Protecting and Restoring Urban Tree Canopy for Stormwater Management in Harrisonburg, VA

Community Meeting May 25, 2017

Green Infrastructure Center

CITY OF HARRISONBURG VIRGINIA

VIRGINIA DEPARTMENT OF FORESTRY

Tonight

Project Overview

Trees are Green Infrastructure

Data – How are we doing?

Community Ideas

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

USDA Forest Service has funded cities in 7 states to demonstrate how they can utilize trees for stormwater management.

Harrisonburg applied to be one of the test cities!

This project ends in Summer 2018

Urban flooding

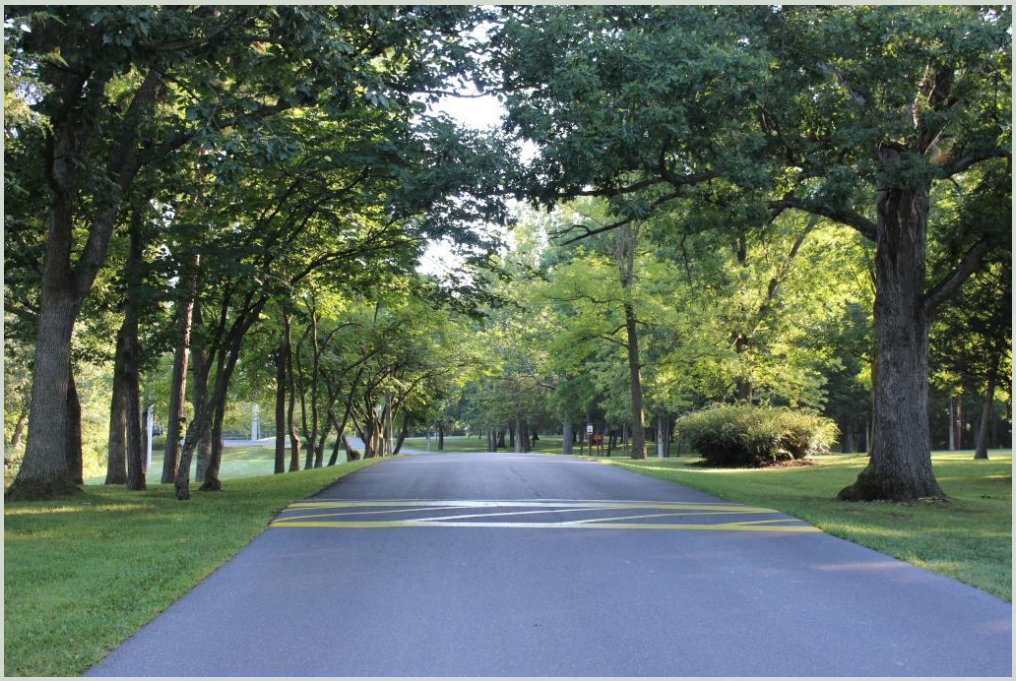
7 southern states:

SC, NC, GA, FL, AL, OK, VA

Project Goals

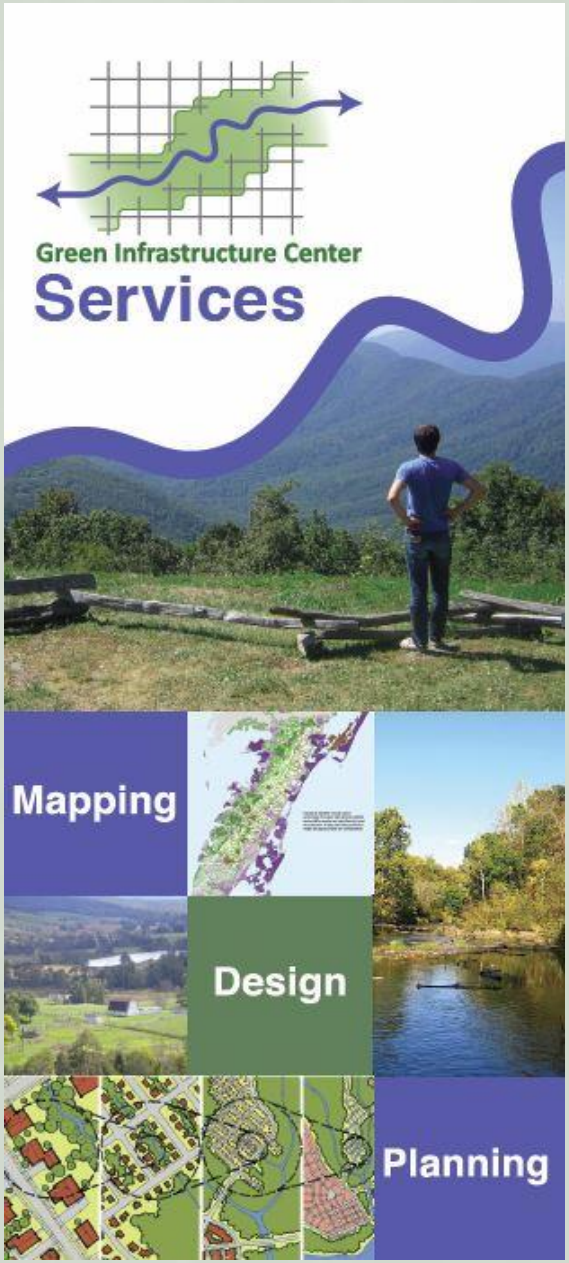
This project is helping Harrisonburg map, evaluate, protect and restore its urban forests for improved stormwater management and clean water.

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



Project Outcomes

- ✓ Ordinance language or other program/policy documents for using trees to meet stormwater regulations
- ✓ Written step by step methodology for linking urban forest systems to urban MS4 requirements.
- ✓ Recommendations for how Harrisonburg can best adopt new programs, codes, processes to better integrate city's trees as part of stormwater management
- ✓ Sharing the work – a case booklet and presentation detailing methodology, lessons learned, best practices



Who is helping the city?

The Green Infrastructure Center and VA DOF are helping the city!

The GIC is the technical service provider in partnership with the Virginia Department of Forestry. The GIC helps communities evaluate green assets and manage them to maximize ecology, economy and culture. We do this by:

Providing community assistance

Building landscape models

Teaching courses and workshops

Research into new methodologies

KEEP IT CLEAN, HARRISONBURG
STOP POLLUTED RUNOFF

Harrisonburg's stormwater is everybody's business!

Stormwater Management is intended to protect the water quality of city streams and rivers. Harrisonburg's Stormwater Management Program is a city-wide effort and depends on cooperation with all city departments (e.g. Department of Public Works, Department of Community Development and Planning, Department of Public Utilities, the Department of Parks and Recreation) and you!

www.harrisonburgva.gov/stormwater-management-program

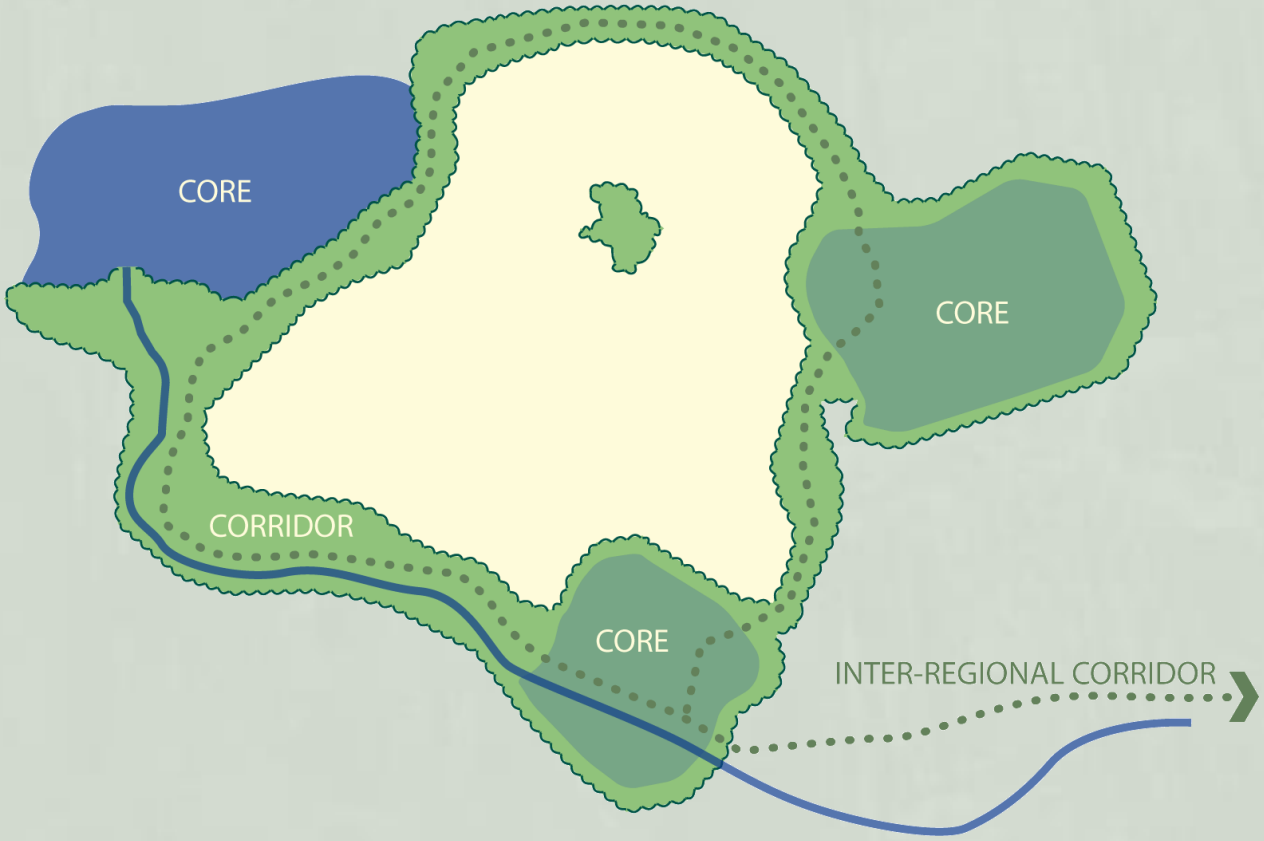
What is green infrastructure?

Map of a portion of Harrisonburg showing gray infrastructure including buildings and roads (left). Classified high-resolution satellite imagery (right) adds a green infrastructure data layer (trees and other vegetation) .

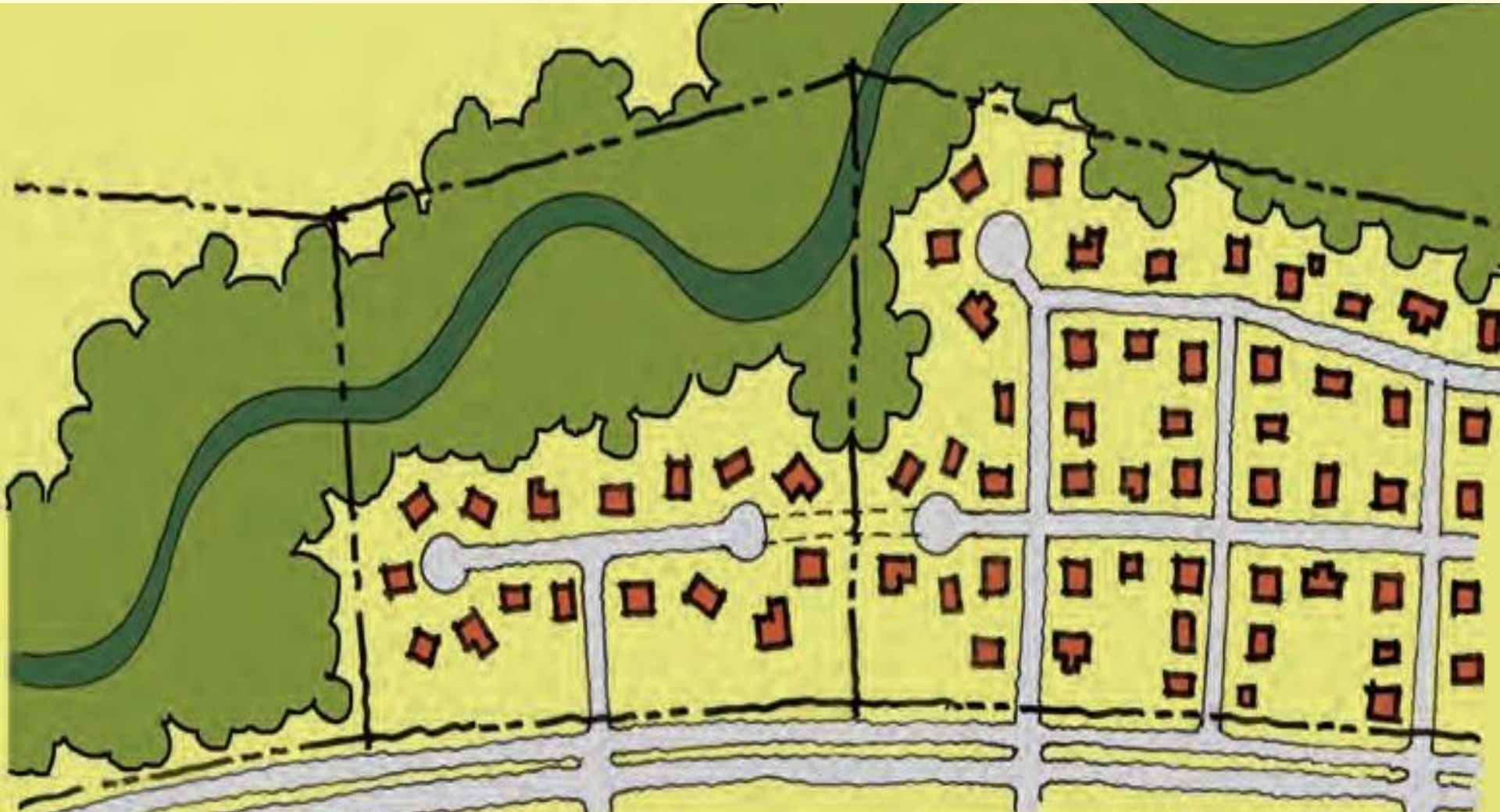
Green Infrastructure Planning Requires Thinking About How to Connect the Landscape

It's about connecting 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 …



Many have heard of Green Infrastructure as best management practices

In 1994, Florida coined the term green infrastructure to describe its wetlands, rivers, dunes, and forest habitats. In 2006, EPA added BMPs such as raingardens to the definition. The key is to first consider natural infrastructure (trees, forests, rivers) protect them and connect them, build in the least impactful manner, then mitigate impacts. So, ***first conservation, then mitigation.***

Rain gardens

Permeable pavers

Filterra Boxes

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!

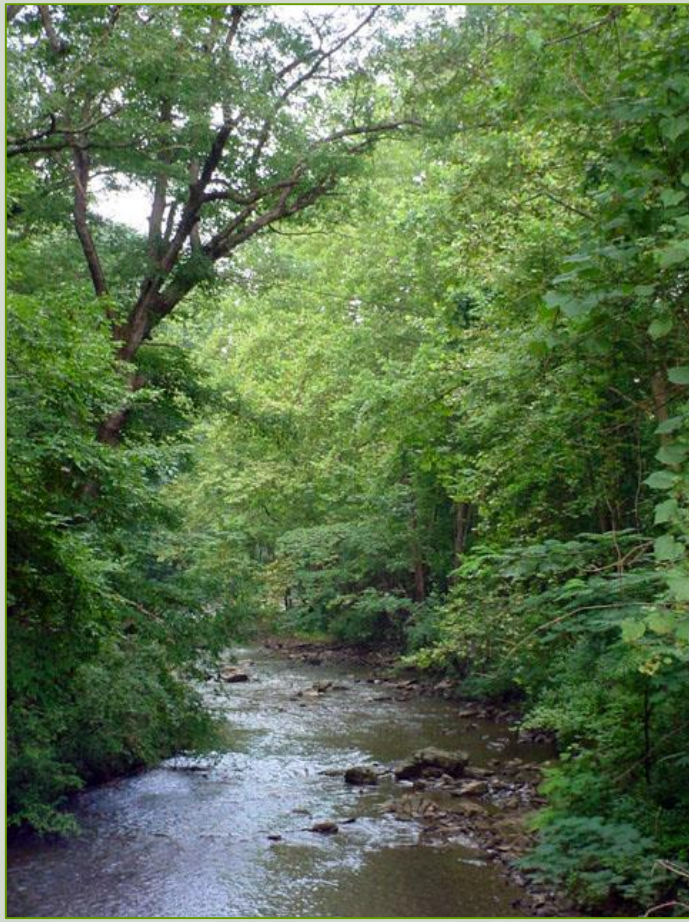
Estimates for the amount of water a typical street tree can intercept in its crown, range from 760 gallons to 4000 gallons per tree per year, depending on species.

Forests Save Water Treatment Costs

Forest cover protects surface water sources and aquifer recharge zones and reduces the cost of drinking water treatment. American Water Works Association found a 10% increase in forest cover reduced treatment costs for drinking water by 20%. (Ernst et al. 2004)

The Skidmore Reservoir feeding the city is protected by the forests of the George Washington and Jefferson National Forests!

Trees = cheaper water treatment



Urban Tree Canopy Values

Trees provide more attractive areas for development, historic districts, commercial areas opportunities for people to interact with nature.

A study by the University of Washington found that people shopped longer and more often in tree-lined retail areas and spent about 12 percent more money.

Trees = more tax revenue even in developed commercial districts!

Job Development

Small companies, especially those that are have well paid and skilled workforce place a strong importance on the “green” of the local environment.
Crompton Love and Moore, 1997

The creative class: artists, media, lawyers, analysts, make up 30 percent of the U.S. workforce and they place a premium on outdoor recreation and access to nature.
Florida, 2002

Trees and parks attract better paid jobs and thus a better tax base = $

Trees: for Health

- Access to fitness opportunities. (addresses obesity, nature deficit disorders)
- Clean air – trees absorb pollutants, VOCs, filter runoff, cool the city. (combat asthma)
- Well being and mental health - -people heal faster when they can see or access green. (hospitals need this for patients, reduces absenteeism of workers)
- Less crime occurs near trees. (issue especially for downtowns and public housing areas)
- A mere 20 minute exposure to green space drastically increases cognitive abilities (huge implications for schools)

Treed areas = healthy safer communities!

Green Landscapes = Real Estate $$$

- $ Having a park within 1,500 feet of a home increased its sale price between $845 - $2,262 (in 2000 dollars). Economic Benefits of Recreation, Open Space, Recreation Facilities and Walkable Community Design, 2010
- $ The larger the park, the more significant the property value increase. (ibid)

Key message: Parks = better tax base = $!

- $ Large natural forest areas have a greater positive impact on nearby property prices than smaller urban parks or developed parks such as playgrounds, skate parks or golf courses.

Bigger intact forests/natural areas = more $!

Trees: Create Healthy Communities

- Access to fitness opportunities. (addresses obesity, nature deficit disorders)
- Clean air – trees absorb pollutants, VOCs, filter runoff, cool the city. (combat asthma)
- Well being and mental health - -people heal faster when they can see or access green. (hospitals need this for patients, reduces absenteeism of workers)
- Less crime occurs near trees. (issue especially for downtowns and public housing areas)
- Employees will exercise if they can access green where they work and on the way to work. (addresses employee health)

Urban Tree Canopy Benefits

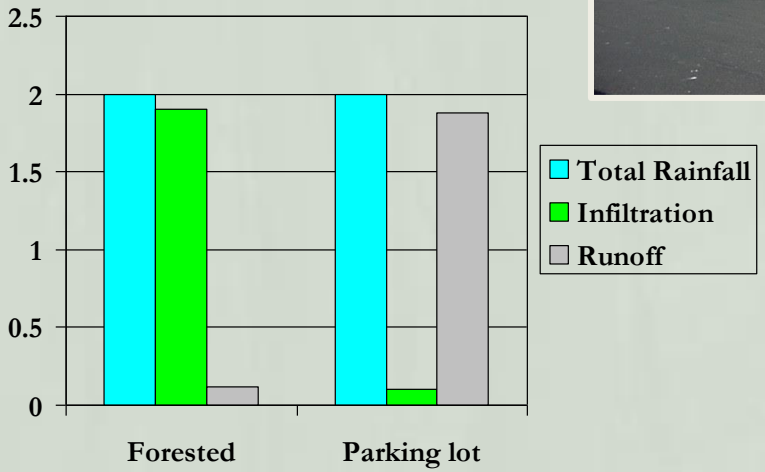
Intercepting rainfall

Delaying runoff

Transpiring captured stormwater

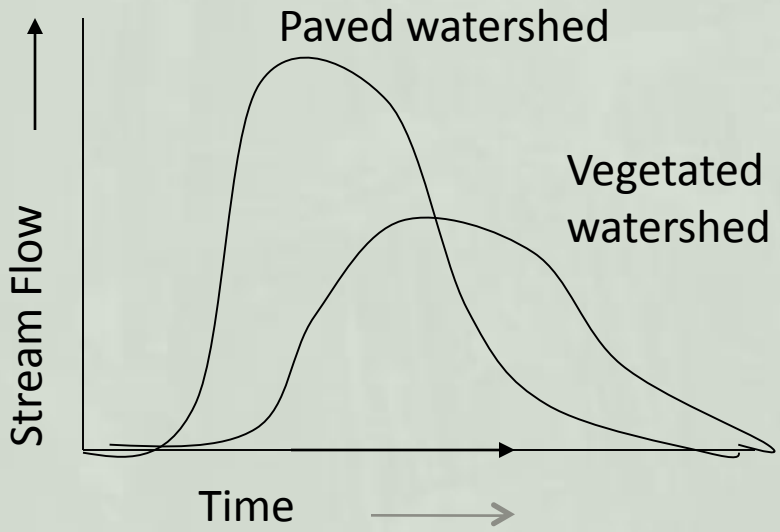
Paved Areas Can Cause Extreme Flows

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!



Water flow strategies

How do we make this…

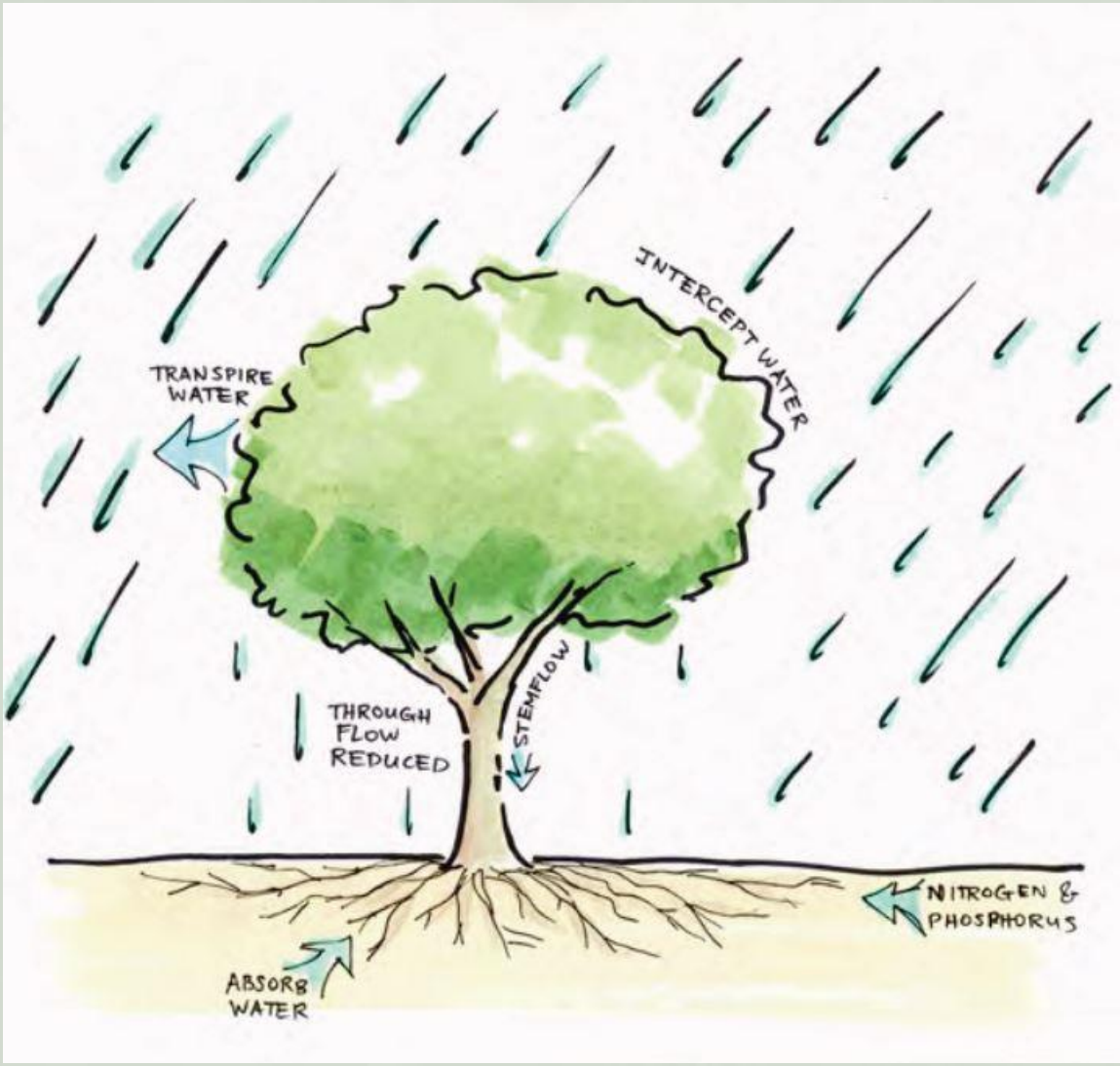
function like this?

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



As you might suspect:

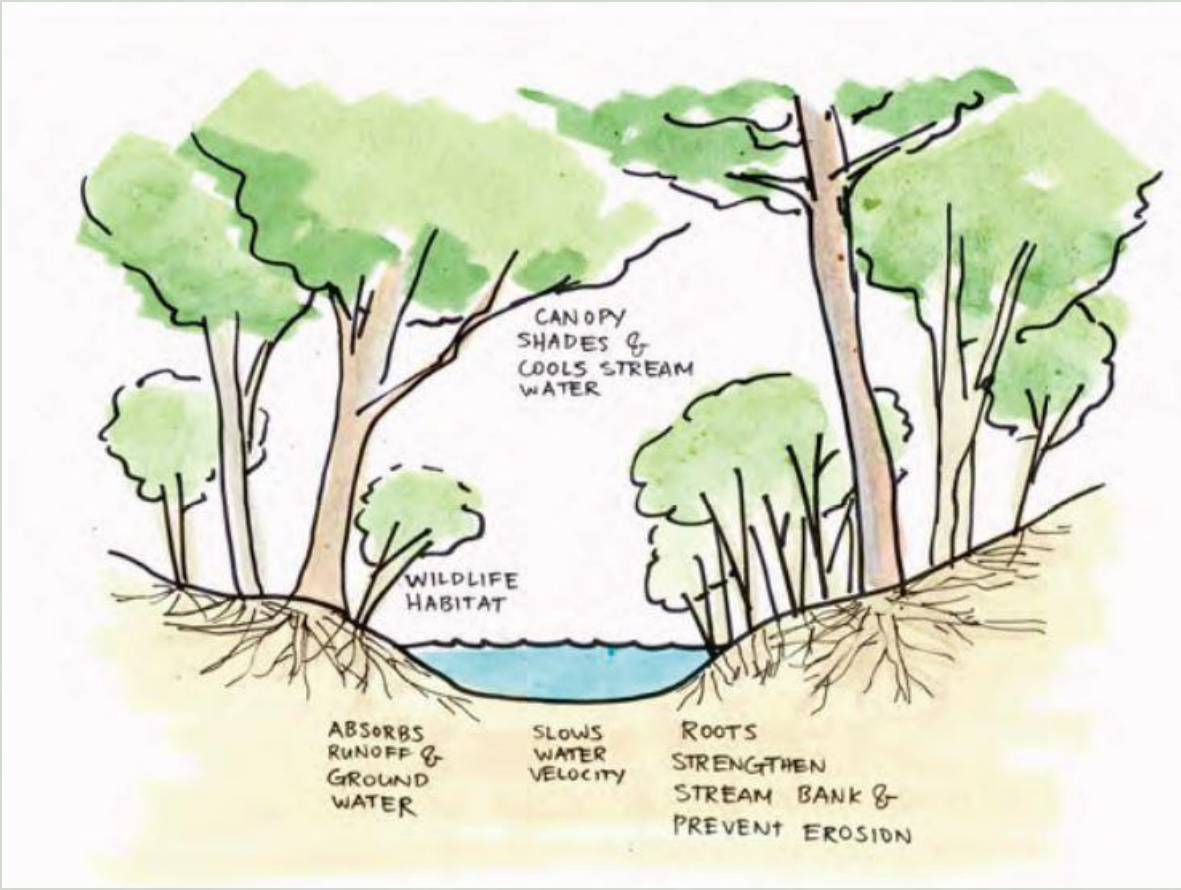
Tree canopy effectiveness is

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

Forested Buffers

A 100-foot wide buffer removes more than 90% of nitrogen, phosphorus and sediment from overland runoff.

But, buffers can't solve lack of stormwater management.



This parking lot could be retrofitted so we get less of this …

One acre of pavement releases 36 times more runoff than a forest.

During a rainfall event of one inch, one acre of forest will release 750 gallons of runoff, while a parking lot will release 27,000 gallons.

(PennState Extension).

Flooding in Harrisonburg, VA

Supersized Streets

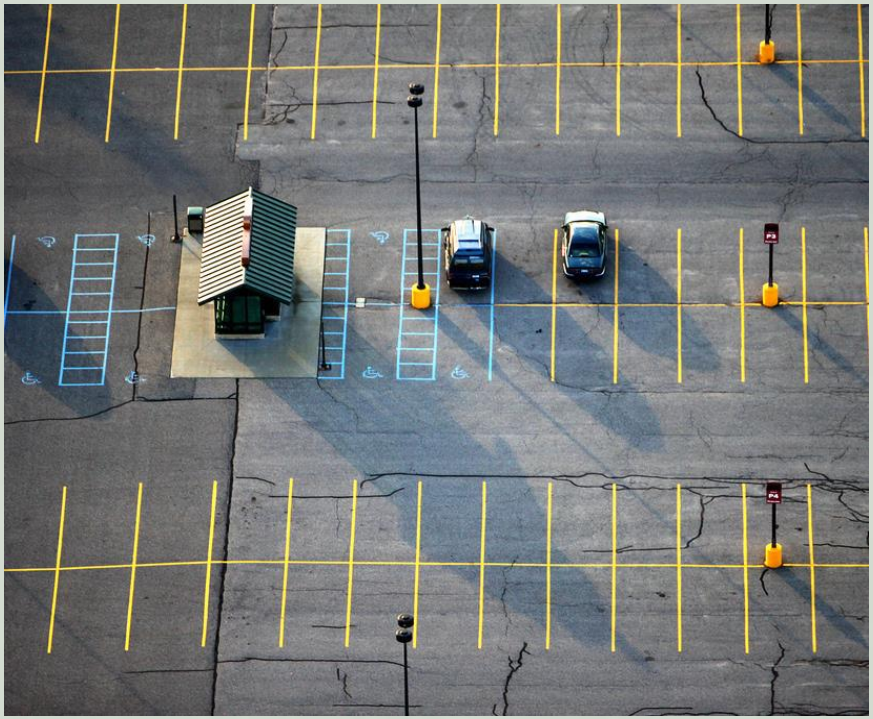
- Increase imperviousness
- Decrease stormwater uptake
- Increase urban heat island effect

Variable Space Sizing

Not all of us drive this →

← Some of us drive this.

Restripe Parking Lots

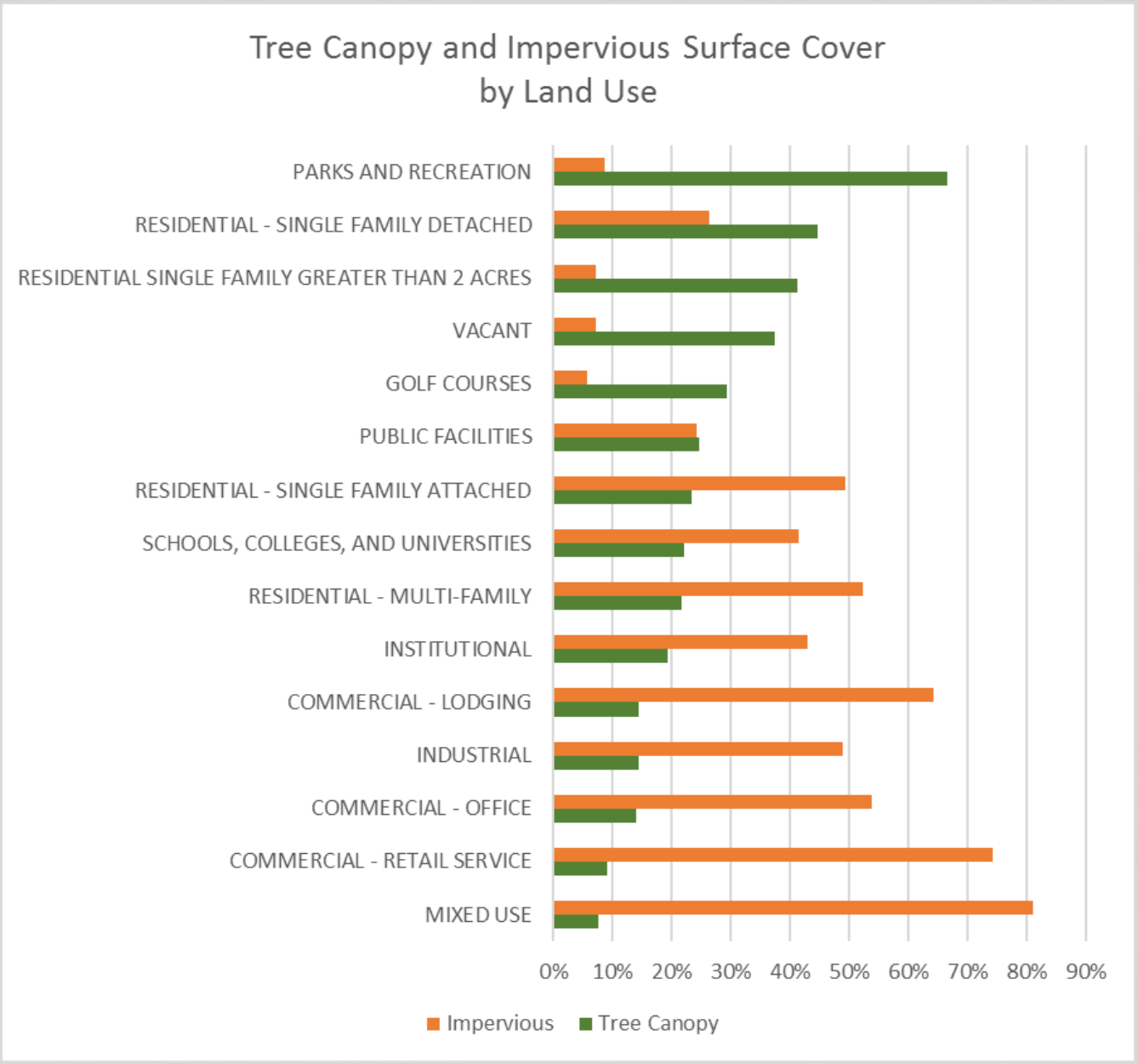


How?

- Match parking requirements to demand requirements (Harrisonburg parking studies or regional parking studies)
- Incentivize permeable pavement especially at high city elevations

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.)



Canopy varies greatly. So even if good citywide, it may be deficient in some zoning types, land uses or neighborhoods.

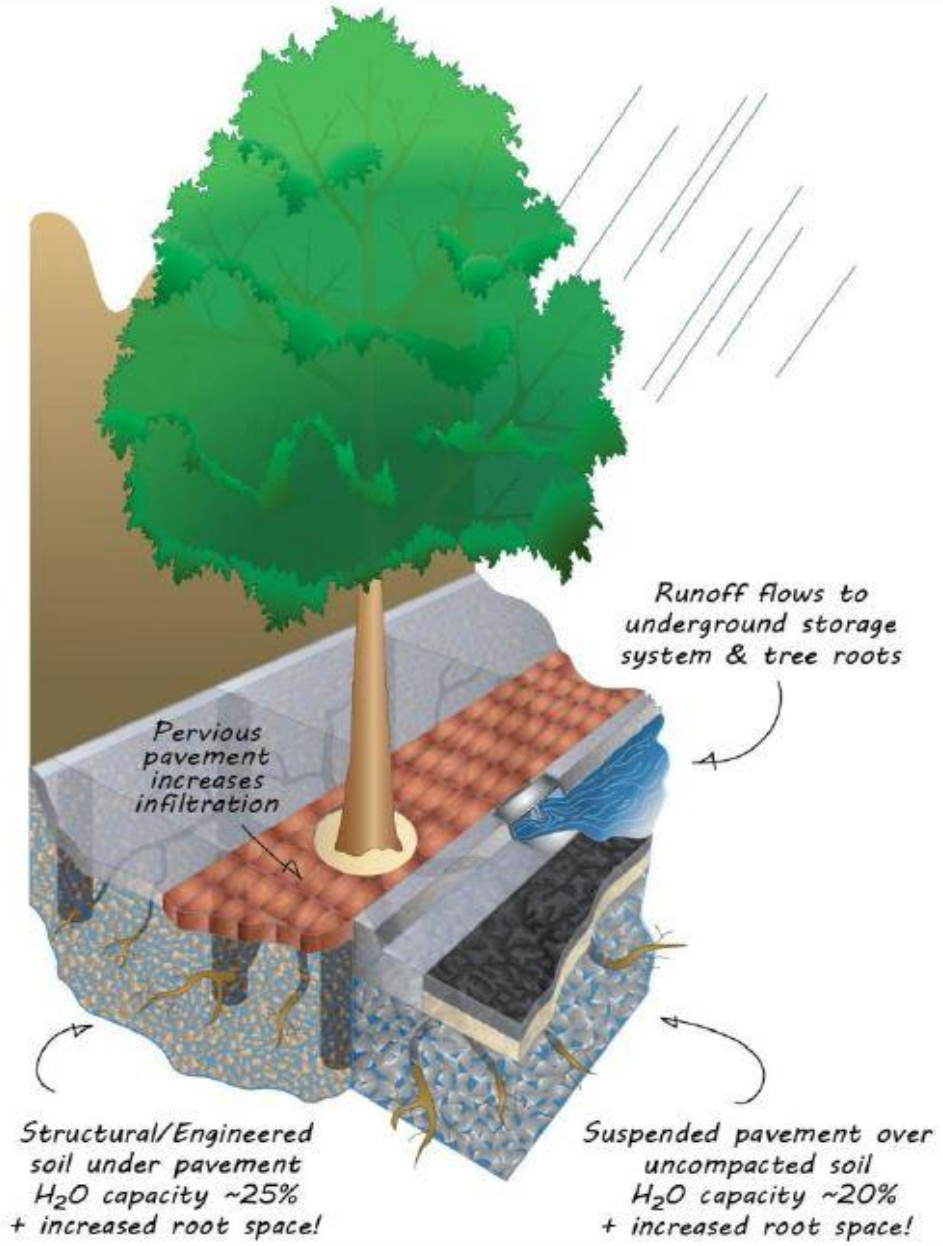
Urban Trees Often Need Better Care and More Room to Grow

Adequate Planting Area

This city tree has a larger planting bed so the trees roots can get oxygen and water.

A general rule: 1000 cubic feet soil vol. per tree.

Accommodate Large Trees



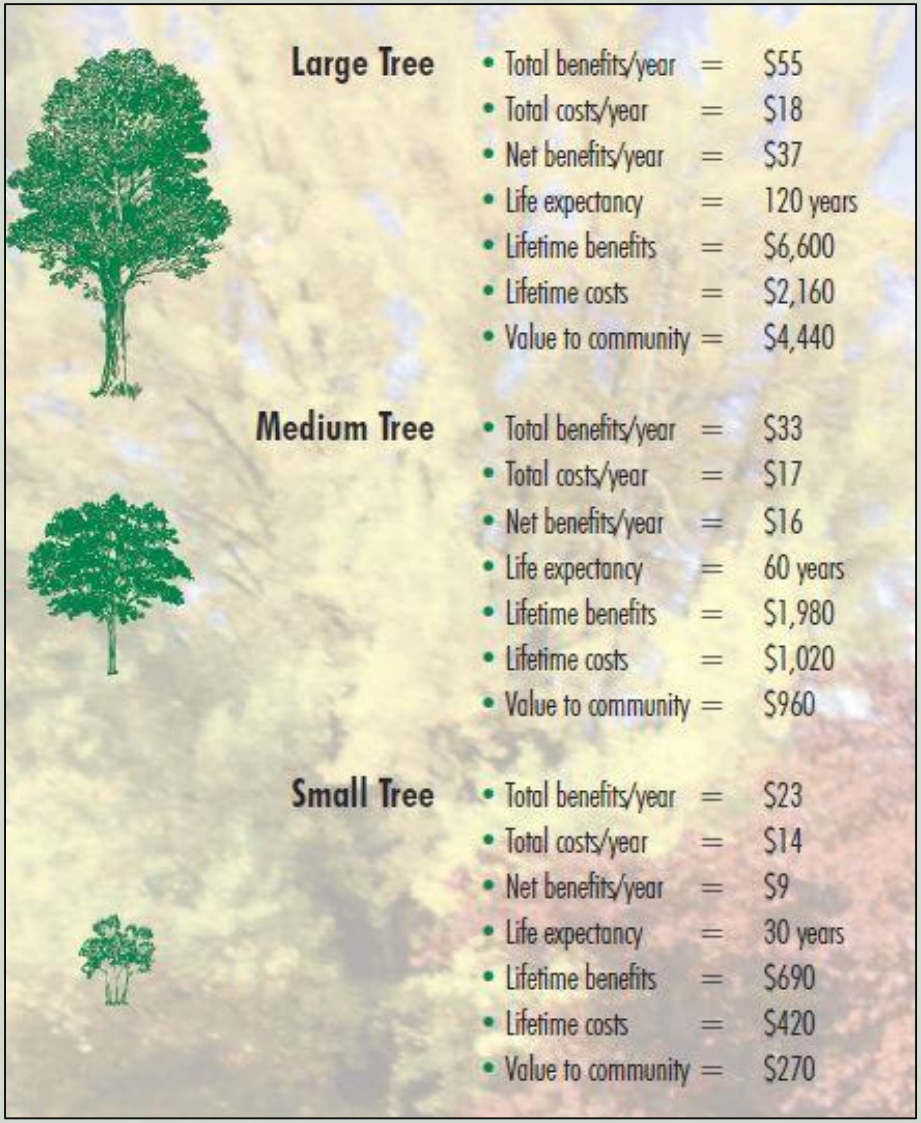
Tree image, Davey Trees.

Larger trees offer greater benefits – so think carefully when setting planting goals for streets!

Consider use of structural soils and permeable pavement, rather than just choosing small trees! Trees will pay back your investment!

Harrisonburg used silva cells in the downtown streetscape project!

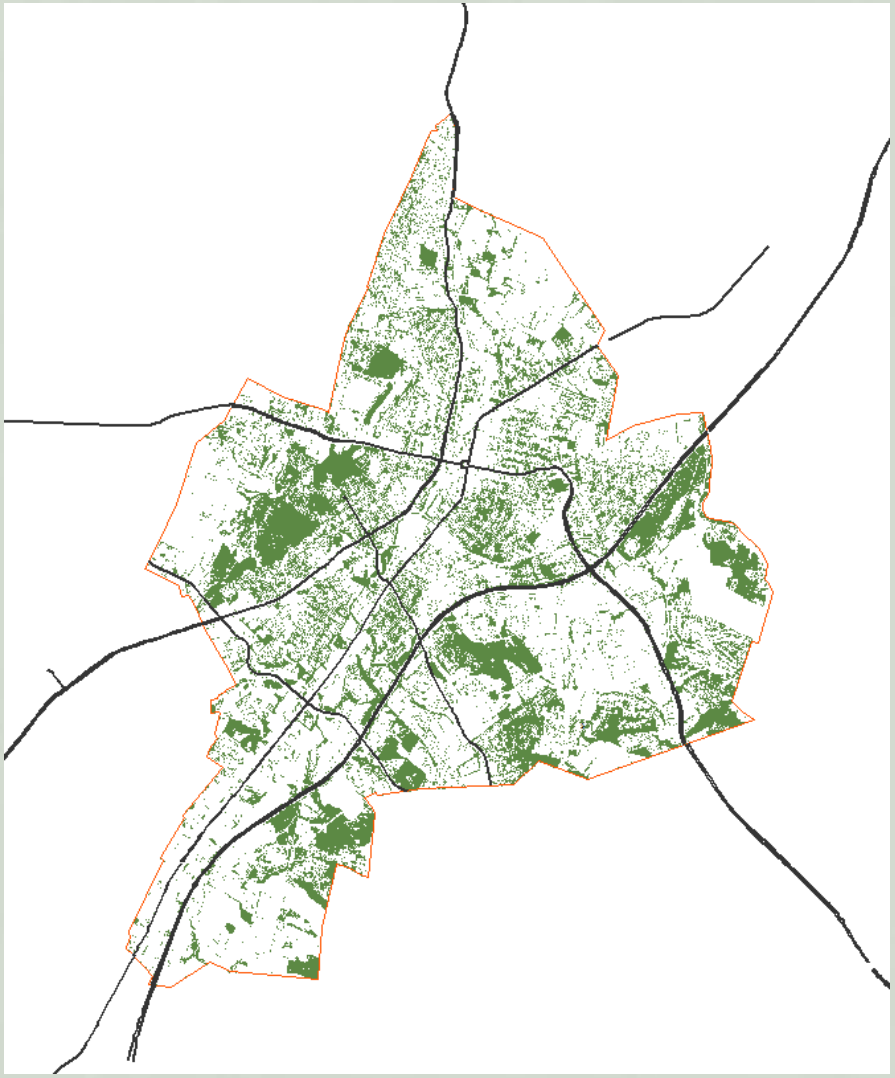
Annual Average Benefits

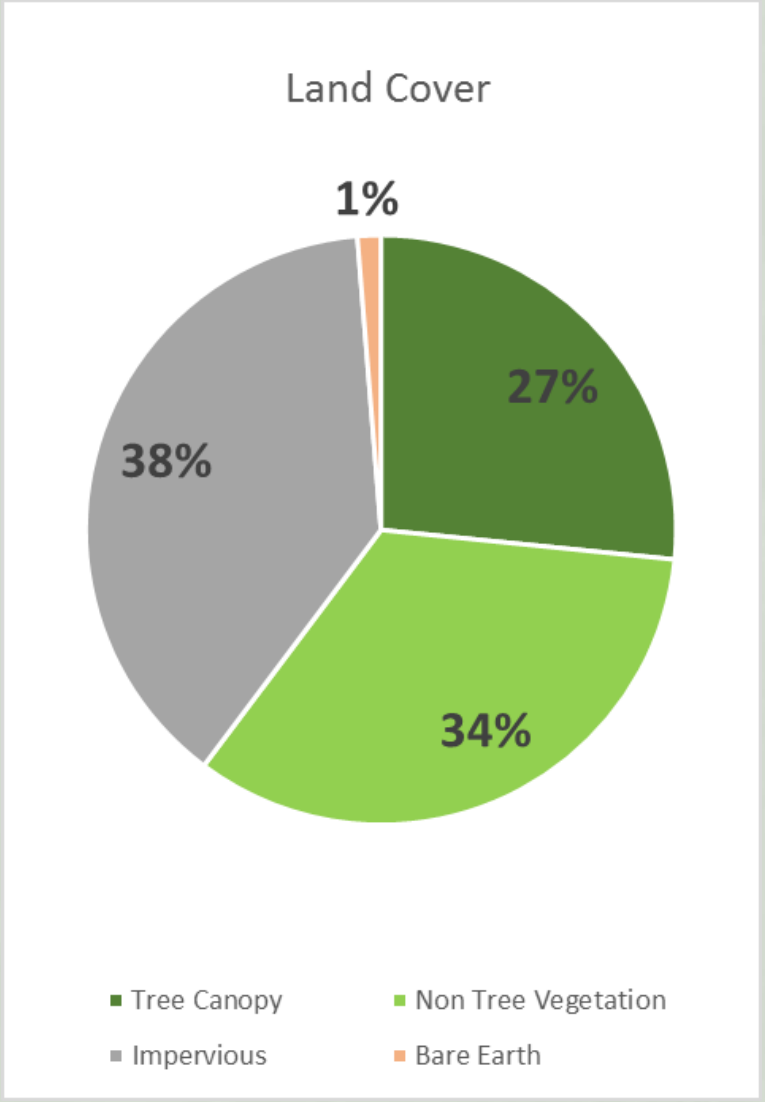


USDA Forest Service, Center for Urban Forest Research

Using GIS, we can estimate where it's possible to plant trees, and the benefits of doing so. We put big trees where we can fit them, then medium trees, then small.

Tree Canopy and Land Cover in Harrisonburg

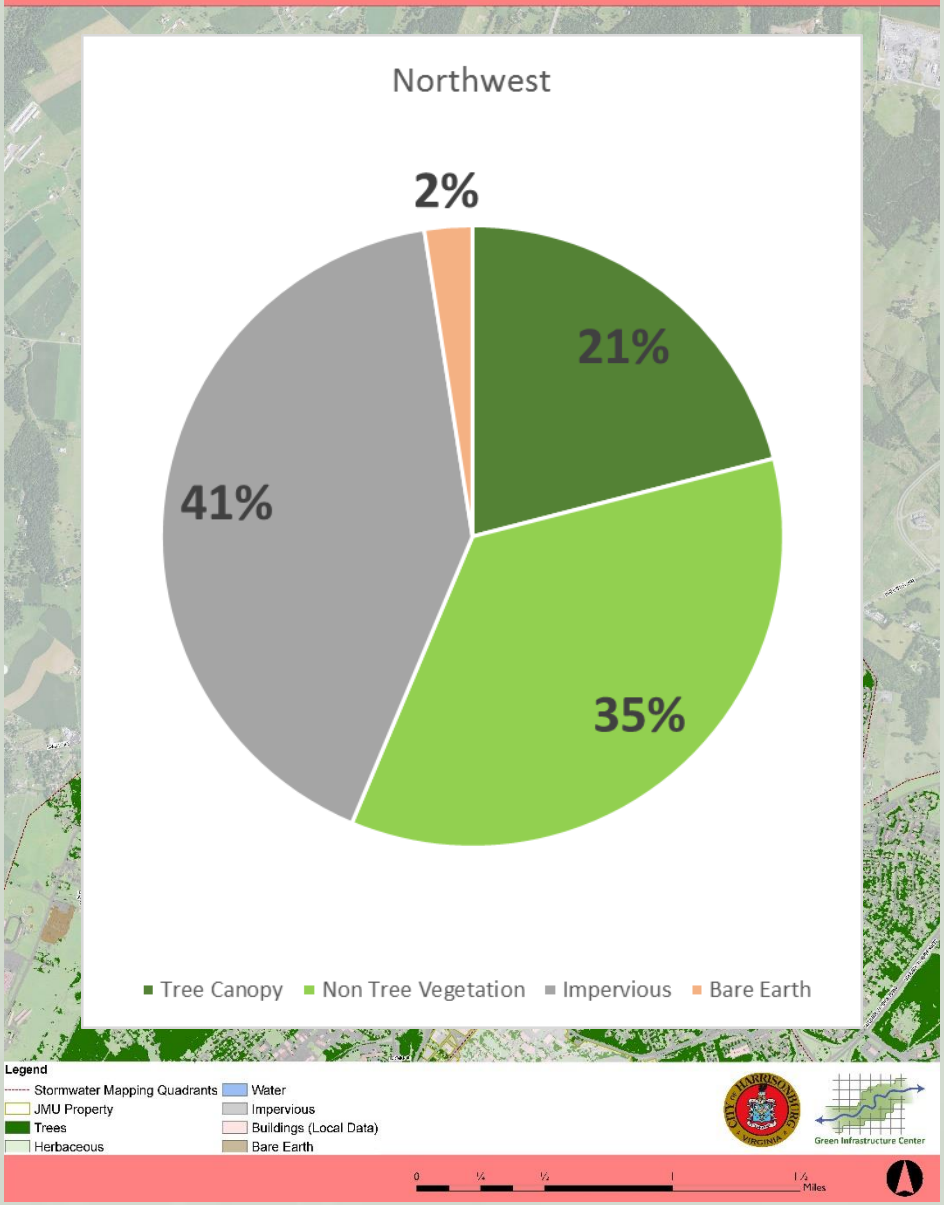




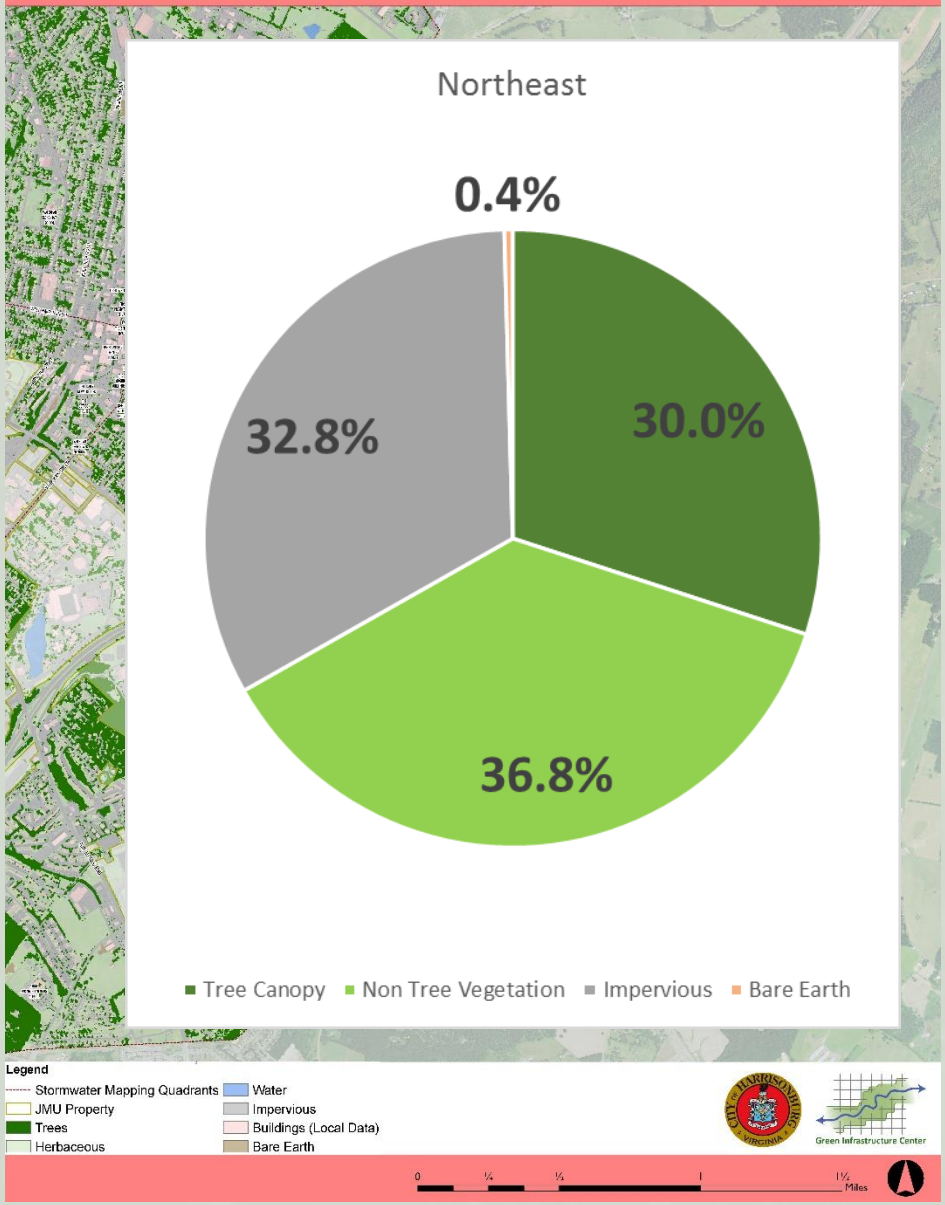
How Does Harrisonburg Compare?

Virginia City	Percent Tree Canopy
Charlottesville	45%
Fredricksburg	44%
Waynesboro	43%
Richmond	42%
Blacksburg	30%
Harrisonburg	**26.5%**
Norfolk	25%
Woodstock	24%

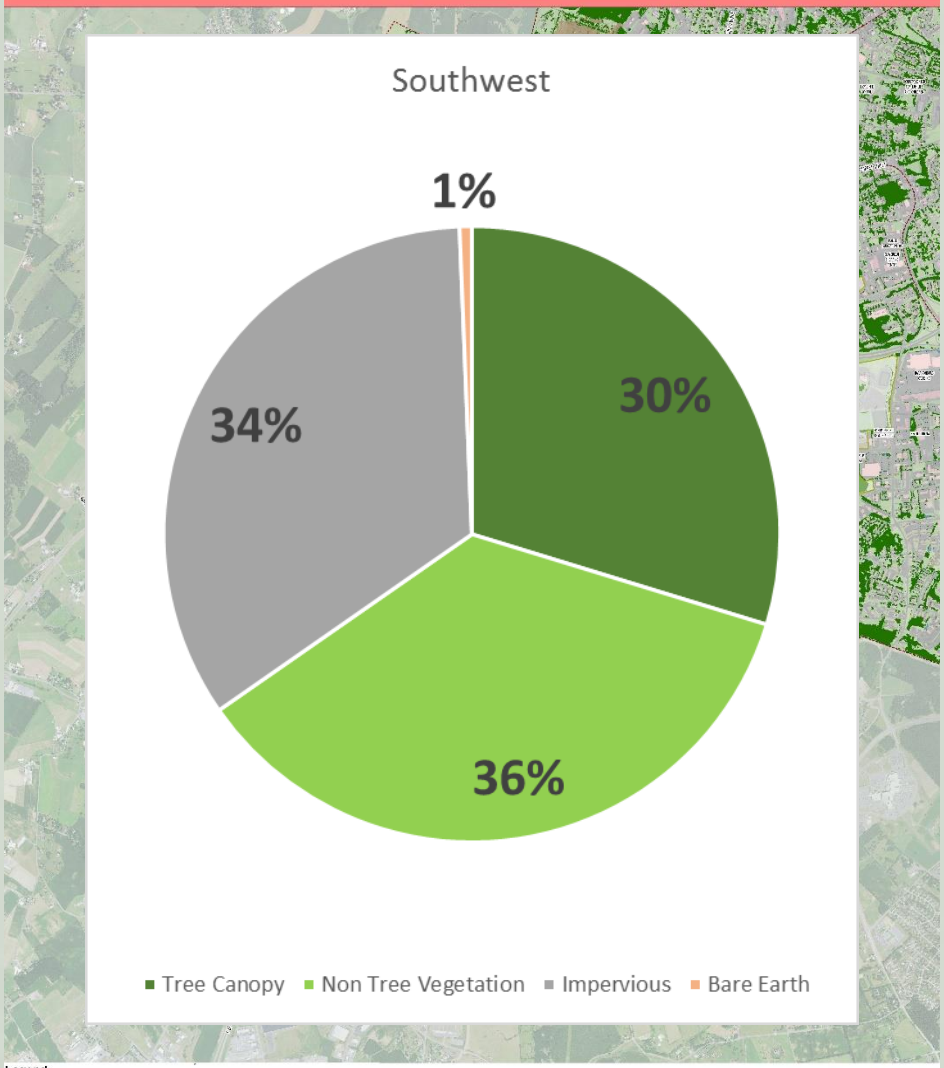
Harrisonburg Land Cover Classification : Stormwater Mapping Quadrant 1



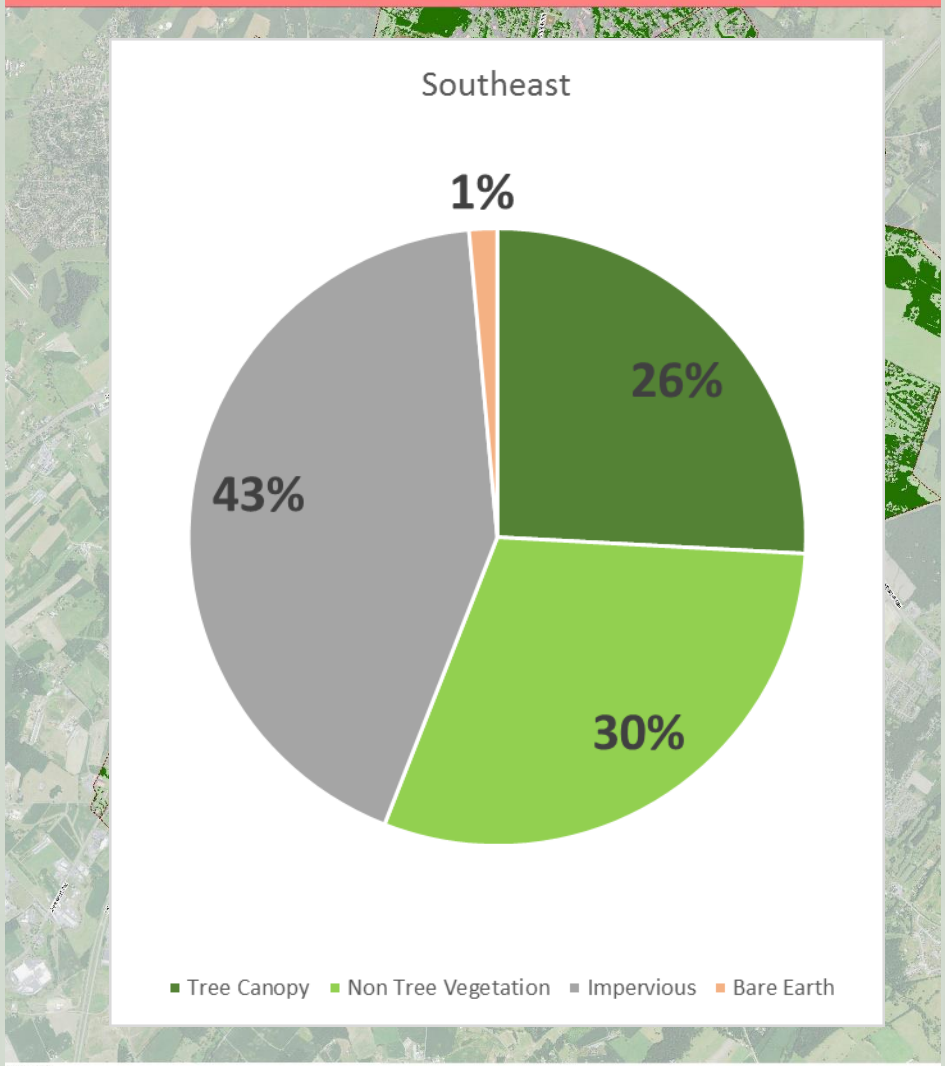
Harrisonburg Land Cover Classification : Stormwater Mapping Quadrant 2



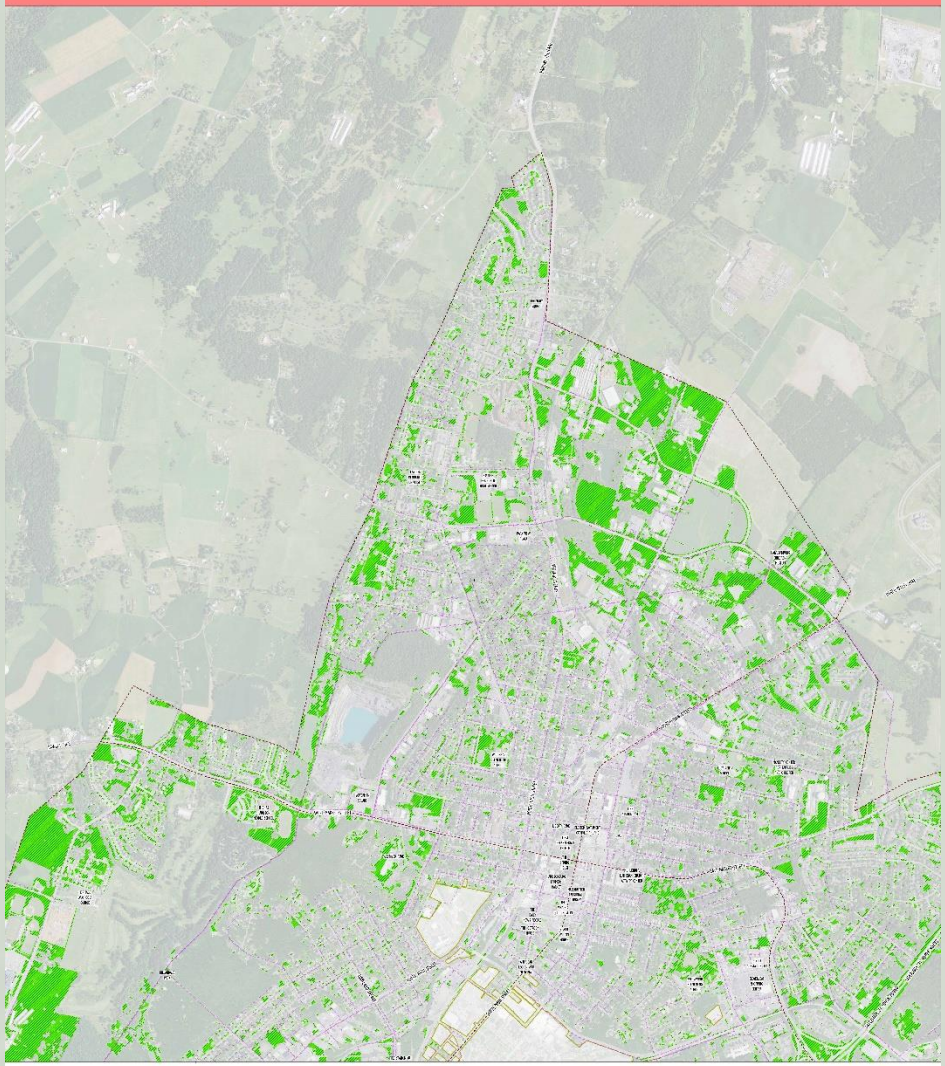
Harrisonburg Land Cover Classification : Stormwater Mapping Quadrant 3



Harrisonburg Land Cover Classification : Stormwater Mapping Quadrant 4



Possible Planting Area on Pervious Surfaces: Quadrant 1



Stormwater Mapping Quadrants
JMU Property
Possible Planting Area on Pervious Surfaces

Overhead Utilities
Primary
Secondary

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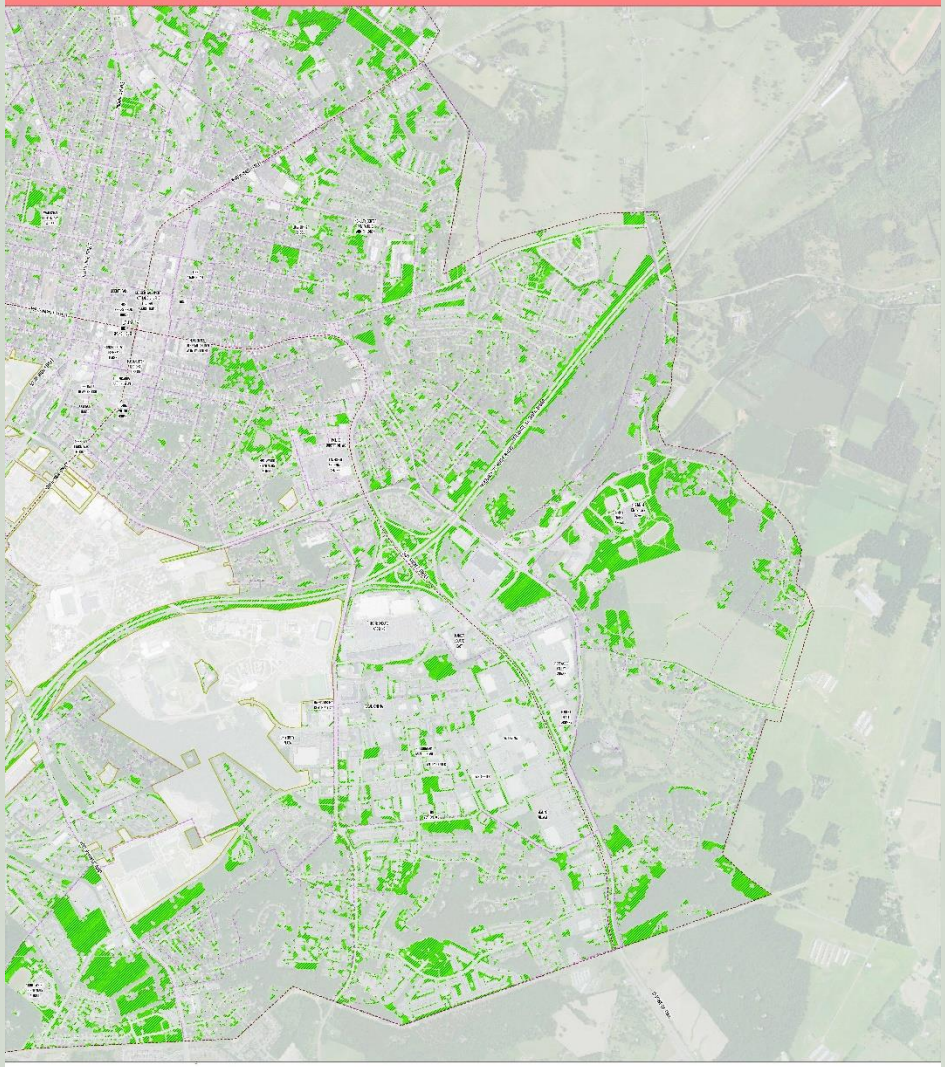
0 ¼ ½ 1 1¼ Miles

Possible Planting Area on Pervious Surfaces: Quadrant 2



Stormwater Mapping Quadrants
JMU Property
Possible Planting Area on Pervious Surfaces

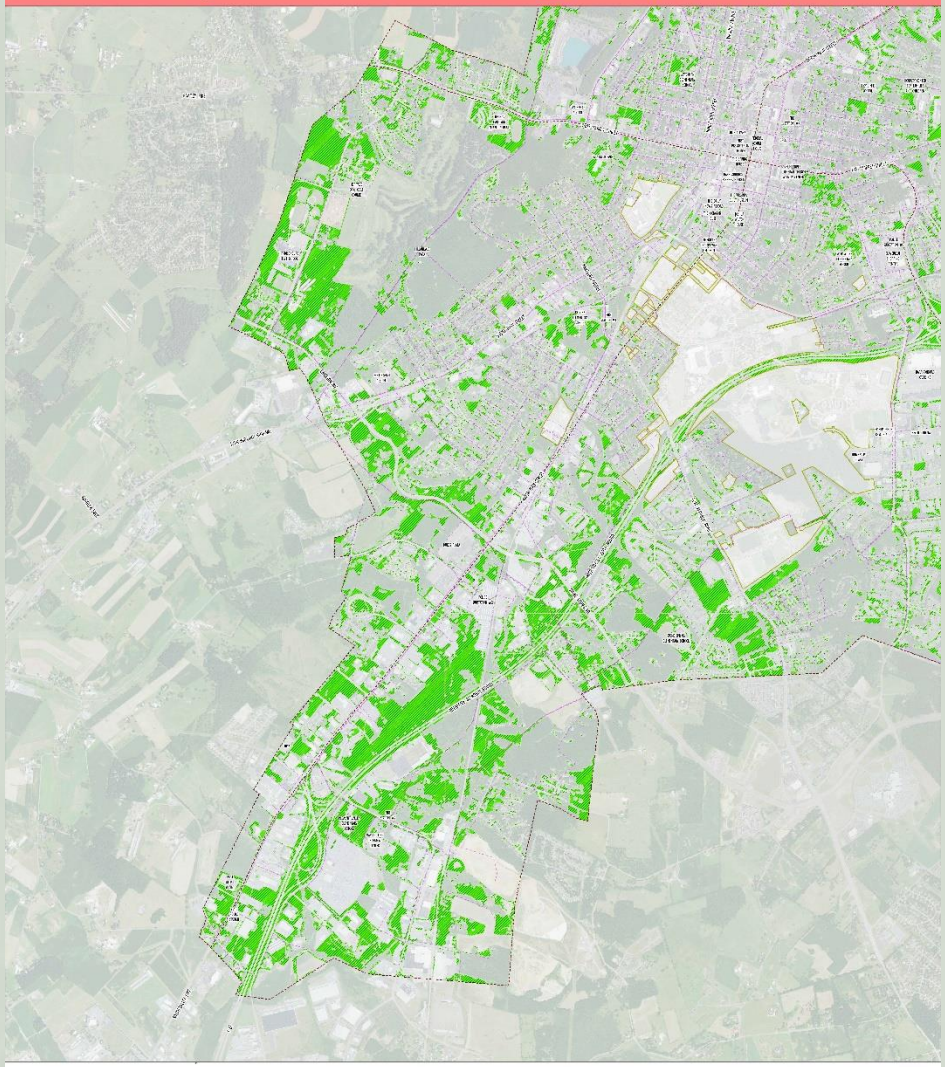
Overhead Utilities
Primary
Secondary

Green Infrastructure Center

DRAFT, May 2017

0 ¼ ½ 1 1½ Miles

Possible Planting Area on Pervious Surfaces: Quadrant 3



Stormwater Mapping Quadrants
JMU Property
Possible Planting Area on Pervious Surfaces

Overhead Utilities
Primary
Secondary

Green Infrastructure Center

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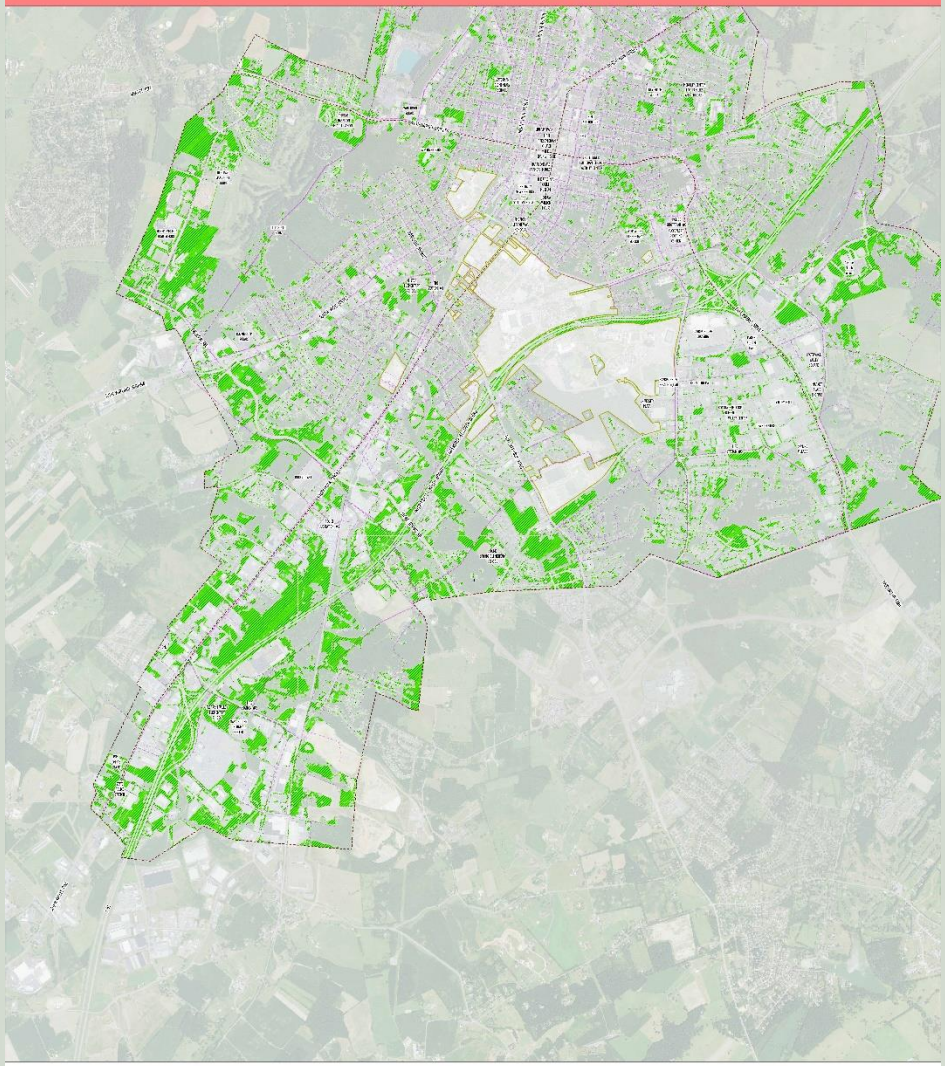
0 ¼ ½ 1 1½ 2 Miles

Possible Planting Area on Pervious Surfaces: Quadrant 4



Stormwater Mapping Quadrants
JMU Property
Possible Planting Area on Pervious Surfaces

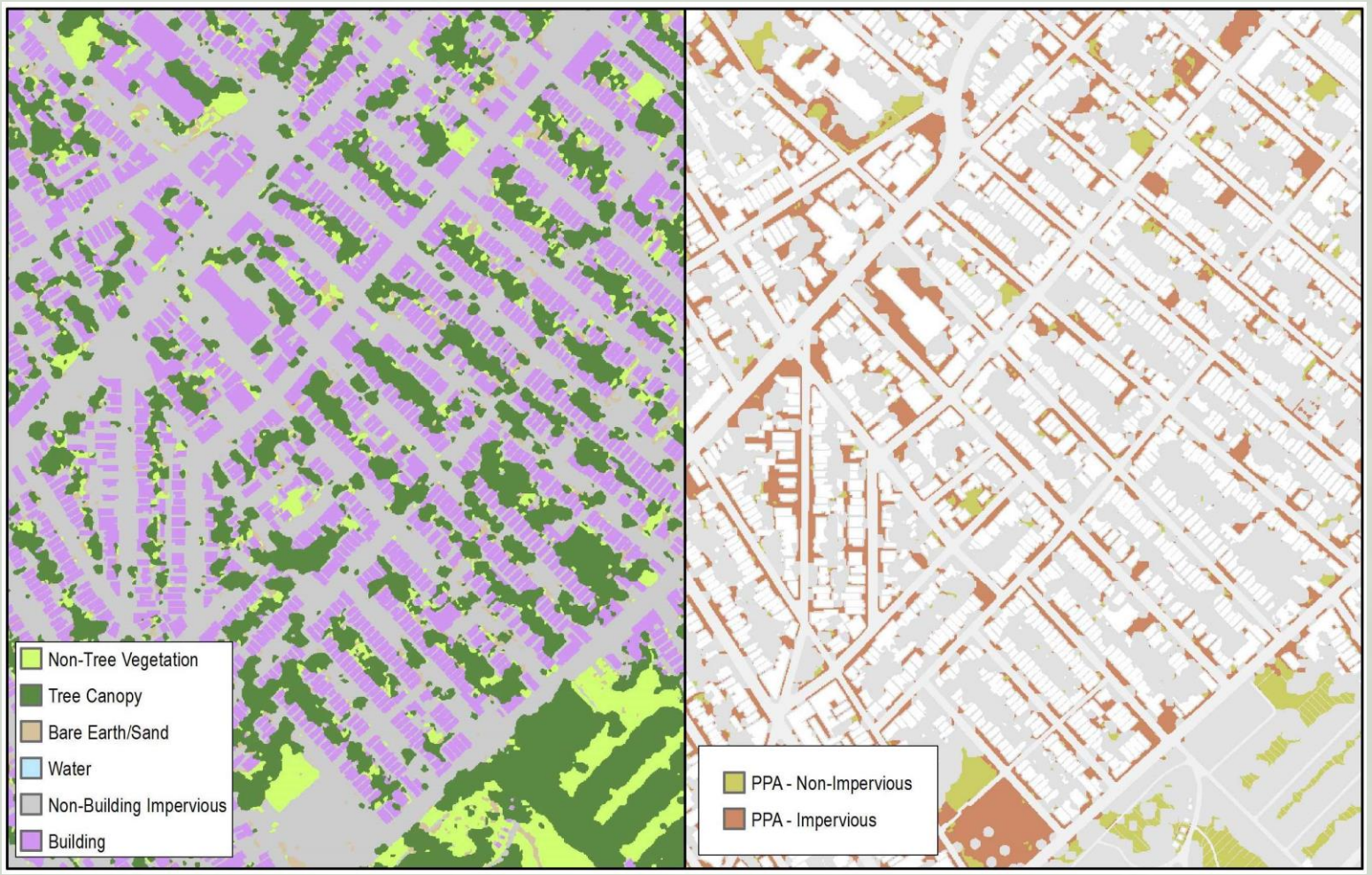
Overhead Utilities
Primary
Secondary

Green Infrastructure Center

DRAFT, May 2017

0 ¼ ½ 1 1½ 2 2½ Miles

Where Can We Fit Trees?
Possible Planting Areas



Possible Planting Area vs. Potential Tree Canopy

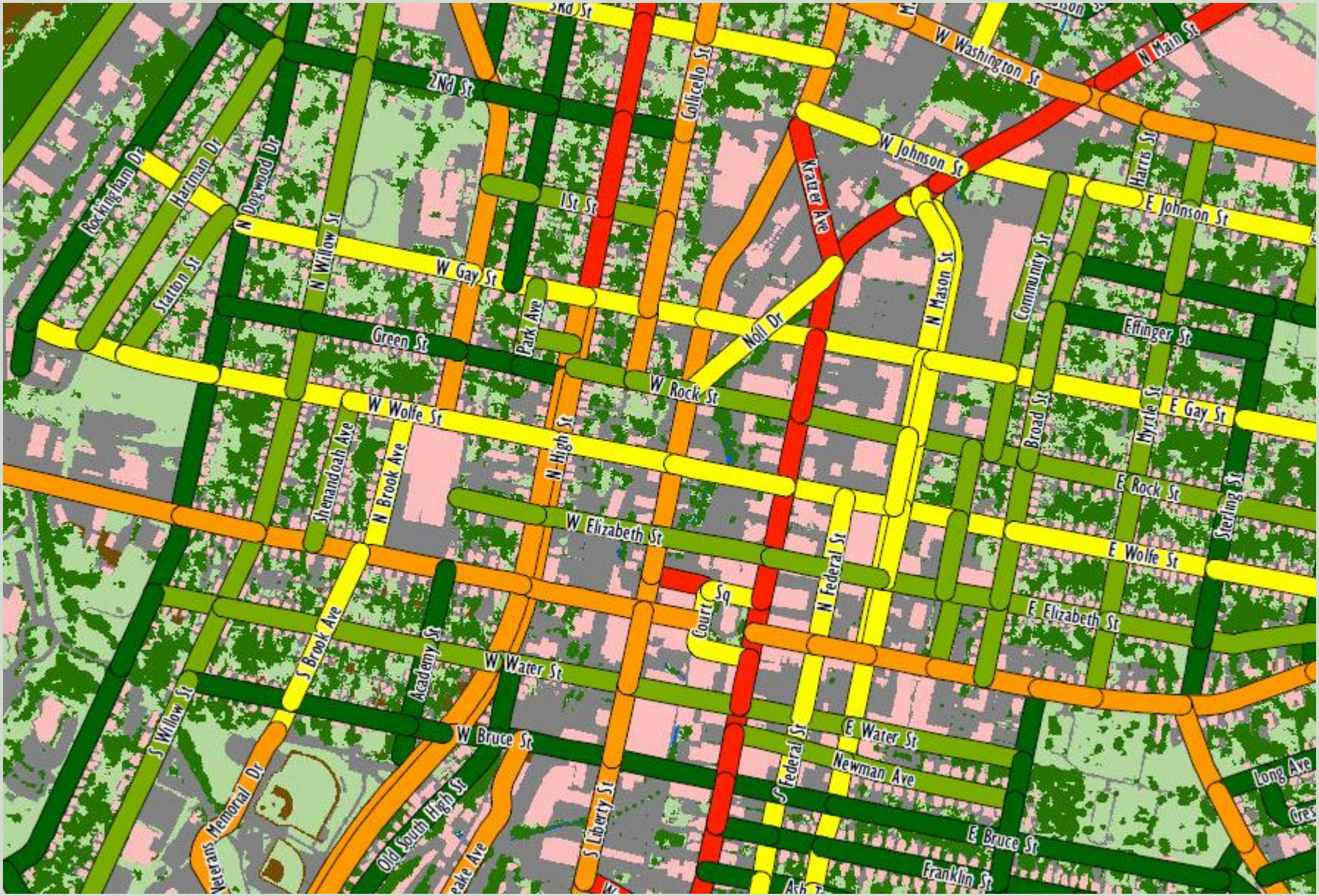
Using PPA to inform strategic goal setting

Future scenarios – Where can we plant trees for maximum benefits? For example, revitalize a commercial corridor?

What would it take to reach certain canopy goals?

Percent of PPA Covered	New TC (Sq. Ft.)	New AOI TC %	Small Trees	Medium Trees	Large Trees	Total Trees
1%	750,777	26.82%	466	289	153	908
2%	1,501,554	26.98%	933	579	307	1,819
3%	2,252,331	27.15%	1,399	869	460	2,728
4%	3,003,108	27.31%	1,866	1,158	614	3,638
5%	3,753,885	27.47%	2,333	1,448	767	4,548
6%	4,504,661	27.64%	2,799	1,738	921	5,458
7%	5,255,438	27.80%	3,266	2,027	1,075	6,368
8%	6,006,215	27.97%	3,733	2,317	1,228	7,278
9%	6,756,992	28.13%	4,199	2,607	1,382	8,188
10%	7,507,769	28.30%	4,666	2,896	1,535	9,097
11%	8,258,546	28.46%	5,133	3,186	1,689	10,008
12%	9,009,323	28.63%	5,599	3,476	1,843	10,918
13%	9,760,100	28.79%	6,066	3,765	1,996	11,827
14%	10,510,877	28.96%	6,533	4,055	2,150	12,738
15%	11,261,654	29.12%	6,999	4,345	2,303	13,647
16%	12,012,431	29.29%	7,466	4,634	2,457	14,557
17%	12,763,207	29.45%	7,932	4,924	2,611	15,467
18%	13,513,984	29.62%	8,399	5,214	2,764	16,377

How green are the city's streets?



Strategy:
Plant more trees

Trees On Your Property!

Percent of land held by private owners in Harrisonburg: 93.5%

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

Increasing tree canopy and decreasing stormwater runoff is ultimately in private landowner's hands!

Discussion – at displays

- ✓ How green is your area of the city (see maps)?
- ✓ What challenges do you see for city trees?
- ✓ Have you used the credit for stormwater utility?
- ✓ Where is flooding a problem?
- ✓ How could we plant more trees?

Let’s look at maps – provide comments!

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Map Displays