Municipal Tree Care Management in the U.S.: A 2014 Urban & Community Forestry Census of Tree Activities

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Urban Forestry Manager, Davey Resource Group

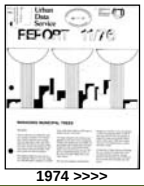
National Webinar
September 29, 2016

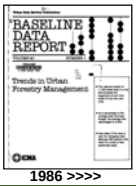
Many Partners and Supports

Universities, Non-profits, Government, Industry

Dr. Kielbaso, Ken Ottman, and Colleagues



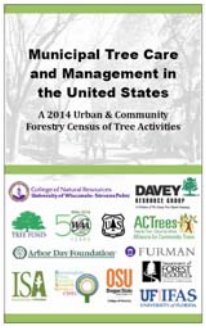





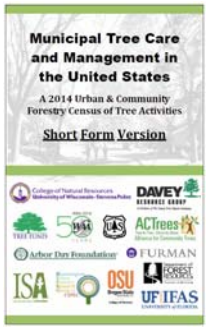

1974 >>>> 1980 >>>> 1986 >>>> 1993 >>>>

Started Collecting Data Since 1974

Survey Instrument



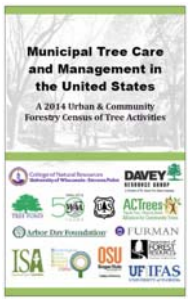
109 Questions

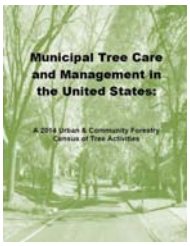


53 Questions

Long and Short Form Versions

Municipal Tree Care & Management in the U.S.





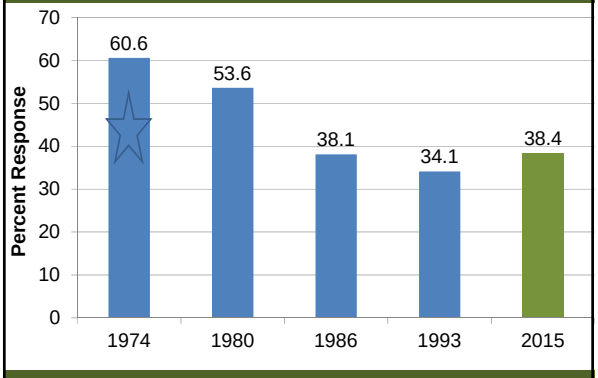
(http://bit.ly/MuniTree)

A 2014 U&CF Forestry Census of Tree Activities

4 Regions and 9 Divisions

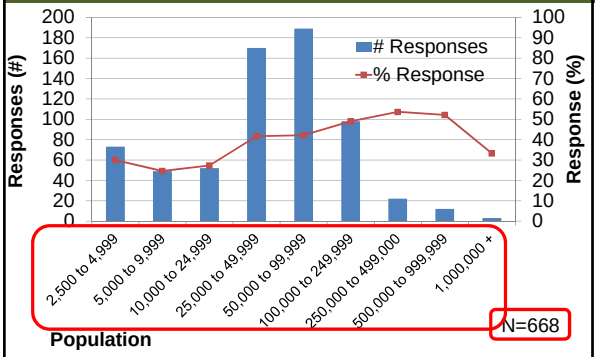
United States Census Bureau Definitions

Study Design



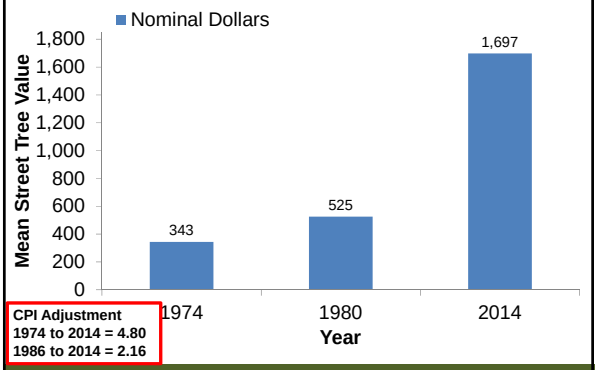
Survey Response Rate

Study Design



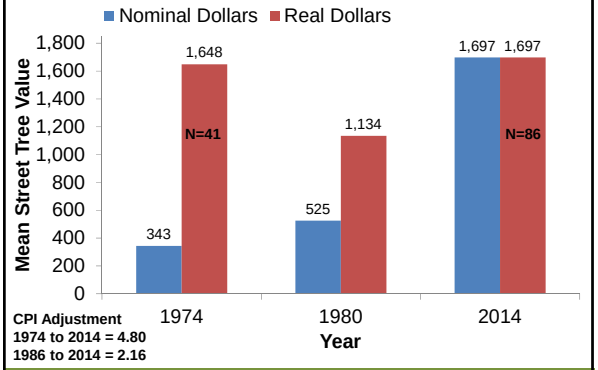
Survey Response Rate

Value of Money



Nominal (historic) and Real (adjusted) Values

Value of Money

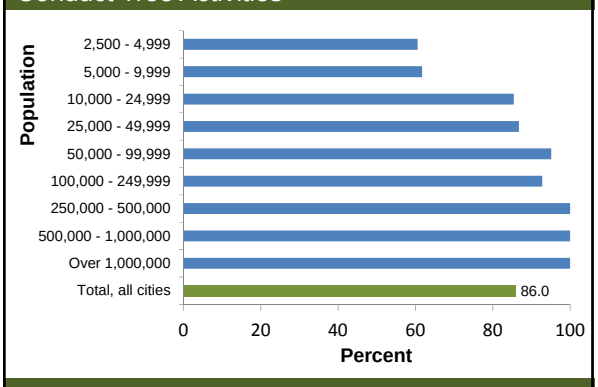


Nominal (historic) and Real (adjusted) Values

What's Your Urban Forest Like?

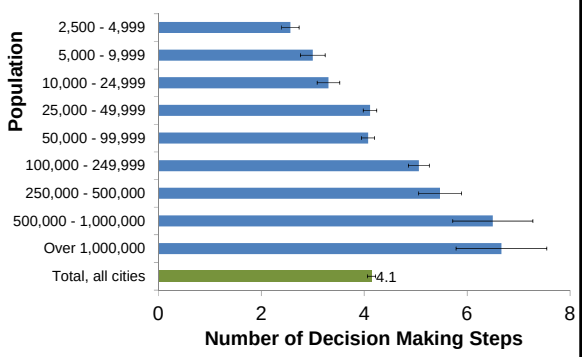
Many Challenges to Growing the Urban Forest

Conduct Tree Activities



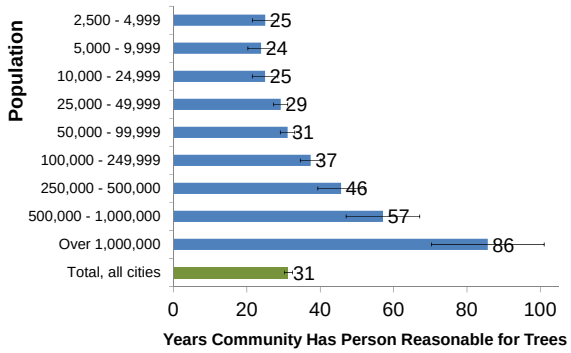
Percentage of Who Said Yes

How Many Decision Making Levels



From the Field to the Highest Level

Years of Tree Management Responsibility

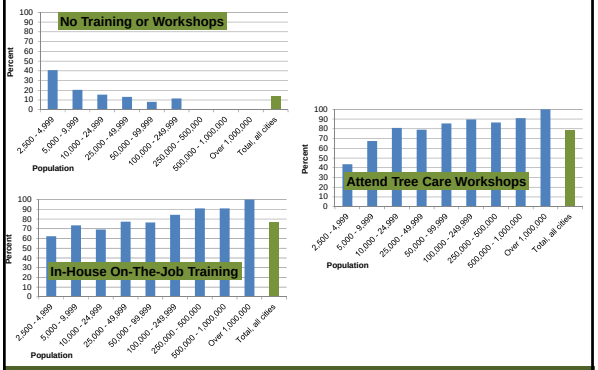


A Person Responsible for Trees in Community

What's in your Wallet?

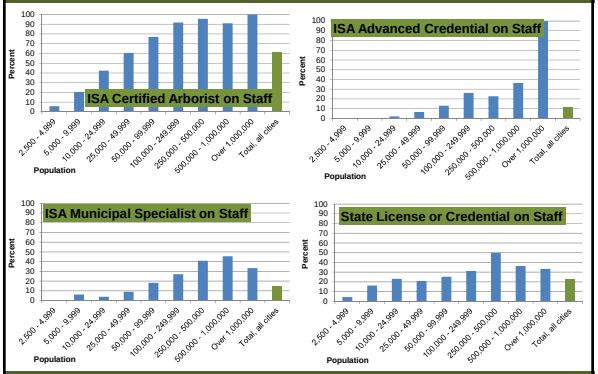
Training and Credentials

What's in your Wallet?



Training and Credentials

What's in your Wallet?

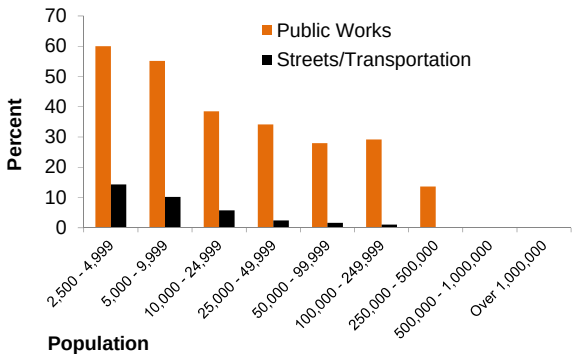


Training and Credentials

Baseline Indicator: What's in your Wallet?

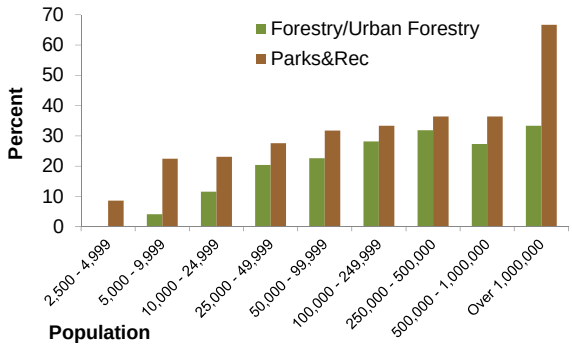
Training and Credentials

Municipal Department Responsible Public Trees



Had to Pick One Department Only

Municipal Department Responsible Public Trees



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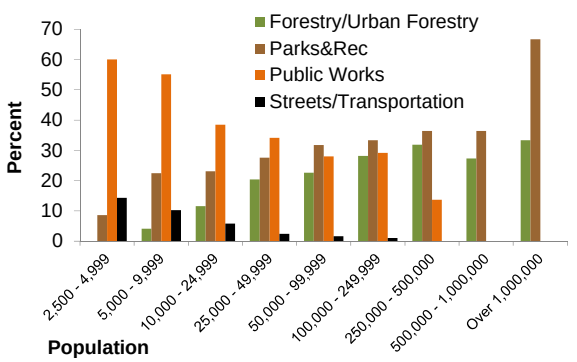

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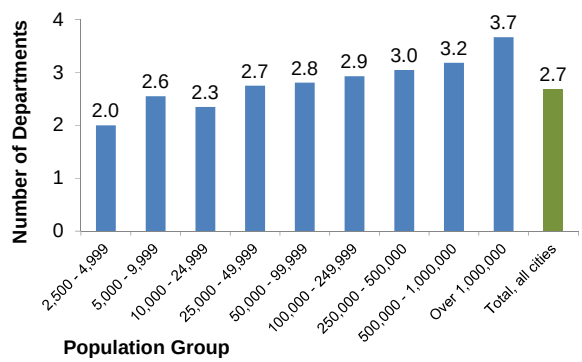


# of Departments Associated With Tree Management

Community Tree Management Statements

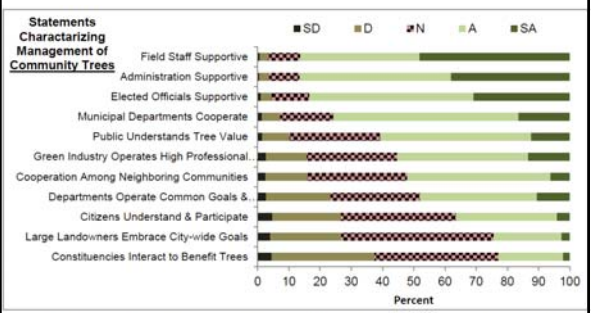
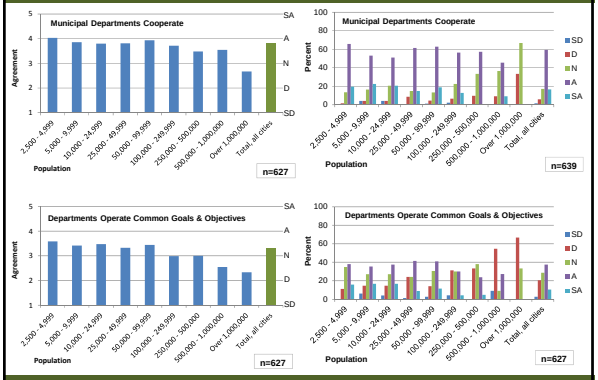


Figure 1-7. How strongly do you agree or disagree with these statements characterizing your community and the management of trees? (n=633 to 641, SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree)

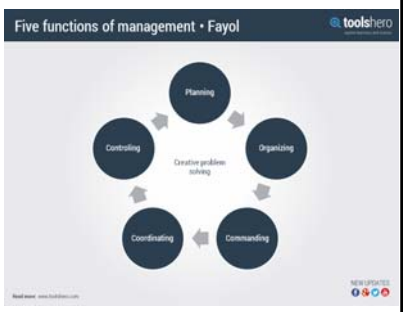
Strength with Agree and Disagree with Statement

Municipal Department Responsible Public Trees



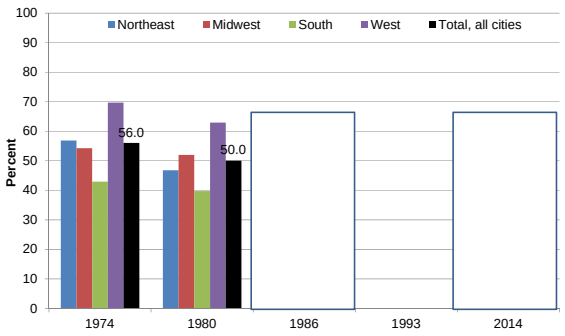
# of Departments Associated With Tree Management

Systematic Management



Henri Fayol – Father of Systematic Management

Systematic Management



% of Communities Rated as Systematic

Baseline Indicators: Pruning Cycle

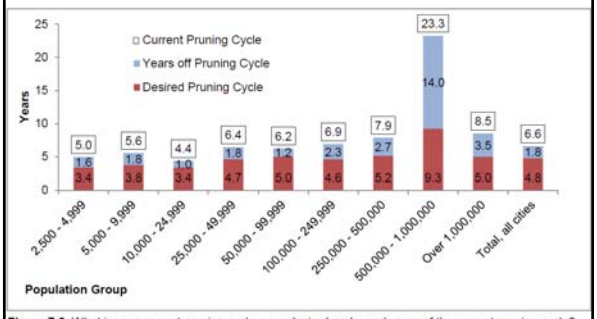
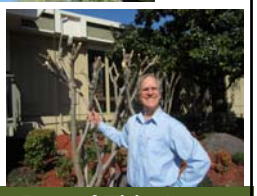


Figure 7-3. What is your current pruning cycle, your desired cycle, and years of the current pruning cycle? (current cycle n=227, desired cycle n=146)

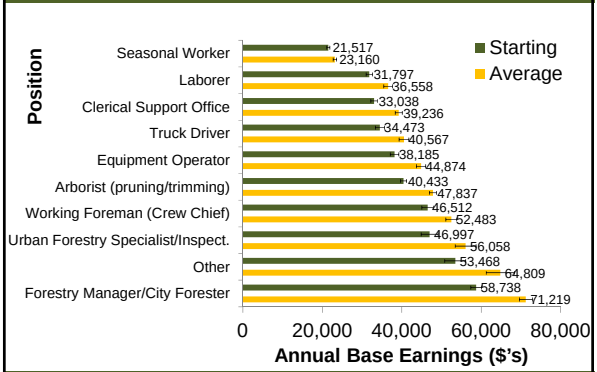
Current, Desired, & Time Off Cycle

Just What are You Worth?



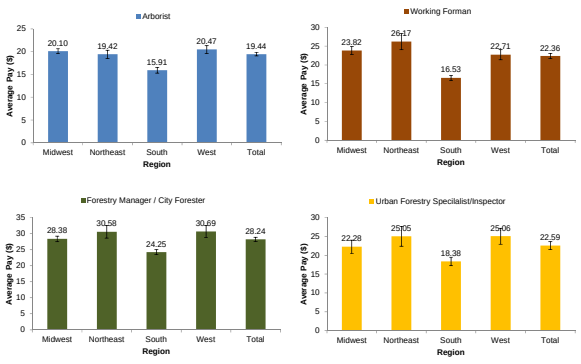
Compensation is Part of This Answer

Positions and Pay (Annual Earnings $'s)



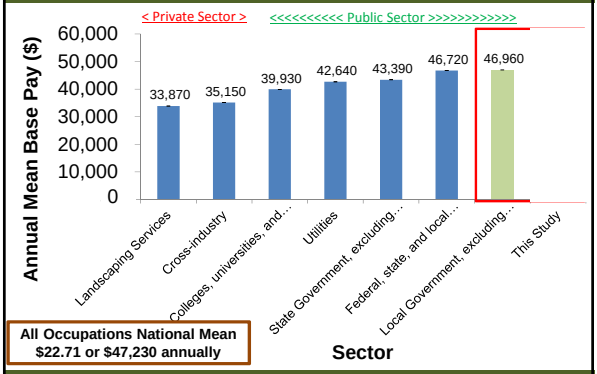
What Do Municipal Staff Earn?

Positions and Starting Pay (Annual Base $'s)



Some Region Examples?

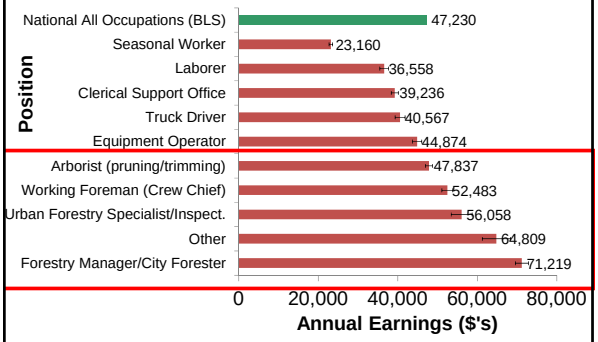
Positions and Pay (Annual Mean Earnings $'s)



All Occupations National Mean $22.71 or $47,230 annually

How Do Arborists Compare?

Positions and Pay (Annual Earnings $'s)



What is the National Mean for All Occupations?

Just How Much Experience

10.7 years in Current Job

20.0 years Experience in Tree Care / Management

Position	Years in Current Position	Years' Experience in Tree Care/ Management	% of Full-time for the Position	Annual Salary ($)[1]	Sample Size (n)
Arborist/Forester	11.0	22.1	88.0	63,994	226
City Administrator/Manager	10.4	10.3	14.3	79,929	16
City Clerk/Treasurer	11.5	1.0	2.0	36,500	2
City Engineer	6.8	6.8	100.0	85,450	2
City Planner	10.4	9.4	39.5	62,040	7
Consultant (e.g., Arborist, Forester)	17.3	29.0	20.0	56,640	3
Forestry Foreman	2.0	25.0	100.0	N/A	1
Landscape Architect	12.4	19.4	74.0	66,519	8
Other	11.9	19.4	61.2	68,454	77
Parks & Recreation Director/Manager	9.6	17.4	38.5	75,228	53
Public Works Director/Manager	10.1	18.0	35.0	78,665	30
Public Works Foreman/Superintendent	7.8	15.9	43.7	79,142	36
Street Foreman/Superintendent	15.4	19.7	77.5	50,038	10
Tree Warden	10.0	27.9	41.4	55,111	10
Mean All Positions	10.7	20.0	67.8	67,664	481
Median All Positions	8	20	100	68,250	481
SEM All Positions	0.4	0.5	1.9	1,146	481

[1] Based on a full-time equivalent 2080 base hour year.

Mid- to late-career positions

Just How Many Municipal Jobs

32,588 (± 5,864) Full-Time Equivalents

49,362 (± 9,675) Total Employees

		Full-Time Equivalents					Total Employees				
Classification	Population (n)	Sampled (n)	Mean	SEM	Total	CI 95%	Sampled (n)	Mean	SEM	Total	CI 95%
Total, all cities	7,478	508	4.36[1]	2.10	32,588	5,864	614	6.60[1]	0.66	49,362	9,675
Population Group											
2,500 - 4,999	2,344	47	3.31	0.60	7,756	2,758	65	4.90	0.59	11,486	2,712
5,000 - 9,999	1,883	35	3.10	0.61	5,836	2,253	46	5.10	0.56	9,603	2,068
10,000 - 24,999	1,750	41	4.70	0.76	8,233	2,609	49	7.00	0.81	12,250	2,780
25,000 - 49,999	786	121	5.25	0.50	4,127	771	156	8.30	0.49	6,524	756
50,000 - 99,999	442	146	6.27	0.53	2,770	460	173	9.10	0.63	4,022	547
100,000 - 249,999	200	87	11.78	1.27	2,356	501	91	14.50	1.45	2,900	572
250,000 - 500,000	41	20	18.28	4.23	749	351	21	21.40	4.19	877	347
500,000 - 1,000,000	23	9	18.22	2.10	419	100	10	19.00	2.99	437	143
Over 1,000,000	9	2	38.00	17.0	342	353	3	140.30	97.24	1,263	2,018

First time this has been estimated?

Important functions of trees ... value, benefits, money

Social
- Aesthetics and Shade
- Property Values

Ecologic
- Energy Savings
- Water Interception
- Air Pollutant Removal

Economic
- Business activity
- Human health

...that no trees & dead trees don't provide ... liability, costs, money

Municipal Budgets

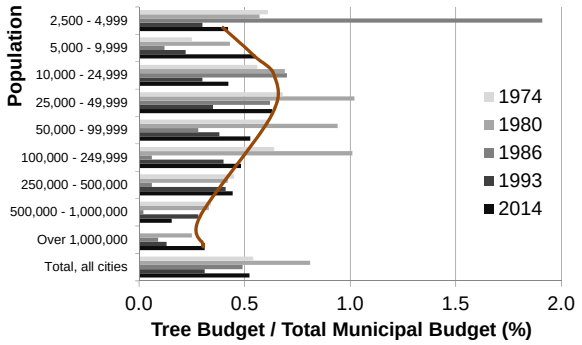
How much money is needed?

What's the best comparison method?

What's the context?

How Much is Needed?

Municipal Budgets



Percent Tree Budget of Municipal Budget

Municipal Budgets

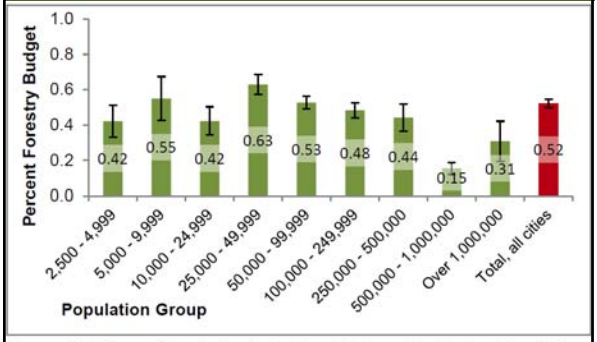


Figure 2-4. Percent forestry budget of the total municipal budget. (n=463)

Percent Tree Budget of Municipal Budget

Municipal Budgets

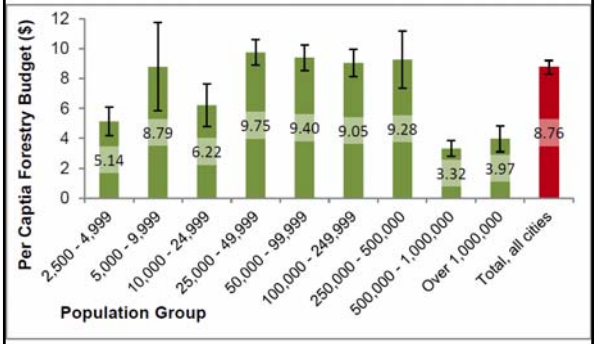
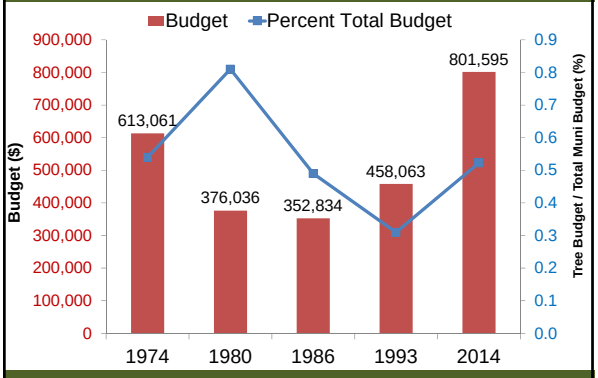


Figure 2-5. Per capita forestry budget. (n=477)

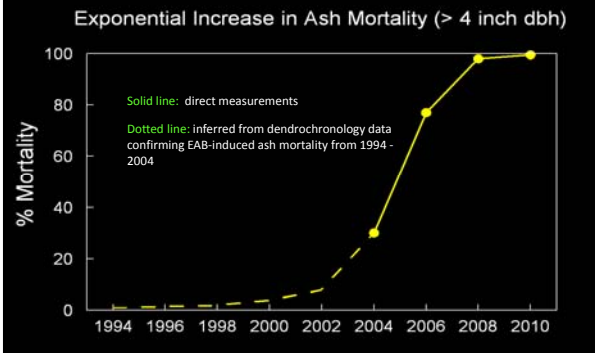
Per Capita Tree Budget

Municipal Budgets



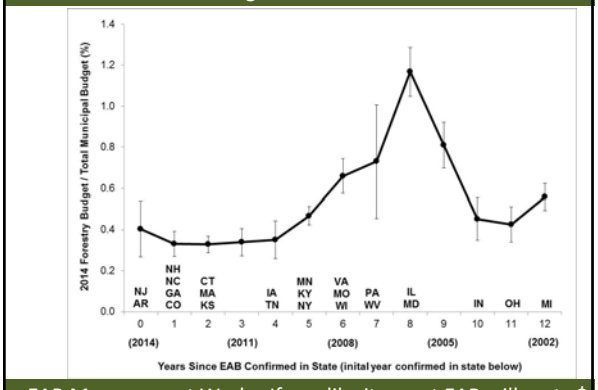
Budget (Real $'s) and Tree Budget as % of Municipal Budget

EAB-Induced Ash Mortality SE Michigan

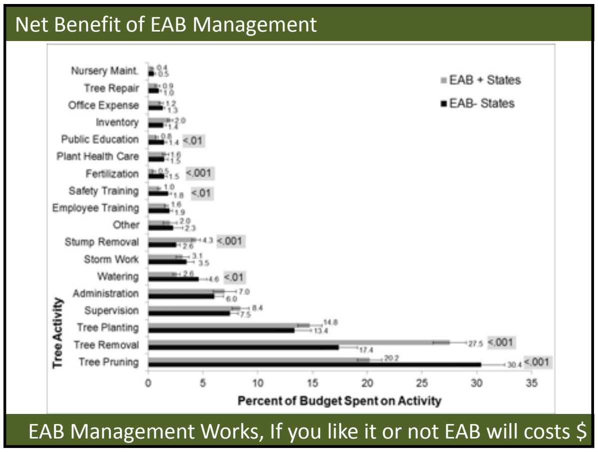


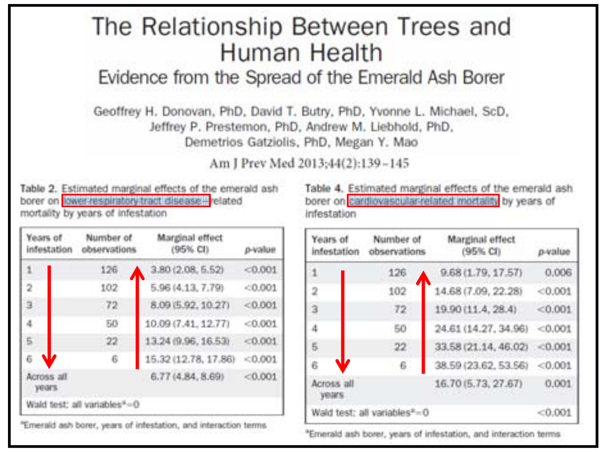
The outcome of doing nothing (Image by Dan Herms)

Net Benefit of EAB Management



EAB Management Works, If you like it or not EAB will costs $





The Relationship Between Trees and Human Health

Evidence from the Spread of the Emerald Ash Borer

Geoffrey H. Donovan, PhD, David T. Butry, PhD, Yvonne L. Michael, ScD, Jeffrey P. Prestemon, PhD, Andrew M. Liebhold, PhD, Demetrios Gatziolis, PhD, Megan Y. Mao

Am J Prev Med 2013;44(2):139–145

Table 2. Estimated marginal effects of the emerald ash borer on lower respiratory tract disease–related mortality by years of infestation

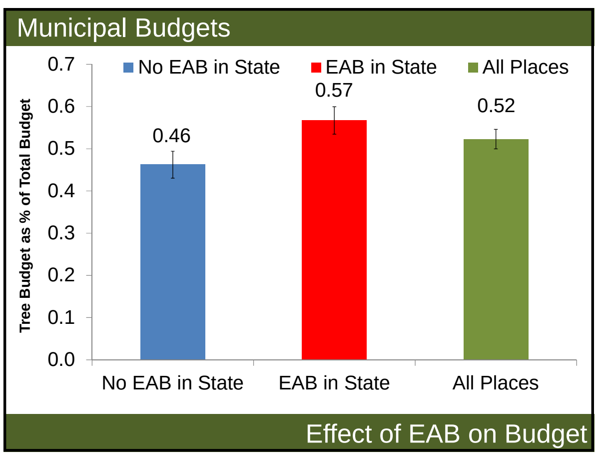
Years of infestation	Number of observations	Marginal effect (95% CI)	p-value
1	126	3.80 (2.08, 5.52)	<0.001
2	102	5.96 (4.13, 7.79)	<0.001
3	72	8.09 (5.92, 10.27)	<0.001
4	50	10.09 (7.41, 12.77)	<0.001
5	22	13.24 (9.96, 16.53)	<0.001
6	6	15.32 (12.78, 17.86)	<0.001
Across all years		6.77 (4.84, 8.69)	<0.001
Wald test: all variables[a]=0			

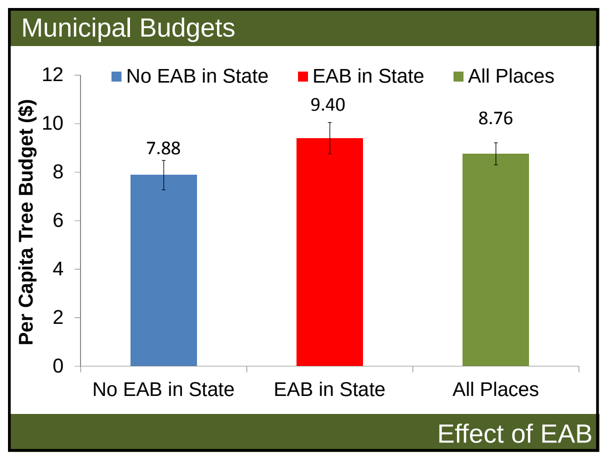
[a]Emerald ash borer, years of infestation, and interaction terms

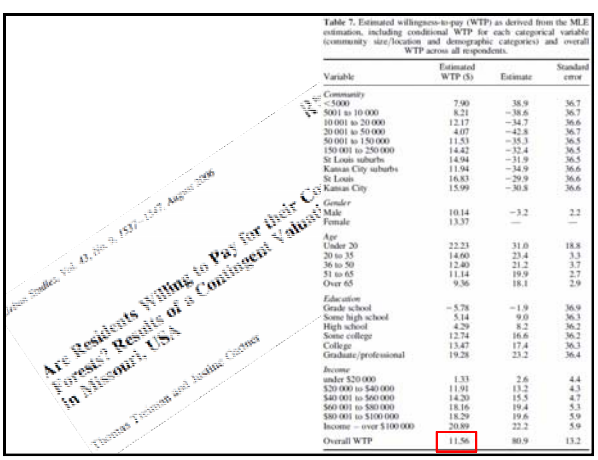
Table 4. Estimated marginal effects of the emerald ash borer on cardiovascular-related mortality by years of infestation

Years of infestation	Number of observations	Marginal effect (95% CI)	p-value
1	126	9.68 (1.79, 17.57)	0.006
2	102	14.68 (7.09, 22.28)	<0.001
3	72	19.90 (11.4, 28.4)	<0.001
4	50	24.61 (14.27, 34.96)	<0.001
5	22	33.58 (21.14, 46.02)	<0.001
6	6	38.59 (23.62, 53.56)	<0.001
Across all years		16.70 (5.73, 27.67)	0.001
Wald test: all variables[a]=0			<0.001

[a]Emerald ash borer, years of infestation, and interaction terms







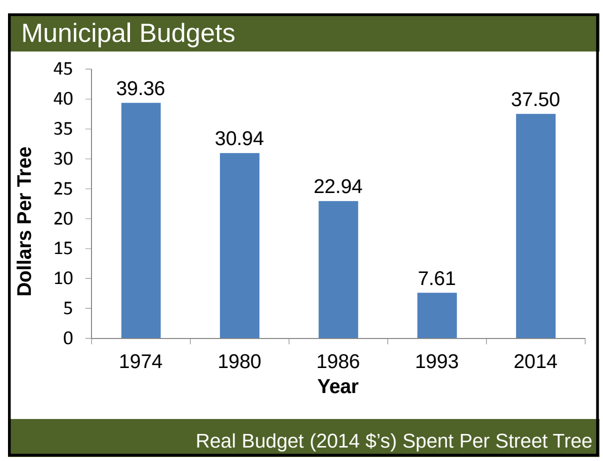
...ban Studies, Vol. 43, No. 9, 1537–1547, August 2006

Are Residents Willing to Pay for their Co... Forests? Results of a Contingent Valuat... in Missouri, USA

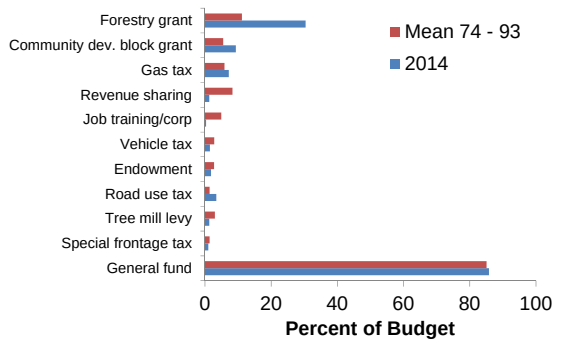
Thomas Treiman and Justine Gartner

Table 7. Estimated willingness-to-pay (WTP) as derived from the MLE estimation, including conditional WTP for each categorical variable (community size/location and demographic categories) and overall WTP across all respondents.

Variable	Estimated WTP ($)	Estimate	Standard error
Community			
<5000	7.90	38.9	36.7
5001 to 10 000	8.21	−38.6	36.7
10 001 to 20 000	12.17	−34.7	36.6
20 001 to 50 000	4.07	−42.8	36.7
50 001 to 150 000	11.53	−35.3	36.5
150 001 to 250 000	14.42	−32.4	36.5
St Louis suburbs	14.94	−31.9	36.5
Kansas City suburbs	11.94	−34.9	36.6
St Louis	16.83	−29.9	36.6
Kansas City	15.99	−30.8	36.6
Gender			
Male	10.14	−3.2	2.2
Female	13.37	—	—
Age			
Under 20	22.23	31.0	18.8
20 to 35	14.60	23.4	3.3
36 to 50	12.40	21.2	3.7
51 to 65	11.14	19.9	2.7
Over 65	9.36	18.1	2.9
Education			
Grade school	−5.78	−1.9	36.9
Some high school	5.14	9.0	36.3
High school	4.29	8.2	36.2
Some college	12.74	16.6	36.2
College	13.47	17.4	36.3
Graduate/professional	19.28	23.2	36.4
Income			
under $20 000	1.33	2.6	4.4
$20 000 to $40 000	11.91	13.2	4.3
$40 001 to $60 000	14.20	15.5	4.7
$60 001 to $80 000	18.16	19.4	5.3
$80 001 to $100 000	18.29	19.6	5.9
Income – over $100 000	20.89	22.2	5.9
Overall WTP	11.56	80.9	13.2

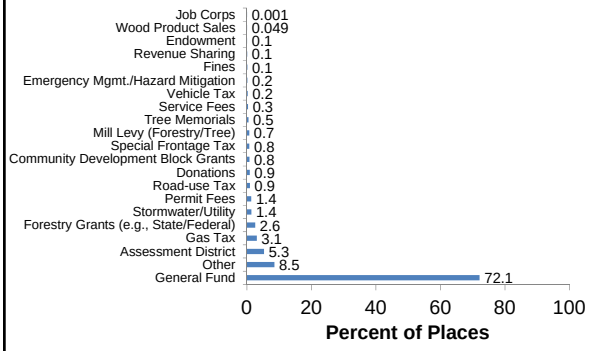


Sources of Funding



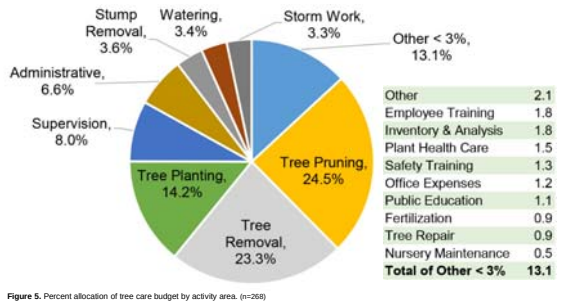
Types of Sources Used

Sources of Funding



Who Pays the Bills?

Where Does the Money Go?

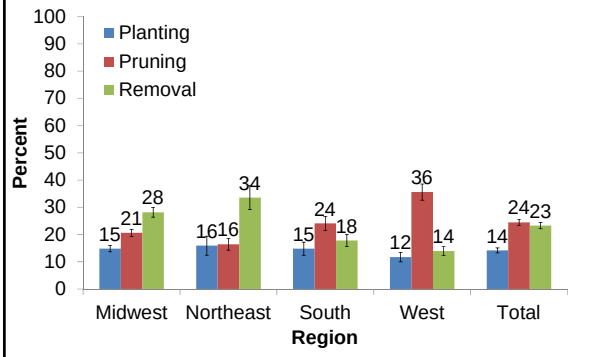


Other	2.1
Employee Training	1.8
Inventory & Analysis	1.8
Plant Health Care	1.5
Safety Training	1.3
Office Expenses	1.2
Public Education	1.1
Fertilization	0.9
Tree Repair	0.9
Nursery Maintenance	0.5
Total of Other < 3%	**13.1**

Figure 5. Percent allocation of tree care budget by activity area. (n=268)

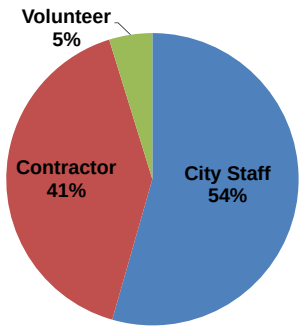
The Big Three (Planting, Pruning, Removal) & More

Where Does the Money Go?



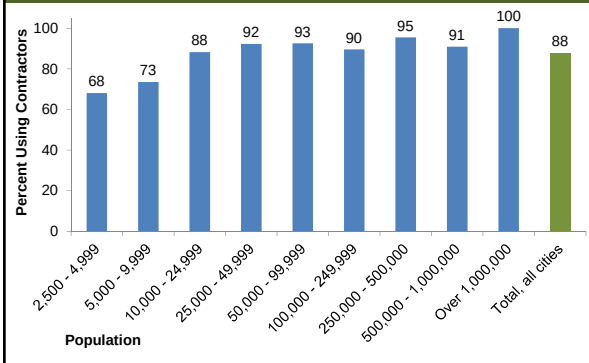
The Big Three (Planting, Pruning, Removal) by Region

Who Does the Work?



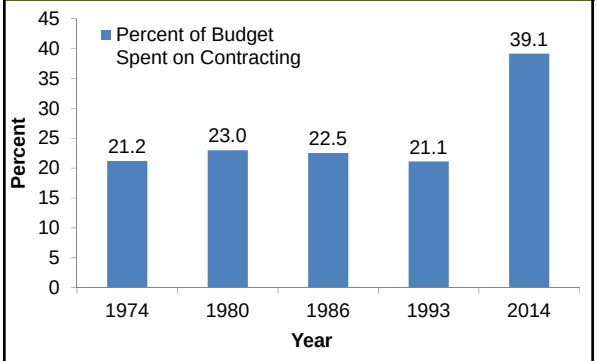
A Short Form Story

Who Does the Work?



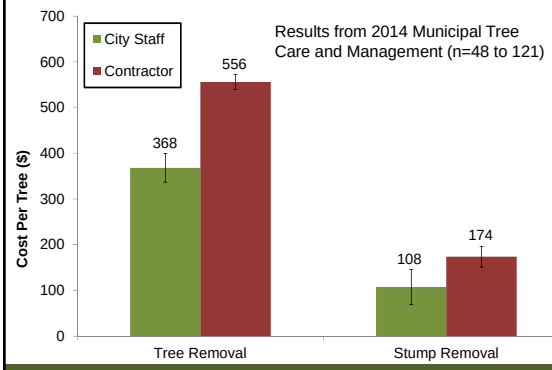
How Common are Contractors Hired?

Who Does the Work?



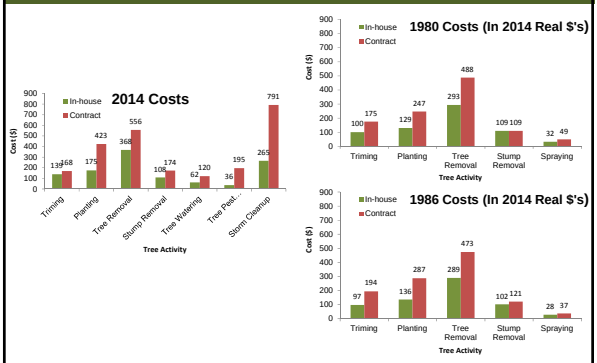
A Short Form Story

Cost to Remove Urban Trees and Stumps



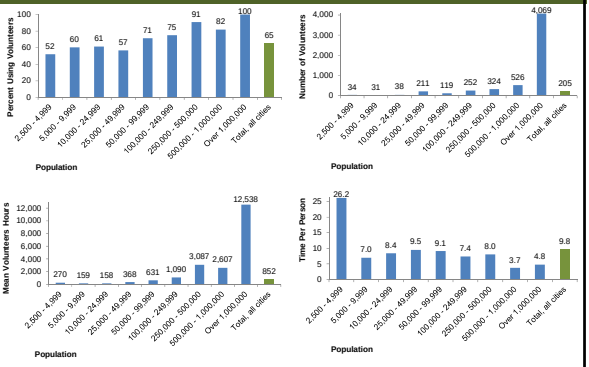
Cost for Activity Per Tree

Should I Contract or Should I In-house



Yup, Depends, What's Your Question

Who Does the Work?



A Volunteer Story

Who Does the Work?

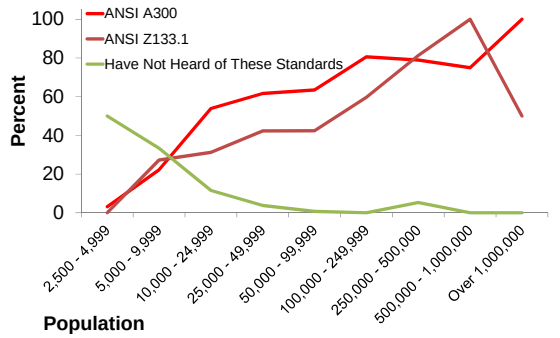
- 345,466 (195,754 SEM) people volunteered
- 1,484,204 (665,460) hours with tree activities
- 714 (320 SEM) FTE's (2080 hour base year)
- $35 million volunteer impact ($23.56 per hour)

A Volunteer Story

Why Do We Write Standards?

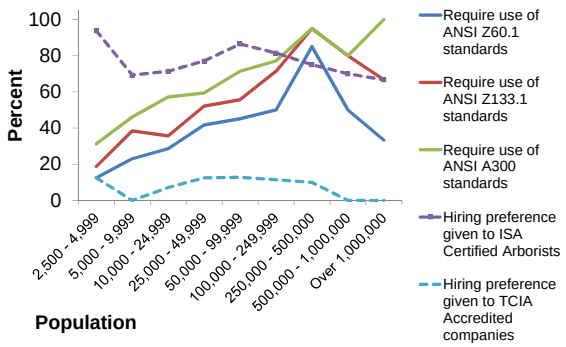
The Concept of Tree Pruning is Complex

Standards of Work and Practice



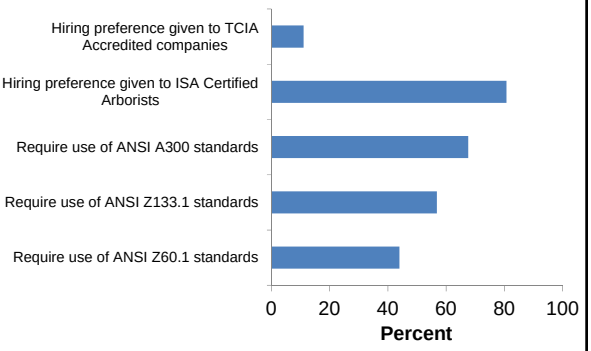
Commonality of Incorporation into Tree Management Procedures

Standards of Work and Practice



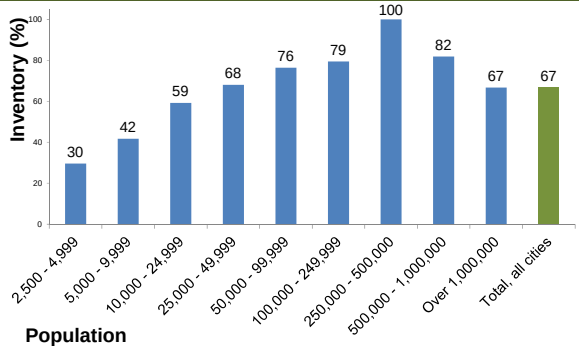
Use with Hiring Contractors

Standards of Work and Practice



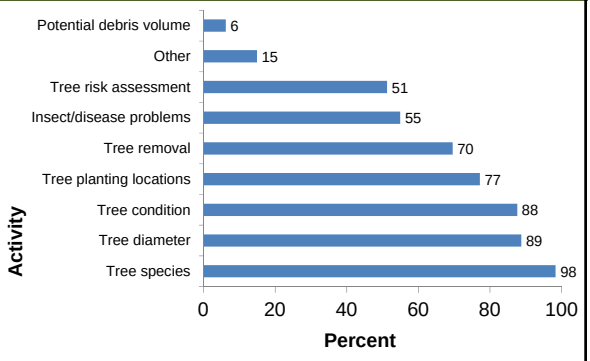
Use with Hiring Contractors

Know About Your Tree Population?



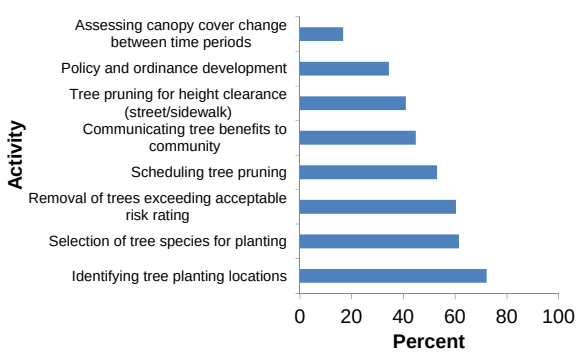
Commonality of Tree Inventory Systems

Tree Inventory



What Data is Collected

Tree Inventory



What They are Used For

Tree Canopy

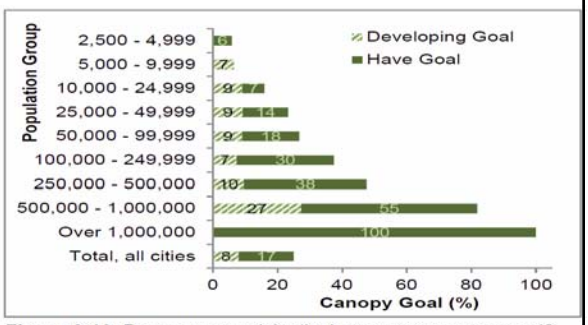
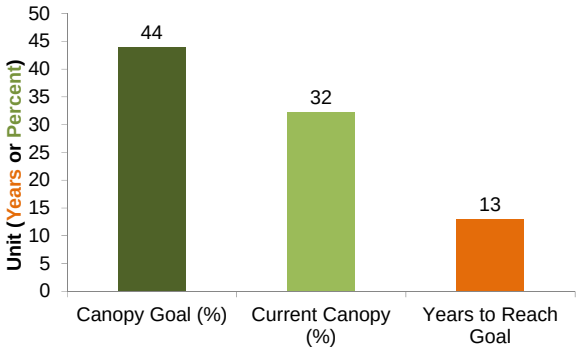


Figure 6-10. Does your municipality have a tree canopy goal? (n=629)

Do you have a goal or developing one?

Tree Canopy

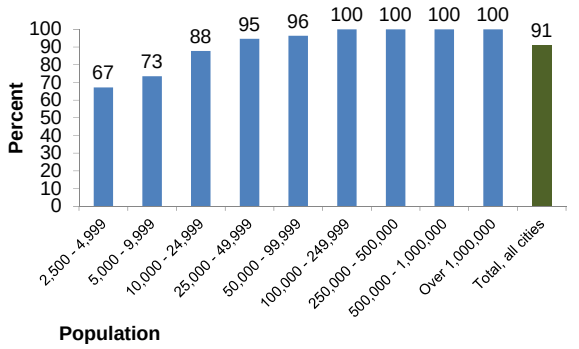


Do you have a goal or developing one?

The Urban Forestry Through Your Eyes

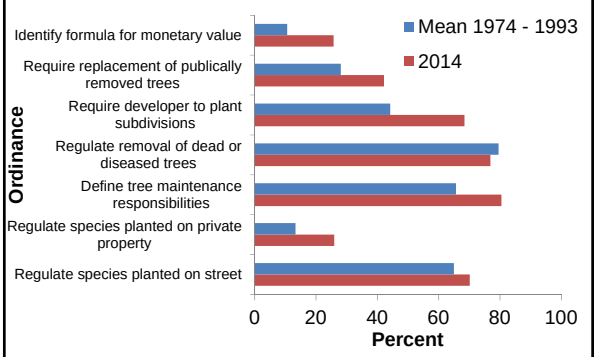
What is your urban forest?

Policy Through Ordinance



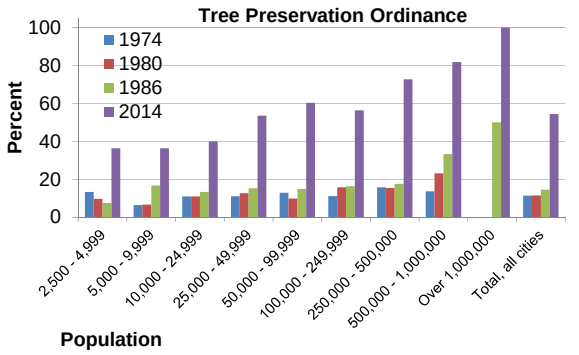
Does a Community have a Tree Ordinance

Policy Through Ordinance



Does a Community have a Tree Ordinance

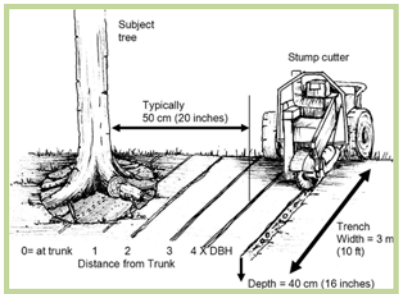
Policy Through Ordinance



Tree Preservation Ordinance

Tree Stability and Trenching

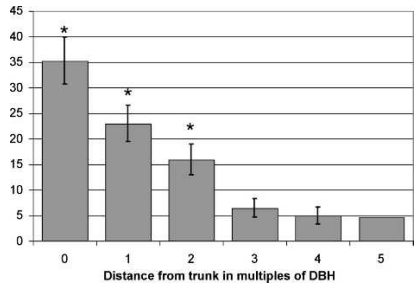
Critical Root Zone Calculations – "Absolute"



Smiley, E.T. 2008. Root Pruning and Stability of Young Willow Oak. Arboriculture & Urban Forestry 34(2)123-128

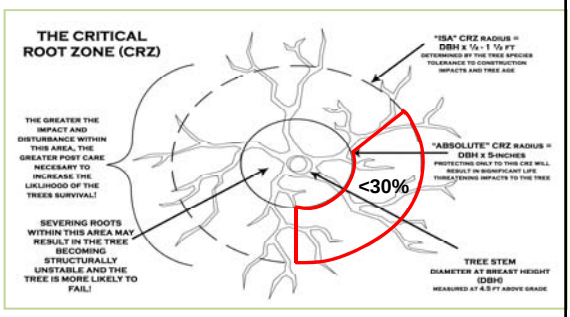
Subject Trees: 15 cm (6 in)

Tree Stability and Trenching



3 Times DBH or Further

Critical Root Zone

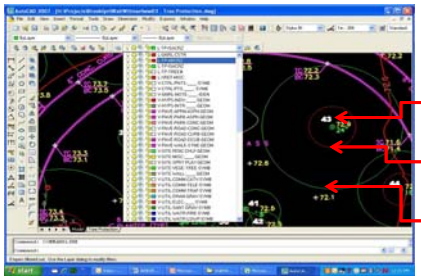


Critical and Absolute Values

Critical Root Zone

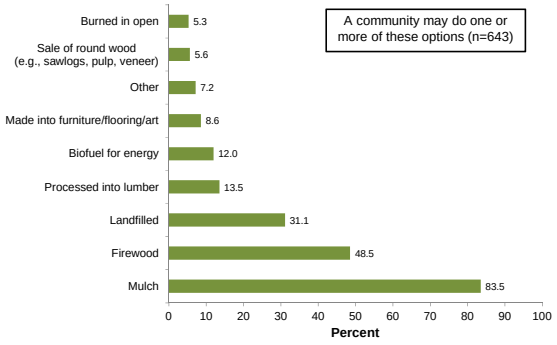
Critical and Absolute Values (Image by Jeremy Barrick)

Do You Speak Engineer



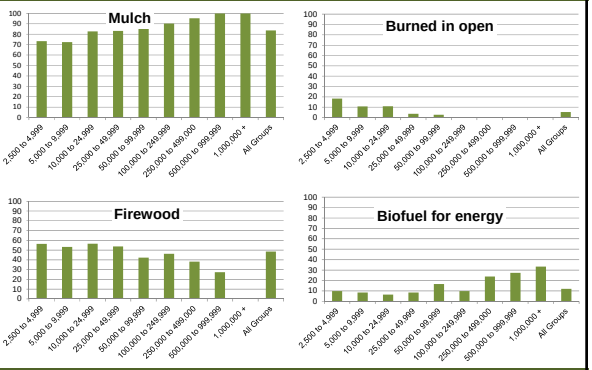
Computer Aided Design (CAD) (Image by Jeremy Barrick)

Municipal Forestry Disposal of Removed Trees



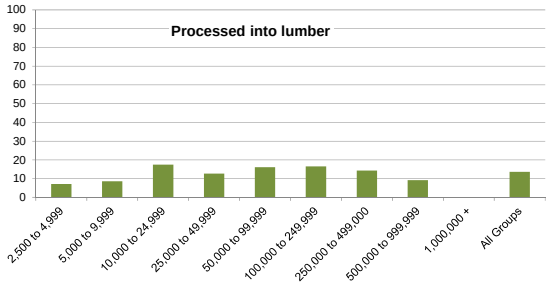
Results from a 2014 National Survey

Municipal Forestry Disposal of Removed Trees



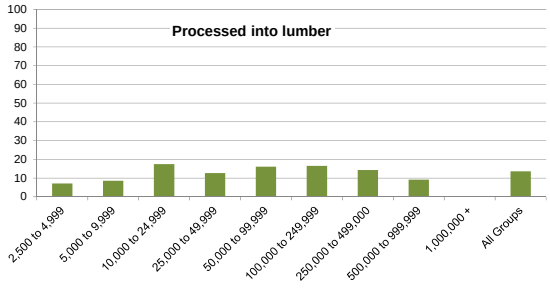
Results from a 2014 National Survey (y axis in percent, x axis as population)

Municipal Forestry Disposal of Removed Trees



Results from a 2014 National Survey (y axis in percent, x axis as population)

Municipal Forestry Disposal of Removed Trees



Results from a 2014 National Survey (y axis in percent, x axis as population)

Innovations in Arboriculture

Treatment by Divine Intervention (Photos by Joe Hoffman)

Tree Diversity and Scale (Landscape Level)

All Regions

Species	% Freq
Acer platanoides	5.3
Fraxinus pennsylvanica	3.2
Gleditsia triacanthos	3.0
Acer saccharinum	2.8
Acer rubrum	2.8
Quercus virginiana	1.2
Acer saccharum	1.2
Pyrus calleryana	0.8
Liquidambar styraciflua	0.7
Tilia cordata	0.7
Platanus x acerifolia	0.7
Celtis occidentalis	0.7
Ulmus pumila	0.6
Lagerstroemia indica	0.6
Quercus palustris	0.5

115 Species

71 Genera

32 Families

The entire U.S. urban forest is diverse

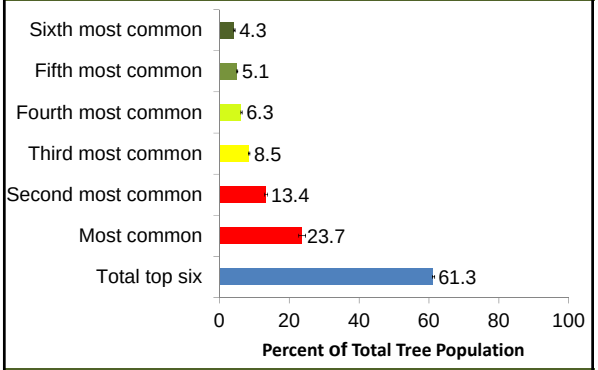
Tree Diversity and Scale (Regional Level)

Midwest Region

Species	Places (n)	% Freq	SEM
Acer platanoides	34	14.2	1.6
Fraxinus pennsylvanica	31	13.8	1.6
Acer saccharinum	37	12.6	1.8
Acer rubrum	25	9.8	1.3
Quercus palustris	7	9.3	2.0
Gleditsia triacanthos	48	8.7	0.6
Ulmus americana	7	7.9	2.1
Picea pungens	7	7.9	1.4
Acer x freemanii	7	6.9	1.6
Pyrus calleryana	6	6.7	1.1
Acer saccharum	17	6.6	0.7
Fraxinus americana	9	6.6	0.7
Tilia cordata	11	6.6	1.0
Celtis occidentalis	12	5.6	1.0
Quercus rubra	5	4.2	0.5

Diversity if a city has this tree species (% of total)

Tree Diversity and Scale (Local Level)



Dominance by the top 6 species in a community

Urban Forestry Program Models

Tree City USA
USDA-FS CARS
SMA Accredited UF Programs
Clark & Matheny 1997 Model
Kenney et al. 2011 Updated Model

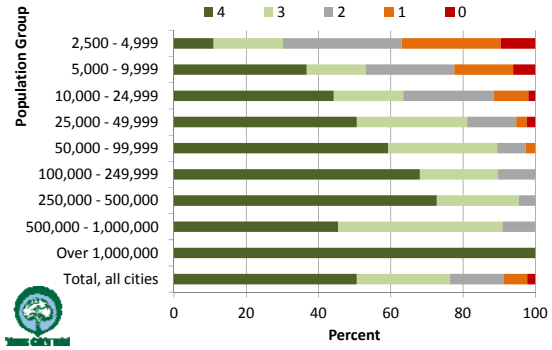
Tree City USA Standards

Standard 1 Tree Board or Department
Standard 2 Tree Care Ordinance
Standard 3 Budget ≥ $2 Per Capita Annually
Standard 4 Arbor Day Observance & Proclamation

TREE CITY USA

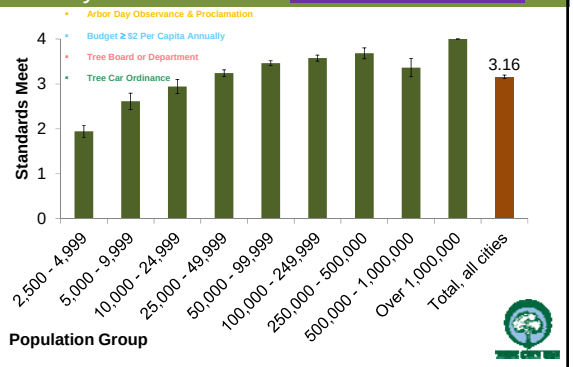
Meet these four Standards and your in

Tree City USA Standards All Four Standards



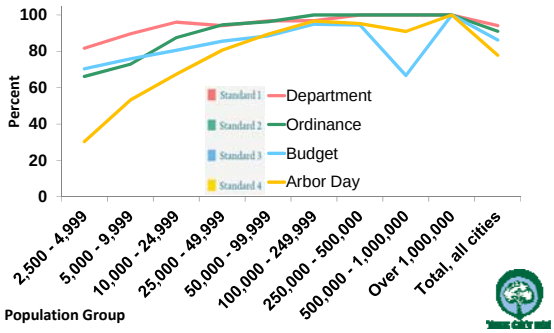
Meet these Seven Standards and your in

Tree City USA Standards All Four Standards



Meet these four Standards and your in

Tree City USA Standards All Four Compared



Meet these four Standards and your in