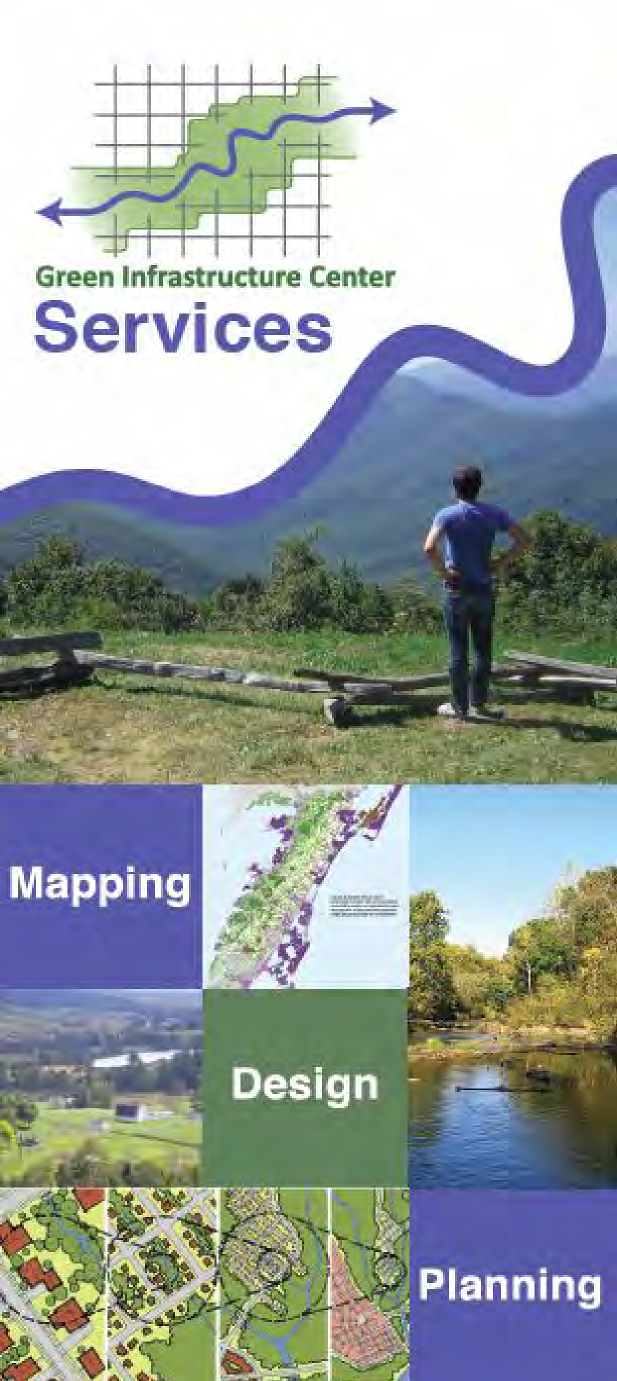
Presentation to the Environmental Planning Subcommittee

Restoring and Preserving Urban Tree Canopy for Stormwater Management

By Karen Firehock, Executive Director,
Green Infrastructure Center Inc.
August 27, 2020

GREEN INFRASTRUCTURE CENTER INC.



The Green Infrastructure Center (GIC) is the technical services provider and we wrote the proposal to fund the project with the Florida Forest Service.

The GIC) is a nonprofit organization that helps communities evaluate green assets and manage them to maximize ecology, economy and culture.

We do this by:

Building landscape models

Teaching courses and workshops

Researching new methodologies

Helping communities create strategies

www.gicinc.org

Slide Show Topics

- ❑ Project Overview
- ❑ Trees as Green Stormwater Infrastructure
- ❑ Data – How are we doing?
- ❑ Codes – What did we find?
- ❑ Q&A

Tree Canopy Project: Trees to manage stormwater and other benefits too!

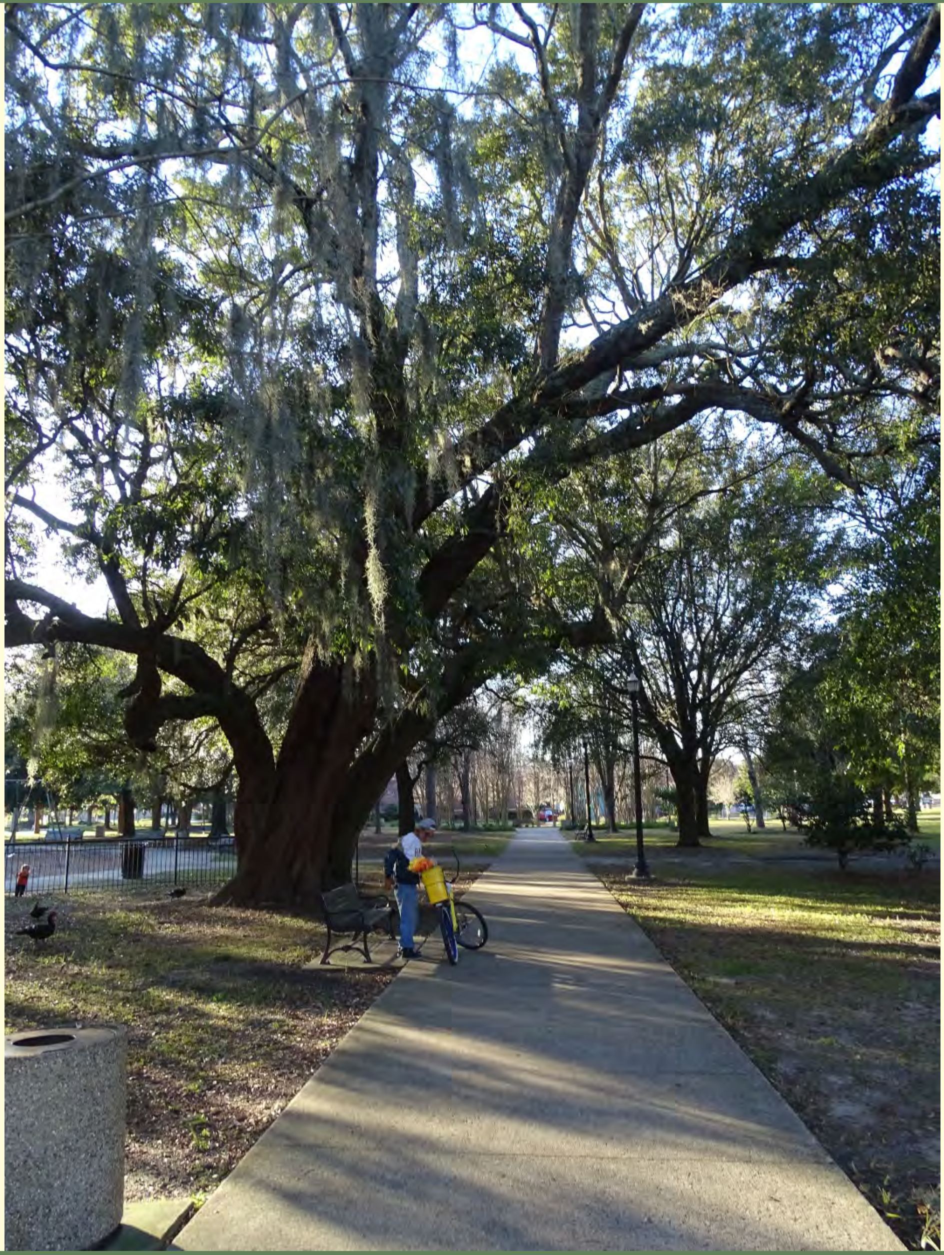
GIC partnered with forestry agencies in 6 states to obtain funds from USDA Forest Service Southern Regionto show how to utilize trees for stormwater management.

6 southern states:
VA, NC, SC, GA, FL, AL
FL: Jacksonville, Orange Coutny, Miami Beach

Project Goals

This project was initiated to help Jacksonville map, evaluate, protect and restore its urban forests for improved stormwater management and clean water.

Urban forests are a vital tool in managing and reducing runoff.

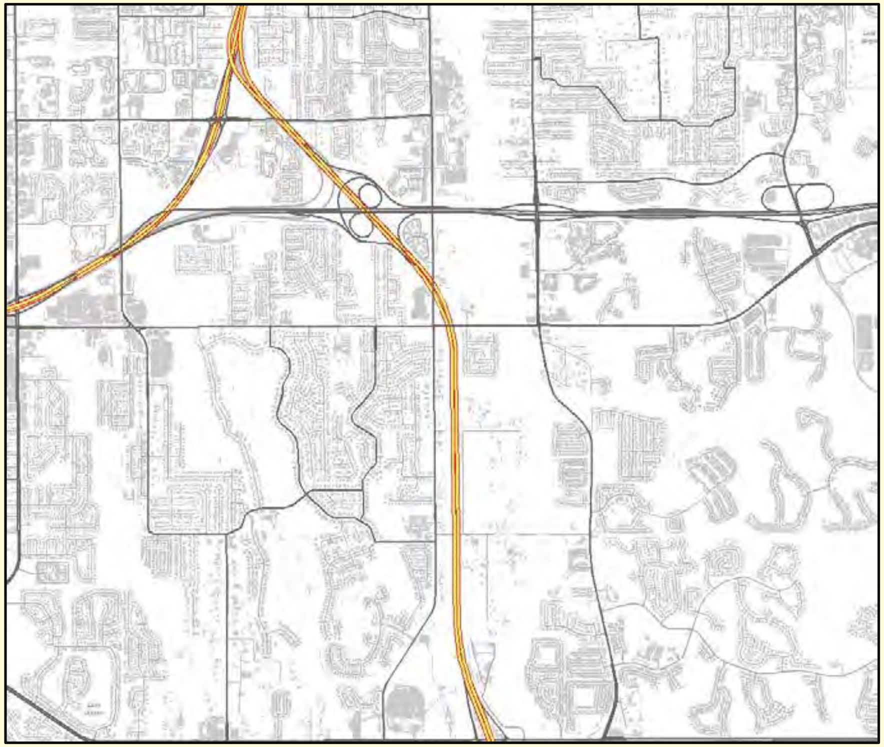


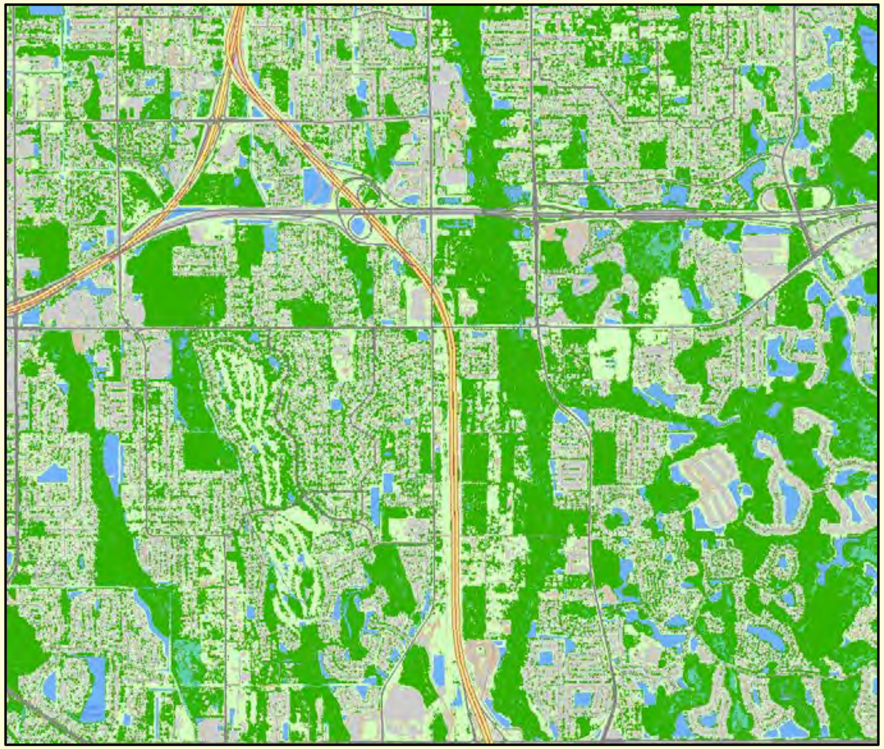
Project Outcomes

- ✓ Map of the city's urban forest and possible planting areas.
- ✓ Method for linking urban forest systems to urban stormwater management.
- ✓ Calculating stormwater uptake by trees
- ✓ Recommendations for how the city can adopt new programs, codes, processes to better integrate the city's trees as part of stormwater management
- ✓ Sharing the work – a case booklet and presentation detailing methodology, lessons learned, best practices on line now!

http://www.gicinc.org/trees_stormwater.htm

What is green infrastructure?





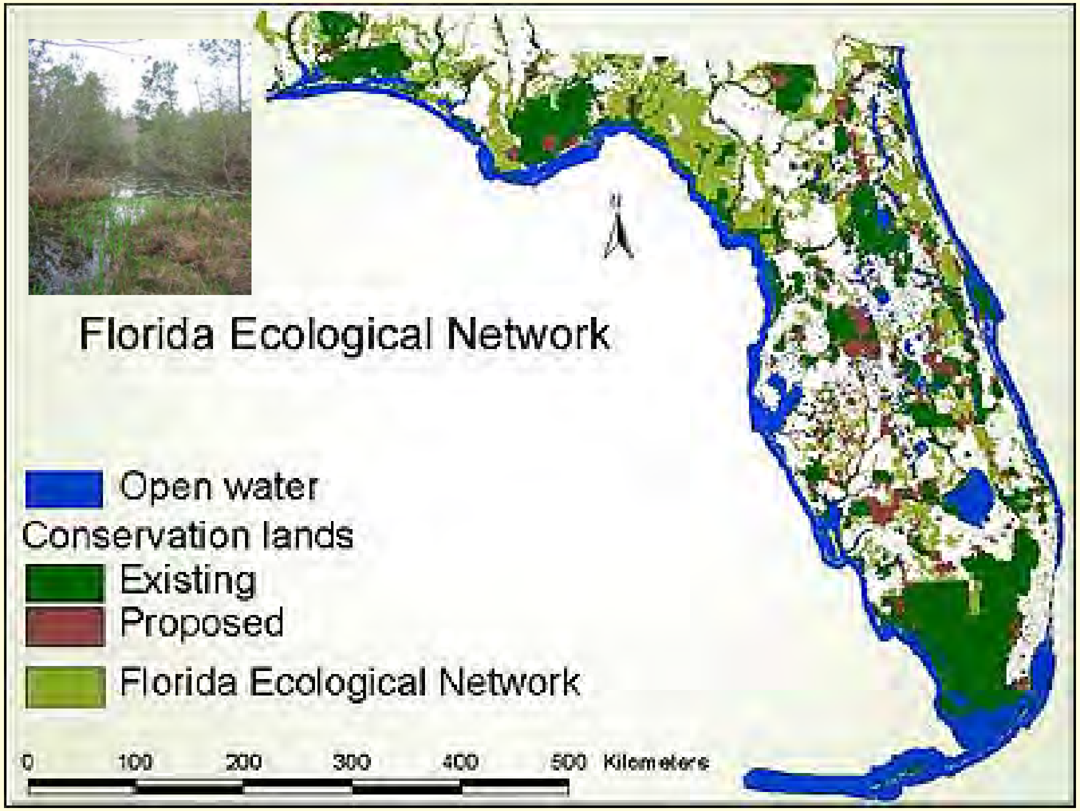
Left shows the gray infrastructure including buildings and roads (left). Classified high-resolution satellite imagery (right) adds a green infrastructure data layer (trees and other vegetation).

Term Origin …

Florida coined the term "Green Infrastructure." in a *1994* report to the governor by the Florida Greenways Commission.

It was intended to show that natural systems are important components of our "infrastructure."

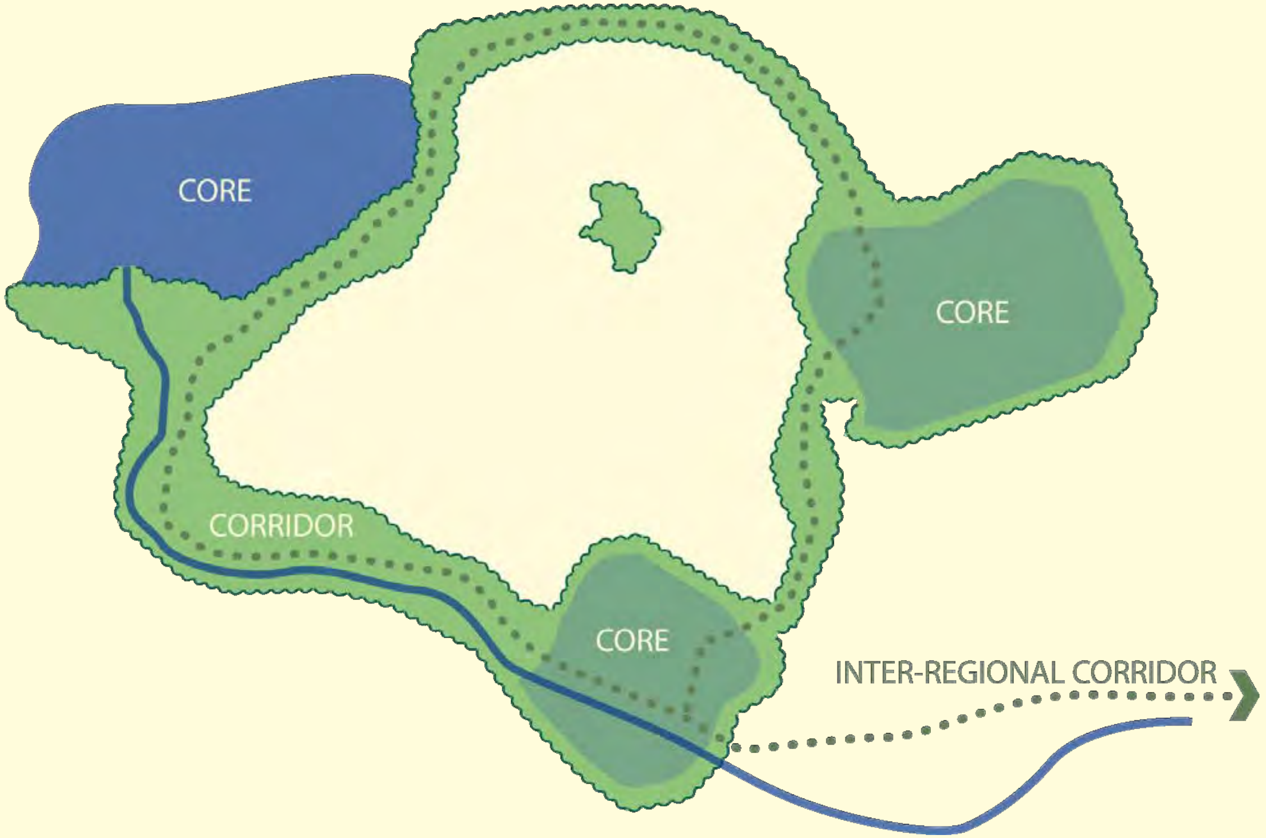
Univ. of Florida built a model to show key assets.



"The Commission's vision for Florida represents a new way of looking at conservation, an approach that emphasizes the interconnectedness of both our natural systems and our common goals and recognizes that the state's 'green infrastructure' is just as important to conserve and manage as our built infrastructure."

Green Infrastructure Planning Requires Thinking About How to Connect the Landscape

Not just key habitat patches but how we connect them!



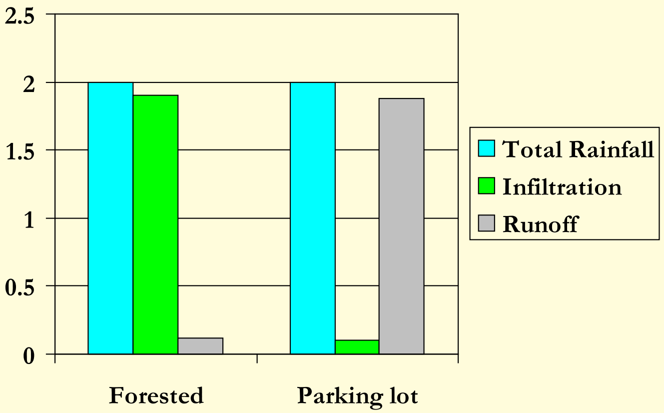
The problem of developments that protect green space without thinking about connections beyond parcel boundaries ...

Trees: the original – and best – green infrastructure!

Trees give us cleaner air, shade, beauty and stormwater benefits at a cost that is far cheaper than engineered systems!

Estimates for the amount of water a typical tree can intercept in its crown, range from 760 gallons to 4000 gallons per tree per year, depending on species.

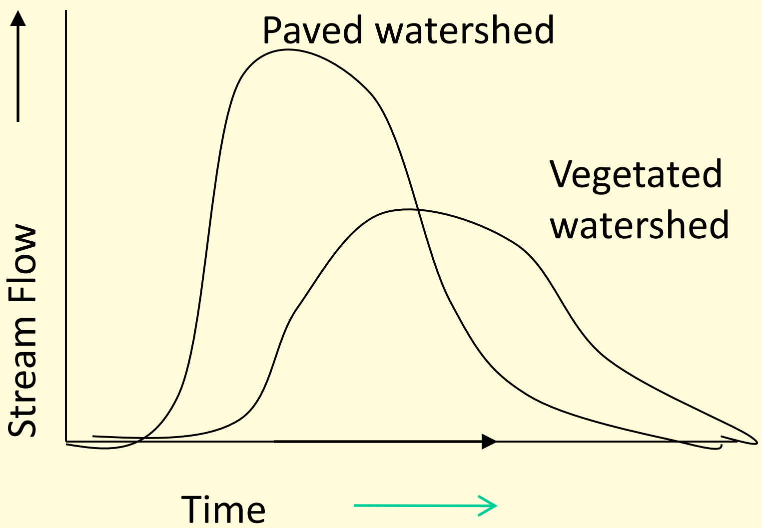
Impacts from Lack of Trees and Too Much Impervious Surface...



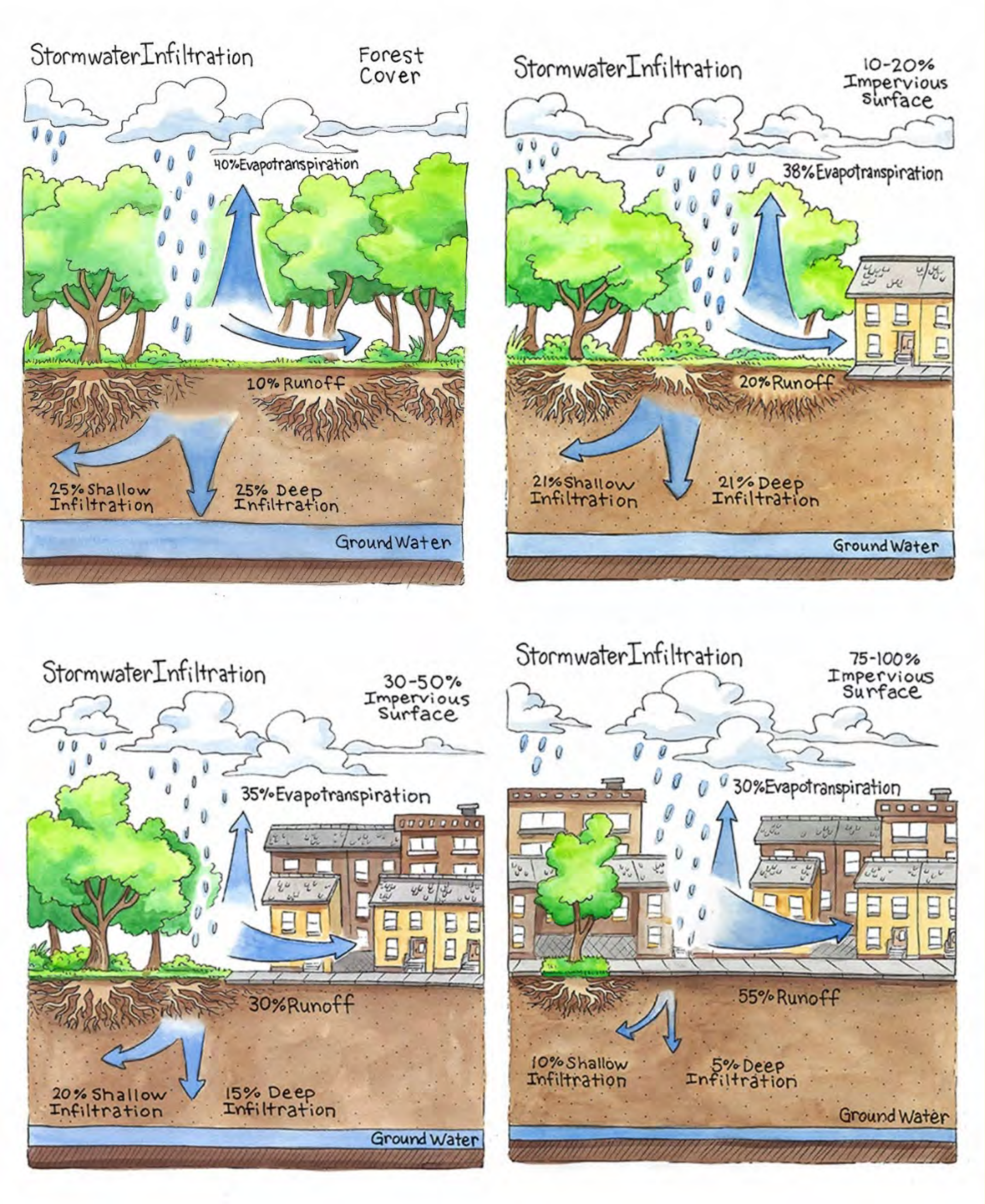
1. Impervious surfaces prevent rain infiltration, causing greater runoff volume and velocity.

2. Storm flows peak sooner in the stream at higher volumes.

3. Higher volumes and velocities of runoff lead to more flooding and damages – the firehose effect!

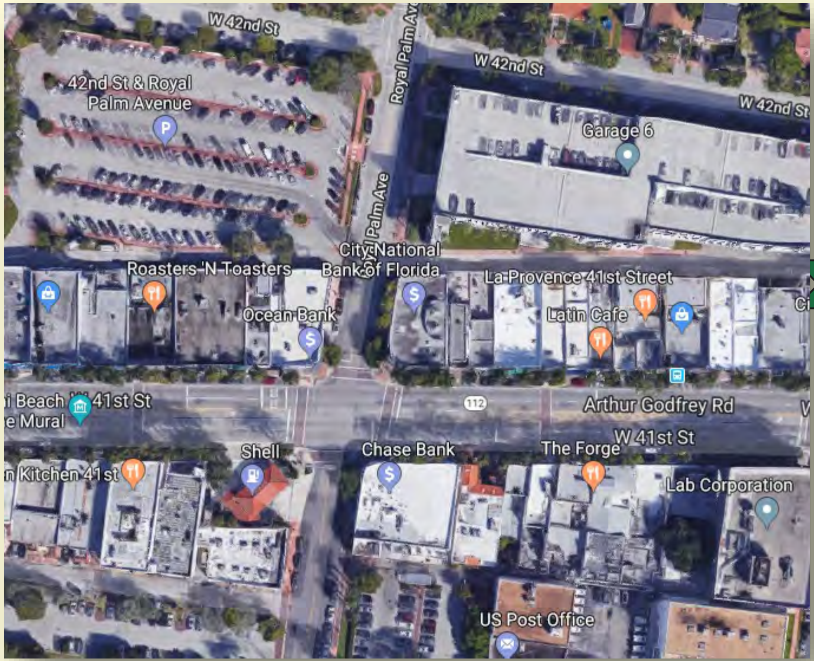


As land cover changes, so does stormwater infiltration …



Water flow strategies

How do we make this…



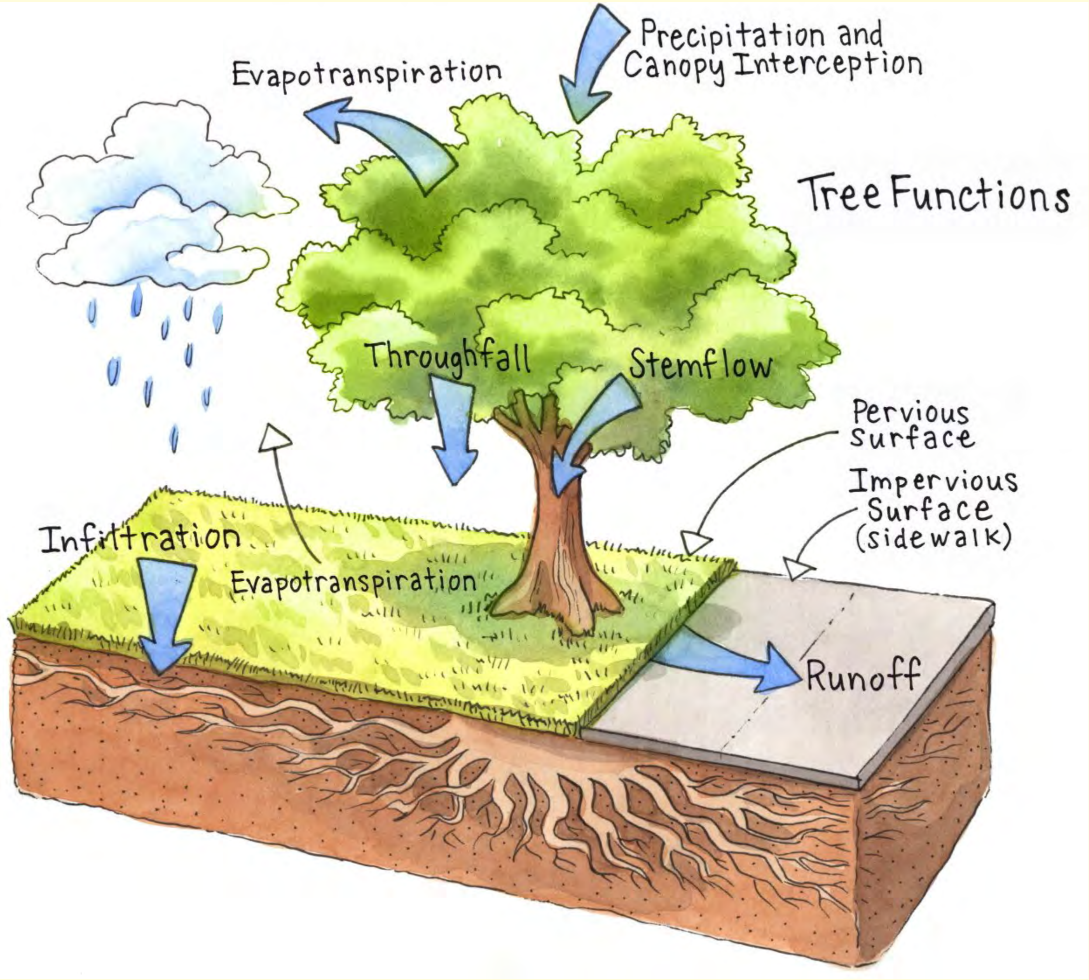
function like this?

Urban Tree Canopy

20% of annual rainfall or > retained in crown
(Xiao et al., 2000)

Delays runoff up to 3.7 hours

↑ infiltration capacity of soils

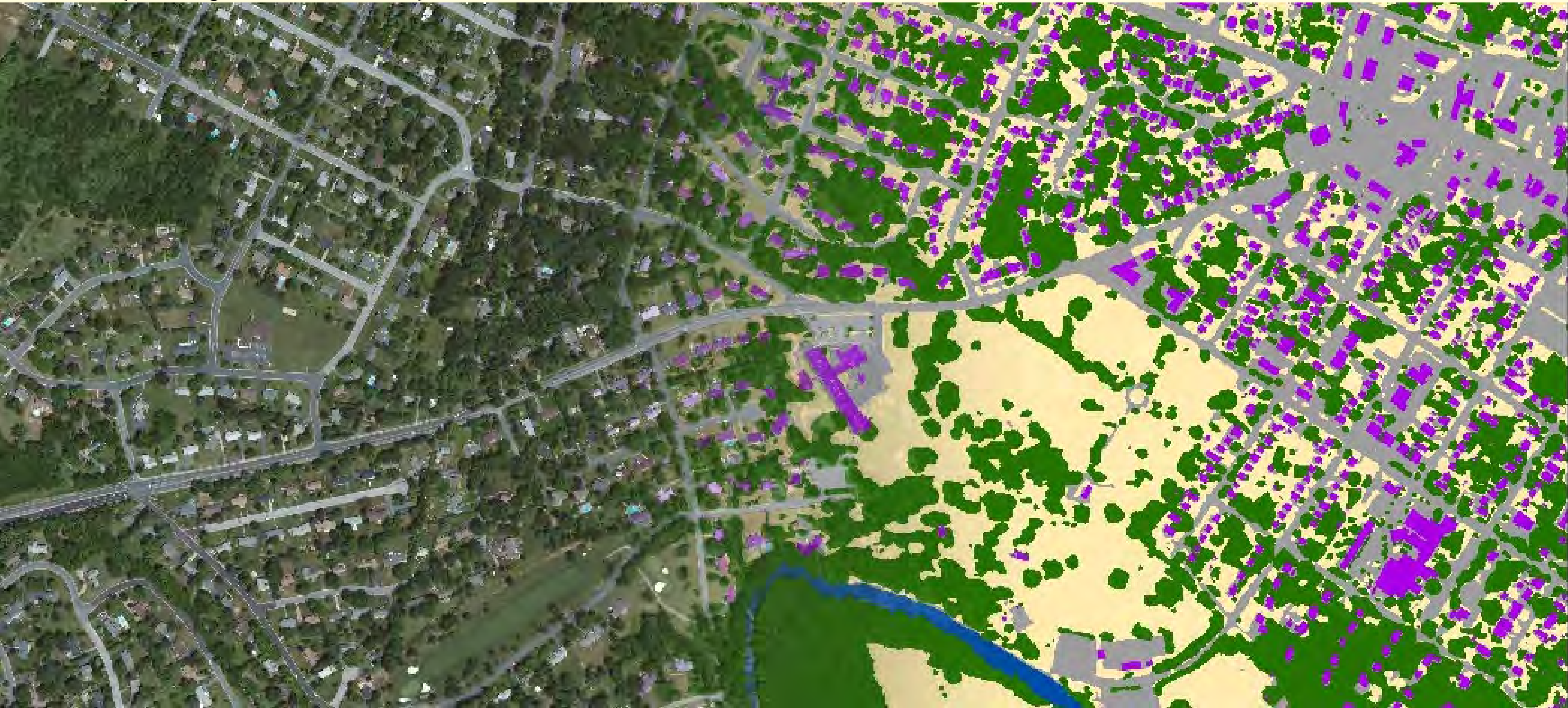


Tree canopy effectiveness is …

- Highest during short, low intensity storms
- Lower as rainfall amount and intensity increases

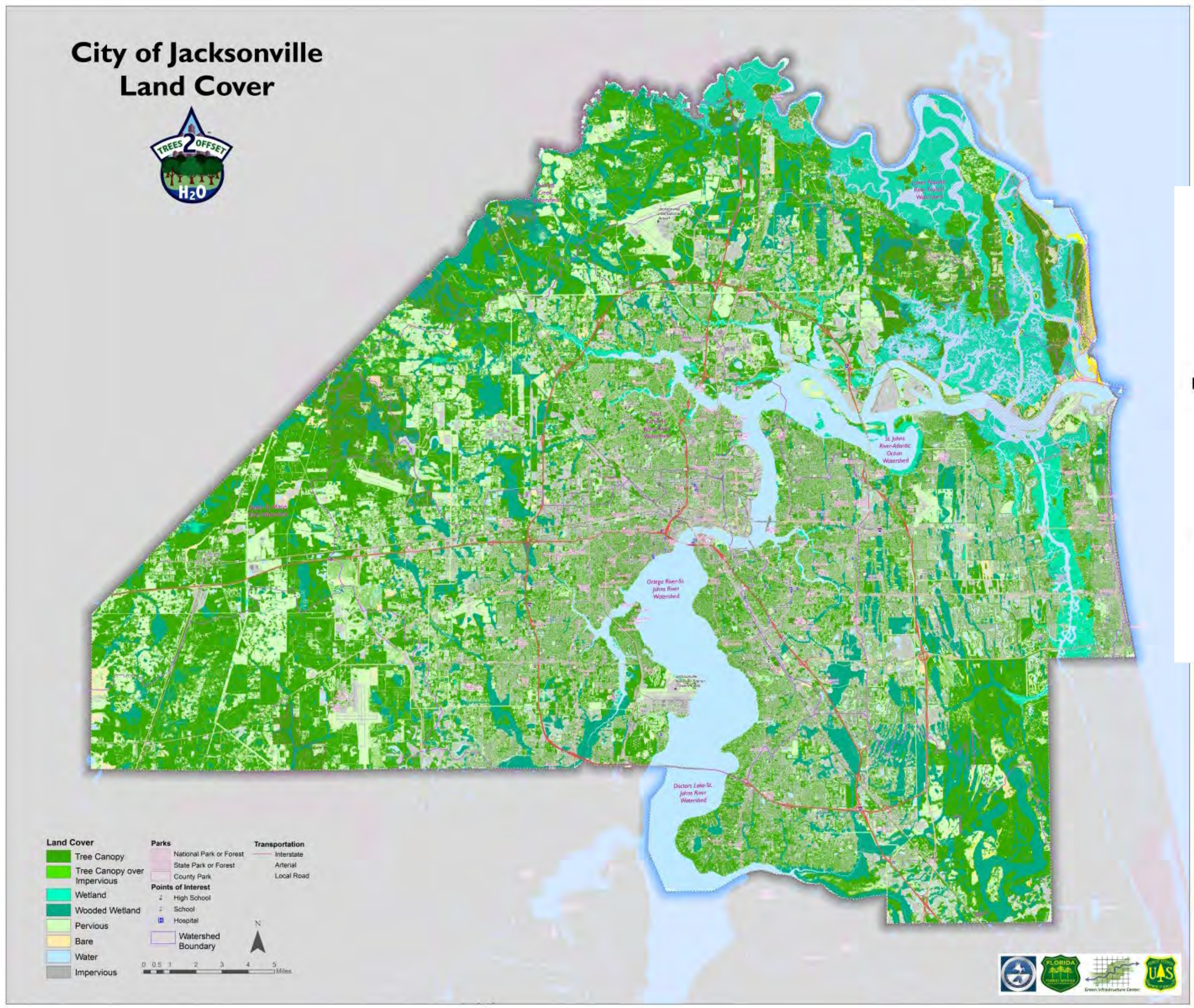
Measuring The Trees – Using Image Classification

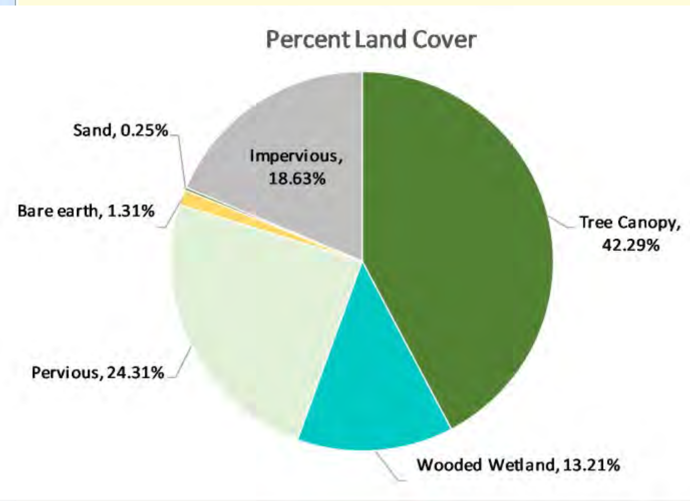
Image classification is the process of breaking an image into discrete 'classes', with one of the most common applications being to identify land use classes (urban, agriculture, forest, etc.)



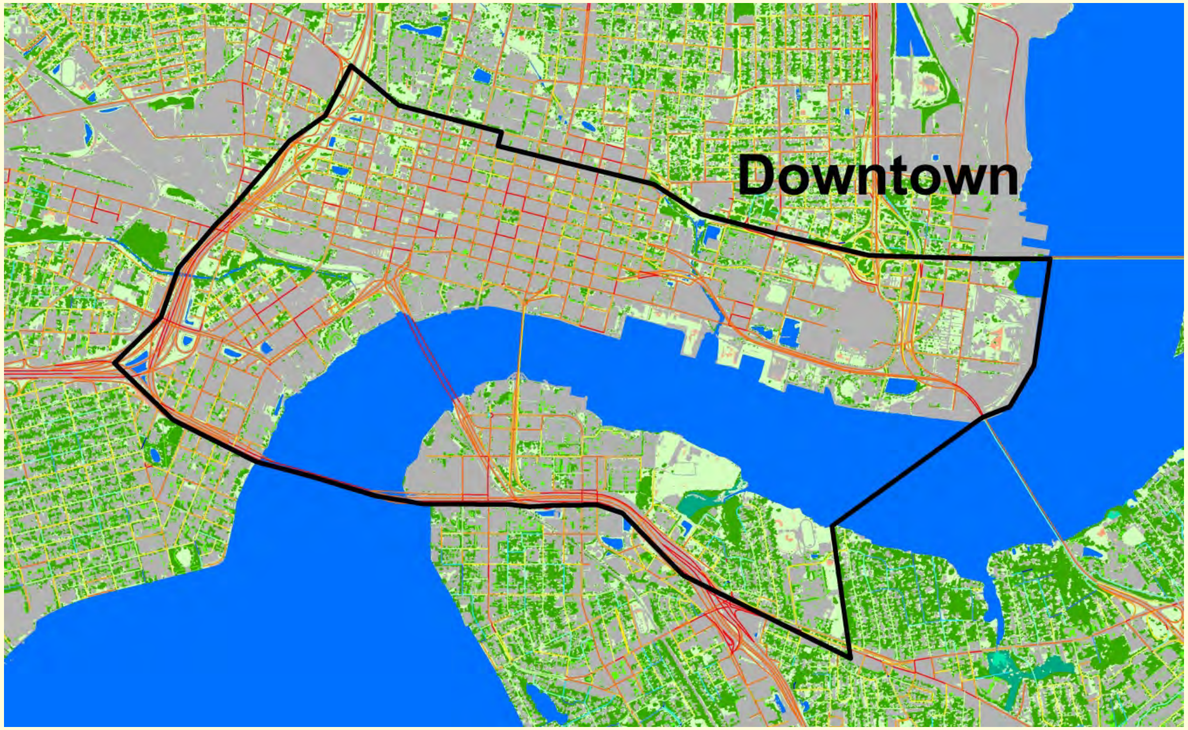
Results! How well canopied is Jacksonville?

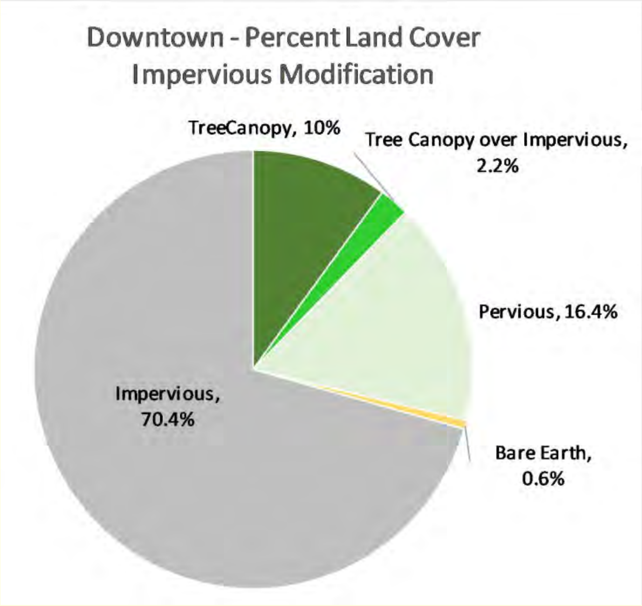
Tree Canopy = 42%



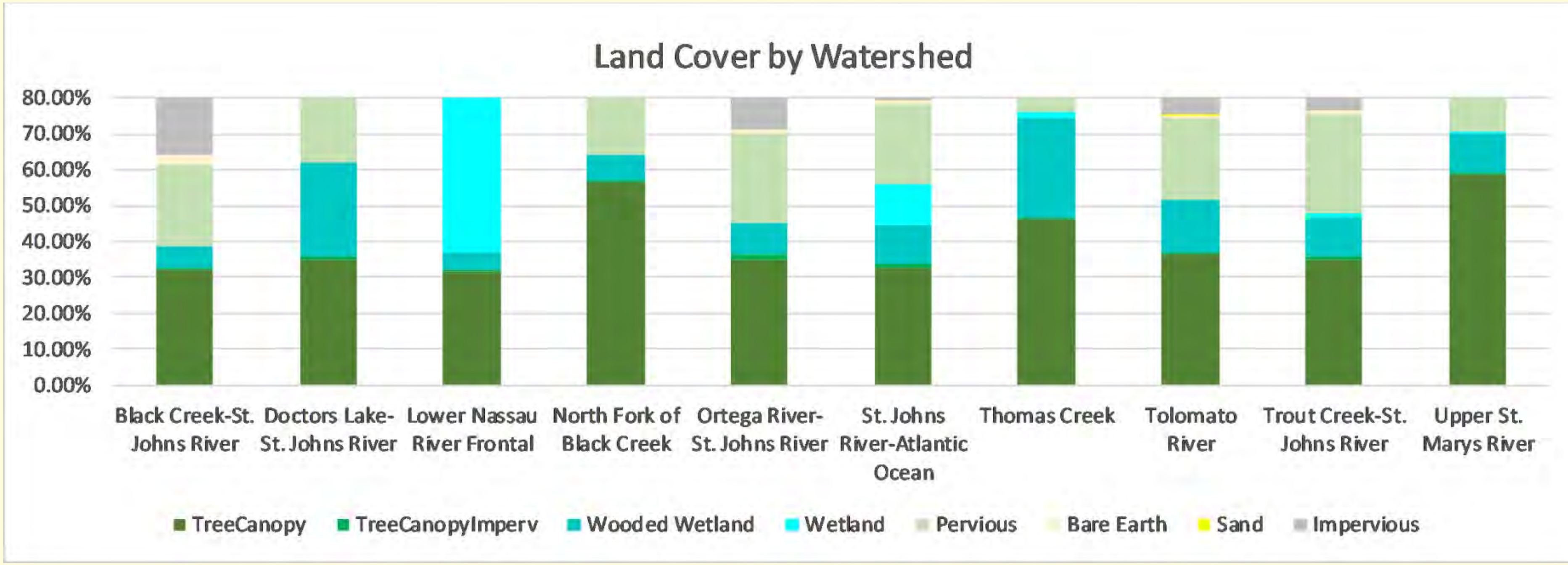


But …an area downtown area is only 12.2 %, so it varies a lot!





Land cover by Watershed



Calculating Stormwater Uptake by Trees – It's complicated!

Tree Over Parking Lot

Tree Over Natural Forest Cover

Tree Over Lawn

Tree Over Street

Forestry Work Group Study

Tree canopy works to reduce the proportion of precipitation that becomes stream and surface flow, also known as *water yield*.

The Hynicka and Divers study (1996) modified the water yield equation of the SCS model by adding a canopy interception term (C_i), resulting in:

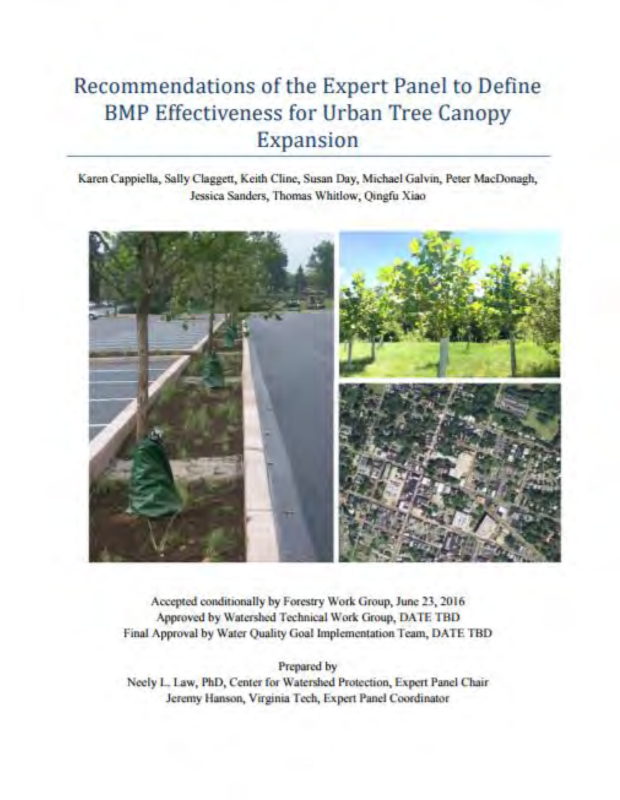
$$R = \frac{(P - C_i - I_a)^2}{(P - C_i - I_a) + S}$$

Where R is runoff

P is precipitation

I_a is the initial abstraction,

S is the potential maximum retention after runoff begins for the subject land cover. (S = 1000/CN – 10)



Recommendations of the Expert Panel to Define BMP Effectiveness for Urban Tree Canopy Expansion

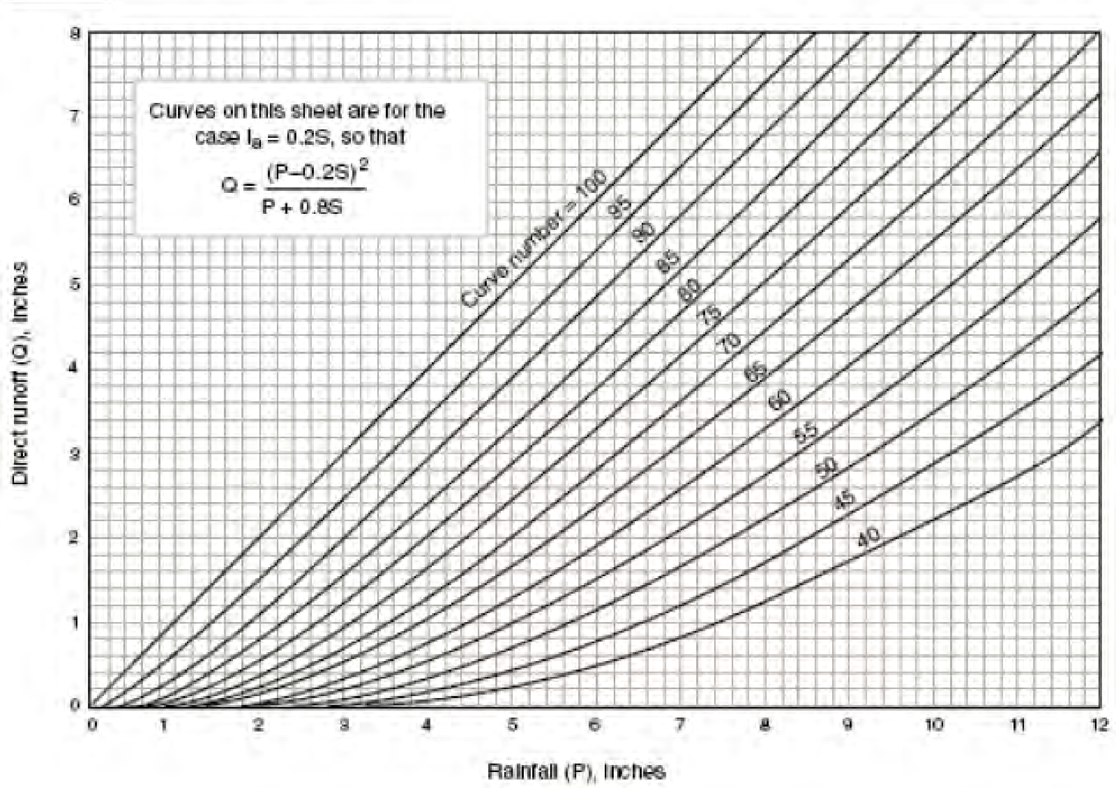
Karen Cappiella, Sally Claggett, Keith Cline, Susan Day, Michael Galvin, Peter MacDonagh, Jessica Sanders, Thomas Whitlow, Qingfu Xiao

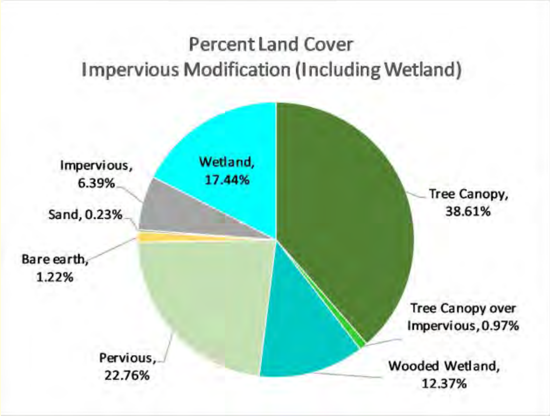
Accepted conditionally by Forestry Work Group, June 23, 2016
Approved by Watershed Technical Work Group, DATE TBD
Final Approval by Water Quality Goal Implementation Team, DATE TBD

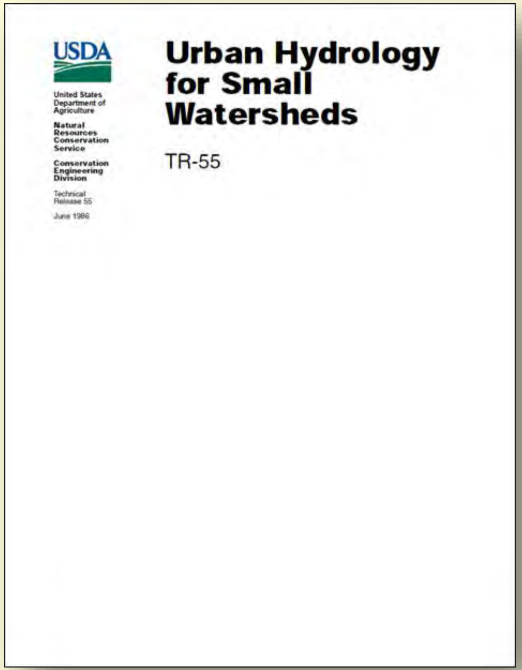
Prepared by
Neely L. Law, PhD, Center for Watershed Protection, Expert Panel Chair
Jeremy Hanson, Virginia Tech, Expert Panel Coordinator

Different land cover types result in different rates of runoff

Figure 2-1 Solution of runoff equation.







The NRCS Runoff Curve Number (CN)

- ✓ A coefficient used to estimate runoff from precipitation, accounting for losses due to canopy interception, surface storage, evaporation, transpiration and infiltration.
- ✓ Curve numbers have been developed for a variety of land covers and soil conditions.
- ✓ Most engineers, public works staff understand how to apply this approach.

Curve numbers for trees in different conditions.

Stormwater Runoff Yield Estimation

The landcover map was combined with a map of hydrologic soil groups (source: NRCS SSURGO) to calculate areas of landcover within each soil hydrolgic group. The area counts were used to compute composite curve numbers for each drainage basin and landcover combination. The table below provided the curve numbers used for each landcover/soil group combination.

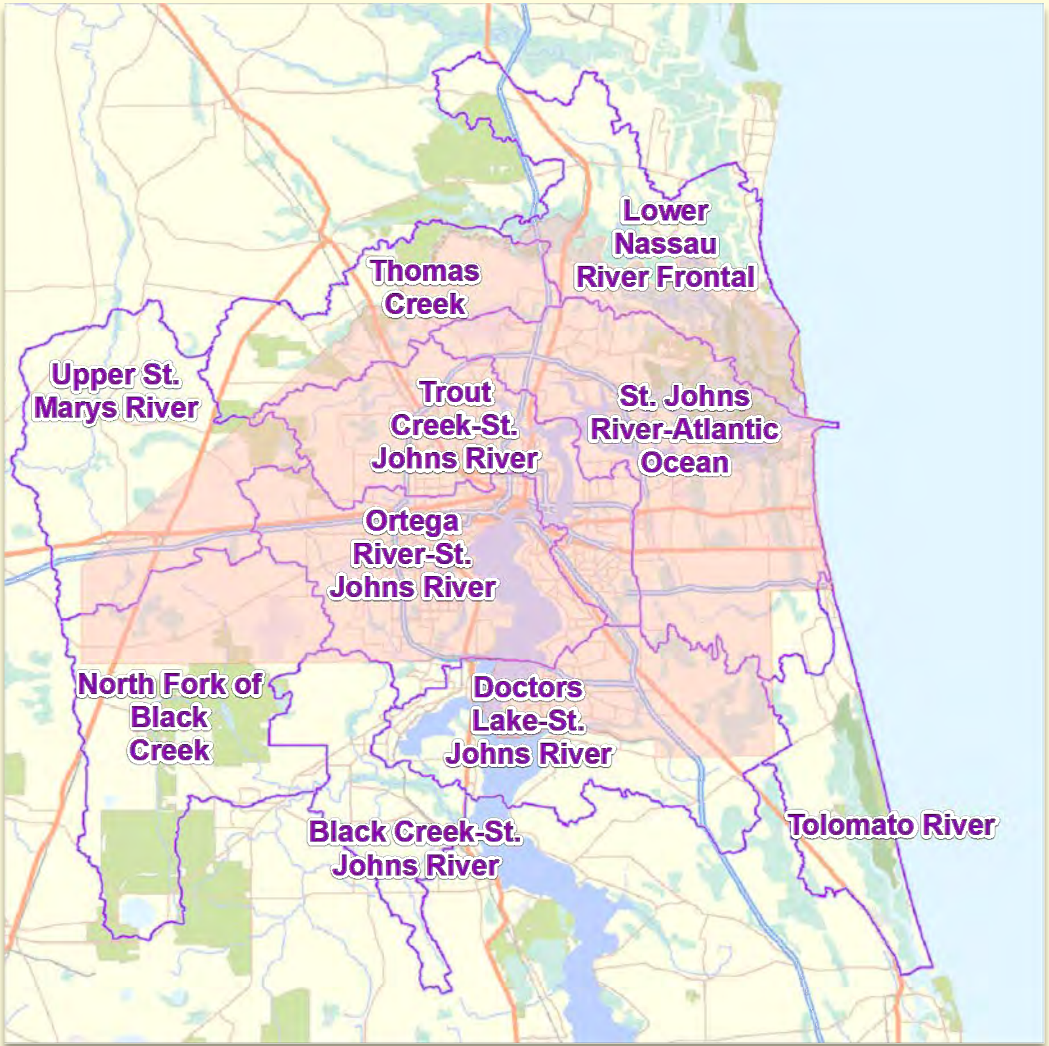
Curve Numbers from TR-55

		A	A/D	B	B/D	C	C/D	D
1	Trees over pervious	37	78	59	78	72	78	78
2	Trees over Impervious	96	96	96	96	96	96	96
3	Pervious	39	80	61	80	74	80	80
4	Water	100	100	100	100	100	100	100
5	Impervious	98	98	98	98	98	98	98
6	Bare Earth	77	94	86	94	91	94	94
7	Forested open space	30	77	55	77	70	77	77
8	Forested wetland	77	77	77	77	77	77	77
9	Wetlands	100	100	100	100	100	100	100
10	Sand	77	94	86	94	91	94	94

Rainfall Interception

Benefits are typically modeled on a tree-by-tree basis. We need to be able to apply benefits on a per unit area basis…

We need to analyze trees based on the conditions of the setting and soils by watershed (HUC10).



The GIC stormwater calculator models the benefit of maintaining or increasing urban canopy.

JACKSONVILLE INTL AP — **Urban Tree Canopy Stormwater Model** — version August 14, 2020

The Green Infrastructure Urban Tree Canopy Stormwater Model estimates stormwater runoff yields for current and potential land cover. The methodology is based upon the NRCS TR-55 method for small urban watersheds. It is used to provide better estimates using GIC's high-resolution land cover and modeling of potential canopy area.

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				million gallons												
	TOTALS	**55.4%**	**15.4%**	**1,859.1**	**-**	**-**	**55.4%**									
	Statistics by Drainage Basin (current settings)							Variable								Variable
	Area	**Current Tree Cover**	**Current Impervious Cover**	**Tree H20 Capture**	**Increased H2O w/xx% tree loss**	**Added H2O Capture w/xx% PCA**	**Adjusted Tree Cover from loss and gain scenarios**	Pick an Event	Pick a loss scenario		Converted Land			Canopy Added		Enter % canopy to add
		%		*million gallons*			%	**Event**	**% UTC loss**	**% FOS Loss**	**% Imperv**	**Max TC Possible**	**Maximum Potential Added Canopy Area**	**% Canopy Added**	**% of PCA achieved**	
1	Black Creek-St. Johns River	38.8%	35.7%	3.8	-	-	39%	1 yr / 24 hour	0%	0%	0%	46.3%	7.5%	0.0%	0%	
2	Doctors Lake-St. Johns River	61.7%	18.1%	223.1	-	-	62%	1 yr / 24 hour	0%	0%	0%	68.1%	6.4%	0.0%	0%	
3	Lower Nassau River Frontal	70.0%	5.4%	85.8	-	-	70%	1 yr / 24 hour	0%	0%	0%	77.5%	7.5%	0.0%	0%	
4	North Fork of Black Creek	64.2%	6.3%	213.9	-	-	64%	1 yr / 24 hour	0%	0%	0%	70.5%	6.3%	0.0%	0%	
5	Ortega River-St. Johns River	45.0%	28.9%	253.9	-	-	45%	1 yr / 24 hour	0%	0%	0%	54.9%	9.8%	0.0%	0%	
6	St. Johns River-Atlantic Ocean	50.5%	23.2%	408.1	-	-	50%	1 yr / 24 hour	0%	0%	0%	58.7%	8.2%	0.0%	0%	
7	Thomas Creek	75.4%	3.5%	216.3	-	-	75%	1 yr / 24 hour	0%	0%	0%	79.7%	4.2%	0.0%	0%	
8	Tolomato River	51.4%	24.6%	1.8	-	-	51%	1 yr / 24 hour	0%	0%	0%	56.0%	4.6%	0.0%	0%	
9	Trout Creek-St. Johns River	47.3%	24.0%	268.4	-	-	47%	1 yr / 24 hour	0%	0%	0%	57.7%	10.4%	0.0%	0%	
10	Upper St. Marys River	68.5%	4.6%	183.9	-	-	69%	1 yr / 24 hour	0%	0%	0%	79.2%	10.7%	0.0%	0%	

- Build the use of the tool into the development process.
- Understand which landscapes and parcels take up the more stormwater. Protect those parcels.

Changing the event storm (rainfall vol.) changes the amount of water captured. Can also model adding more trees (PCA = possible canopy area).

JACKSONVILLE INTL AP — **Urban Tree Canopy Stormwater Model** — version August 14, 2020

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	Current Tree Cover	Current Impervious Cover	Tree H20 Capture	Increased H2O w/xx% tree loss	Added H2O Capture w/xx% PCA	Adjusted Tree Cover from loss and gain scenarios
			million gallons			
TOTALS	55.4%	15.4%	2,195.3	-	46.4	57.5%

Statistics by Drainage Basin (current settings)

	Area	Current Tree Cover	Current Impervious Cover	Tree H20 Capture	Increased H2O w/xx% tree loss	Added H2O Capture w/xx% PCA	Adjusted Tree Cover from loss and gain scenarios	Variable: Pick an Event	Variable: Pick a loss scenario		Variable: Converted Land			Canopy Added	Variable: Enter % canopy to add
		%		million gallons			%	Event	% UTC loss	% FOS Loss	% Imperv	Max TC Possible	Maximum Potential Added Canopy Area	% Canopy Added	% of PCA achieved
1	Black Creek-St. Johns River	38.8%	35.7%	4.5	-	0.18	43%	2 yr / 24 hour	0%	0%	0%	46.3%	7.5%	3.8%	50%
2	Doctors Lake-St. Johns River	61.7%	18.1%	264.5	-	1.56	62%	2 yr / 24 hour	0%	0%	0%	68.1%	6.4%	0.6%	10%
3	Lower Nassau River Frontal	70.0%	5.4%	99.6	-	0.31	70%	2 yr / 24 hour	0%	0%	0%	77.5%	7.5%	0.4%	5%
4	North Fork of Black Creek	64.2%	6.3%	262.5	-	1.58	65%	2 yr / 24 hour	0%	0%	0%	70.5%	6.3%	0.6%	10%
5	Ortega River-St. Johns River	45.0%	28.9%	301.7	-	19.81	50%	2 yr / 24 hour	0%	0%	0%	54.9%	9.8%	4.9%	50%
6	St. Johns River-Atlantic Ocean	50.5%	23.2%	472.8	-	12.88	53%	2 yr / 24 hour	0%	0%	0%	58.7%	8.2%	2.5%	30%
7	Thomas Creek	75.4%	3.5%	251.9	-	3.84	78%	2 yr / 24 hour	0%	0%	0%	79.7%	4.2%	2.1%	50%
8	Tolomato River	51.4%	24.6%	2.1	-	0.00	52%	2 yr / 24 hour	0%	0%	0%	56.0%	4.6%	0.1%	3%
9	Trout Creek-St. Johns River	47.3%	24.0%	310.8	-	4.50	48%	2 yr / 24 hour	0%	0%	0%	57.7%	10.4%	1.0%	10%
10	Upper St. Marys River	68.5%	4.6%	225.1	-	1.68	70%	2 yr / 24 hour	0%	0%	0%	79.2%	10.7%	1.1%	10%

Can also model runoff from the loss of trees… how much more water runs off!

JACKSONVILLE INTL AP — **Urban Tree Canopy Stormwater Model** — **version** August 14, 2020

The Green Infrastructure Urban Tree Canopy Stormwater Model estimates stormwater runoff yields for current and potential land cover. The methodology is based upon the NRCS TR-55 method for small urban watersheds. It is used to provide better estimates using GIC's high-resolution land cover and modeling of potential canopy area.

Statistics by Drainage Basin (current settings)

	Area	Current Tree Cover	Current Impervious Cover	Tree H20 Capture	Increased H2O w/xx% tree loss	Added H2O Capture w/xx% PCA	Adjusted Tree Cover from loss and gain scenarios	Pick an Event	Pick a loss scenario		Converted Land			Canopy Added	Enter % canopy to add
		%		million gallons			%	Event	% UTC loss	% FOS Loss	% Imperv	Max TC Possible	Maximum Potential Added Canopy Area	% Canopy Added	% of PCA achieved
	TOTALS	55.4%	15.4%	2,195.3	15.9	-	49.0%								
1	Black Creek-St. Johns River	38.8%	35.7%	4.5	0.08	-	29%	2 yr / 24 hour	10%	0%	0%	46.3%	7.5%	0.0%	0%
2	Doctors Lake-St. Johns River	61.7%	18.1%	264.5	1.37	-	57%	2 yr / 24 hour	5%	0%	0%	68.1%	6.4%	0.0%	0%
3	Lower Nassau River Frontal	70.0%	5.4%	99.6	0.36	-	62%	2 yr / 24 hour	8%	0%	0%	77.5%	7.5%	0.0%	0%
4	North Fork of Black Creek	64.2%	6.3%	262.5	3.23	-	44%	2 yr / 24 hour	20%	0%	0%	70.5%	6.3%	0.0%	0%
5	Ortega River-St. Johns River	45.0%	28.9%	301.7	3.83	-	40%	2 yr / 24 hour	5%	0%	0%	54.9%	9.8%	0.0%	0%
6	St. Johns River-Atlantic Ocean	50.5%	23.2%	472.8	3.44	-	45%	2 yr / 24 hour	5%	0%	0%	58.7%	8.2%	0.0%	0%
7	Thomas Creek	75.4%	3.5%	251.9	0.22	-	70%	2 yr / 24 hour	5%	0%	0%	79.7%	4.2%	0.0%	0%
8	Tolomato River	51.4%	24.6%	2.1	0.01	-	46%	2 yr / 24 hour	5%	0%	0%	56.0%	4.6%	0.0%	0%
9	Trout Creek-St. Johns River	47.3%	24.0%	310.8	3.31	-	42%	2 yr / 24 hour	5%	0%	0%	57.7%	10.4%	0.0%	0%
10	Upper St. Marys River	68.5%	4.6%	225.1	0.01	-	64%	2 yr / 24 hour	5%	0%	0%	79.2%	10.7%	0.0%	0%

Variable (Pick an Event / Pick a loss scenario / Converted Land); Variable (Enter % canopy to add)

Can model land pollution uptake or runoff for nitrogen, phosphorus and sediment. This shows the water quality impacts for adding or losing trees!

version August 14, 2020

stimates stormwater runoff yields for current and potential land cover. The
n watersheds. It is used to provide better estimates using GIC's high-resolution

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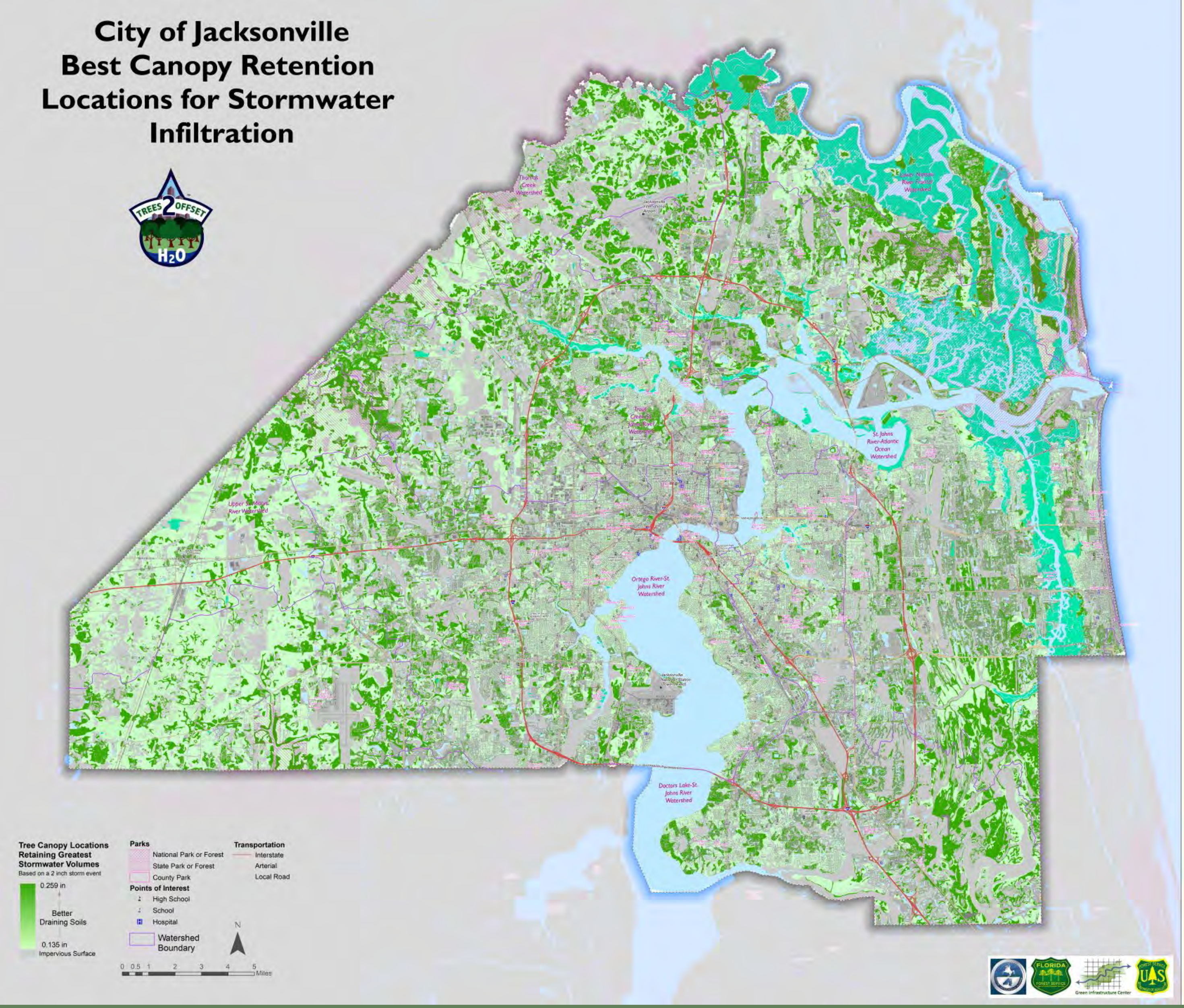
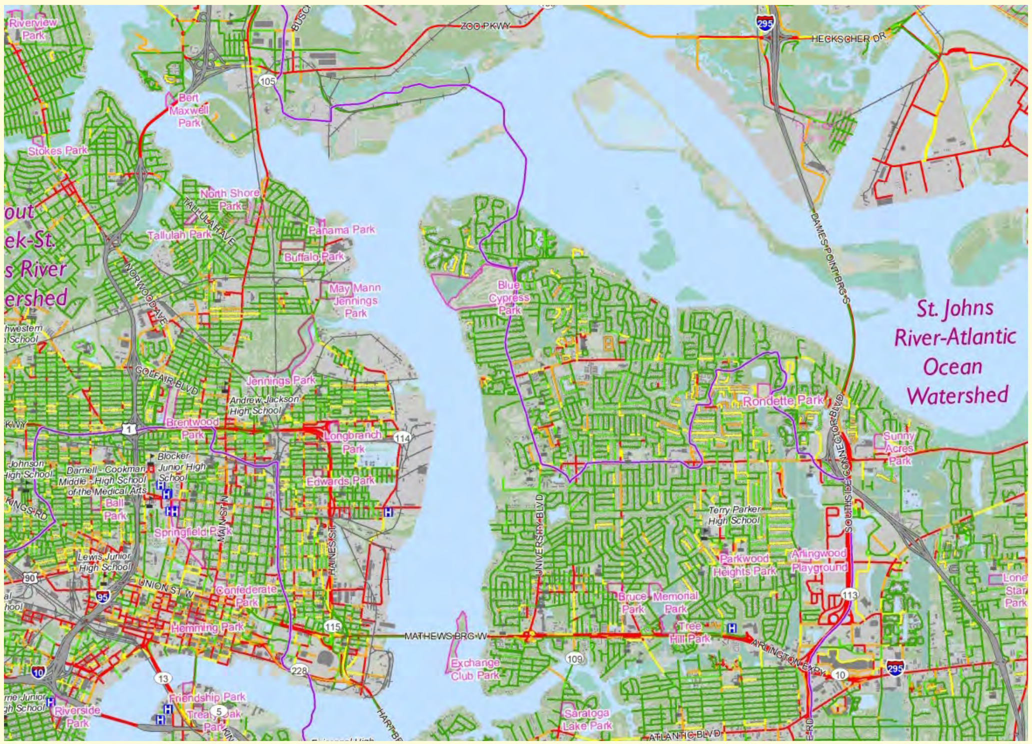
55.9%									1936209	32	158072	39	99386	27	-7874	0	-630	0	-747	0
	Variable							Variable	Statistics by Drainage Basin (current settings)											
Adjusted Tree Cover from loss and gain scenarios	Pick an Event	Pick a loss scenario		Converted Land			Canopy Added	Enter % canopy to add	Non-Point Pollution Captured by Existing Trees (% = percent of total load without trees)						Change in Pollution Load from Landuse Variables (% = percent increase or decrease of total load)					
%	Event	% UTC loss	% FOS Loss	% Imperv	Max TC Possible	Maximum Potential Added Canopy Area	% Canopy Added	% of PCA achieved	N lbs/yr	N (%)	P lbs/yr	P (%)	SED t/yr	SED (%)	N lbs/yr	N (%)	P lbs/yr	P (%)	SED t/yr	SED (%)
39%	2 yr / 24 hour	0%	0%	0%	46.3%	7.5%	0.4%	5%	2,589	15	210	21	167	12	-16	0	-1	0	-2	0
62%	2 yr / 24 hour	0%	0%	0%	68.1%	6.4%	0.1%	2%	235,037	37	19,196	46	11,831	31	-275	0	-22	0	-25	0
70%	2 yr / 24 hour	0%	0%	0%	77.5%	7.5%	0.0%	0%	100,084	45	8,196	52	4,594	31	0	0	0	0	0	0
64%	2 yr / 24 hour	0%	0%	0%	70.5%	6.3%	0.0%	0%	242,011	46	19,817	51	11,144	35	0	0	0	0	0	0
45%	2 yr / 24 hour	0%	0%	0%	54.9%	9.8%	0.0%	0%	238,953	20	19,387	27	15,089	20	0	0	0	0	0	0
52%	2 yr / 24 hour	0%	0%	0%	58.7%	8.2%	1.6%	20%	402,857	26	32,839	34	21,830	23	-7,583	-1	-607	-1	-720	-1
75%	2 yr / 24 hour	0%	0%	0%	79.7%	4.2%	0.0%	0%	231,107	58	18,944	63	10,055	43	0	0	0	0	0	0
51%	2 yr / 24 hour	0%	0%	0%	56.0%	4.6%	0.0%	0%	2,629	28	215	37	138	26	0	0	0	0	0	0
47%	2 yr / 24 hour	0%	0%	0%	57.7%	10.4%	0.0%	0%	264,295	23	21,501	30	15,394	22	0	0	0	0	0	0
69%	2 yr / 24 hour	0%	0%	0%	79.2%	10.7%	0.0%	0%	216,647	54	17,767	59	9,144	33	0	0	0	0	0	0

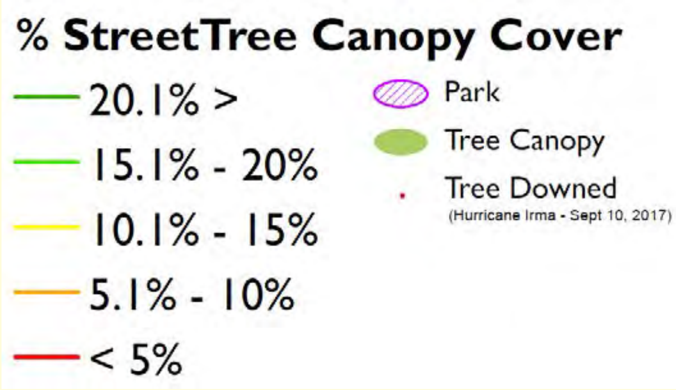


Optimal places for canopy retention.

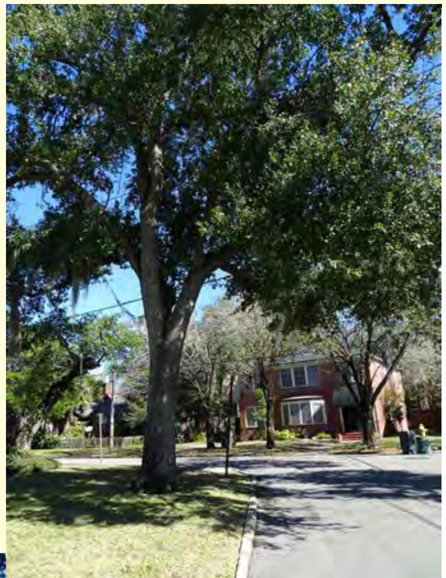
The darker green are areas where trees take up more water.

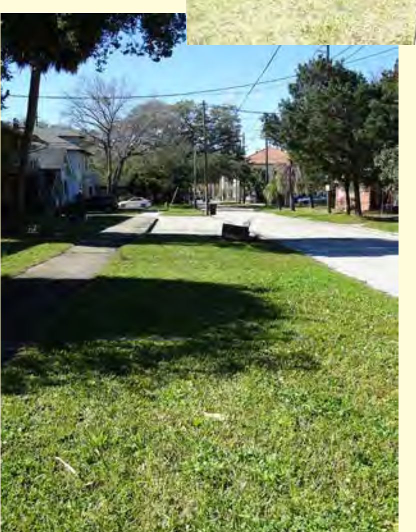
Street by street analysis. How green are the city's streets with canopy?

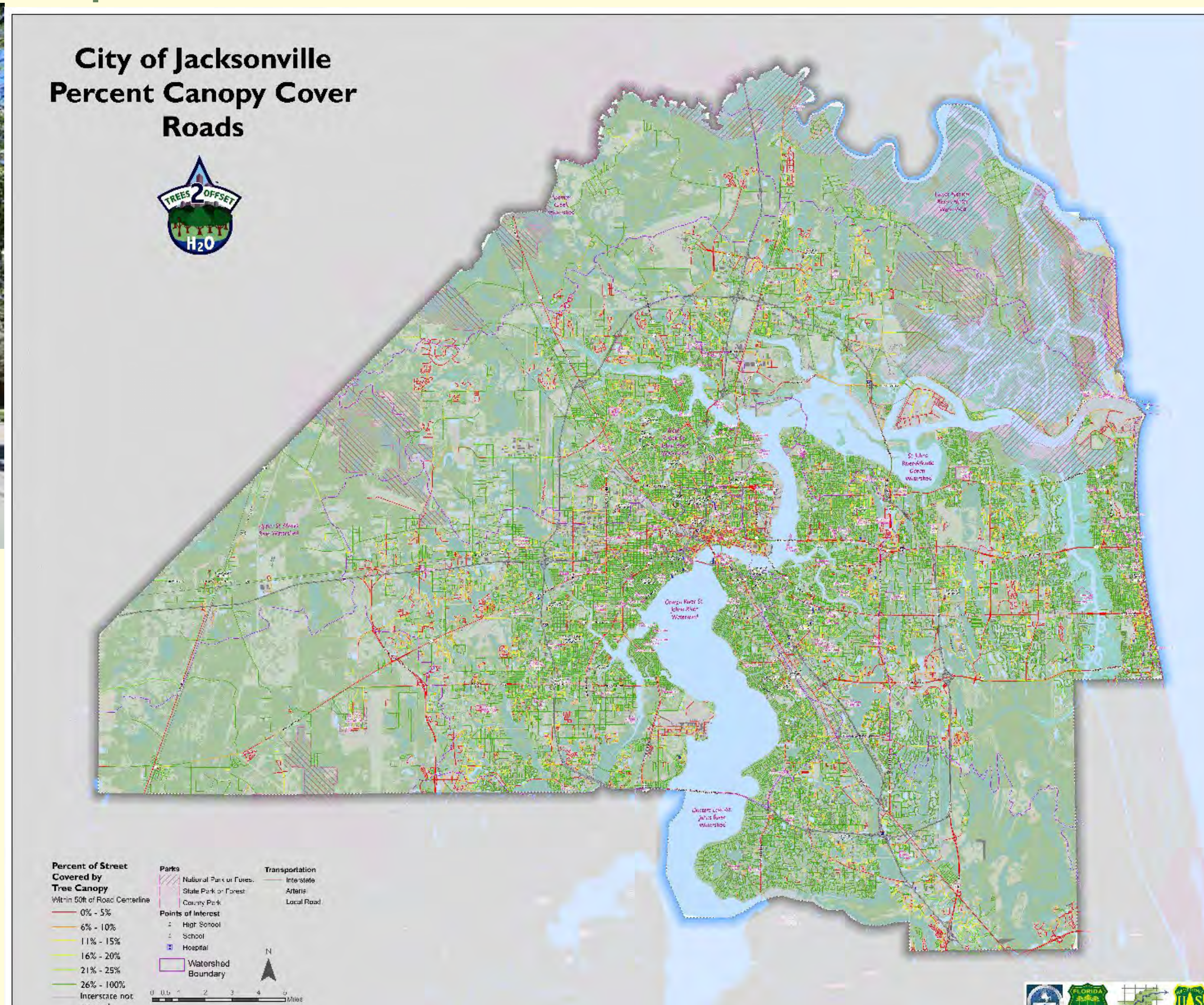




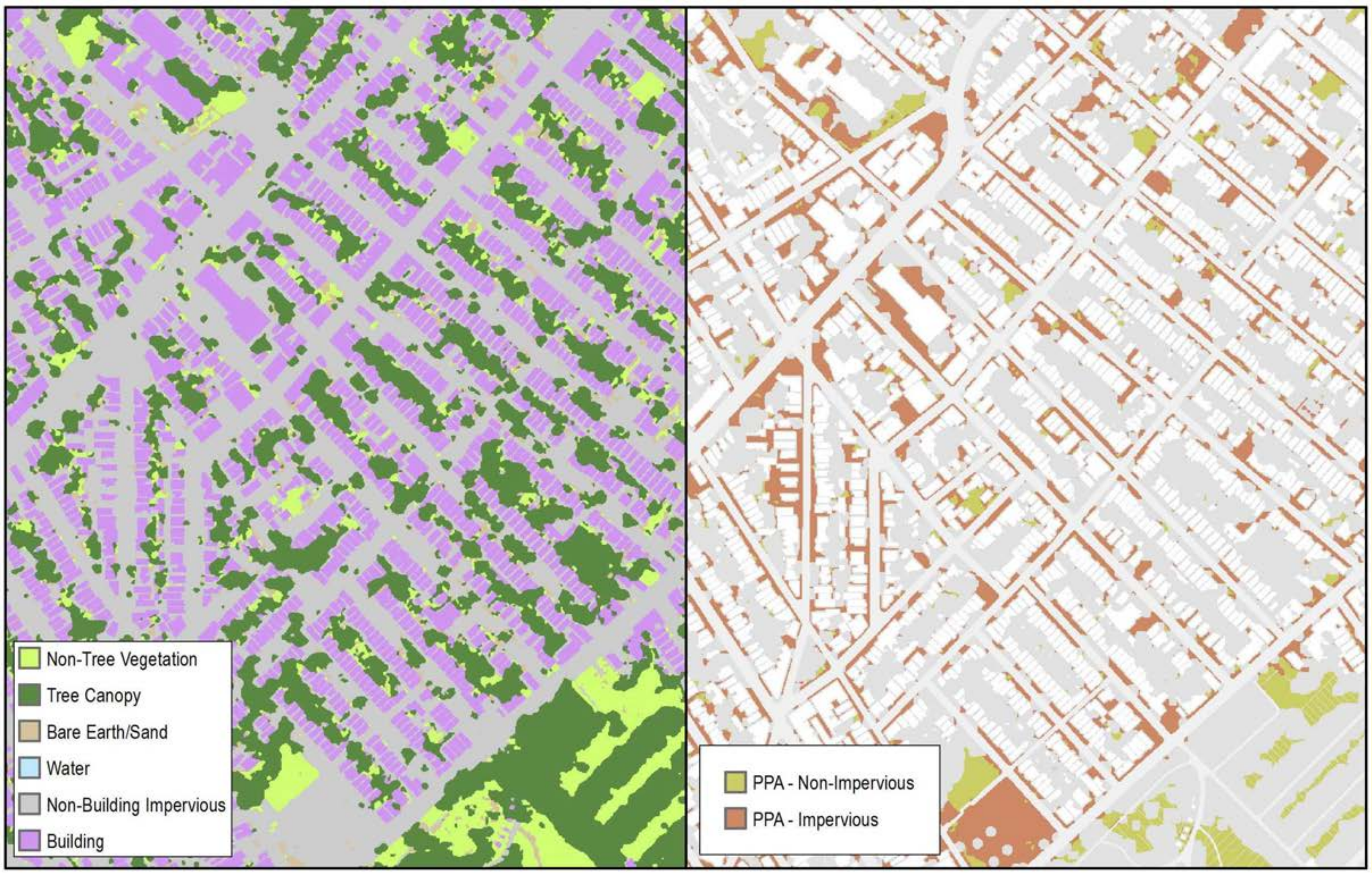
Here is the street by street map!





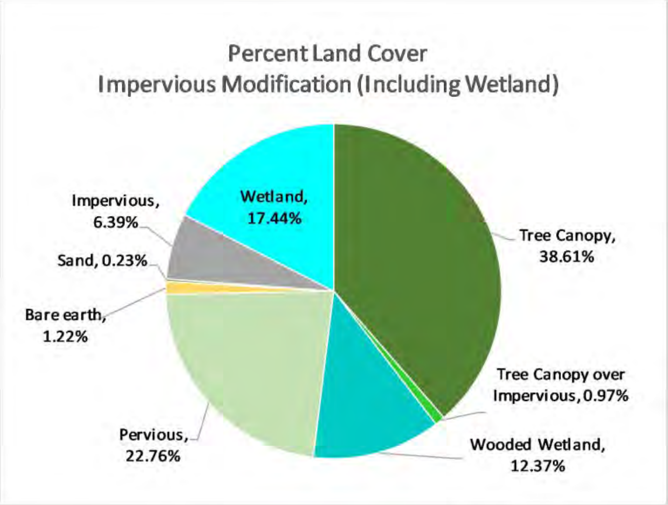


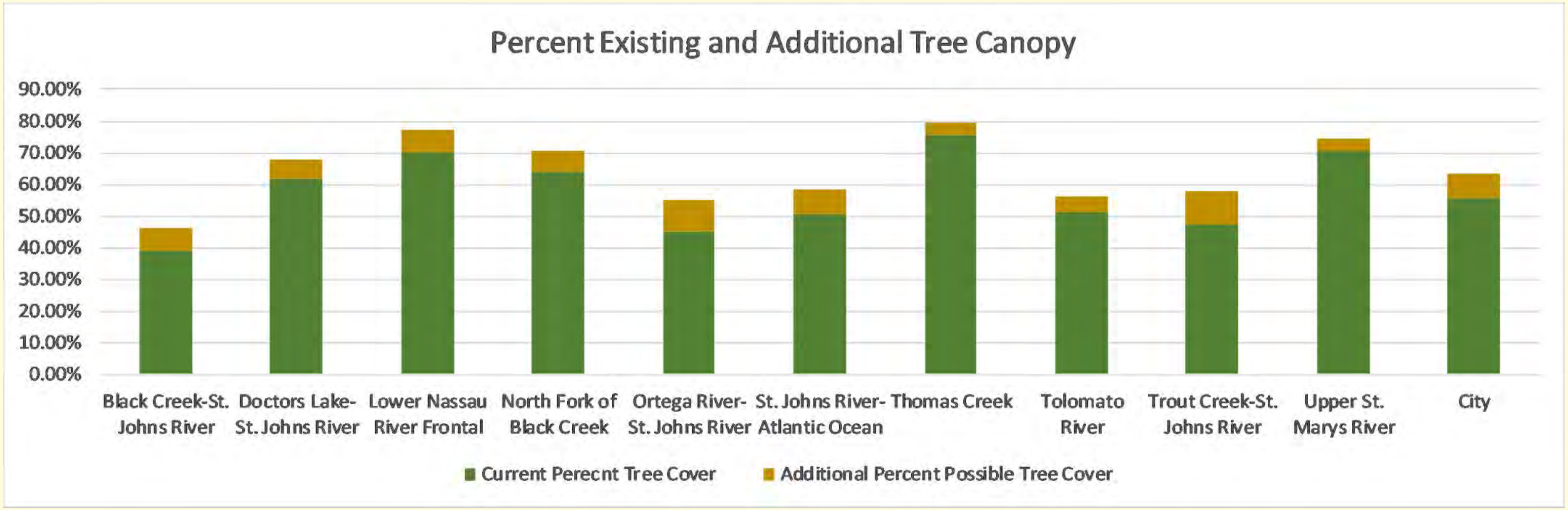
Where Can We Fit Trees? Possible Planting Areas

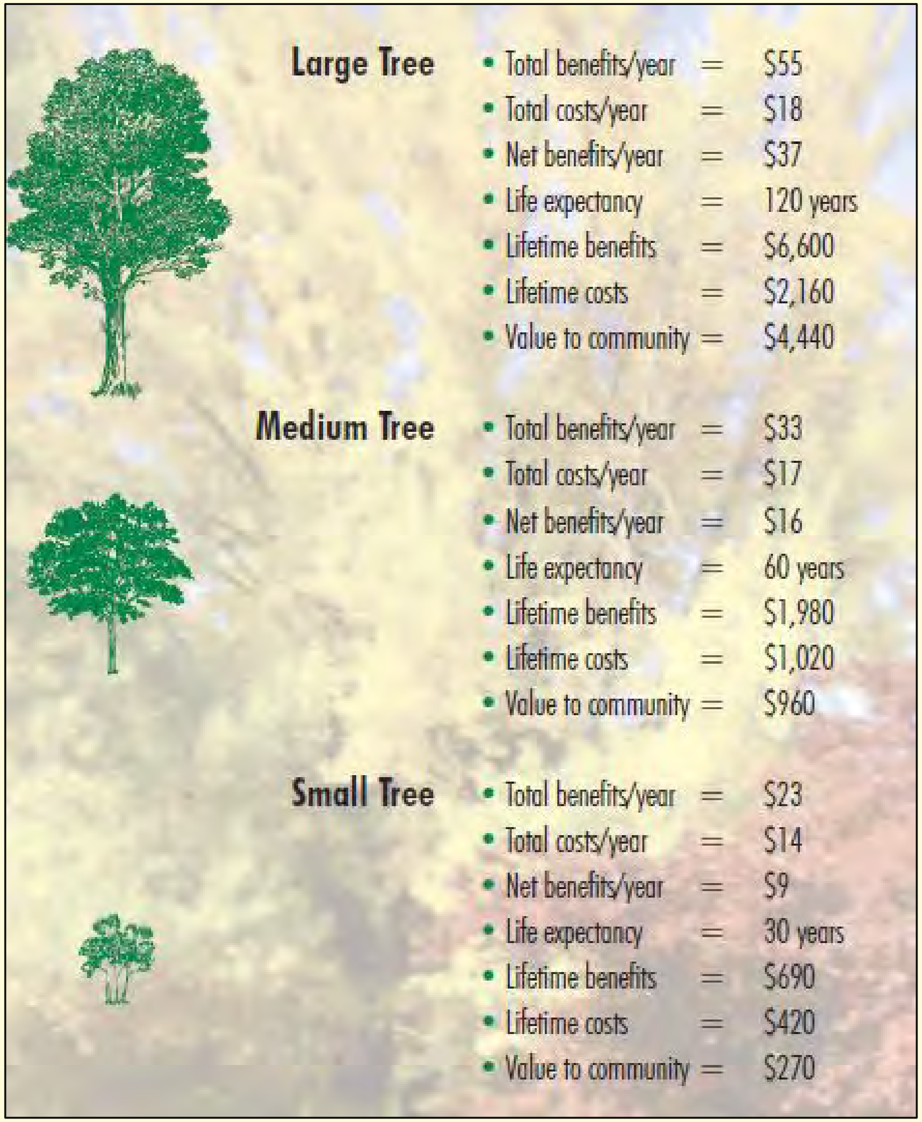


Possible Planting Area vs. Potential Tree Canopy

Planting area available by watershed







USDA Forest Service, Center for Urban Forest Research

Annual Average Benefits

Using GIS, we can estimate where it's possible to plant trees, and the benefits of doing so.

Palm trees have low benefits and high costs. Palm Benefits/Costs: Ex. Sabal Palm

Factor	Dollar Value
Total benefits/year	$4
Total costs/year	$30

Palms have the highest nutritional requirements of any plant grown in the state of Florida (Broschat 2010a).

All potential planting areas are not created equal. Optimal Tree Planting Locations

If planting for stormwater, choose these locations.

Next question: What policies and practices are needed?

Codes and Policy Audit answers two questions:

Do city policies allow too much impervious area?

For example does the city mandate excessive parking area?

Does it provide incentives to reduce impervious area?

Can the city manage and expand the urban forest?

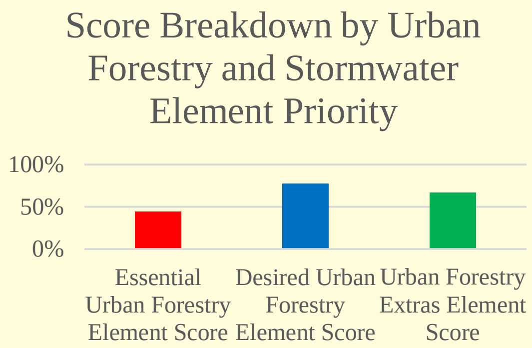
For example, are tree care and management well funded and implemented?

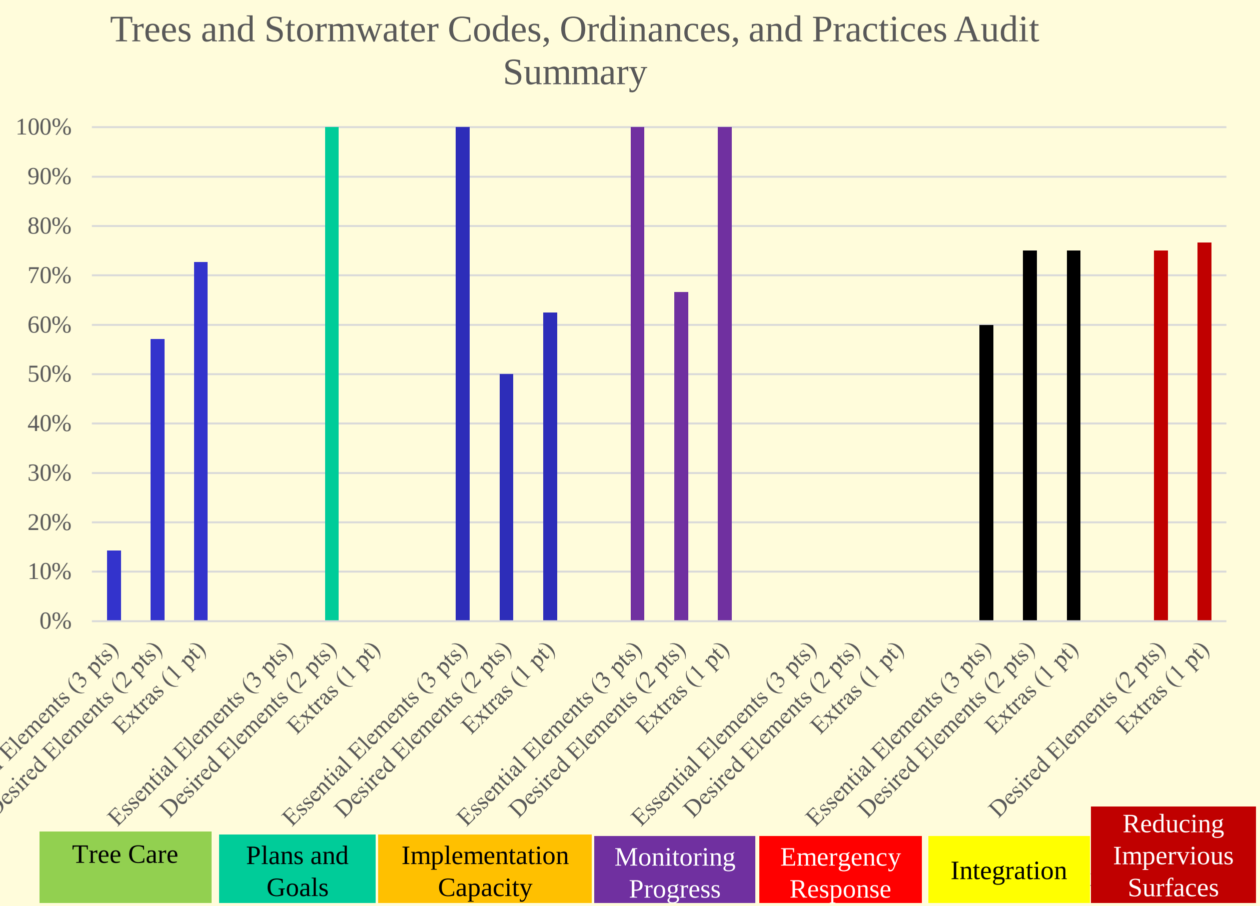
Does the city have a strategy for planting trees in areas most in need?

Policy: What proposed code changes did the team develop?

This is a summary only.
A longer report was provided to the city in 2019.

How did the city score?





The city has an excellent urban forestry program!

https://www.coj.net/trees

But there is always more that can be done!

GREEN INFRASTRUCTURE CENTER INC.

A spreadsheet is used to track each city's codes and forest management

INTEGRATION

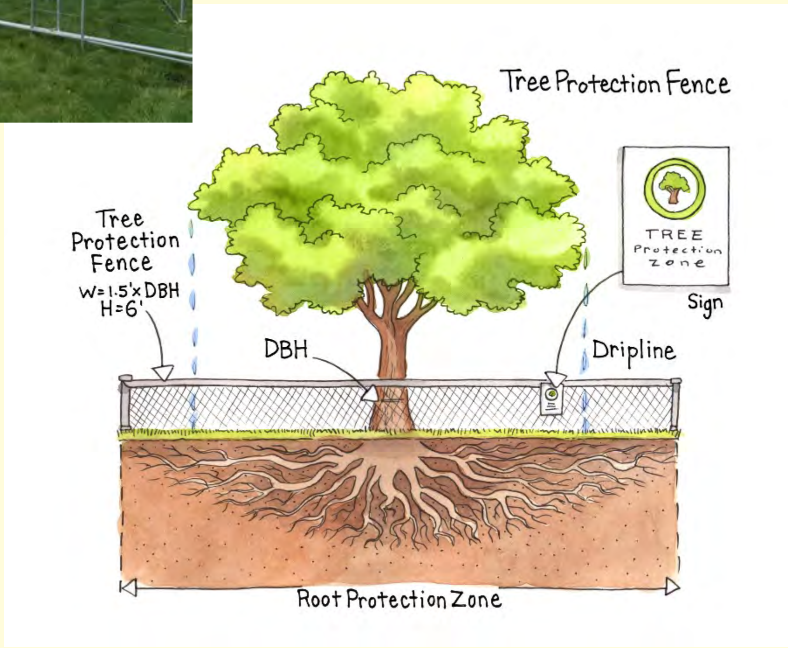
Integration of urban forestry principles in other local government codes and ordinances, practices and community awareness is essential for success in urban forestry initiatives. These initiatives include planting, sustaining and managing an urban forest canopy. Integration can include tree requirements in stormwater codes, developers using Silva cells to encourage tree root growth and

Feature	Present?	City of Jacksonville Comments	GIC Comments	Source	What to Look For	Score	Potential Score
Stormwater Management							
Is the municipality subject to the MS4 permit program?	Yes				"Not a scoring item"	N/A	N/A
Does the stormwater division have an itemized program of stormwater infrastructure maintenance? Does it include planting trees to soak up more stormwater?	No				Identify where maintenance or new construction is required to ensure proper function of the municipal stormwater system. Also enumerate the cost of maintenance and construction. Factor new tree planting costs into the stormwater management improvement plan. Municipalities where definitive stormwater management improvement programs include tree plantings score one point. Municipalities where stormwater management		1
Does the municipality have a SWM utility fee? If so, are trees provided as credits to minimize the fee?	Yes		Trees are not specifically provided as a way to reduce the fee. Some constructed BMPs that can reduce the fee are porous pavement, constructed wetlands, and stormwater ponds.	http://www.coj.net/departments/cityfees/docs/ac-manual-2011-final.aspx	Develop a SWM utility fee which funds the cost of stormwater maintenance and tree plantings (see above). Allow for a reduction of the fee by reducing impervious surfaces (and decreasing stormwater runoff) onsite. Advertise the program and provide technical assistance. Municipalities with an effective SVM utility fee and fee reduction program which includes trees score two points. Municipalities with an effective SWM utility fee but with no way to reduce the fee using trees score one point. Municipalities with no	1	2
Is stormwater required to be treated for quality before it is discharged?			(Don't see this as a requirement)		Require treatment of stormwater for quality before discharge. Municipalities who do so score one point.		1
Are there effective design criteria for stormwater BMPs which include green roofs (that may or may not be able to support trees), bioswales, rain gardens, forested swales, Filterra boxes, constructed wetlands, permeable pavers, permeable asphalt etc. Do they encourage plant material?			(SW BMP Handbook referenced in the stormwater reduction fee manual does not actually link to the BMP Manual p. 15 of manual). Found a state stormwater design manual (in Jacksonville Library). Is that what is being	http://www.coj.net/departments/cityfees/docs/ac-manual-2011-final.aspx	Develop design criteria for as many known Best Management Practices as possible. Smaller municipalities may depend on state or county stormwater management manuals which often do not include a complete range of BMP's. If this is the case, develop an addendum to the state/county manual which covers the entire spectrum of BMP's. Municipalities with a stormwater management manual including 20 or more		2

During construction require tree protection fencing placement that best ensures tree survival.

- Current COJ codes required tree protection fence placement only 6' from the base of any tree.

- Tree protection best practices recommend tree protection fence placement at a distance of 1.5' per DBH inch from the trunk of three.



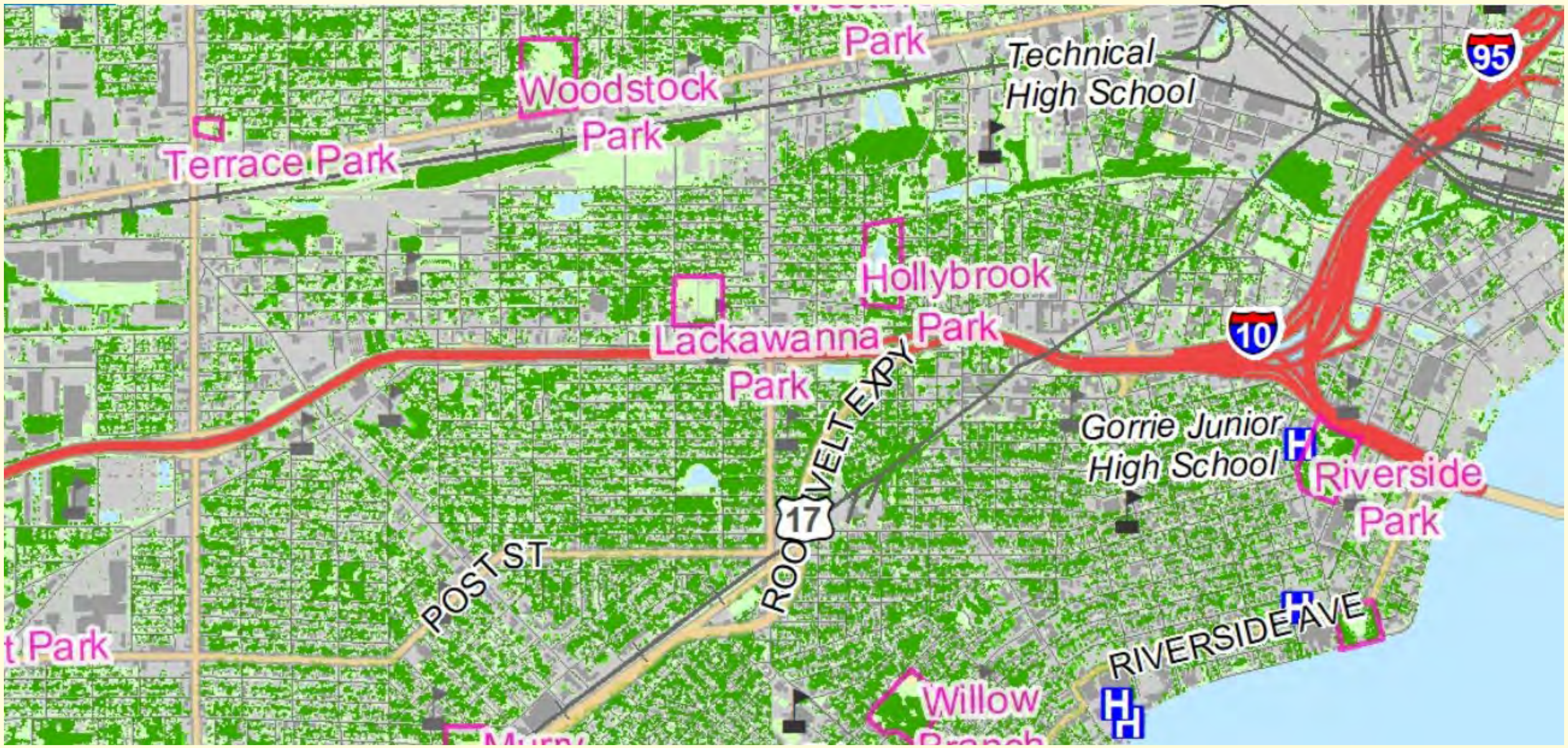
During construction require sturdy tree protection fencing.

- Current COJ codes require plastic tree protection fencing three feet high.
- Tree protection best practices recommend 6’ sturdy metal fencing to adequately protect trees in high risk construction settings or trees of special significance (e.g. historic trees).

Require at least 1,000 cubic feet of soil volume for new tree plantings.

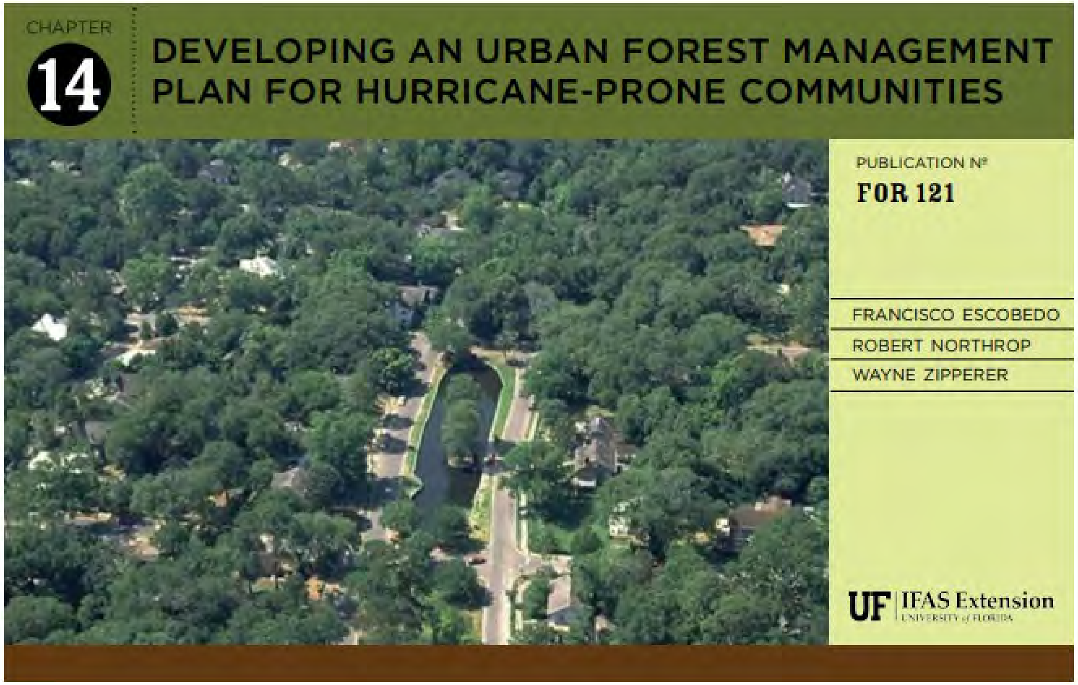
- Urban trees typically only live for seven years.
- Increase tree survivability by providing adequate soil volume and drainage.

Conduct a land cover assessment every four years.



- Compare tree canopy levels over time.
- Understand where tree loss is occurring and be able to take mitigation steps.

Develop an Urban Forest Management Plan for the City of Jacksonville.



- Set clear measurable goals with actionable steps for a municipality's urban forest.
- Link urban forestry goals to those of other departments (including Planning, Parks and Recreation, Public Works etc.)

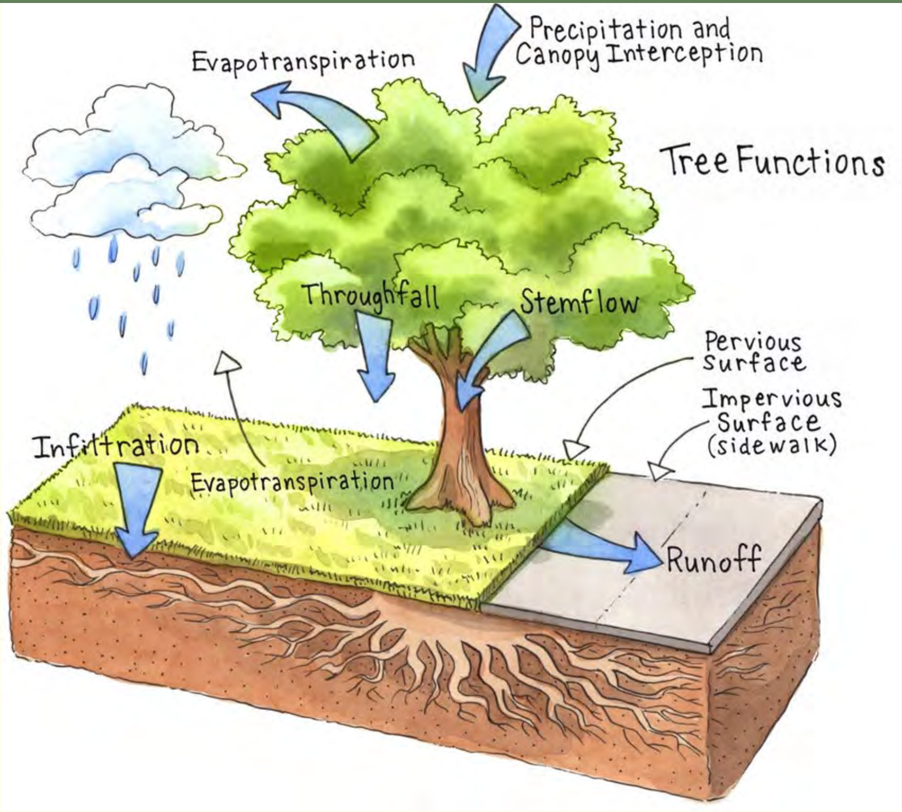
Develop a Forestry Emergency Response Plan

- Include sections and document protocol on tree risk assessment completion on city-owned property.
- Include sections on risk management and pre-disaster response

Reduce parking space requirements and increase parking lot perviousness.

- Some parking lots have excess spaces and therefore excess impervious surfaces and more stormwater runoff.
- Use Low Impact Development (LID) technology to increase parking lot perviousness, provide more shade, and increase parking lot attractiveness.

Link the city's urban trees to stormwater infrastructure.



- Establish city trees role as infrastructure to receive federal aid for post-storm clean up efforts.
- Credit urban trees in the stormwater utility fee to promote more urban tree plantings.

Encourage tree plantings on private property.

- Establish neighborhood community tree planting campaigns.
- Partner with local business for discount coupons on trees and tree materials.

Encourage shade tree plantings on city property.

- Shade trees provide more shade and habitat than palm or crepe myrtle counterparts.
- Shade trees require significantly less maintenance than palms.

Work with developers to shrink the development footprint.

- Do not permit lot line to lot line clearing. Require retention of healthy clusters of trees.
- Look for opportunities to minimize impervious surfaces.


Discussion

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