0.01$

Table 2.

Cross-Tabulation for Confidence and Priority±

	Percentage of Responses				
	Very Confident	Mostly Confident	Somewhat Confident	Not Very Confident	I Don't Think About It
What portion of your household's recyclable waste do you place in your blue recycling cart at home?					
All	82.1	70.1	41.0	48.3	0.0
Most	16.3	27.3	46.6	20.7	50.0
Some	0.7	1.8	12.4	31.0	33.3
None	1.0	0.8	0.0	0.0	16.7
Total	**100**	**100**	**100**	**100**	**100**

Source: 2016 Hillsborough County Recycling Survey

± Percentages total to 100% by column (Confidence Level)

$X2 = 253.896$; $\phi = 0.402$; $p \leq 0.001$

Partners in Municipal Research

The **Florida League of Cities' Center for Municipal Research & Innovation** is the primary source for local government research at the League. The center's **Partners in Municipal Research Program** bridges the gap between the academic community and Florida's municipal governments through research collaborations, open discussion of current research projects, data sharing, and opportunities for research-focused education in the form of workshops, reports and publications. The CMRI has formed collaborative partnerships with more than 30 researchers at 12 state and national research institutes/universities and is committed to enhance and learn from their research. The research series published in *Quality Cities* shares a variety of municipal-related topics that the partners are studying. To learn more, contact Liane Schrader at *lshrader@flcities.com* or visit *floridaleagueofcities.com/research*.

are "not very confident." Furthermore, respondents with high levels of confidence also place a substantially larger portion of their household's recyclable waste into the county-provided blue recycling cart (Table 2). Ninety-eight percent of "very confident" respondents indicate that they place all or most of their household's recyclable materials in the blue recycling cart, while only 69 percent of respondents who are "not very confident" do the same[2].

The results also suggest that confidence is associated with a reduction in contamination, which can help to lower costs and increase output for municipal recycling programs. For example, those with higher levels of confidence are significantly more likely to rinse out food containers before recycling them. Nearly 80 percent of "very confident" respondents report doing so, compared with less than 50 percent of respondents who are "somewhat" or "not very confident." Confident recyclers are also more likely to return plastic bags to the grocery store for recycling rather than disposing of them in the trash or through other suboptimal means.

RECOMMENDATIONS

This relationship between confidence and proper recycling practices underscores the importance of education and outreach in successful municipal recycling programs, a fact that is attested to by industry leaders and academics alike. In its own best-practices guidelines, the U.S. Environmental Protection Agency (EPA) advises that " . . . regular communication with the public helps reduce contamination and increase participation." A number of academic studies have supported this claim, and some evidence suggests that every dollar (per capita) spent on recycling education can increase participation rates by as much as 2 percent.

To determine more effective public outreach efforts, survey respondents were asked to indicate the best methods for informing them about recycling (Table 3). Frequent responses included direct mailers (66 percent), information left on the blue recycling cart (41 percent), and email notifications (31 percent). In hopes of maximizing the impact of these communications, respondents were also asked to indicate which types of information would encourage them to recycle. A majority of respondents (52 percent) indicated that knowing more about what is done with recycled materials would encourage them to recycle, while approximately one third of respondents said that they would like to better understand the environmental costs/benefits (37 percent) as well as the fiscal benefits that recycling produces for the municipality (34 percent).

The findings suggest that citizens are amenable to learning more about recycling and that a better understanding of the functionality and benefits of local programs may help to increase their participation. As the public's confidence in how and what to recycle increases, municipalities will be better poised to address the dual hurdles of participation and contamination, resulting in more robust and sustainable recycling programs.

Table 3.
What is the Best Way to Inform You about Recycling? (n = 1,570)

	Frequency	Percentage
Information left on my blue recycling cart	645	41.1
Direct mail from Hillsborough County	1,044	66.5
Email notifications	495	31.5
County website	401	25.5
County social media	240	15.3
Through my neighborhood/community association	221	14.1
Local news media	362	23.1
Online search engine	139	8.9
County education and outreach events	147	9.4
Other	26	1.7

Source: 2016 Hillsborough County Recycling Survey

† Categories are not mutually exclusive, so percentages do not total to 100.

Stephen Neely, Ph.D. is an assistant professor of public administration at the University of South Florida, School of Public Affairs. JoAnne Fiebe, MUCD, LEED AP, is a visiting assistant research professor at the University of South Florida, Florida Center for Community Design and Research, and Taryn Sabia is director of the Florida Center for Community Design and Research. All tables and sources for this study are available by emailing *srneely@usf.edu*. QC

Endnotes

[1]The survey used a non-scientific sample, allowing residents to opt-in to the survey online.

[2]We acknowledge the potential for a simultaneous relationship between these variables – wherein frequent recycling will lead to greater confidence on the part of citizens; however, we would also emphasize that the link between knowledge and behavior is consistent with the findings of prior studies and it suggests that helping citizens increase their confidence in what and how to recycle will result in increased participation.

URBAN FORESTRY

What Have Trees Done for Me Lately?

How about nicer neighborhoods, a stronger economy and more?

by Shawn Landry
University of South Florida

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Consider a time when you had to leave your car in a surface parking lot during an all-day meeting in July. Did you look for a parking space in the shade of a large tree?

Most Floridians would choose the shady spot, because of the cooling effect provided by that tree. Moderating air temperatures is one of the obvious benefits that trees provide, but scientists have been studying the ecosystem services provided by trees for decades.

The term "ecosystem services" describes the direct and indirect contributions that nature (in this case, trees and forests) provide to human well-being. Years of research has resulted in robust models to estimate the monetary value of ecosystem services, including air pollution removal; energy savings from reducing the need for air conditioning; intercepting rainfall to reduce stormwater runoff; and, of course, removal of carbon from the atmosphere by converting carbon dioxide to oxygen.

Research drawing upon the freely available i-Tree Tools (*itreetools.org*) suggests that trees in the **City of Tampa,** for example, provide more than $16 million per year in annual benefits from these services alone. Furthermore, a standard appraisal of replacement costs suggests that the trees in Tampa are worth $1.69 billion. What have trees done for you lately? Cities like Tampa and **Gainesville** have measured their urban forest and used i-Tree Tools to answer that question.

Trees and urban forests provide many additional benefits that are not quantifiable using i-Tree or other available tools. Numerous economic studies have associated trees with an increase in residential property values, home sales and rental prices. Research from **Portland,** Ore., estimated that street trees could add $15.3 million in annual property tax revenues, because residential homes with trees in their yards had higher sale prices.

In commercial areas, shoppers indicate that they will travel a greater distance to, and spend 9 percent to 12 percent more, in central business districts with high-quality tree canopies. Local econometric studies and opinion surveys can be used to estimate the monetary value of many tree benefits in a city.

Not all the benefits need to be quantified in economic terms. The University of Washington has assembled an excellent resource that summarizes much of the research into trees' contribution to human health and well-being (*depts.washington.edu/hhwb/*). Studies suggest that the presence of trees or activities in nature are associated with shorter recovery times following hospitalization; can alleviate symptoms of Alzheimer's disease, dementia, stress and depression; mitigate symptoms of Attention Deficit Disorder; and improve mental health overall.

A long-term cohort study in **Tokyo** found that elderly residents lived longer when they had access to tree-lined streets and green public space.

Trees also can help with the fight against crime. Research in **Chicago** found 25 percent fewer acts of domestic violence, 56 percent fewer violent crimes and 48 percent fewer property crimes at public housing buildings with greater amounts of trees and vegetation. In residential neighborhoods, trees have been associated with lower crime. In Portland, fewer property crimes were found in neighborhoods with more street trees. Research from **Baltimore** found that a 10 percent increase in tree canopy was associated with a roughly 12 percent decrease in crime.

These benefits are just a sampling of the valuable services provided by trees and urban forests. Public opinion surveys have shown that urban residents recognize and value these benefits, but also express concern about some of the problems associated with trees. Consequently, a goal of managing trees in cities should be to maximize the benefits while minimizing the costs and problems. Cities in Florida, such as Tampa and Gainesville, are beginning to conduct the research and monitoring necessary to maximize the benefits provided by trees in their urban forest. Will your city be next to ask the question: "What have trees done for me lately?"

Shawn Landry, Ph.D., is a research professor at the University of South Florida School of Geosciences and director of the USF Water Institute (*waterinstitute.usf.edu*). QC

Estimates of the Value of Ecosystem Services Associated with Tampa's Urban Forest

NUMBER OF TREES
8.7 million, including mangroves
4.4 million, excluding mangroves

STRUCTURAL VALUE
$1.69 billion*

TOTAL CARBON STORAGE
627,000 tons ($8 million)**

ANNUAL CARBON SEQUESTRATION
17,000 tons/year ($216,410/year)**

POLLUTION REMOVAL
1,110 tons/year ($9.6 million/year)***

BUILDING ENERGY SAVINGS
$4.6 million/year****

AVOIDED STORMWATER RUNOFF
29.8 million cubic feet/year ($1.9 million/year)

TOTAL PER YEAR
$16.3 million/year

*Cost to replace the trees based on Council of Tree and Landscape Appraisers valuation procedures.

**Value for carbon estimated at $12.73 per ton of CO2 equivalent in August 2016.
Source: California Air Resources Board, "California Cap-and-Trade Program August 2016 Joint Auction #8: California Post Joint Auction Public Proceeds Report" (2016), available at *arb.ca.gov/cc/capandtrade/auction/aug-2016/ca_proceeds_report.pdf*.

***Pollution removal value is calculated based on the prices of $1,136 per ton (carbon monoxide), $3,399 per ton (ozone), $530 per ton (nitrogen dioxide), $196 per ton (sulfur dioxide), $15,855 per ton (particulate matter less than 10 microns and greater than 2.5 microns), $179,886 per ton (particulate matter less than 2.5 microns).

****Energy saving value is calculated based on the prices of $116.2 per MWH and $17.3 per MBTU.

The Urban Forest, in Dollars and Cents

Estimates of the monetary value of ecosystem services provided by trees can be calculated using the i-Tree tools (*itreetools.org*) developed by the U.S. Forest Service. These values include only a portion of the potential benefits provided by trees and the urban forest.

Based on field data collected in 2011 by the University of Florida and University of South Florida, and estimates developed using the i-Tree tools, the City of Tampa was home to nearly 8.7 million tree stems. See Tampa's urban forest reports at *tampagov.net/planning-division/programs/natural-resources-section*. The replacement structural value for all of these trees (for example, in case of a devastating storm) was $1.69 billion. Pollution removal was valued at $9.6 million per year, including health effects and externality costs associated with carbon monoxide, ozone, sulfur dioxide, nitrogen dioxide and harmful particulate matter smaller than 10 microns.

Tampa's trees stored 627,000 tons of carbon, which would be worth $8 million under the California cap-and-trade program. Residential building energy savings resulting from tree shade was valued at $4.6 million per year.

Trees can help reduce stormwater runoff by intercepting rainfall. The estimated value of avoided stormwater runoff was $1.9 million per year. Based on the ecosystem services estimates that we can quantify using existing scientific models, the annual benefits provided by trees in the City of Tampa was at least $16.3 million per year.

3D visualization of a significant storm surge.

3D VISUALIZATION COURTESY OF UNIVERSITY OF FLORIDA HISTORIC PRESERVATION PROGRAM

DIGITAL TECHNOLOGY

Envisioning the Future of Florida's Historic Coastal Communities

Research project creates precise 3D model to calculate climate threats

by Morris Hylton III
University of Florida

The adaptation of Florida's coastal communities to rising seas and increased flooding must consider the consequences for historic districts and cultural resources.

A critical first step is proper documentation. Any intervention that alters a historically designated building or neighborhood must be informed by research and accurate drawings, photographs and other materials that record existing physical conditions. Traditional recording methods, however, are often labor intensive, time consuming and costly.

In 2012, the **University of Florida Historic Preservation Program** launched the Envision Heritage initiative to explore how new and emerging digital technologies can be used to document, conserve and interpret historic buildings and places endangered by sea level rise, among other threats. Much of the work uses 3D terrestrial laser scanning that significantly diminishes the time needed in the field and produces data with an accuracy of as much as two to four millimeters.

The resulting point cloud – a collection of millions of xyz coordinates – can then be used to generate the products needed to make informed decisions about adapting historic buildings and communities or mitigating their potential loss. These products include 3D visualizations of sea level rise and storm surge scenarios.

Beginning in March 2016, researchers with Envision Heritage partnered with the University of Florida School of Landscape Architecture and Planning and the College of Design, Construction and Planning GeoPlan Center to undertake a pilot project in **Cedar Key.**

Among Florida's earliest settlements, Cedar Key was established in 1859. After a railroad connected Cedar Key to **Fernandina Beach** and the Atlantic, the city quickly became a significant port for the shipment of goods, and home to the lumber mills that supplied the Eberhard Faber and Eagle Pencil companies. Many late-19th and early-20th-century wood frame buildings survive today, making up the core of a National Register and local historic district.

The historic character of downtown Cedar Key helps draw as many as 300,000 annual visitors and financially sustains some

3D visualization of a significant storm surge.

3D VISUALIZATION (TOP) AND PHOTO COURTESY OF UNIVERSITY OF FLORIDA HISTORIC PRESERVATION PROGRAM

BY THE NUMBERS

Cedar Key 3D Visualization of Storm Surge

Approximately **1,300 feet,** or just over three blocks, of Second Street were digitally documented.

The main or street elevations of **23 buildings** were recorded.

29 individual scans were undertaken to complete the point cloud.

Data collection in the field took only **six hours total.**

Processing the data, creating a point cloud and modeling the storm surge scenario took **32 hours.**

The point cloud is made up of **213,000,000 individual xyz coordinates.**

Accuracy of the point cloud is to within **two to four millimeters.**

700 residents. With the city's history of hurricanes and storm surge, local leaders and property owners are actively exploring strategies for protecting their community.

To assist with these efforts, the University of Florida laser scanned an approximately three-block stretch of Second Street – one of the city's main thoroughfares, lined with historic structures housing restaurants, galleries and shops. The individual scans were combined to create a point cloud that captures all the elements making up the urban environment, including buildings, streets, sidewalks and infrastructure.

The point cloud was then used to generate a 3D visualization of a significant storm surge – one of 12-feet, occurring at high tide during a full moon. This visualization technique allowed researchers to better understand how flood water might behave and which structures and segments of the street were most vulnerable. The 3D storm surge visualization was included in a video that was shown at the Cedar Key Chamber of Commerce Welcome Center during the *Think Water Think Cedar* Key program – a series of lectures and events to raise awareness of sea level rise among residents and visitors.

The laser scan data was also used to digitally fabricate a model of Second Street and the buildings that line it. This model was placed in a touch tank in which real water was slowly poured, to demonstrate a variety of potential storm surge and flooding events. The combination of digital visualizations and physical model proved effective in generating public dialog on the topic.

On September 2, 2016, Hurricane Hermine made landfall in Cedar Key. A Category 1 hurricane, Hermine caused a nine-foot storm surge that occurred close to high tide and during a full moon – nearly the same scenario digitally modeled by the University of Florida some six months earlier. The 3D visualization proved accurate in predicting the most vulnerable properties. If needed, the laser scan data could have also been used in repairing any historic buildings damaged by wind and water.

Based on the success of the pilot study, plans are under way to laser scan and digitally document the core of Cedar Key and develop 3D visualizations and vulnerability studies for all the streets and buildings that make up the historic city. The results of the project were shared with a national audience at the second *Keeping History Above Water* conference, held on October 29-November 1 in Annapolis, Md. The University of Florida Envision Heritage team hopes to replicate and expand its work to other cities across Florida.

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