

Virginia's Street Trees: Findings from a 4-year i-Tree Study

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A partnership of Virginia Tech and Virginia State University

www.ext.vt.edu



August 15th 2012

Street Trees in Virginia ~

What We Have, What We Want,
& How We Get There

PRESENTATION OVERVIEW

- Project background
- Project methods
- Summary of findings
- Take-home messages



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PROJECT BACKGROUND

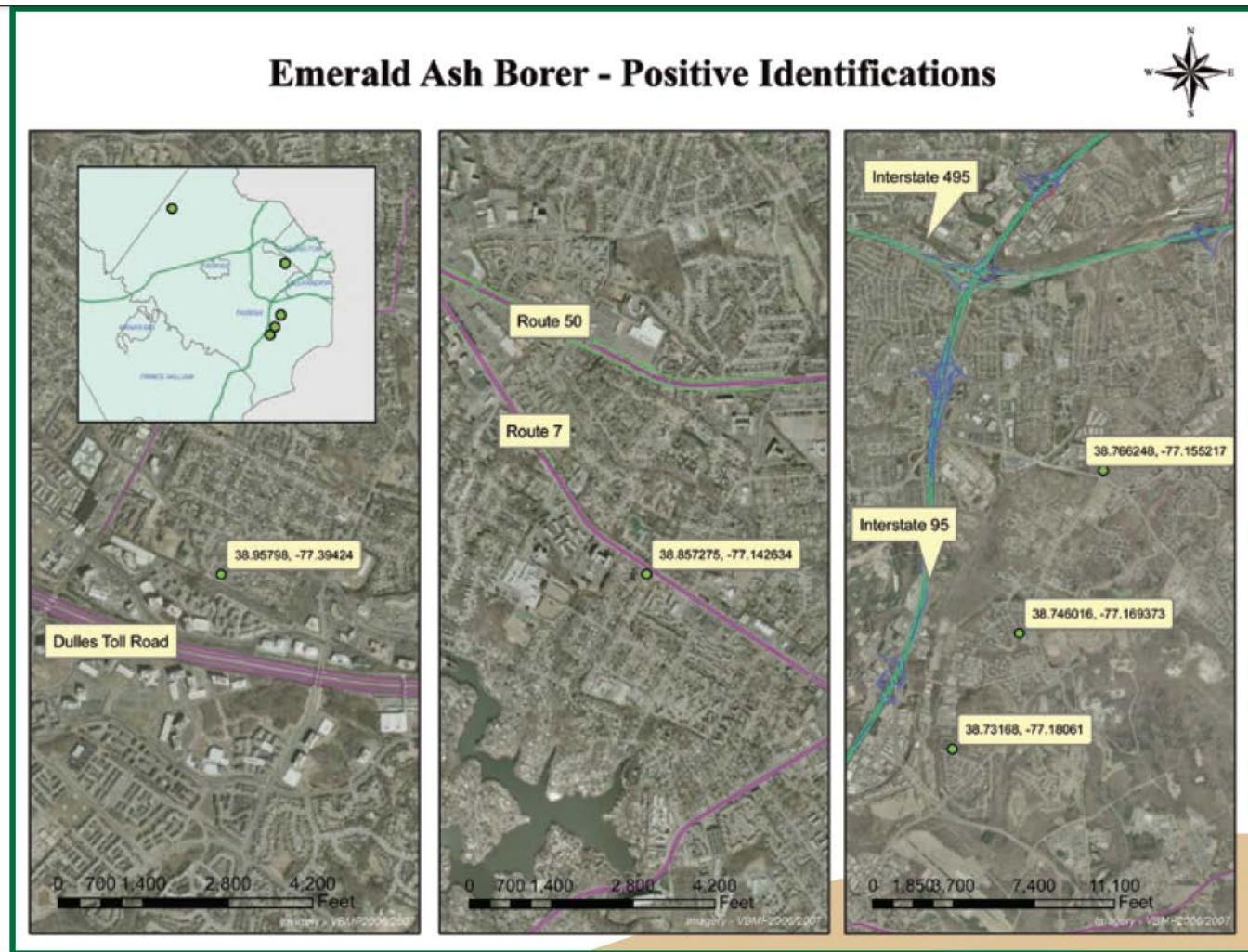
- Emerald ash borer (EAB) rediscovered in VA in 2008



THE “GREEN MENACE” IS BACK AND THIS
TIME, IT’S HERE TO STAY

PROJECT BACKGROUND

- Emerald ash borer (EAB) rediscovered in VA in 2008



PROJECT BACKGROUND

- Midwestern urban forests were being devastated by EAB

09-23-08

Cooperative Emerald Ash Borer Project

EAB locations in Illinois, Indiana, Maryland,
Michigan, Missouri, Ohio, Pennsylvania,
Virginia, Wisconsin, West Virginia and Canada

September 23, 2008

10 states plus
the Canadian
infestations



SE Michigan:

- **20 million dead ash trees**
(Anulewicz et al. 2007)

PROJECT BACKGROUND

- Midwestern urban forests were being devastated by EAB



Belvedere Dr., Toledo, OH. Left: Before EAB June 2006 | Right: Peak EAB June 2009

PROJECT BACKGROUND

- Midwestern urban forests were being devastated by EAB



DAVID JOLES / STAR TRIBUNE / ZUMAPRESS

◀ BACK

NEXT ▶

Devastated Neighborhood

Forty trees in this St. Paul, Minn., neighborhood were felled in 2009. The emerald ash

PROJECT BACKGROUND

- Midwestern urban forests were being devastated by EAB

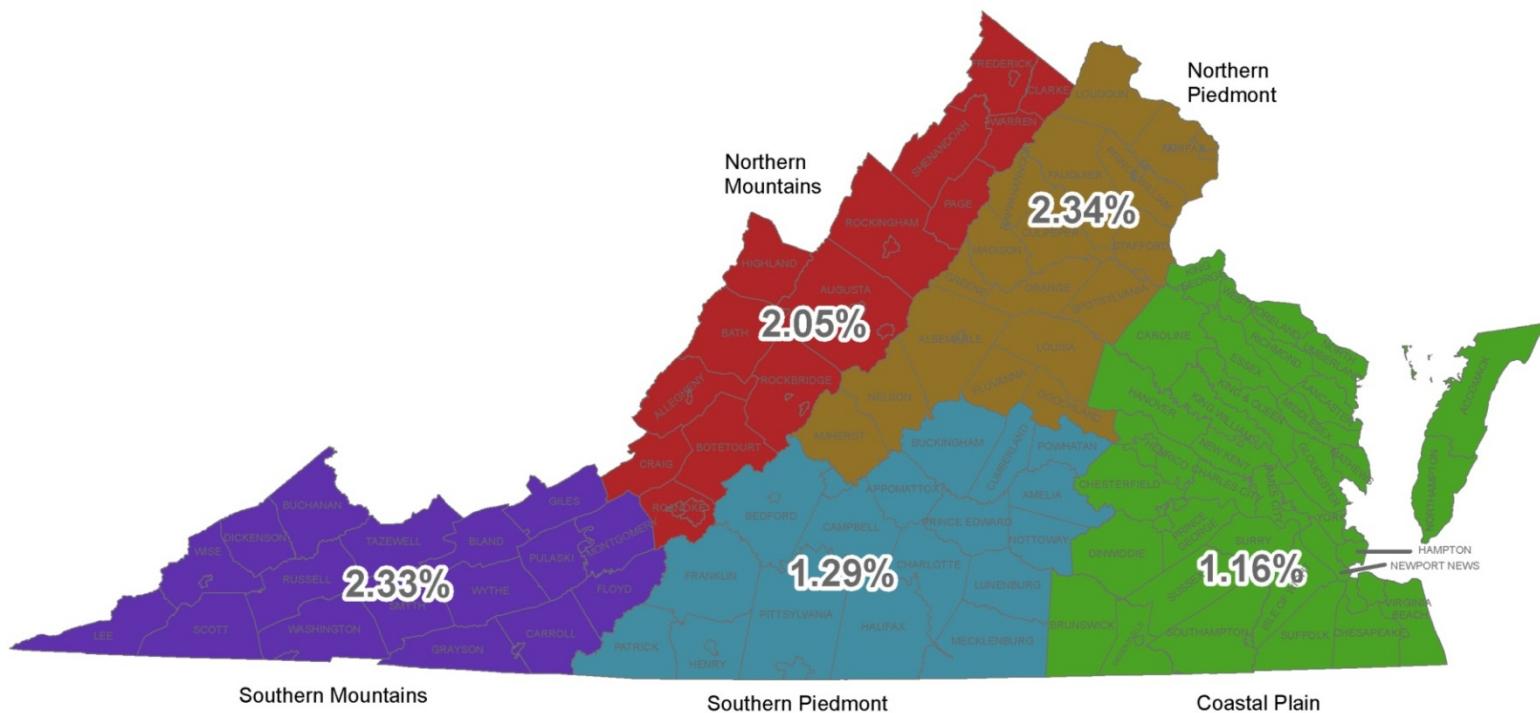
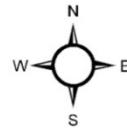


PROJECT BACKGROUND

- Native ash abundance was variable and uncertain



Ash Abundance by FIA Sub-Region
as a percentage of Total Forested Volume
(all trees $\geq 5.0"$ DBH)



PROJECT BACKGROUND

- Native ash abundance was variable and uncertain

Table 2

Developed land, canopy cover, and ash (*Fraxinus* sp.) density for selected cities and regions in the eastern United States.

Areas	Developed land (ha)	Canopy cover (ha)	Ash trees per ha developed land	Ash trees per ha canopy cover
Cities				
Atlanta, GA	24,846	8418	1.57	4.62
Baltimore, MD	18,593	1219	16.03	244.44
Boston, MA	11,357	663	2.35	40.18
Chicago, IL	57,162	1338	6.77	289.37
Indianapolis, IN	72,360	8417	2.05	17.65
Livonia, MI	8859	981	2.61	23.58
Milwaukee, WI	23,142	822	4.08	114.92
Minneapolis, MN	13,733	1243	14.58	161.06
Morgantown, WV	1745	309	22.01	124.22
Palatine, IL	3300	303	7.94	86.47
Philadelphia, PA	29,854	1310	4.36	99.27
Syracuse, NY	5912	467	1.13	14.24
Troy, MI	8273	940	7.03	61.83
Urbana, IL	2477	145	3.40	58.13
Washington, DC	13,362	9797	2.40	3.27
Wilmington, DE	2522	99	1.62	41.20
Mean	18,594	2279	6.25	86.53
Regions				
MI, OH, IN ^a	919,470	85,139	6.60	71.28
MI ^b	339,773	35,118	11.06	107.04
OH ^c	673,000	59,900	6.41	72.03

Virginia and DC:

- 1.33 million ash trees on developed lands**

PROJECT BACKGROUND

- Native ash abundance was variable and uncertain

Locality	% <i>Fraxinus</i> as Street Trees	Source
34 SD localities	36	Ball et al. 2007
Minneapolis, MN	21	Minn. Parks & Rec.
Gastonia, NC	19	Raupp et al. 2006
Florence, KY	13	Raupp et al. 2006
Lincolnshire, IL	13	Raupp et al. 2006
Chicago, IL	12	Raupp et al. 2006
Kansas City, MO	10	Raupp et al. 2006
Toledo, OH	9	Raupp et al. 2006
Marion, IN	5	Raupp et al. 2006
New York, NY	4	Raupp et al. 2006

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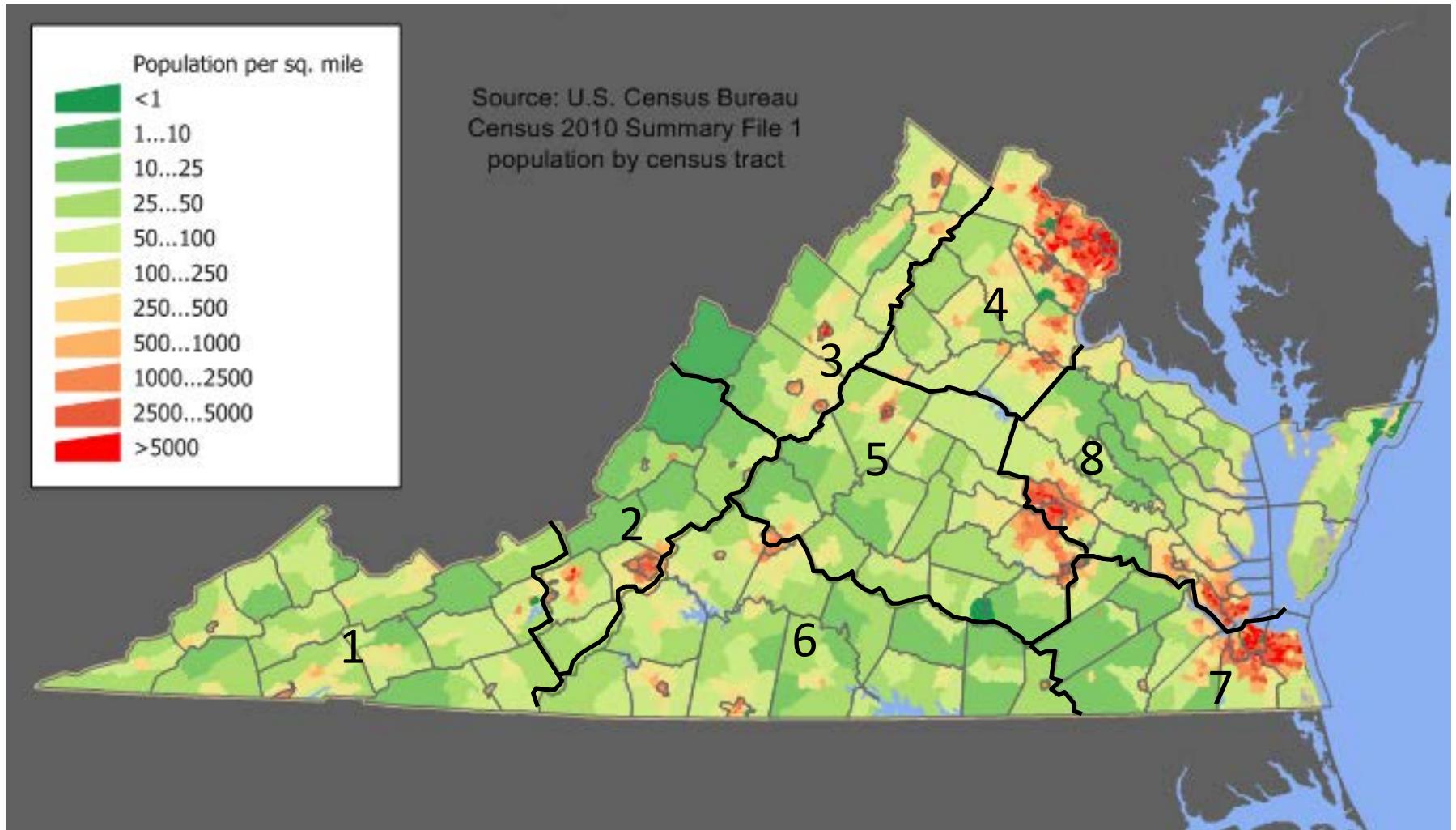


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PROJECT METHODS

- Zonation of state and identification of prospect localities

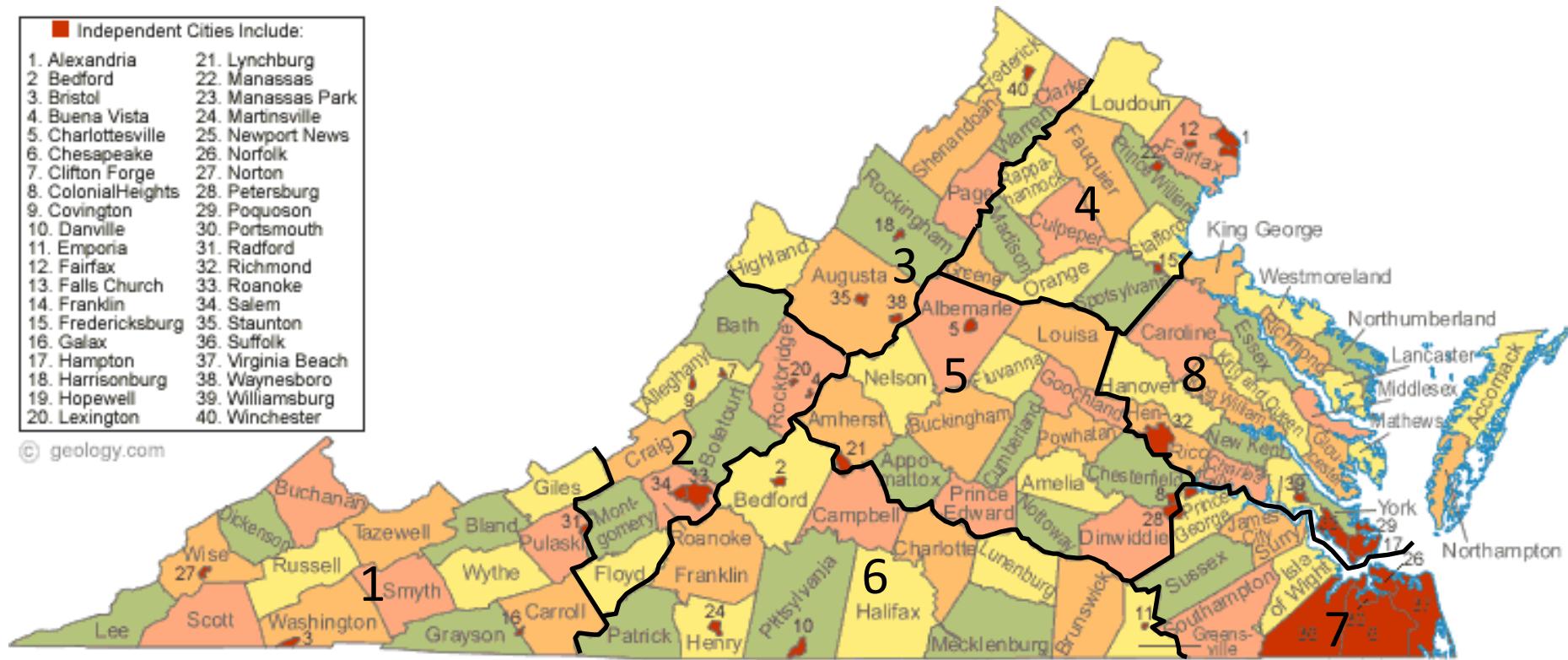


PROJECT METHODS

- Zonation of state and identification of prospect localities

Independent Cities Include:	
1. Alexandria	21. Lynchburg
2. Bedford	22. Manassas
3. Bristol	23. Manassas Park
4. Buena Vista	24. Martinsville
5. Charlottesville	25. Newport News
6. Chesapeake	26. Norfolk
7. Clifton Forge	27. Norton
8. Colonial Heights	28. Petersburg
9. Covington	29. Poquoson
10. Danville	30. Portsmouth
11. Emporia	31. Radford
12. Fairfax	32. Richmond
13. Falls Church	33. Roanoke
14. Franklin	34. Salem
15. Fredericksburg	35. Staunton
16. Galax	36. Suffolk
17. Hampton	37. Virginia Beach
18. Harrisonburg	38. Waynesboro
19. Hopewell	39. Williamsburg
20. Lexington	40. Winchester

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PROJECT METHODS

- Zonation of state and identification of prospect localities

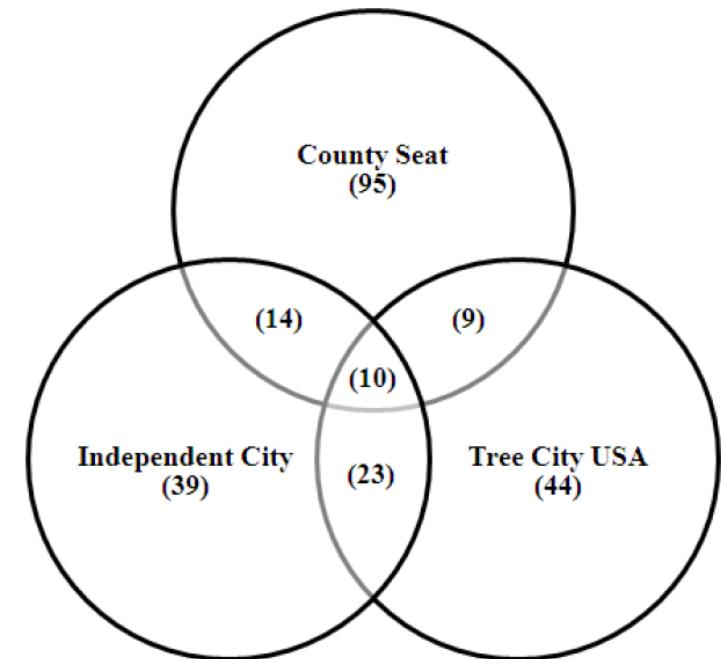


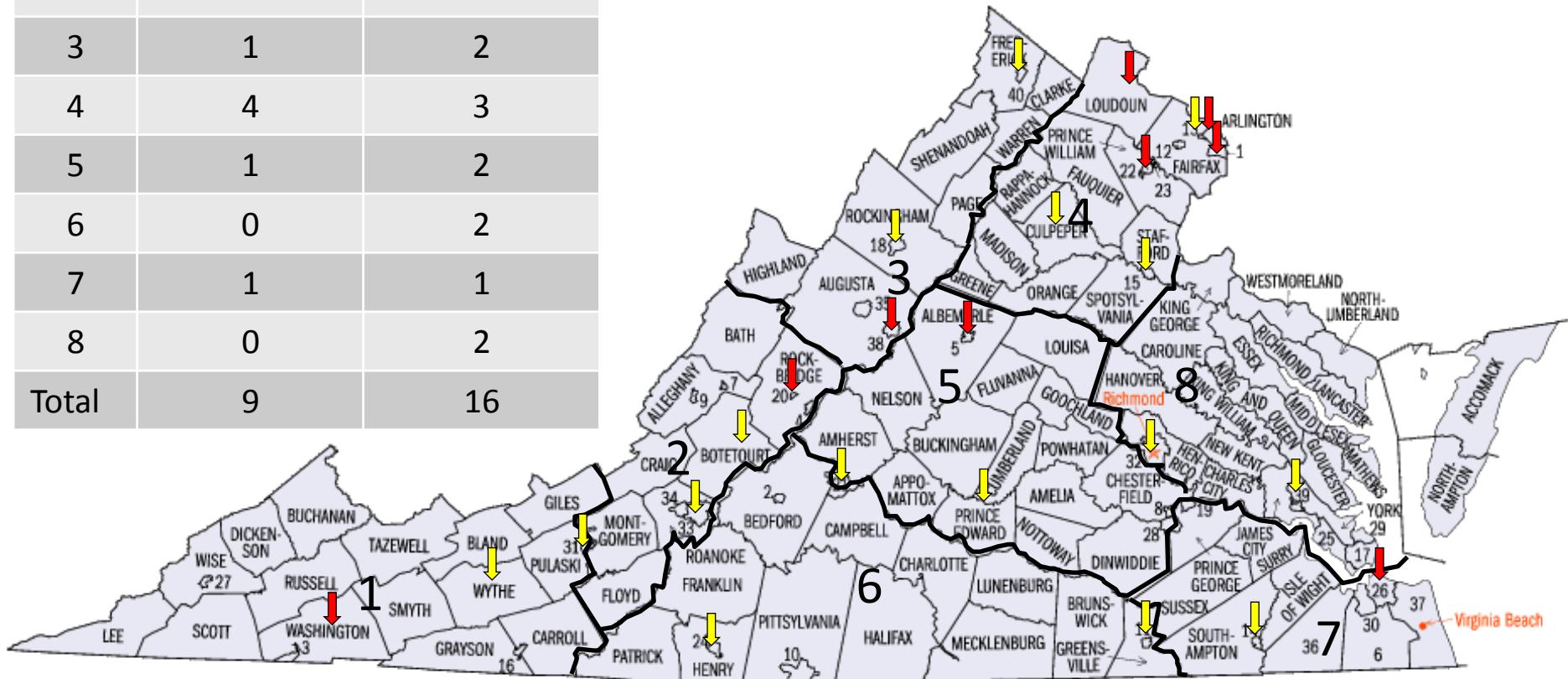
Table 3.1.1: Street tree inventory status of Virginia municipalities that are a Tree City USA (TCUSA), county seat, or independent city based on contact efforts from 2008 to 2011.

Locality Type	Existing Street Tree Inventory Status			
	Yes	No	Unknown	Total
County Seat (Not TCUSA)	0	4	68	72
Independent City (Not TCUSA)	0	6	10	16
Tree City USA				
Independent City	9	12	2	23
Not Independent City	5	16	0	21
Total	14	38	80	132

PROJECT METHODS

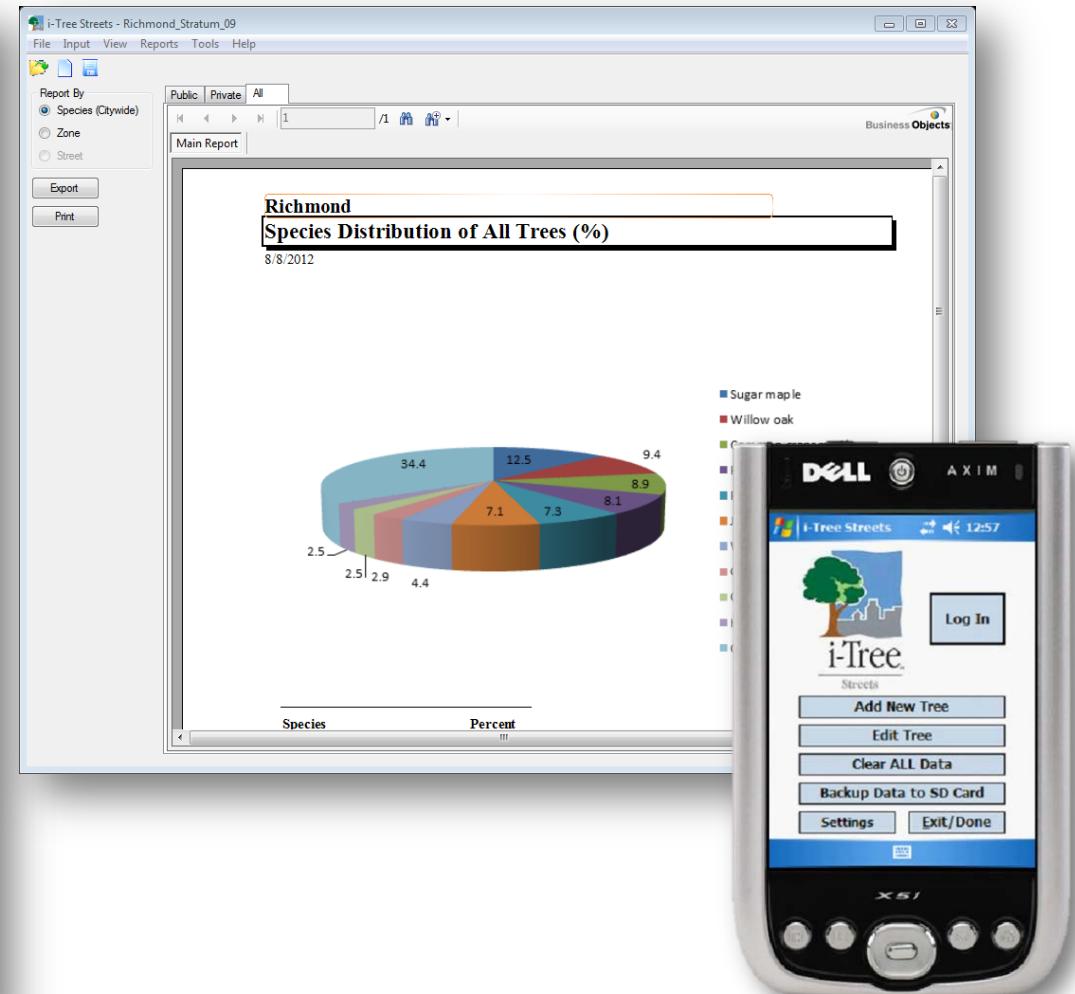
- Zonation of state and identification of prospect localities

Zone	Complete ↓	Sample ↓
1	1	2
2	1	2
3	1	2
4	4	3
5	1	2
6	0	2
7	1	1
8	0	2
Total	9	16



PROJECT METHODS

- Street tree inventory data collection



PROJECT METHODS

- Street tree inventory data collection

Sample Inventory Method

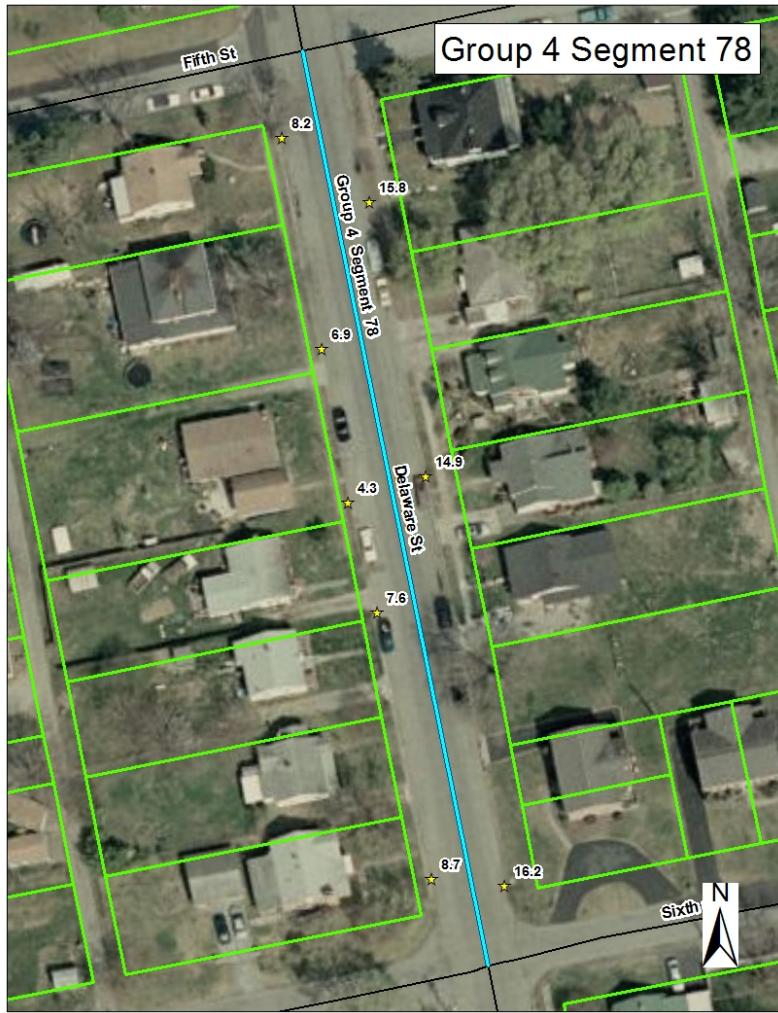


Sample Street Tree Inventories	
N	16
Sampling Intensity (% of streets sampled)	
Minimum	4% - Richmond
Median	13%
Maximum	33% - Buchanan

Goal:
**≤10% relative standard error
for total street tree population
estimate**

PROJECT METHODS

- Street tree inventory data collection



PROJECT METHODS

- Street tree inventory data preparation

Tree Inventory

Treelid	Zone	StreetSeg	CityManaged	SpCode	LandUse	SiteType	Loc
2	Council District 3	16115	Yes	BDL OT	Single family residential	Parkway	Not
3	Council District 3	16115	Yes	BDM OT	Single family residential	Lawn	Not
4	Council District 3	16115	No	Green ash	Single family residential	Parkway	Not
5	Council District 3	16115	No	Green ash	Single family residential	Parkway	Not
6	Council District 3	16115	Yes	BDM OT	Single family residential	Parkway	Not
7	Council District 3	16115	Yes	BDM OT	Single family residential	Parkway	Not
8	Council District 3	16115	Yes	BDS OT	Single family residential	Parkway	Not
9	Council District 3	16115	Yes	BDS OT	Single family residential	Parkway	Not
10	Council District 3	16115	No	Green ash	Single family residential	Parkway	Not
11	Council District 3	16115	Yes	Sugar maple	Single family residential	Parkway	Not
12	Council District 3	16115	Yes	Sugar maple	Single family residential	Parkway	Not
13	Council District 3	16115	Yes	BDS OT	Single family residential	Parkway	Not
14	Council District 3	16115	Yes	BDS OT	Single family residential	Parkway	Not
15	Council District 2	15032	Yes	Chinese elm	Multi-family residential	Parkway	Not
16	Council District 2	15032	Yes	Chinese elm	Multi-family residential	Parkway	Not
17	Council District 2	15032	Yes	Chinese elm	Multi-family residential	Parkway	Not
18	Council District 2	15032	Yes	Chinese elm	Multi-family residential	Tree Well	Not
19	Council District 2	15032	Yes	Chinese elm	Multi-family residential	Tree Well	Not
20	Council District 2	15032	Yes	Chinese elm	Multi-family residential	Tree Well	Not

Total Records: 3272 **OK** **Cancel**

New **Edit** **Delete** **Duplicate** **Help**

Define Species

Species Code	Common Name	Scientific Name	Assigned Sp. Value	Non-Tree?
AB	Fir	Abies spp	CEL OTHER	<input type="checkbox"/>
ABCO	White fir	Abies concolor	CEL OTHER	<input type="checkbox"/>
ACBA2	Bailey acacia	Acacia baileyana	BES OTHER	<input type="checkbox"/>
ACBU	Trident maple	Acer buergerianum	BDS OTHER	<input type="checkbox"/>
ACCA	Hedge maple	Acer campestre	BDM OTHER	<input type="checkbox"/>
ACFR	Freeman maple	Acer x freemanii	BDL OTHER	<input type="checkbox"/>
ACGI	Amur maple	Acer ginnala	BDS OTHER	<input type="checkbox"/>
ACGR	Paperbark maple	Acer griseum	BDS OTHER	<input type="checkbox"/>
ACMA	Bigleaf maple	Acer macrophyllum	BDL OTHER	<input type="checkbox"/>
ACNE	Boxelder	Acer negundo	BDM OTHER	<input type="checkbox"/>
ACN	Cloud maple	Acer nigrum	BDL OTHER	<input type="checkbox"/>

Delete **New** **Stocking**

Assigned Species Value
 Common Name: **CEL OTHER** Scientific Name: **Conifer Evergreen Large Other** Tree Type: **CEL**

OK **Cancel**

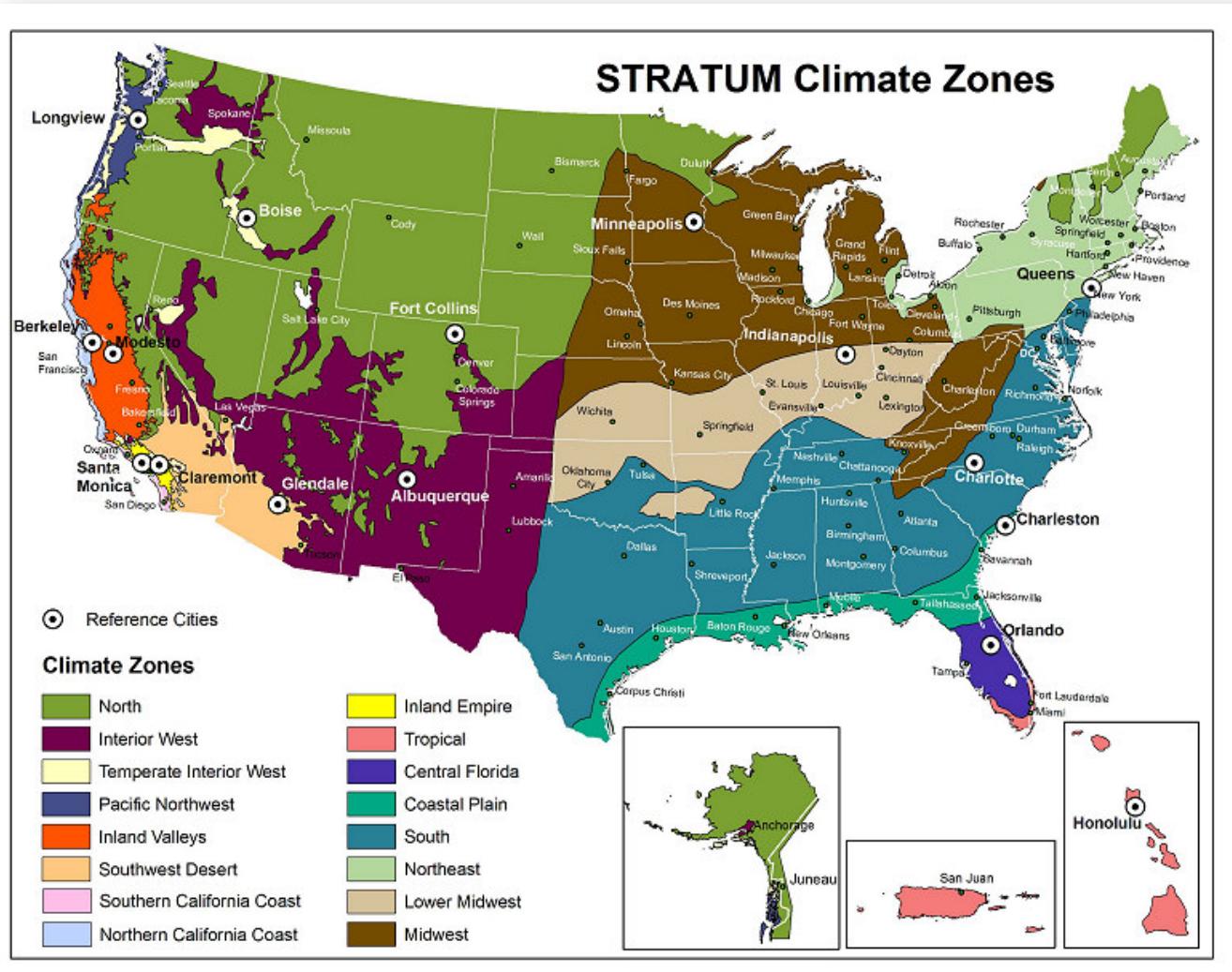
Benefit Prices

Electricity (\$/Kwh)	0.0759	SO2 (\$/lb)	1.97
Natural Gas (\$/Therm)	1.046	VOC (\$/lb)	6.26
CO2 (\$/lb)	0.0075	Stormwater Interception (\$/gallon)	0.0099
PM10 (\$/lb)	2.49	Average Home Resales Value (\$)	201,800
NO2 (\$/lb)	6.55		

OK **Cancel** **Help**

PROJECT METHODS

- Street tree inventory data preparation



PROJECT METHODS

- Street tree inventory data analysis

The screenshot shows the i-Tree Streets software interface. The menu bar includes File, Input, View, Reports, Tools, and Help. The Reports menu is open, showing options like Benefit-Cost Analysis, Resource Structural Analysis, Population Summary, Species Distribution, Relative Age Distribution, Importance Values, Condition, Relative Performance Index, Stocking Level, Maintenance, Land Use, Site Type, Conflicts, Canopy Cover, and Other. The main report window displays a table titled "Population Summary of All Trees". The table has columns for DBH Class (in) (3-6, 6-12, 12-18, 18-24, 24-30, 30-36, 36-42, >42) and Total Standard Error. The table lists various tree species under two categories: Broadleaf Deciduous Large (BDL) and Broadleaf Deciduous Medium (BDM). The BDL category includes Sugar maple, Willow oak, Pin oak, Japanese zelkova, Winged elm, Green ash, American sycamore, Sweetgum, American elm, London planetree, Norway maple, Silver maple, and BDL OTHER. The BDM category includes Red maple, Hedge maple, Ginkgo, and Chinese pistache. The report also shows a header with "Page 1 of 2" and a Business Objects logo.

	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total Standard Error	
Broadleaf Deciduous Large (BDL)										
Sugar maple	52	283	2,036	2,061	1,082	283	52	0	5,849 ($\pm 1,053$)	
Willow oak	26	799	438	541	696	644	773	412	4,406 ($\pm 1,077$)	
Pin oak	26	26	335	541	361	721	850	541	3,427 (± 884)	
Japanese zelkova	0	309	773	1,417	773	52	0	0	3,324 (± 619)	
Winged elm	26	52	309	902	515	206	26	0	2,036 (± 452)	
Green ash	26	103	258	361	232	206	155	26	1,366 (± 408)	
American sycamore	77	26	129	180	387	258	77	0	1,134 (± 743)	
Sweetgum	26	232	309	155	52	26	26	0	825 (± 258)	
American elm	0	52	0	26	129	309	206	52	799 (± 188)	
London planetree	0	52	103	155	129	129	0	0	567 (± 413)	
Norway maple	0	26	180	258	0	26	0	0	490 (± 130)	
Silver maple	26	26	180	129	77	26	0	0	490 (± 139)	
BDL OTHER	258	77	335	361	464	180	155	77	1,933 (± 317)	
Total	541	2,061	5,385	7,086	4,896	3,066	2,345	1,108	155	26,643 ($\pm 2,459$)
Broadleaf Deciduous Medium (BDM)										
Red maple	258	850	1,108	696	412	361	103	26	0	3,813 (± 865)
Hedge maple	77	283	773	26	0	0	0	0	0	1,160 (± 376)
Ginkgo	309	26	155	258	103	52	103	52	0	1,056 (± 382)
Chinese pistache	129	309	490	0	0	0	0	0	0	928 (± 423)

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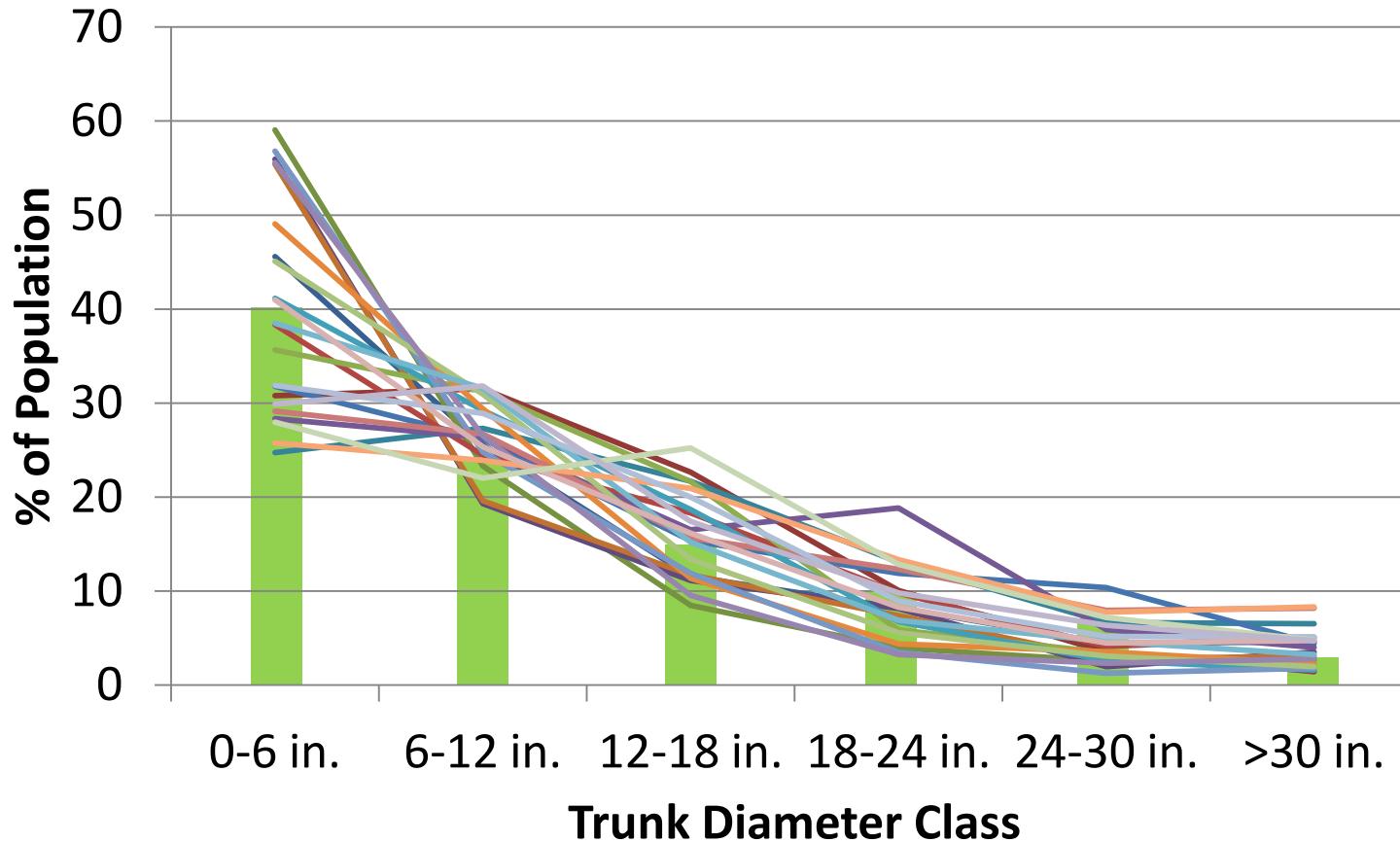
SUMMARY OF FINDINGS

- Street Tree Abundance

N = 22	Total Street Trees (#)	Street Tree Density (#/sq. mi.)	Street Trees per Capita
Minimum	771 Buchanan	144 Abingdon	0.05 Alexandria
Median	5,814	510	0.23
Maximum	46,792 Richmond	1,980 Fredericksburg	0.90 Fredericksburg
Interquartile Range	2,072 – 11,791	312 – 782	0.15 – 0.47
Total	233,240		

SUMMARY OF FINDINGS

- Street Tree Abundance



SUMMARY OF FINDINGS

- Street Tree Composition

N = 22	% Small Stature Spp. (<25')	% Medium Stature Spp. (25'-45')	% Large Stature Spp. (>45')
Minimum	18 Wytheville	9 Franklin City	27 Martinsville
Median	29	24	45
Maximum	50 Franklin City	33 Alex., F'burg, M'velle	60 Richmond
Interquartile Range	23 – 271	1.2 – 2.6	1.4 – 3.7
Goal	10	27	63

SUMMARY OF FINDINGS

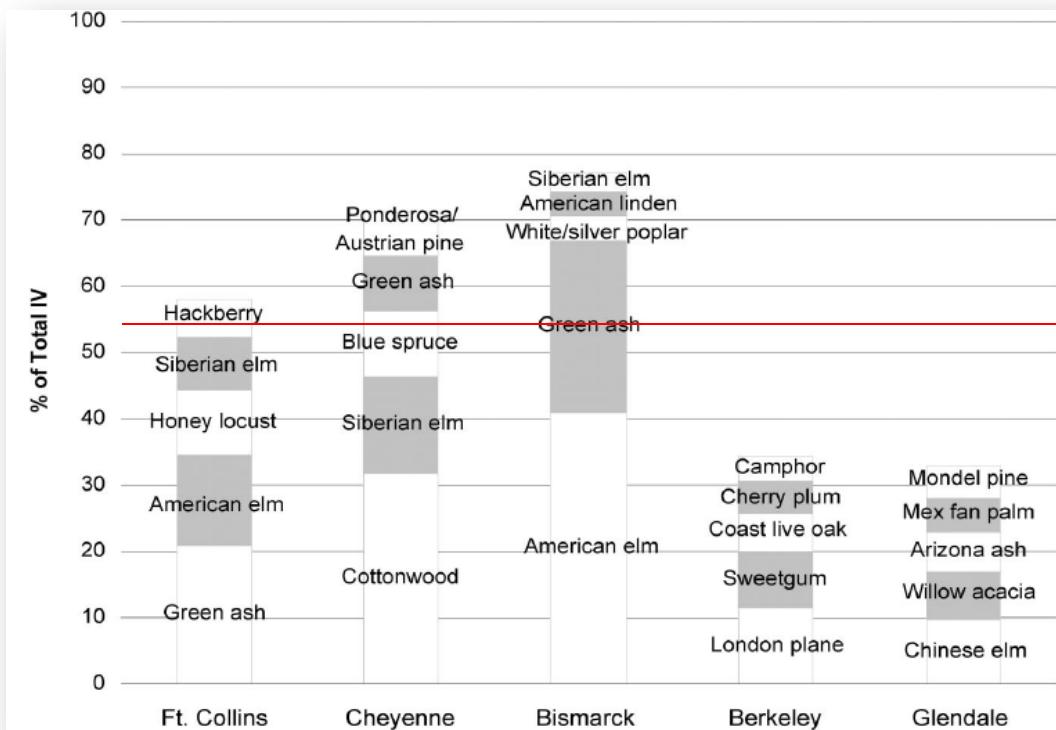
- Street Tree Composition

N = 22	Native Ash Trees (#)	Relative Abundance (%)	Relative Importance (%)
Minimum	0* Buchanan, Franklin	0* Buchanan, Franklin	0* Buchanan, Franklin
Median	84	1.8	2.7
Maximum	1,391 Richmond	6.0 Wytheville	11.3 Abingdon
Interquartile Range	23 – 271	1.2 – 2.6	1.4 – 3.7
Total	5,280		

SUMMARY OF FINDINGS

- Street Tree Composition

N = 22	Sum of Relative Importance of Top-5 Species
Minimum	25.8% Harrisonburg
Median	40.8%
Maximum	64.4% Franklin City
Interquartile Range	33.4% – 47.9%



Municipal forest benefits and costs in five US cities

G MCPHERSON, JR SIMPSON, PJ PEPER... - Journal of forestry, 2005

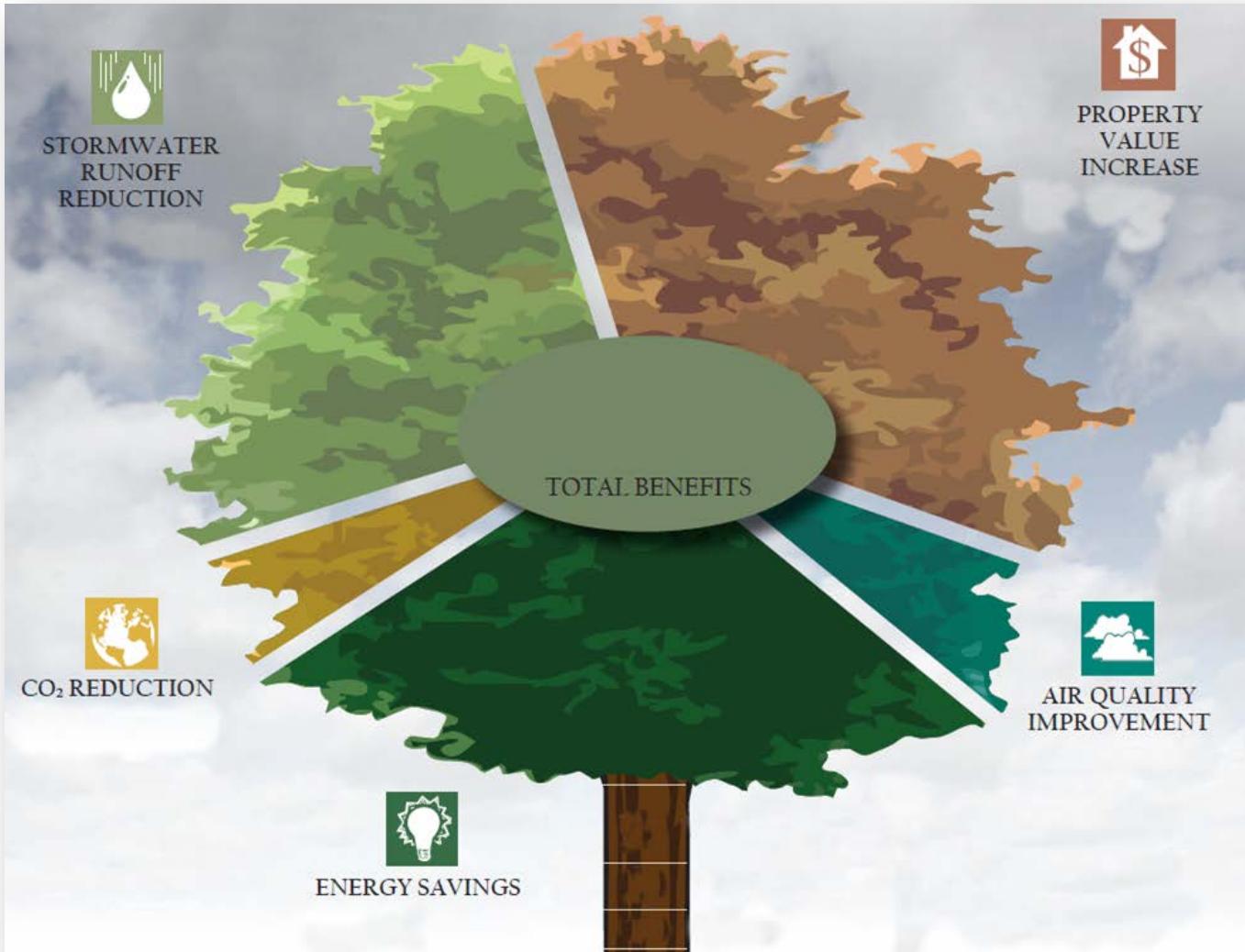
SUMMARY OF FINDINGS

- Street Tree Composition

N = 22	Freq. in Top-5 of Relative Importance	Med. Relative Import. (%)	Max. Relative Import. (%)
<i>Acer</i>	21	16.3	33.5 Winchester
<i>Quercus</i>	13	9.8	30.2 Richmond
<i>Pinus</i>	11	9.4	28.7 Emporia
<i>Cornus</i>	7	5.6	8.1 Martinsville
<i>Fraxinus</i>	2	7.6	10.4 Abingdon

SUMMARY OF FINDINGS

- Street Tree Benefits & Value



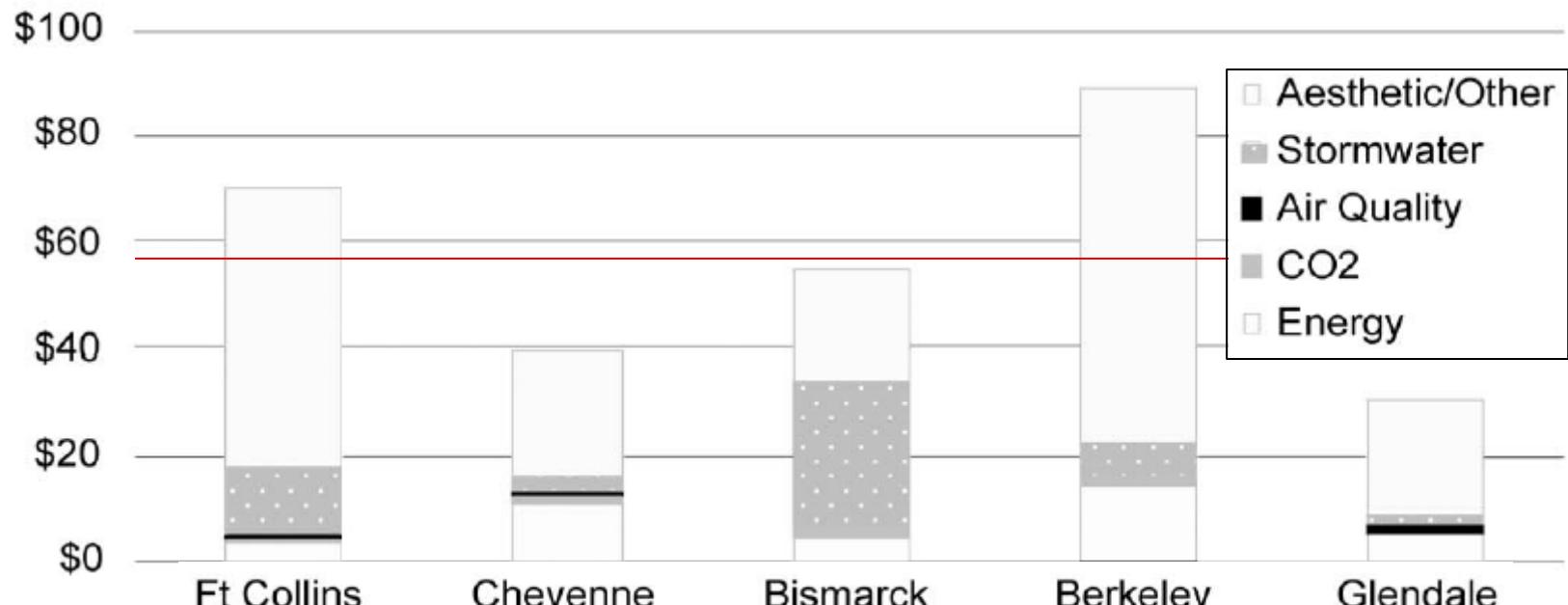
SUMMARY OF FINDINGS

- Street Tree Benefits & Value

N = 22	Gross Annual Benefits (\$)		Replacement Value (\$)	
	Total	Per Tree	Total	Per Tree
Minimum	34,380	32.62	1,467,544	763
	Buchanan	Martinsville	Buchanan	Roanoke
Median	452,387	67.79	17,159,802	2,594
Maximum	4,938,852	170.02	211,889,829	5,229
	Richmond	Falls Church	Richmond	Franklin City
Interquartile Range	100,231 – 1,030,551	54.27 – 99.67	5,606,673 – 33,004,551	2,000 – 3,716
Total	18,845,893		617,578,471	

SUMMARY OF FINDINGS

- Street Tree Benefits & Value



[Municipal forest benefits and costs in five US cities](#)

G MCPHERSON, JR SIMPSON, PJ PEPER... - Journal of forestry, 2005

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TAKE-HOME MESSAGES

- Inventory and assessment reveals assets, liabilities, and opportunities for improving street tree function and value
- Virginia's communities generally have well-structured street tree populations
- Vulnerability to EAB is low in Virginia's street trees, but other potential vulnerabilities exist
- Plant diverse, large-stature trees whenever possible



QUESTIONS?