



STRATUM Technology Showcase

Greg McPherson & Kelaine Vargas
USDA Forest Service
Center for Urban Forest Research
Davis, CA

CaUFC Annual Conference
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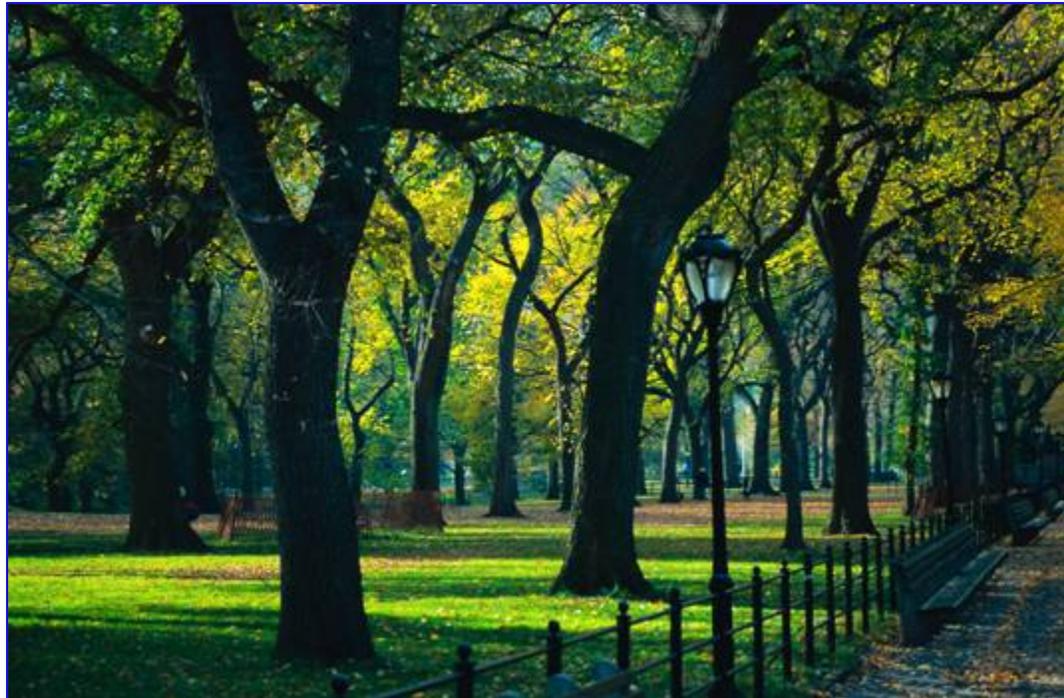
Today

- 🌳 Overview
- 🌳 Install STRATUM
- 🌳 Data Collection – Volunteers & PDAs
- 🌳 An Example Project
- 🌳 Reports
- 🌳 Making Use of Results
- 🌳 Question & Answer



Common Goal

“To improve the condition and extent of the urban and community forest”



i-Tree: Demonstrating That Trees Pay Us Back!

 Trees are assets,
management
adds value by
increasing return
on investment



Public/Private Partnership

- 🌳 USDA Forest Service
 - ◆ Research and Development
 - ◆ State and Private Forestry



- 🌳 Davey Tree Expert Co.



- 🌳 National Arbor Day Foundation  **The National Arbor Day Foundation**



- 🌳 Society of Municipal Arborists

Pulling it Together

i-Tree Cooperative was formed to deliver all Forest Service applications in a single software suite:



-  Credible, USDA FS peer-reviewed tools you can trust
-  Public domain software
-  Accessible
-  Technical support
-  Training workshops

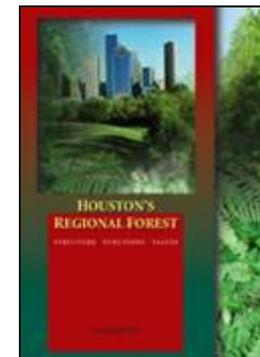
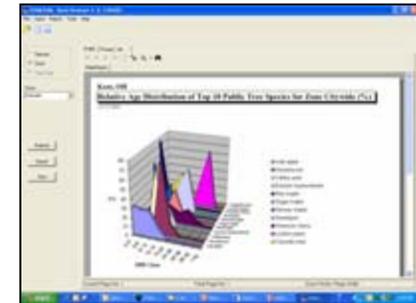
What's Included?

 Two urban forest assessment tools:

- ◆ Assessing street tree populations
- ◆ Assessing urban ecosystems

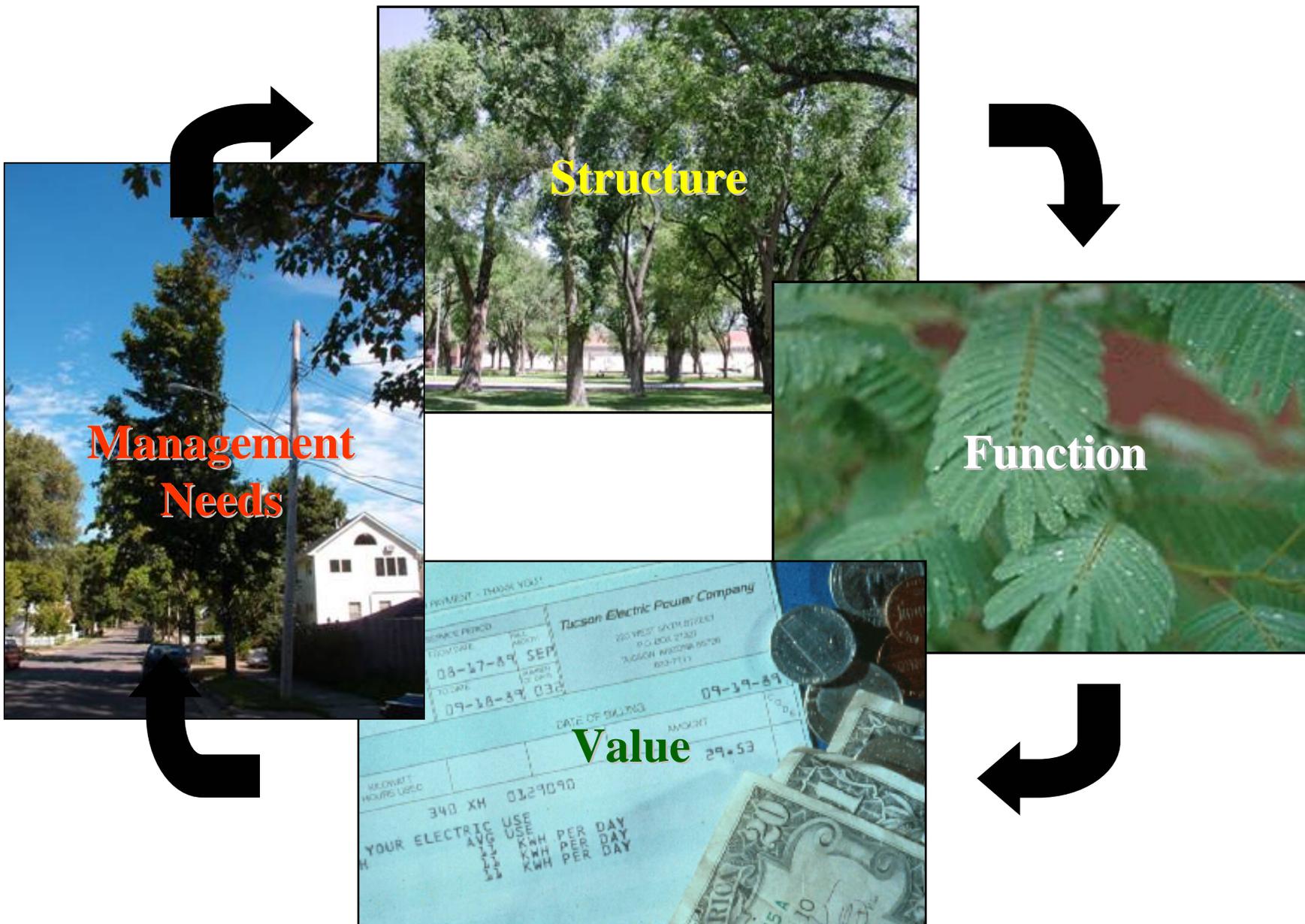
 Multiple utilities:

- ◆ Data collection & transfer
- ◆ Inventory management
- ◆ Storm damage assessment



How is i-Tree Different?

- 🌳 Peer-reviewed science
- 🌳 Public domain software
- 🌳 Information on structure, function, value & management needs
- 🌳 Scalable analyses:
Tree → Neighborhood → Community
- 🌳 Results provided at species & tree level
- 🌳 Local field inventory data required!
- 🌳 Statistically based, standardized sampling protocol

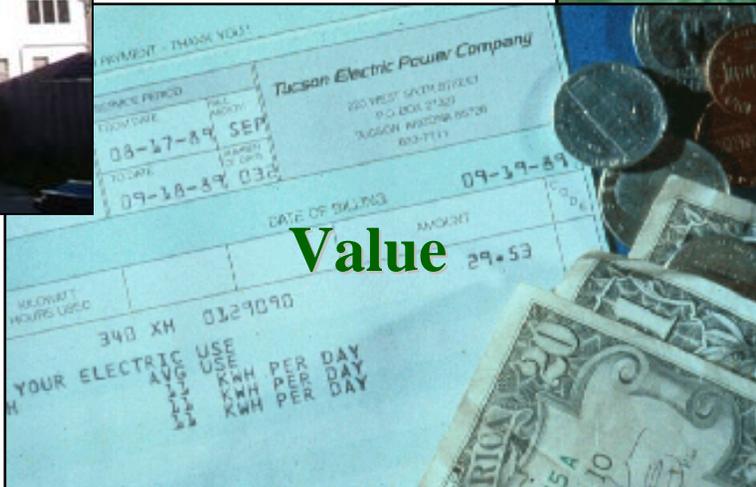


**Management
Needs**

Structure

Function

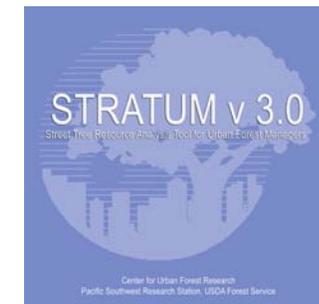
Value



Assessing Street Tree Populations: STRATUM

STRATUM assesses:

- ◆ Structure
- ◆ Function
 - ◆ Energy
 - ◆ Air pollution
 - ◆ Stormwater
 - ◆ Carbon
 - ◆ Property Value
- ◆ Value
- ◆ Management needs

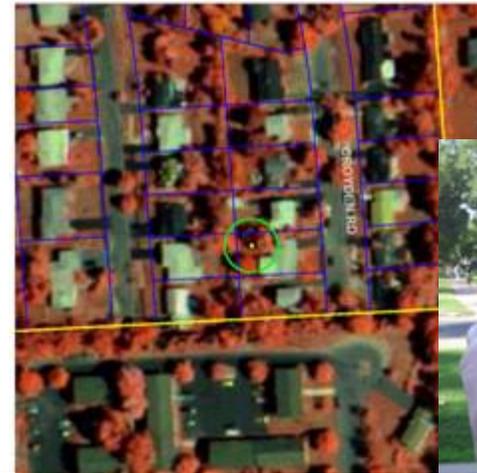


	Total (\$)	\$/capita	\$/tree
Benefit	501,064	11.31	93.64
Cost	94,000	2.12	17.57
Net Benefits	407,064	9.19	76.07
Benefit-Cost Ratio	5.33	5.33	5.33

Assessing Urban Ecosystems: UFORE

UFORE assesses:

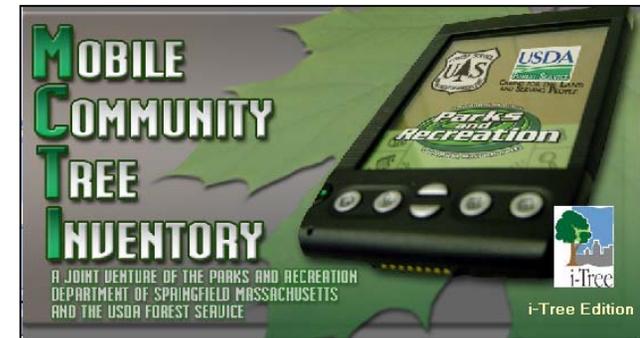
- ◆ Structure
- ◆ Function
 - ◆ Energy
 - ◆ Air pollution
 - ◆ Carbon
- ◆ Value
- ◆ Management
 - ◆ Health
 - ◆ Pest impacts



UFORE
Urban Forest Effects Model

i-Tree Management Utilities

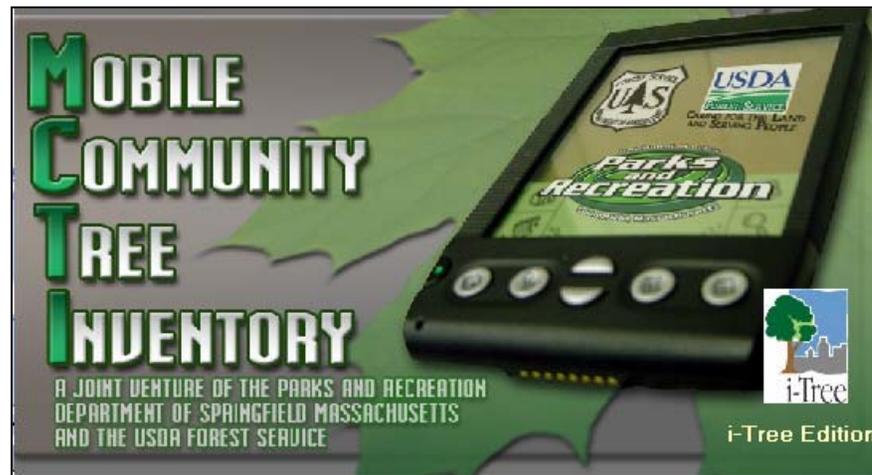
 MCTI—Mobile Community Tree Inventory



 SDAP—Storm Damage Assessment Protocol



Mobile Community Tree Inventory System



- 🌳 Simple, easy-to-use tree inventory system satisfying a variety of community needs
- 🌳 Data collection and management, i-Tree PDA & STRATUM compatible

How does MCTI work?

Variable level of applicability

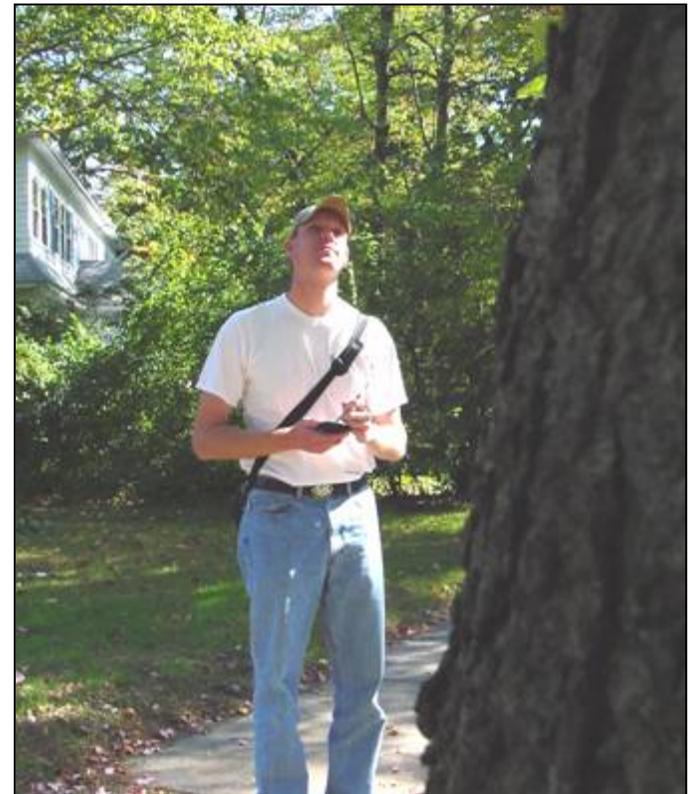
- ◆ Paper to PDA implementation
- ◆ day-to-day management of street & park tree records

Variable inventory protocols

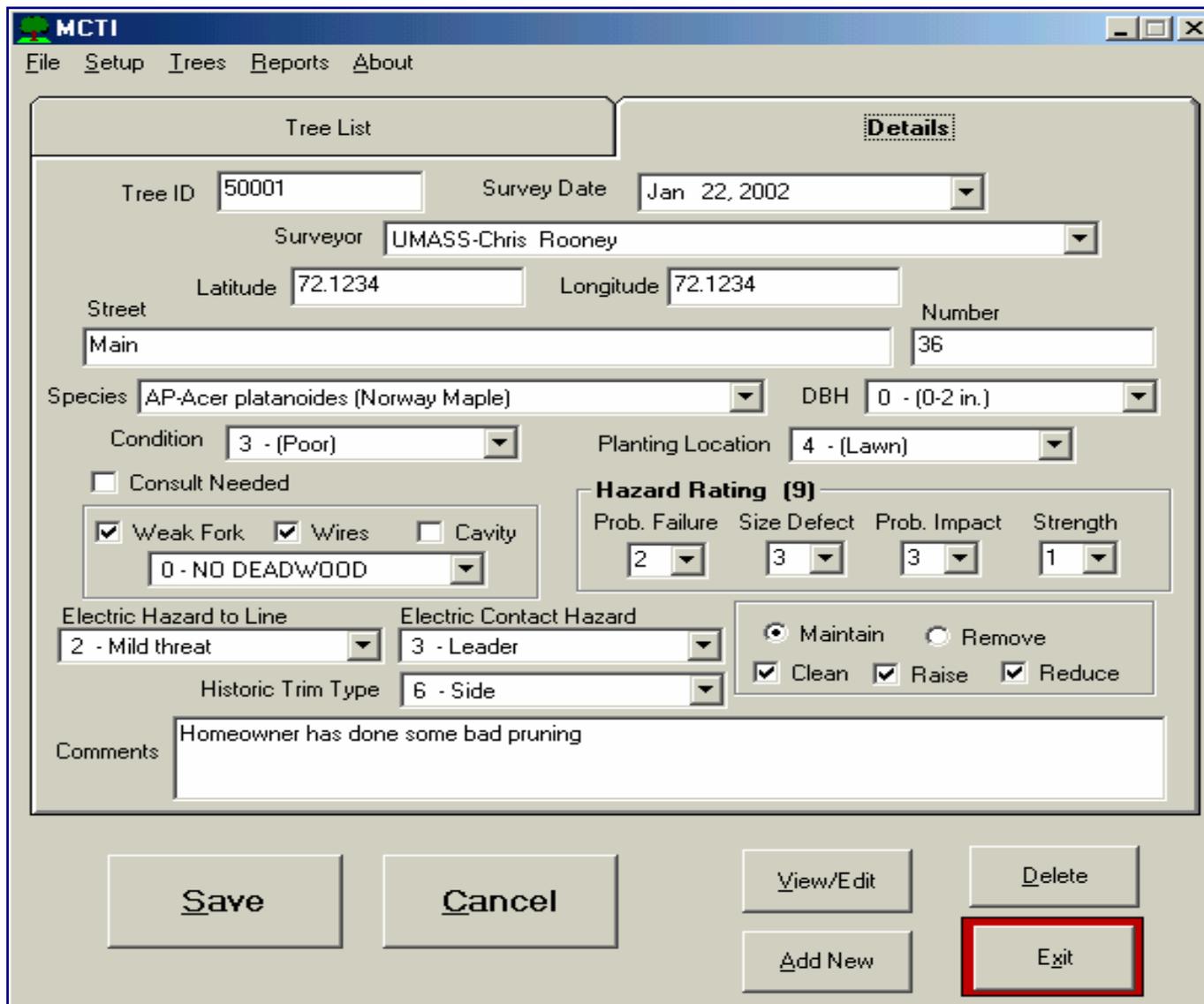
- ◆ Condition
- ◆ Maintenance
- ◆ Risk tree

Three components

- ◆ Paper tally sheet template
- ◆ Desktop application
- ◆ PDA data collection program



MCTI Desktop Application

A screenshot of the MCTI Desktop Application interface. The window title is "MCTI" and it has a menu bar with "File", "Setup", "Trees", "Reports", and "About". The main area is divided into "Tree List" and "Details" tabs. The "Details" tab is active and contains various input fields and dropdown menus for tree data. At the bottom, there are several buttons: "Save", "Cancel", "View/Edit", "Delete", "Add New", and "Exit". The "Exit" button is highlighted with a red border.

MCTI

File Setup Trees Reports About

Tree List **Details**

Tree ID: 50001 Survey Date: Jan 22, 2002

Surveyor: UMASS-Chris Rooney

Latitude: 72.1234 Longitude: 72.1234

Street: Main Number: 36

Species: AP-Acer platanoides (Norway Maple) DBH: 0 - (0-2 in.)

Condition: 3 - (Poor) Planting Location: 4 - (Lawn)

Consult Needed

Weak Fork Wires Cavity

0 - NO DEADWOOD

Hazard Rating (9)

Prob. Failure: 2 Size Defect: 3 Prob. Impact: 3 Strength: 1

Electric Hazard to Line: 2 - Mild threat Electric Contact Hazard: 3 - Leader

Historic Trim Type: 6 - Side

Maintain Remove

Clean Raise Reduce

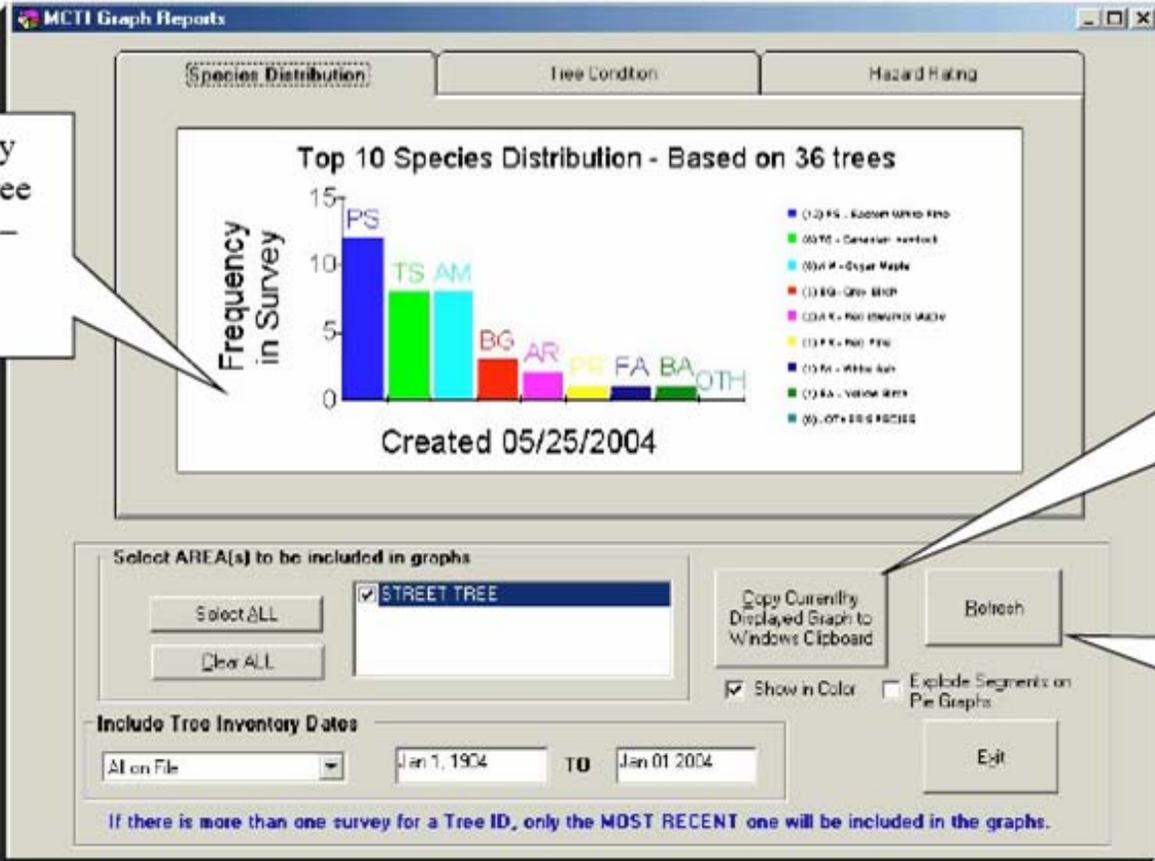
Comments: Homeowner has done some bad pruning

Save Cancel View/Edit Delete Add New Exit

Reporting Screen – Species Distribution

*Tab One – Species Rating

Gives a bar graph of 10 most frequently found species



10 most frequently occurring street tree species in survey – displayed in bar chart format

Copy Currently Displayed Graph to Windows Clipboard

Updates Graph to display any changes in database

MCTI Graph Reports

Species Distribution | Tree Condition | Hazard Rating

Top 10 Species Distribution - Based on 36 trees

Frequency in Survey

Species Code	Frequency
PS	12
TS	8
AM	8
BG	4
AR	3
DE	2
FA	2
BA	1
OTH	1

Created 05/25/2004

Select AREA(s) to be included in graphs

Select ALL | Clear ALL

STREET TREE

Copy Currently Displayed Graph to Windows Clipboard

Refresh

Show in Color | Explode Segments on Pie Graphs

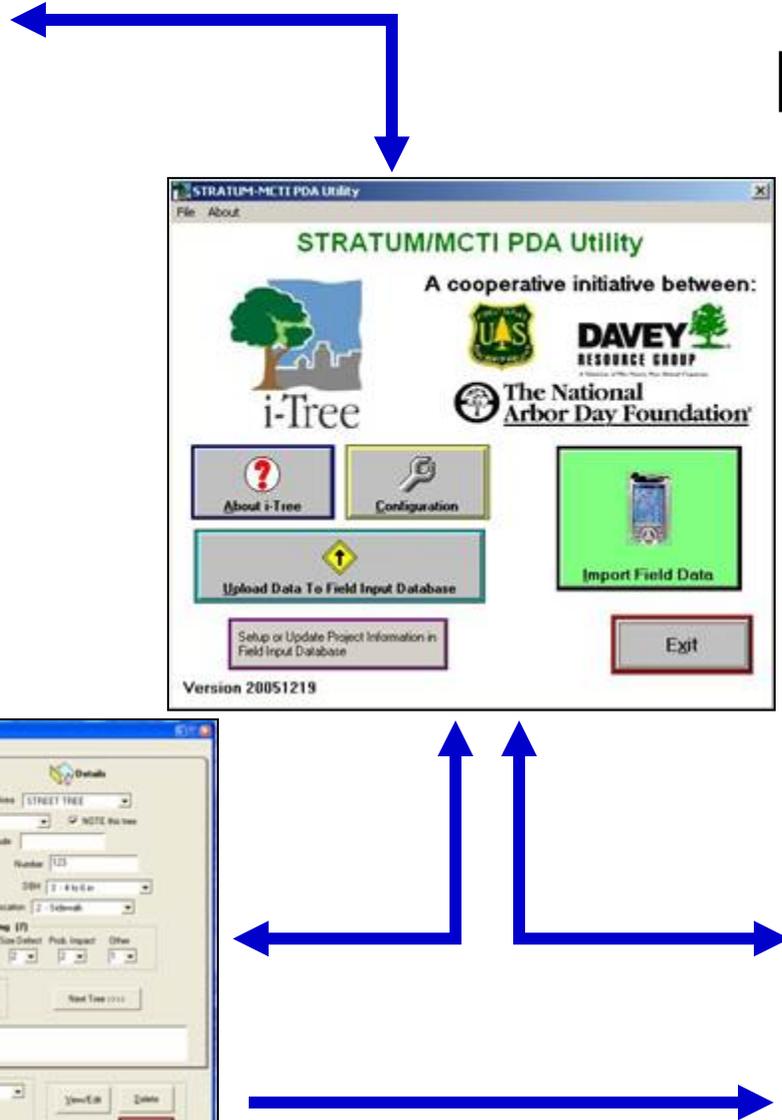
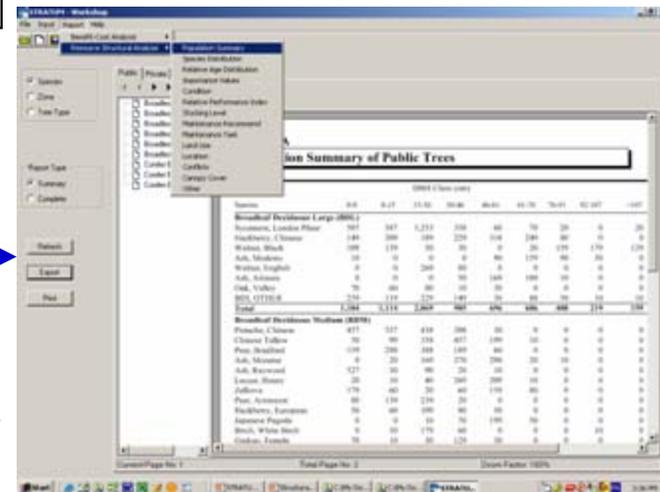
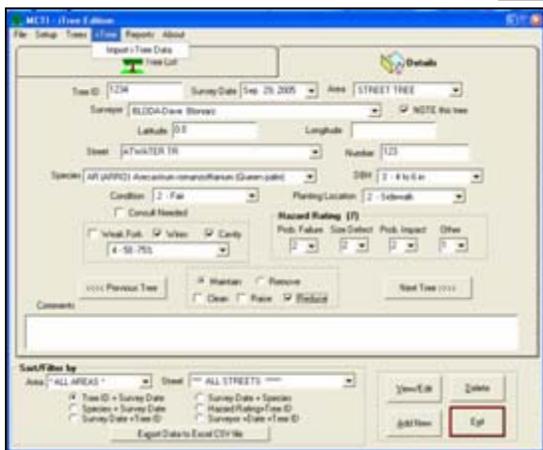
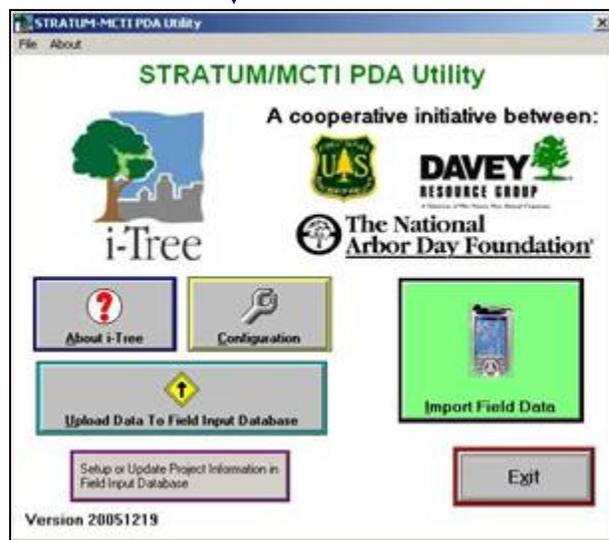
Exit

Include Tree Inventory Dates

All on File | Jan 1, 1904 TO Jan 01 2004

If there is more than one survey for a Tree ID, only the MOST RECENT one will be included in the graphs.

PDA to Desktop Data Transfer STRATUM/MCTI



Storm Damage Assessment Protocol Utility



- 🌳 Standardized method to assess widespread storm damage in a simple, credible, and efficient manner immediately after a severe storm.
- 🌳 Provides information on the time and funds needed to mitigate storm damage.

How does SDAP work?

“Protocol” indicates

- ◆ Rigor
- ◆ Uniformity
- ◆ Adherence

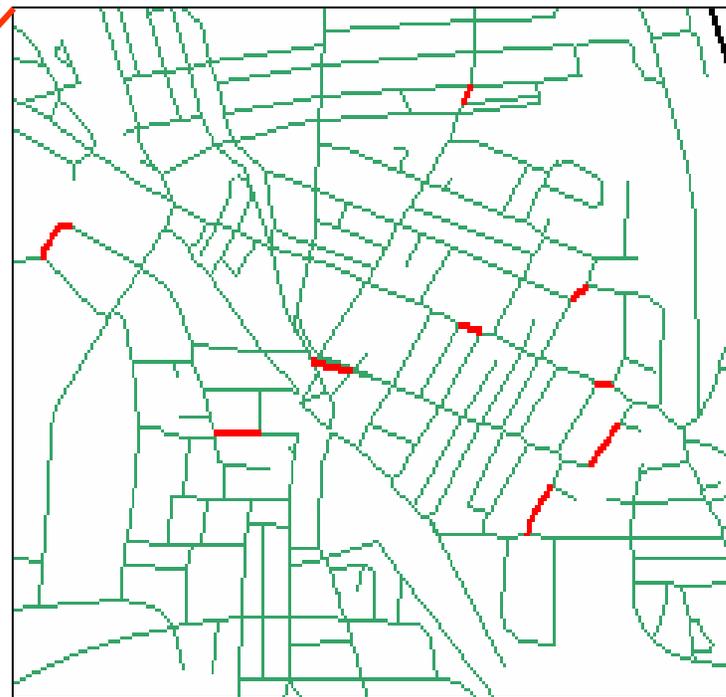
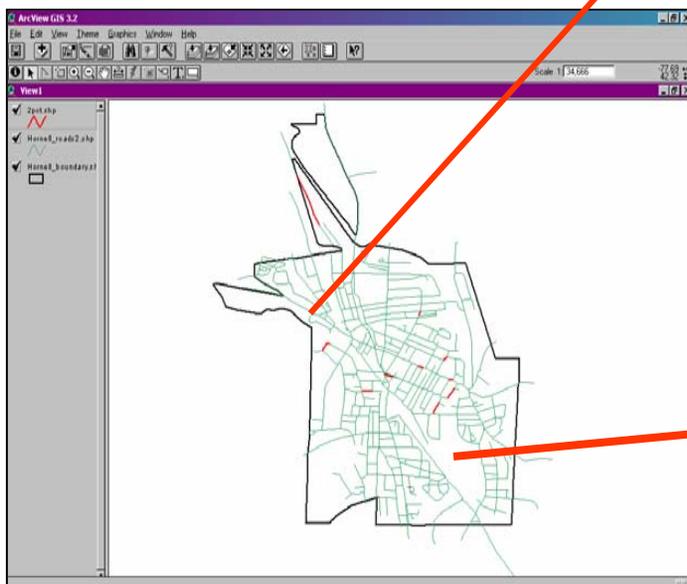
Three replicable components

- ◆ Sampling method
 - ◆ Pre-storm set-up
 - ◆ Post storm sampling
- ◆ Estimating engine
- ◆ Reporting means



Pre-Storm Sampling

- 🌳 Set-up permanent plots
- 🌳 Tree density count
- 🌳 Train post-storm survey team



Post-Storm Assessment

 Re-visit sample segments

 Estimate

- ◆ Crown loss
- ◆ Hazard pruning & removals



Form 5A
POST-Storm Field Data Collection Sheet (Populated Areas)

Community Name: _____ Plot Number: _____

DN Street: _____ TO Street: _____

FROM Street: _____ TO Street: _____

Date: _____ Plot Length (ft/m): _____

ROW Width (feet): _____ Collected by: _____

Start of plot description: _____

End of plot description: _____

ROW Trees ONLY										ROW + 50' Trees ²		
Tree Removals					Tree Pruning					Debris Estimate ³		
Est. Cost	Est. Number of Removals	Tree ID	Time Per Tree	ROW in 100' Plot (Square ft)	CROWN LOSS	DEBRIS YARDS						
									0.75		0-100	
									1.0		101-200	
									1.5		201-300	
									2.0		301-400	
									3.0		401-500	
									4.0		501-600	
									5.0		601-700	
											701-800	
<small> 1. This is same as plot number, the edge of the right-of-way, or whole plot. 2. Rows (only) or total (Crown) Yards collected in this assessment. 3. Estimated. </small>										Extra ⁴		
										Total CL		
										Average		
										Total CY		

Storm Assessment 5:15

Storm Assessment 5:15

ROW Trees 5:26

ROW 6-12: 0

ROW 13-18: 0

ROW 19-24: 0

ROW 25-30: 0

ROW 31-36: 0

ROW 37-42: 0

ROW 43+: 0

Add/Subtract: ADD

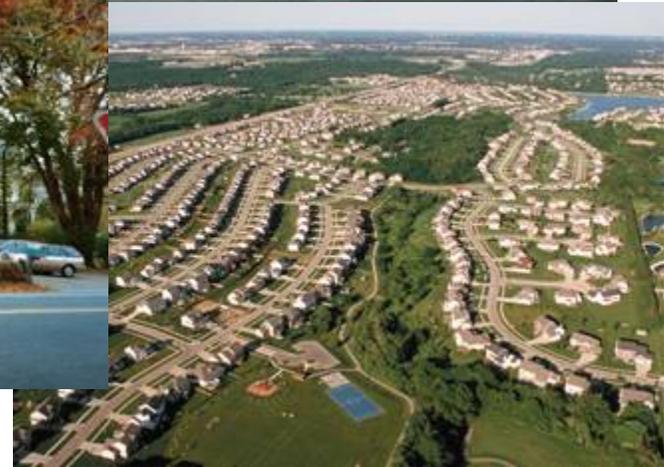
Buttons: Add Records, Review Records, Delete Records, Quit, Abort, Next

Reporting

Analyze costs based on local variables

Community:				Report Date: 5/Jan/2005		
Note: numbers on this page were generated by a "Storm Damage Estimate Template" as revised in 2004 by the USDA Forest Service and Davey Resource Group using post-storm field observations of random plots						
ESTIMATED COST OF TREE DAMAGE				\$0		
COMMUNITY VALUES				Estimate components		
<i>Check the numbers to the right, and correct if necessary</i>				% Street Miles Sampled 0		
Street Miles 0				Removals 0		
Removal Cost/hr 55				Total Removal Hours 0.0		
Pruning Cost/hr 55				Total Removal Cost \$0		
Brush Cost/cu yd 6				Hazard Prune 0		
				Total Pruning Hours 0.0		
				Total Pruning Cost \$0		
				Total Canopy Loss 0		
				Total Brush cu yds 0.0		
				Total Brush Cost \$0		
				Total Cost \$0		
DETAILED POST-STORM CALCULATION 1: Removals and Hazard Pruning						
ON Right-of-Way Trees						
DBH Class (inches)	<i>Tree Removal</i>			<i>Tree Pruning</i>		
	Total of Removal Trees	Removal Time per Tree	Total Hours for Removal	Total Hazard Prune Trees	Time Per Hazard	Total Hours for Hazard Prune
6 to 12	0	3.2	0	0	0.75	0
13-18	0	5.1	0	0	1	0
19-24	0	7.7	0	0	1.5	0
25-30	0	10.2	0	0	2	0
31-36	0	12.5	0	0	3	0
37-42	0	20.4	0	0	4	0
43+	0	28	0	0	5	0
All Rural	0	6.2	0	0	2.5	0
Totals	0		0	0		0
						Plot Info
						<i>Method</i>
						<i>Pct Street Miles in Sample</i>
						0.00%

Who will use i-Tree?



i-Tree Supports Local U&CF Programs

- 🌳 Highlight value of trees
- 🌳 Justify investment in tree programs
- 🌳 Leverage funds from other sources
- 🌳 Develop management plans
- 🌳 Manage data
- 🌳 Baseline for tracking progress



How do I get i-Tree?

🌳 Initial public release of i-Tree has begun!

🌳 Telephone & on-line support available

🌳 Workshop Schedule

- ◆ 2006: Clemson, SC;
Golden, CO;
Minneapolis (Nov)
- ◆ 2007: National training-
of-the-trainer workshop
scheduled for early
spring

🌳 User Feedback = i-Tree
Refinement



How do I get i-Tree?

Visit:

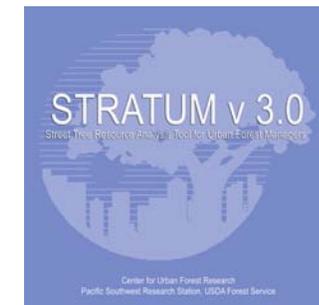
- ◆ <http://www.itreetools.org>
- ◆ Sign up for e-mail newsletter
 - ◆ Updates will be posted on-line



Assessing Street Tree Populations

STRATUM assesses:

- ◆ Structure
- ◆ Function
 - ◆ Energy
 - ◆ Air pollution
 - ◆ Stormwater
 - ◆ Carbon
 - ◆ Property Value
- ◆ Value
- ◆ Management needs



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How does STRATUM work?

Input:

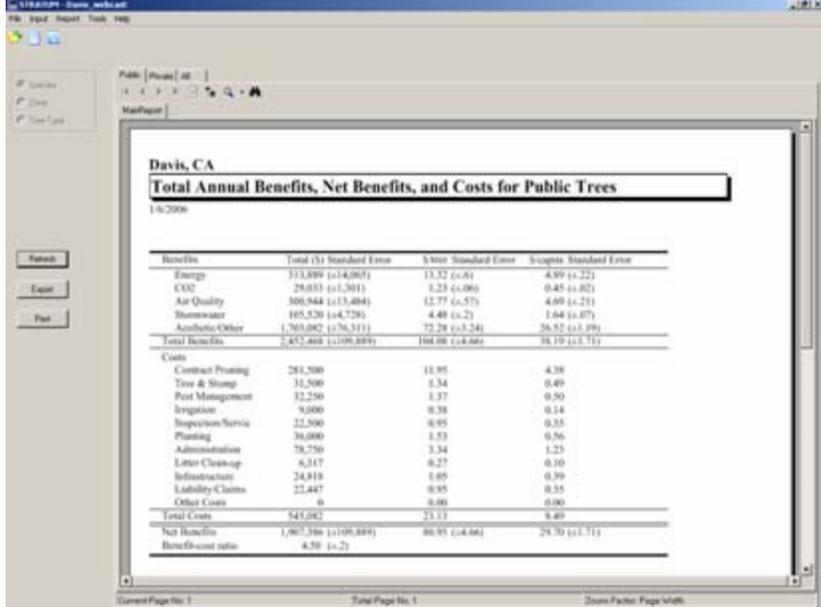
- ◆ Sample inventory (3-5%)
- ◆ Or existing inventory
- ◆ Price adjustments, management costs

Output:

- ◆ Graphs, charts, tables

Benefit:

- ◆ Baseline data to more effectively manage the street tree resource



Benefit	Total (31 Standard Error)	A-Year Standard Error	30-year Standard Error
Energy	313,889 (±14,963)	13.32 (±0)	4.99 (±.22)
CO ₂	29,033 (±1,301)	1.23 (±0.06)	0.45 (±.02)
Air Quality	300,044 (±13,484)	12.77 (±.57)	4.49 (±.21)
Stormwater	165,526 (±4,729)	4.48 (±.2)	1.64 (±.07)
Aesthetics/Other	1,703,082 (±76,311)	72.28 (±3.24)	26.52 (±1.19)
Total Benefits	2,452,468 (±109,889)	104.08 (±4.66)	38.19 (±1.7)
Costs			
Contract Pruning	281,500	11.95	4.38
Tree & Stump	31,500	1.34	0.49
Pest Management	32,250	1.37	0.50
Irrigation	9,000	0.38	0.14
Inspection/Service	22,500	0.95	0.35
Planting	36,000	1.53	0.56
Administration	78,750	3.34	1.23
Litter Clean-up	6,317	0.27	0.10
Infrastructure	24,818	1.05	0.39
Liability/Claims	22,447	0.95	0.35
Other Costs	0	0.00	0.00
Total Costs	545,082	23.13	8.49
Net Benefits	1,907,386 (±109,889)	80.95 (±4.66)	29.70 (±1.7)
Benefit:cost ratio	4.50 (±.2)		

What makes STRATUM different?

- 🌳 Street trees, not entire urban forest
- 🌳 Costs, not only benefits
- 🌳 Management tool, not only for advocacy
- 🌳 Tree inventory-based, not GIS
- 🌳 Answers the question: Do the accrued benefits of street trees outweigh the cost of their management?

Install STRATUM





Data Collection

- 🌳 Working with volunteers
- 🌳 Data collection methods
 - ◆ Paper
 - ◆ i-Tree PDA utility



Volunteer Data Collection: Minneapolis Pilot Project

- 🌳 Summer of 2004, i-Tree software tested using volunteers
- 🌳 Professionals collected information along with volunteers



Purpose of Pilot Project

- 🌳 Accuracy of volunteer data collection
- 🌳 Usability of maps & PDAs
- 🌳 Recruitment, training, organization of volunteers



Volunteer Project Logistics

- 🌳 >3000 trees in sample
- 🌳 Divided city into 20 different groups, needed at least 3 per team or 120 as a goal (89 volunteered)
- 🌳 Each group inventoried 18-24 street segments
- 🌳 Allowed each team 30 days to complete their data collection.

Volunteer Recruitment

- 🌳 Informational open house
- 🌳 Newspaper article in Minneapolis paper
- 🌳 Neighborhood groups
- 🌳 Emails to local corporate volunteer coordinators
- 🌳 Email network
- 🌳 Tree care advisors / Master Gardeners



Volunteer Training

- 🌳 Volunteer manual
- 🌳 Hands-on one day training



Training Components

- 🌳 Classroom tree ID
- 🌳 Outdoor tree ID
- 🌳 Tree characteristics
- 🌳 Measurement
- 🌳 Software/PDA operation



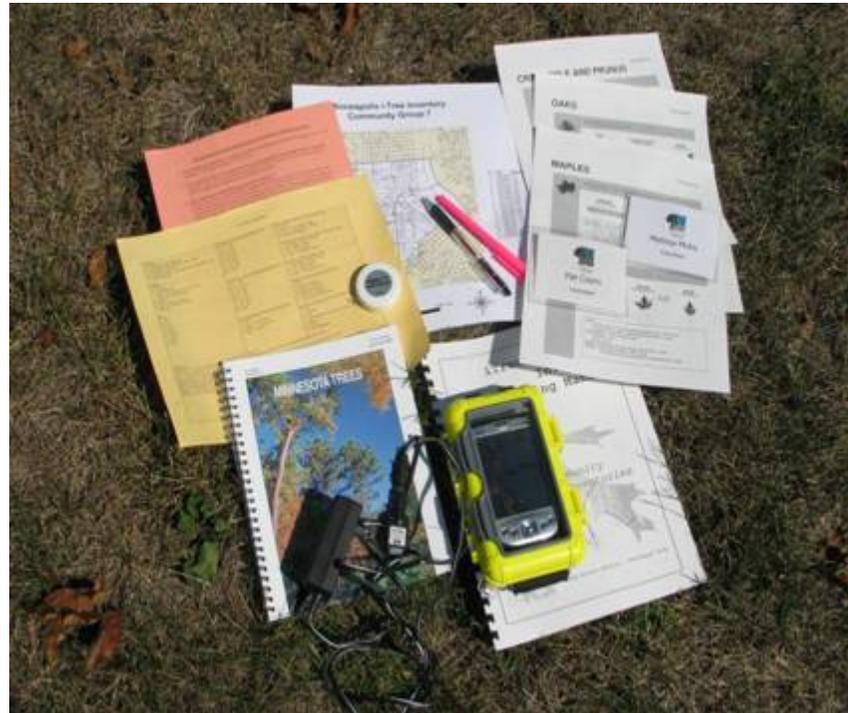
Volunteer Organization

- 🌳 Organizing teams
- 🌳 Scheduling data collection
- 🌳 Distribution of groups



Tools

- 🌳 PDA & charger
- 🌳 PDA backup chip
- 🌳 DBH tape
- 🌳 Map
- 🌳 Reference materials
- 🌳 Phone



Volunteer Recognition

 Recognize
volunteers for
their efforts



Volunteer Data Collection



City of 60,000
20,000 trees

3-5% sample = 600-1,000
trees

4 min / tree = ~50 hrs

4 teams of 3 →
2 6-hr days + 1 day training

Summer Interns



Pair of interns ♦ Sample inventory

Conduct inventory, analyze data, write reports
= ~1-2 months

Results & Recommendations

- 🌳 80% accurate for species, size, leaf condition.
- 🌳 Less accurate for conflicts (66%) & maintenance needs (49%) due to training.
- 🌳 With more focused training, volunteers can collect reliable data:
 - ◆ Cover PDAs, maps, tree assessment in 6-hr day
 - ◆ Separate 3-4 hour tree-ID session w/ “dress rehearsal”
 - ◆ Slide library showing different management needs
 - ◆ Demonstrate how to troubleshoot PDAs
 - ◆ Cover street side safety tips
 - ◆ Show key ways to distinguish most important species

Results & Recommendations

- 🌳 Organization: use questionnaire to determine who wants to survey trees in own neighborhood and group together in training
- 🌳 Develop formal troubleshooting process before deploying volunteers so assistance is available
- 🌳 Have “refresher session” soon after deployment to review solutions to common problems

Summary

 Using volunteers can be successful, evaluate if it is the right choice for your community.



PDA's

Advantages

- 🌳 Fast data collection
- 🌳 Low error rate
- 🌳 No data entry required
- 🌳 Data transfer automated

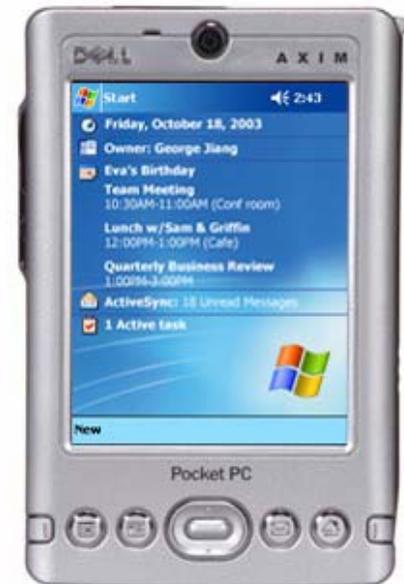


Disadvantages

- 🌳 Up-front equipment expense
- 🌳 Training required
- 🌳 Require maintenance / care
 - ◆ Charging batteries
- 🌳 Units not protected from elements
 - ◆ Water, dust, etc.

Choosing a PDA

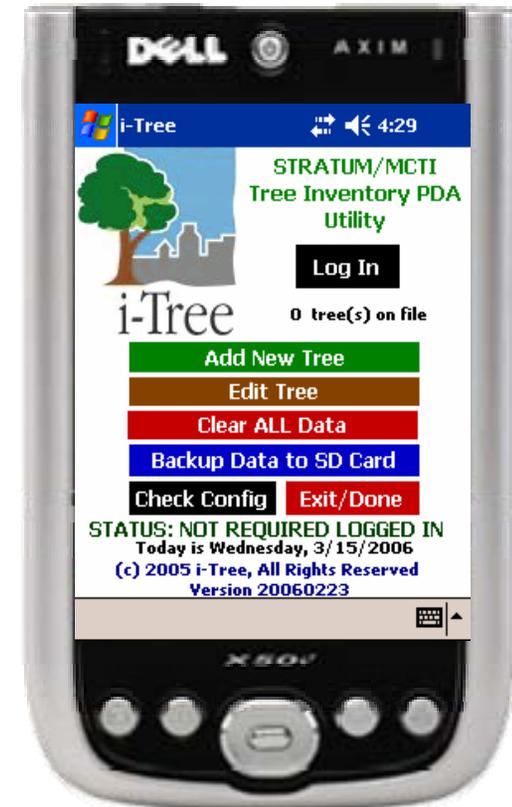
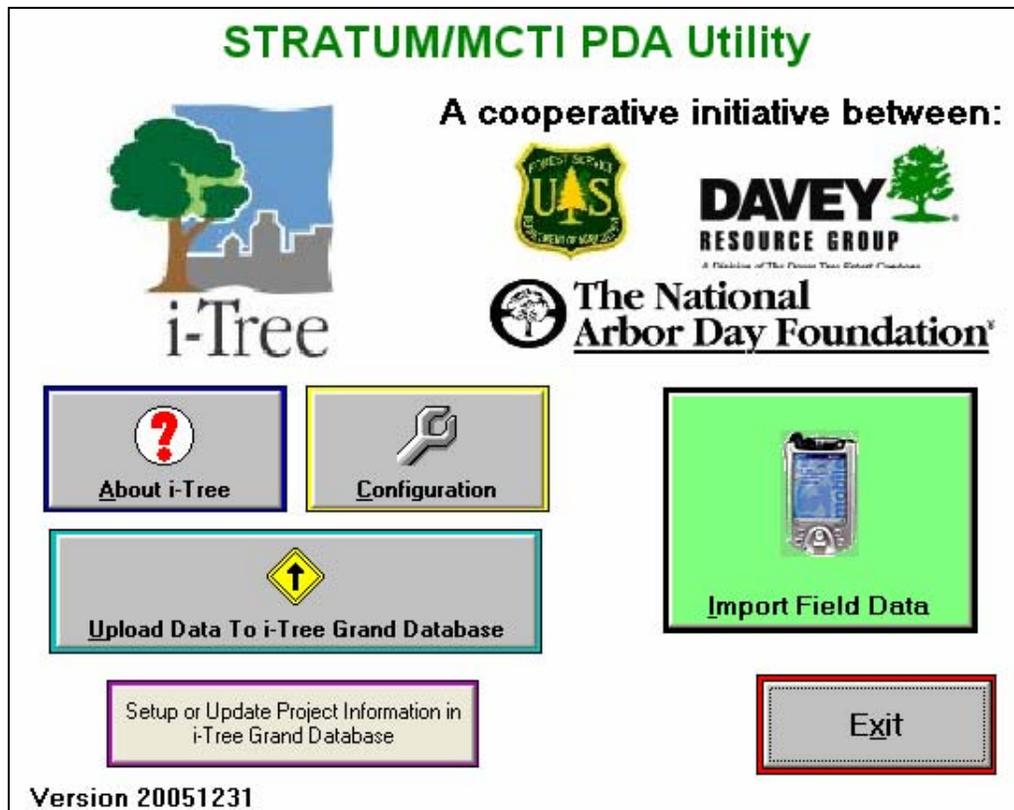
- 🌳 Compatible only with Pocket PCs
 - ◆ Alternative OS (Palm, BlackBerry, Psion, PocketLinux, etc.) are not compatible.
 - ◆ Windows Mobile 2002 or 2003 operating systems (OS).
 - ◆ Mobile 5.0 operating systems
- 🌳 Other considerations
 - ◆ Weatherized models
 - ◆ Back-up media slot
 - ◆ Protective slip covers or carrying cases
 - ◆ High capacity batteries
 - ◆ Cost (\$200-400 or more)



PDA-based Inventory with i-Tree Utility

Two Interfaces

- ◆ Desktop
- ◆ Pocket PC

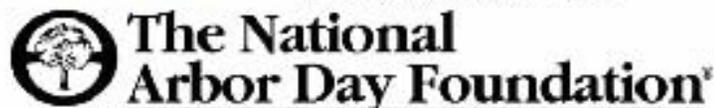


Desktop Interface

STRATUM/MCTI PDA Utility



A cooperative initiative between:



PDA Interface



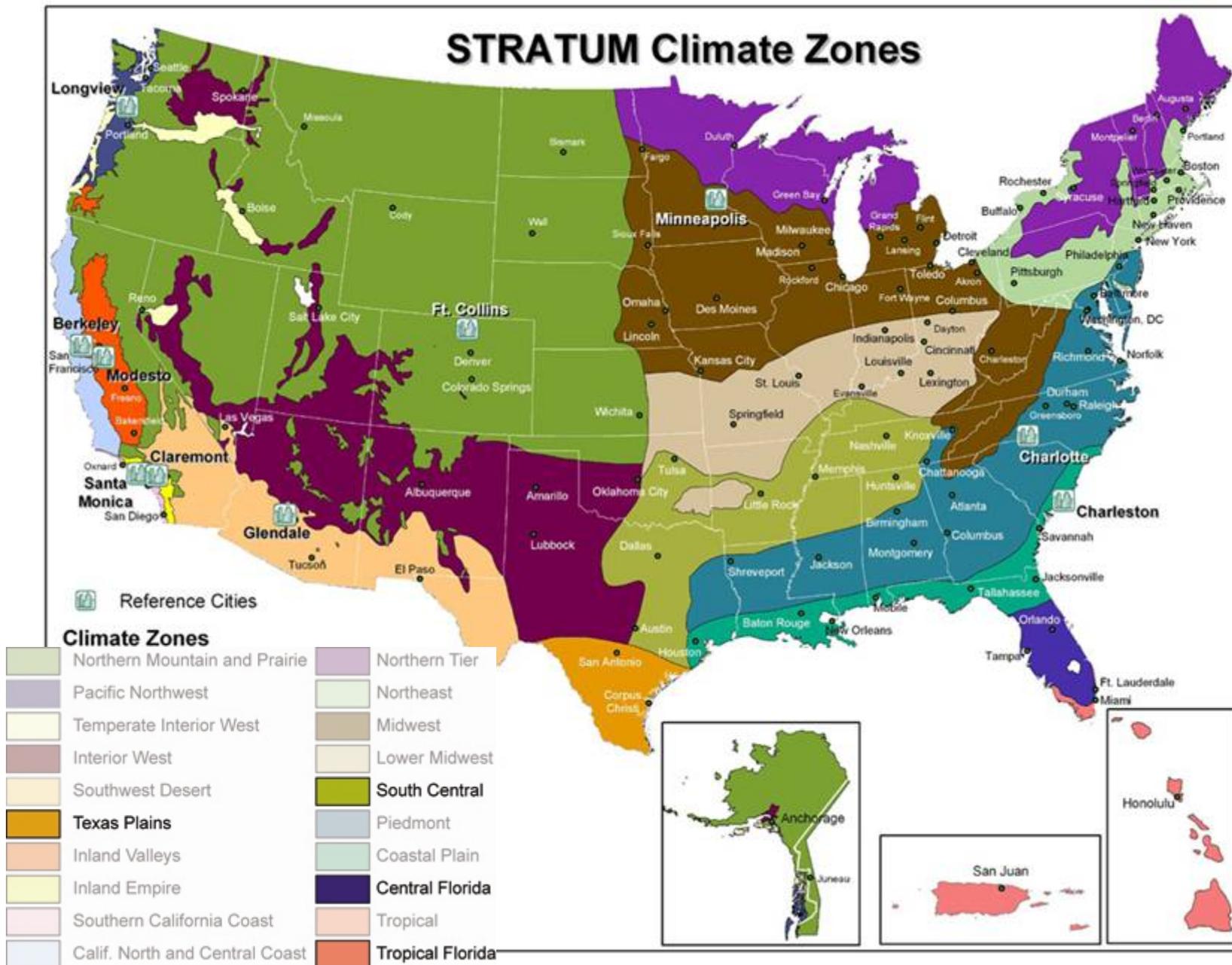


STRATUM v 3.0

Street Tree Resource Analysis Tool for Urban Forest Managers

Center for Urban Forest Research
Pacific Southwest Research Station, USDA Forest Service

STRATUM Climate Zones





Making Use of Your Results



Minneapolis Experience

- 🌳 Minneapolis Evaluation Study
- 🌳 Minneapolis Municipal Forest Assessment
- 🌳 Midwest Community Tree Guide
- 🌳 http://www.itreetools.org/resource_learning_center/reports.html
- 🌳 Other Regional Tree Guides and Municipal Forest Reports
- 🌳 <http://www.fs.fed.us/psw/programs/cufr>

Minneapolis Tree Advisory Commission

selected portions of

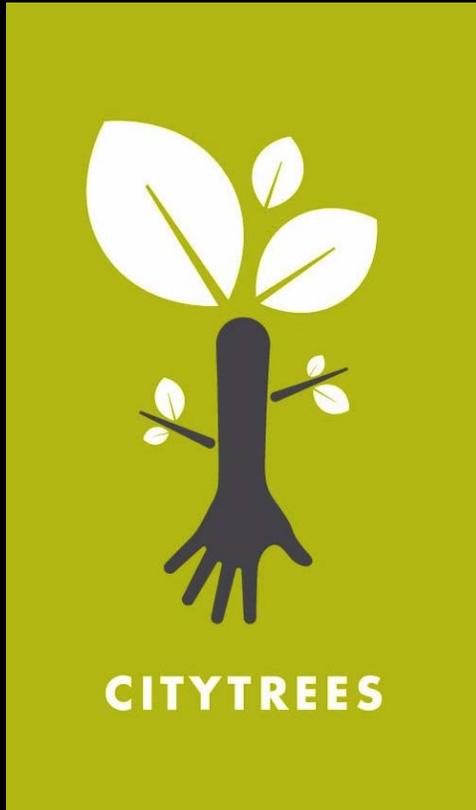
Annual Report

to the

Minneapolis Park & Recreation Board

Minneapolis City Council & Mayor

January 2006



Minneapolis Tree Advisory Commission

Created in October 2005

by the Minneapolis Park & Recreation Board



CITYTREES

Introduction:
How We Got Here

GOAL:
To enhance the
Minneapolis
urban forest &
improve its long
term health.



Minneapolis lost
10,000 elm trees
to Dutch elm disease in 2004 and
could lose that many again this year.

YOU can help

- **Preserve our elms.** Work with a qualified arborist to inject your healthy elms with a preventive fungicide. The average cost is \$300 per tree, every two to three years. Neighbors can band together for a group discount.
- **Remove a sick elm from your yard ASAP** — it is contagious. If your elm is diseased and marked for removal, have it removed right away. Do not store elm firewood in your woodpile unless all of the bark has been removed.
- **Plant a tree in your yard.** Before planting a tree on your boulevard, call the Minneapolis Park & Recreation Board at 612-370-4900 for a tree permit.



Minneapolis
Tree Advisory Commission

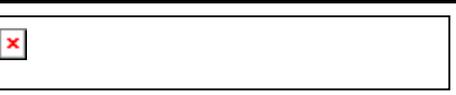
i-Tree Pilot in Minneapolis



Urban Forestry Analysis & Benefits Assessment Software



The first city in the nation to test the data collection and analysis applications of the i-Tree software suite.



Introduction:
How We Got Here



Co-sponsored
by MPRB &
Tree Trust

The State of the Urban Forest

- Benefits
- Impacts
- Threats

Recommendations

- Resources
- Policies
- Outreach



**Minneapolis Tree
Advisory
Commission**

The Benefits of the Urban Forest

The trees of Minneapolis are THE growing capital asset that benefits everyone in the City.



The State of the
Minneapolis
Urban Forest

The **Benefits** of the Urban Forest

Each year Minneapolis street trees provide:

- \$6.8 million in energy savings
- \$9.1 million in reduced storm water runoff
- \$7.1 million increased property value
- Plus improvements to air quality



The State of the
Minneapolis
Urban Forest

**\$24.9 million TOTAL
value each year!**





Minneapolis Urban Forest Summary



Number of Trees

979,000



Tree Cover

26.4%

Top 3 Species

Green Ash, Amer. Elm, Boxelder

% of Population <6" Dia.

47.3%

Pollution Removal

423 tons/year (\$1.9 million/year)

Carbon Storage

250,000 tons (\$4.6 million)

Carbon Sequestration

8,900 tons/year (\$164,000/year)

Building Energy Savings

\$216,000/year

Avoidance Carbon Emissions

\$16,000

Structural (Appraised) Values

\$756 million



The National
Arbor Day Foundation®



To provide **Benefits ...**

Each PUBLIC UTILITY requires ongoing public investments



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**60% of Minneapolis street trees
currently need some maintenance**

The **Impacts** of Dutch Elm Disease

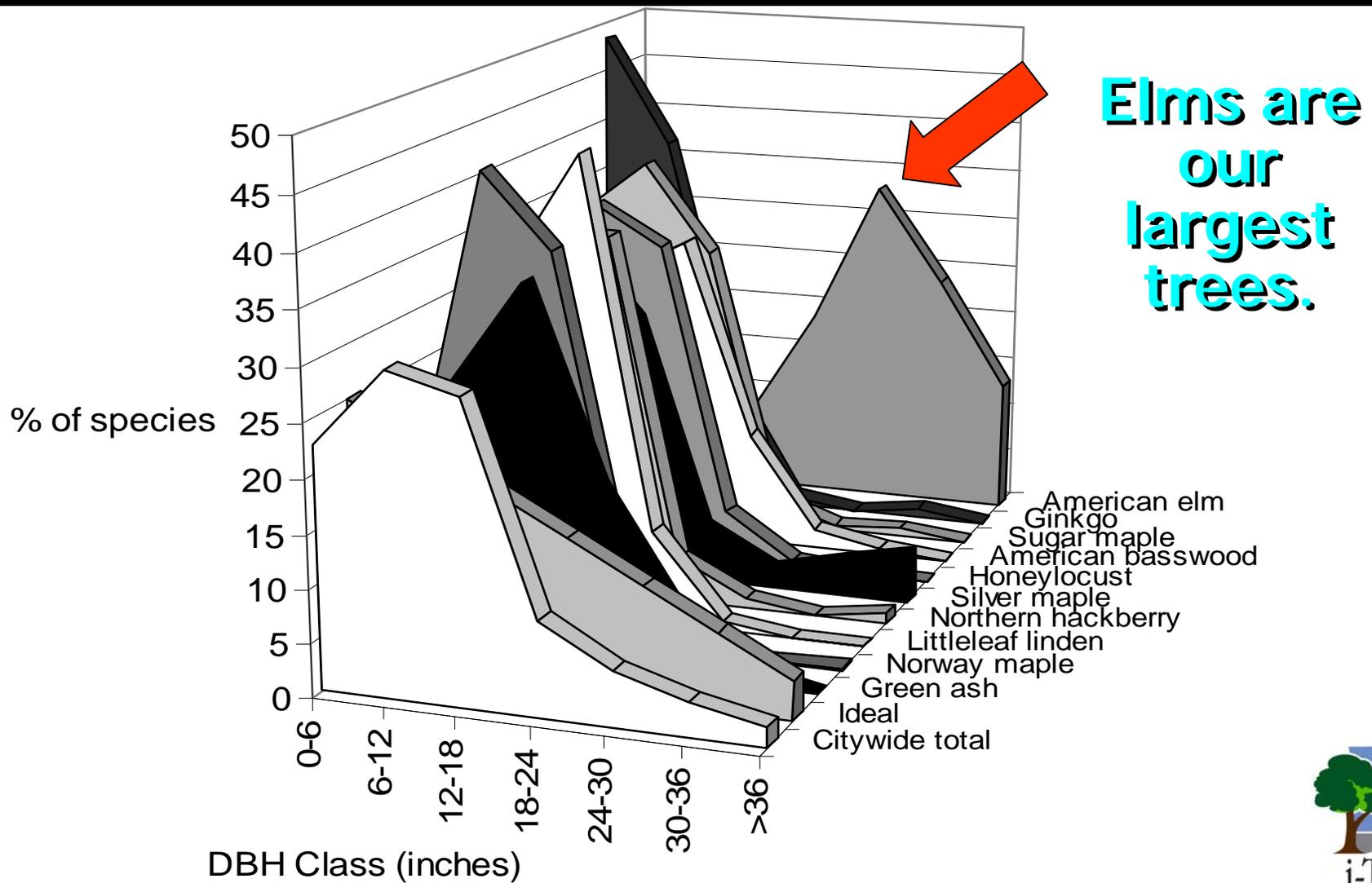
**Only 10% of Minneapolis street trees are elms.
But they generate 30% of tree benefits.**



The State of the
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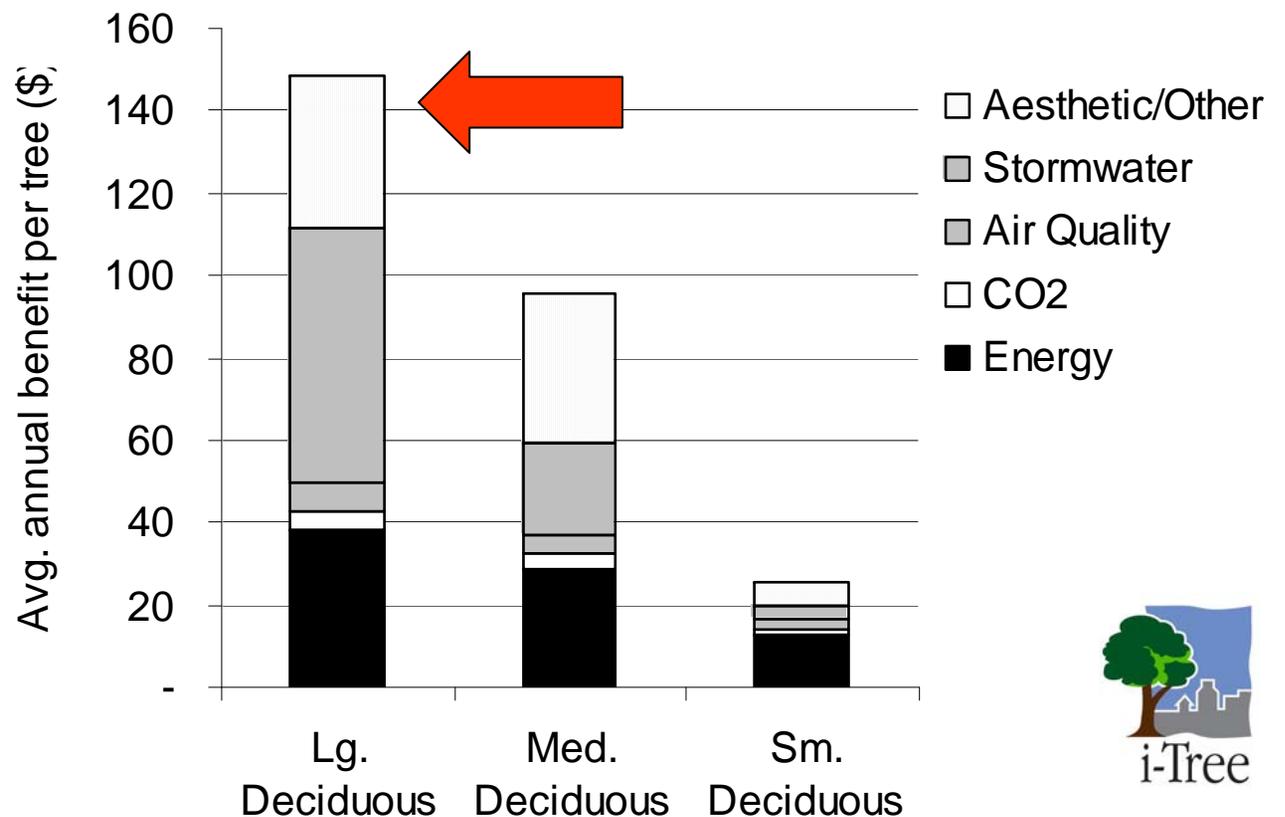
The Impacts—why elms matter



The Impacts—why elms matter

LARGE TREES

= MOST BANG FOR BUCK



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The **Impacts** of Dutch Elm Disease

Minneapolis has irretrievably lost:

- In 2004: 10,153 elms
- In 2005: 6,179 elms



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Major Threats to the Urban Forest

Disasters are looming



The State of the
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Threats to Minneapolis Tree Population



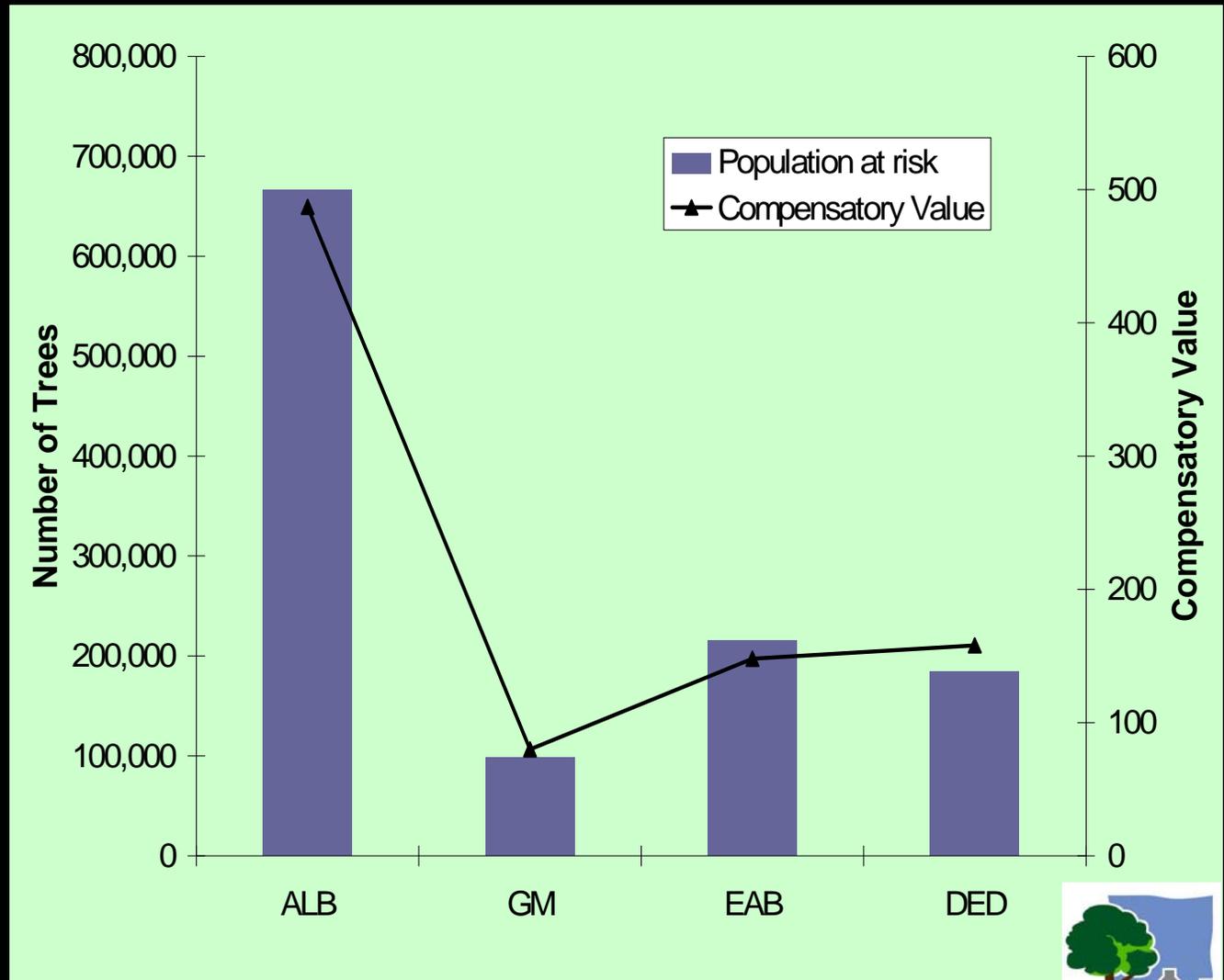
Asian Longhorn Beetle



Gypsy Moths



Emerald Ash Borer



Major Threats to the Urban Forest

Most Minneapolis trees are green ash!

Percentage by Tree Species



RECOMMENDATIONS

- Resources
- Policies
- Outreach



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Advisory
Commission



Resources

1. Fund Park Board Forestry to achieve:

- ✓ Timely removals & pruning
- ✓ Stump removal
- ✓ Tree planting
- ✓ Storm response



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RECOMMENDATIONS

Resources

1. Fund Park Board Forestry
2. Invest in stewardship campaign
3. Support state funding
4. Advocate planned giving



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RECOMMENDATIONS

Policies

1. Adopt urban forestry standards:

- ✓ Incentives for developers
- ✓ Streetscape standards & spec's
- ✓ Private arborist qualifications



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RECOMMENDATIONS



Policies

1. Adopt urban forestry standards
2. Integrate forestry in Comp Plan
3. Institute storm response plan
4. Initiate 50-year vision



**Minneapolis Tree Advisory
Commission**

RECOMMENDATIONS



Outreach

1. Launch Stewardship Campaign

- ✓ Inform constituents
- ✓ Promote participation

including **Citizens Tree Academy**



Outreach

1. Launch Sewardship campaign

✓ Encourage tree planting through

“1000 Trees Planted”

✓ Utilize city cable



Outreach

1. Launch stewardship campaign.
2. Enhance 311 for trees.



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RECOMMENDATIONS

CONCLUSIONS



The State of the Urban Forest

- Benefits
- Impacts
- Threats

Recommendations

- Resources
- Policies
- Outreach



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Minnesota STATEWIDE i-Tree outreach

On a broader scale, the USFS study is serving as a framework for cost-benefit analyses of forestry efforts in Minneapolis and Le Center. Le Center has calculated its 900 or so public trees to save some \$28,000 in energy expenditures and provide some \$8,000 worth of storm-water management services each year. USFS researchers found that nearly

taken their place as a necessity, an important part of the urban infrastructure," he says. "Engineers can always tell you how many miles of road and the cost. Well, up until urban forestry started to gather these figures, it was hard to do. Now we have a little better understanding of that value and how it fits into the picture." 🌳

STREETSIDE TREES ABSORB RAIN AND SIGNIFICANTLY REDUCE RUNOFF INTO STORM SEWERS.



RESOURCES ✦ MARCH-APRIL 2006

MINNESOTA CONSERVATION

LUNTEER



GREEN as money

Urban trees are good investments 10

Brushland dervishes 18

How i-Tree makes a difference:

Through i-Tree ... elected officials see proof of the economics of trees, e.g.:

- Annual \$ benefits of street trees
- Total \$ value of urban forest
- Quantity & cost of maintenance
- Economic losses from DED now
- High % & value of trees threatened
- Costs of deferred vigilance

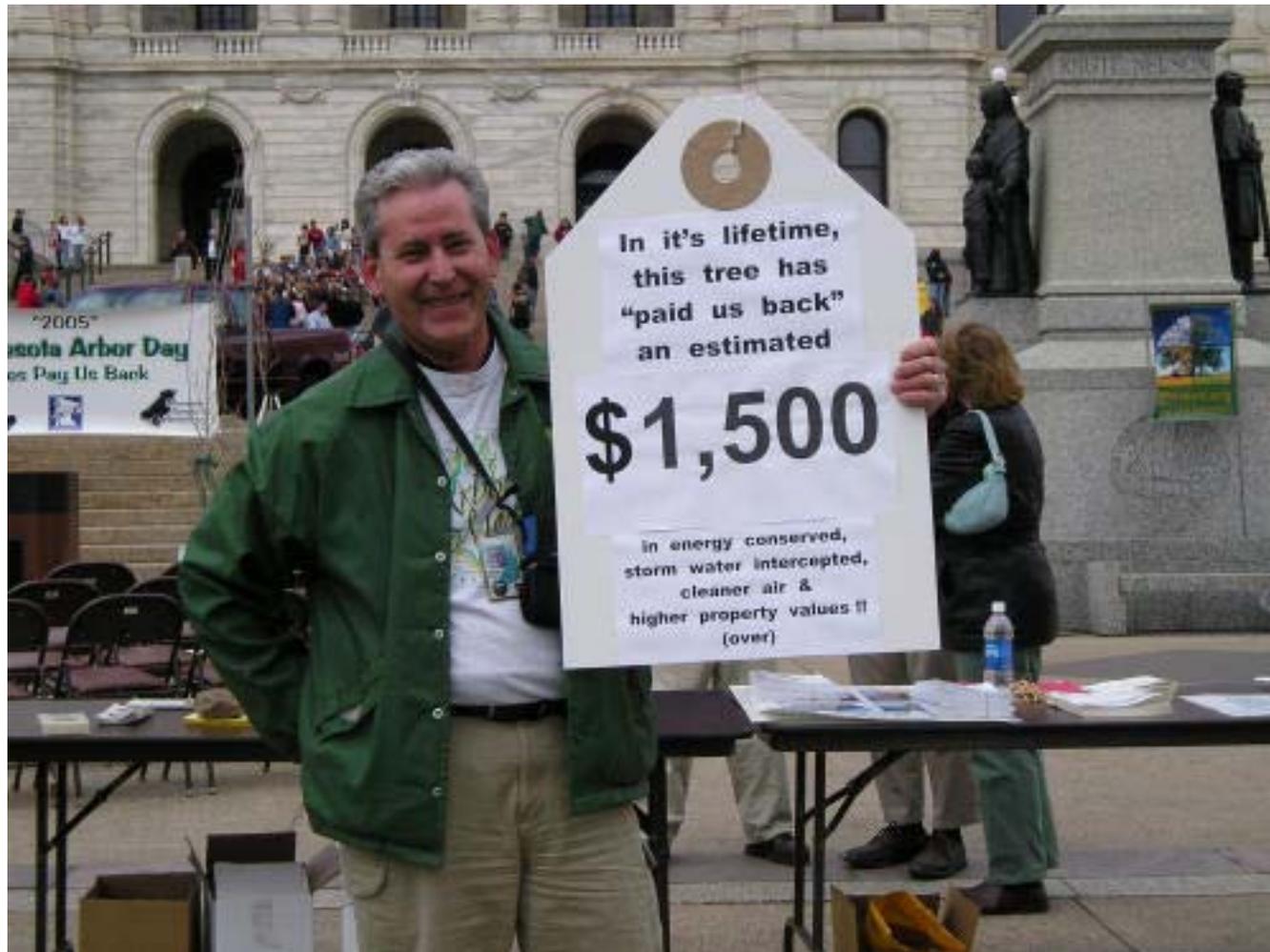


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**Resulting in funding,
leadership & action.**

Questions?

 Visit <http://www.itreetools.org>





Screen Shots of STRATUM and PDA Utility

