

# TREE INVENTORIES

GRAHAM HERBST

COMMUNITY FORESTER – EASTERN NEBRASKA

NEBRASKA FOREST SERVICE



# WHY TREES?

▶ <https://youtu.be/74063UKSmXw>



# Community Comprehensive Plan

- ▶ Environmental Element

- ▶ Should have clear language stating need for planting, maintenance and preservation of trees in open spaces and along streets



- ▶ Transportation Section

- ▶ Should have clear language calling for aesthetic consideration in the development of traffic circulation systems and provide adequate right of way space for tree planting



# Community Forest Management Plan

- ▶ Plan should contain the following
  - ▶ Maintenance standards
  - ▶ **Tree inventories**
  - ▶ Work records
  - ▶ Planting plan
  - ▶ Removal plan
  - ▶ Tree selection process
  - ▶ Design criteria
  - ▶ Personnel training and development
  - ▶ Coordination with departments and other agencies

# Tree Inventories

## ▶ Purpose

- ▶ Obtain and organize information about:
  - ▶ Total number of assets
  - ▶ Species diversity
  - ▶ Condition
  - ▶ Distribution of trees throughout the community

# Tree Inventories

- ▶ Critical tool in the community forest management process
- ▶ Should be part of the overall community comprehensive plan under both the environmental and transportation sections



# Inventories

- ▶ Tree inventory system planning
  - ▶ Improves the efficiency of the urban forest operations
  - ▶ Justifies budget requests



# Who Needs and Inventory?

- ▶ Municipalities
- ▶ College Campuses
- ▶ School Districts
- ▶ Home Owners Associations



# Inventories



- ▶ “Inventories not only give you an accurate picture of the current conditions of the community forest, they tell a story of what the urban forest will look like in the future.” ArborPros

# Inventories

- ▶ Municipalities have the tasks of:
  - ▶ Long term planning
  - ▶ Continuous maintenance
  - ▶ Keeping current tree species lists
  - ▶ Pruning
  - ▶ Planting
  - ▶ Mulching
  - ▶ Pest management



# Inventories are valuable



- ▶ Municipalities
  - ▶ Tool for managing budgets and justifying budget increase requests
  - ▶ Critical for managing emerging insect and disease issues
  - ▶ Developing management strategies because of changing climate conditions
  - ▶ Assist with developing plans for sidewalk infrastructure repair/replacement
- ▶ Utility companies
  - ▶ use inventories to track line clearance needs, problematic species around lines and areas that need more frequent clearance
- ▶ Landscape Contractors
  - ▶ Utilize on HOA properties and commercial projects
    - ▶ Develop yearly management plans, create work orders and proposals and create maps for clients and show monetary value of clients trees

# Types of Inventories

- ▶ Sample
- ▶ Partial
- ▶ Full

# Sample Inventory

- ▶ Random selection of community trees

# Partial Inventory

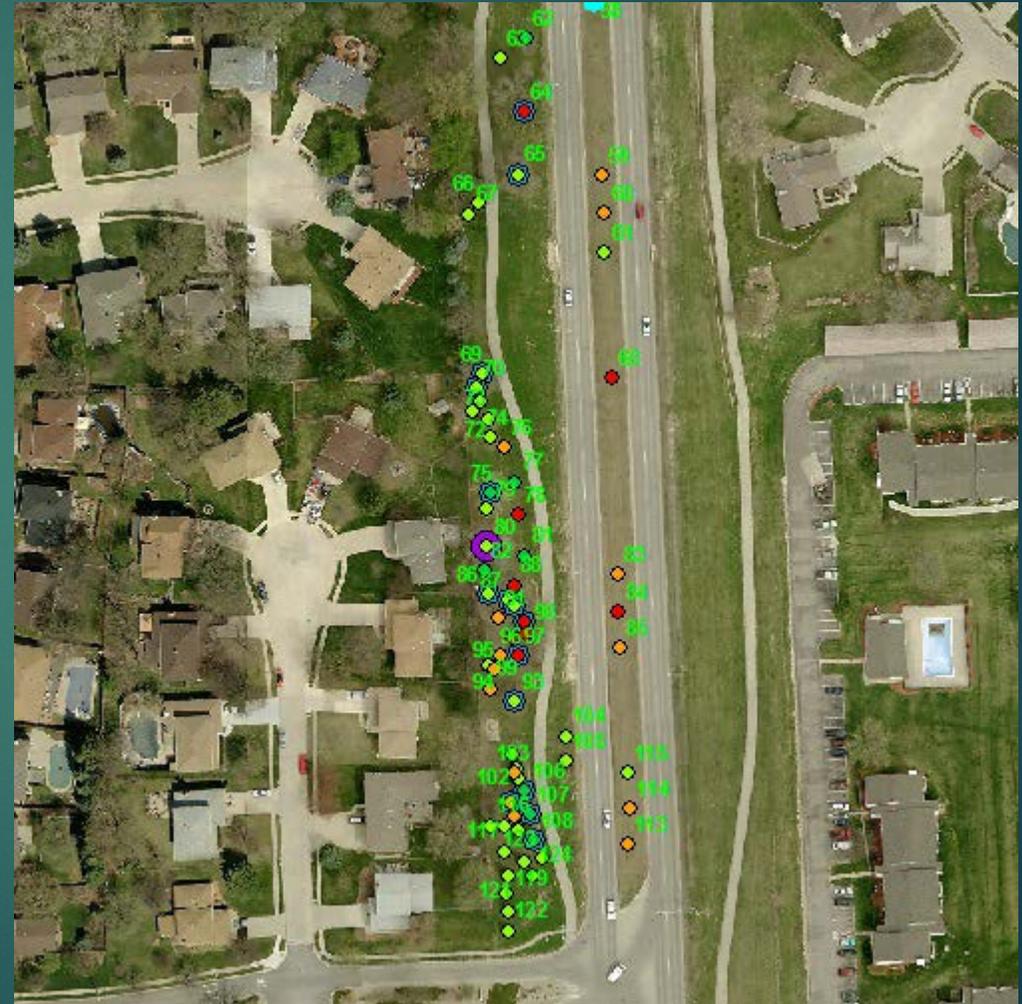
- ▶ Provides information on a portion of the community trees
  - ▶ EX. Inventory only community ash trees
  - ▶ EX. Inventory only a particular area of community
  - ▶ EX. Locating all dead and dying trees

# Full Inventory (Public)

- ▶ Identifies ALL public tree AND empty planting sites
  - ▶ Counts all public trees in right-of-ways, parks, golf courses and any municipally owned land

# Methods of Inventorying

- ▶ Windshield Surveys
- ▶ GIS-based Inventories



# Windshield Surveys

- ▶ Only a snap shot in time, provides only static information
- ▶ Generally done with volunteers and forestry staff
- ▶ Typically done on a tally sheet (paper and pencil)
- ▶ Provides limited information
- ▶ Identifies tree species only to genus typically
- ▶ Estimates size of tree
- ▶ Communicates condition of tree
  - ▶ Excellent
  - ▶ Good
  - ▶ Fair
  - ▶ Poor

# Sample Tally Sheet

City: Lexington #1 of 3 Unit: Street Trees MUNICIPAL TREE INVENTORY **SECT 1** Sample #: 100

SPECIES	Species Code	1-8 inches				9-16 inches				17-24 inches				25-32 inches			
		Exc	Good	Fair	Poor	Exc	Good	Fair	Poor	Exc	Good	Fair	Poor	Exc	Good	Fair	Poor
S. Maple	406	0	3	8	2	3	18	36	5	1	17	23	3	0	14	15	3
S. Elm	404	0	2	2	2	0	2	47	14	0	8	20	0	15	43	18	
Hackberry	107	1	1	0	0	12	14	5	2	13	17	2	1	3	3	6	0
Honeylocust	214	3	9	5	0	3	11	3	1	19	11	2	1	5	0	0	
A. Linden	111	0	0	0	0	2	6	1	0	6	1	2	0	1	1	0	
G. Ash	203	8	7	8	3	7	23	11	2	1	15	8	1	1	1	0	
B. Spruce	126	12	1	0	0	15	10	4	0	0	9	2	0	1	0	0	
N. Maple	116	10	3	0	0	10	7	1	1	4	2	0	0	0	0	0	
Mulberry	407	0	0	0	0	0	0	6	1	0	1	3	0	0	2	4	2
B. Walnut	229	1	1	0	1	7	7	3	0	0	3	1	0	0	0	0	
A. Pine	223	0	1	1	1	2	4	1	1	0	0	0	0	0	0	0	
Crab/Maple	209	2	3	0	0	5	5	13	4	0	1	2	0	0	0	0	
Misc. Fruit	309	6	3	2	6	0	9	3	1	0	1	0	1	0	0	1	0
Jumper	215	4	0	0	0	0	3	0	0	0	0	0	0	0	0	0	
<del>Banyan/Spice</del>																	
Catalpa	305	0	2	1	0	2	3	0	0	4	5	1	1	0	1	1	0
Cedar	301	2	9	5	0	0	30	28	1	0	8	1	0	0	3	0	0
Am Elm	308	0	0	0	0	0	9	7	3	10	10	4	1	12	6	1	1

# GIS-Based Inventory

- ▶ Living document that can always be changing, can be kept up to date
- ▶ Locations of trees can be very specific, GPS coordinates
- ▶ Provides mapping to quickly locate specific trees
- ▶ Can capture lots of information that can be uploaded to tree benefit/valuation software such as iTree
- ▶ Can produce work orders from information
- ▶ Can be utilized with community disaster readiness plans/emergency management plans
- ▶ Calculates community tree stocking rates, can identify locations for planting



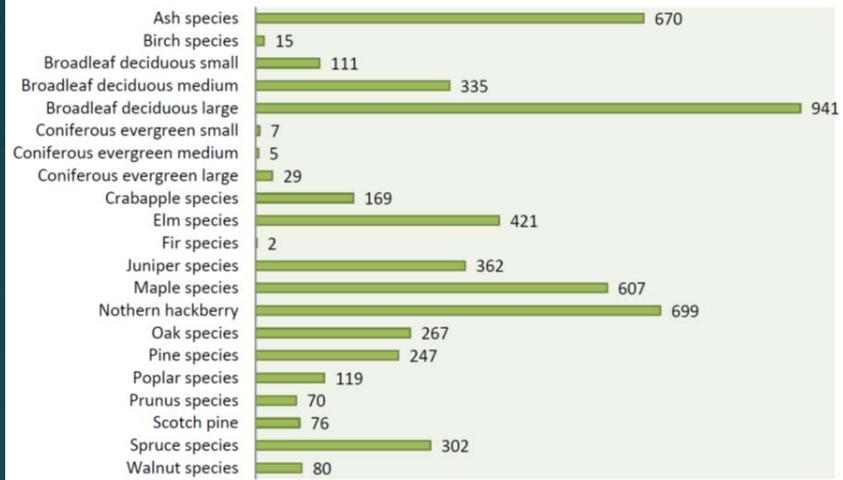
# myTreeKeeper

- ▶ <http://www.davey.com/natural-resource-consulting/urban-forestry-consulting/urban-forestry-management-software/>

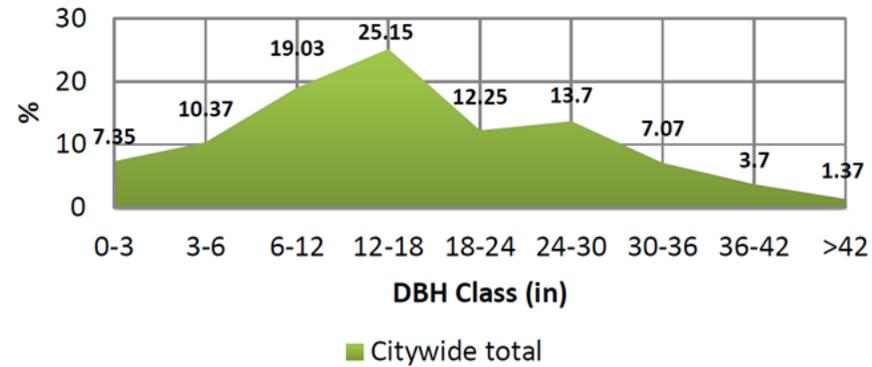
# i-Tree

▶ <https://www.itreetools.org/>

## Inventoried Trees

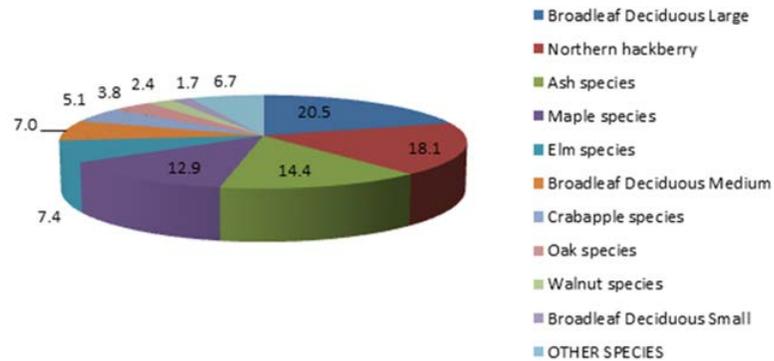


## Relative Age Distribution



## Species Distribution of Public Trees (%)

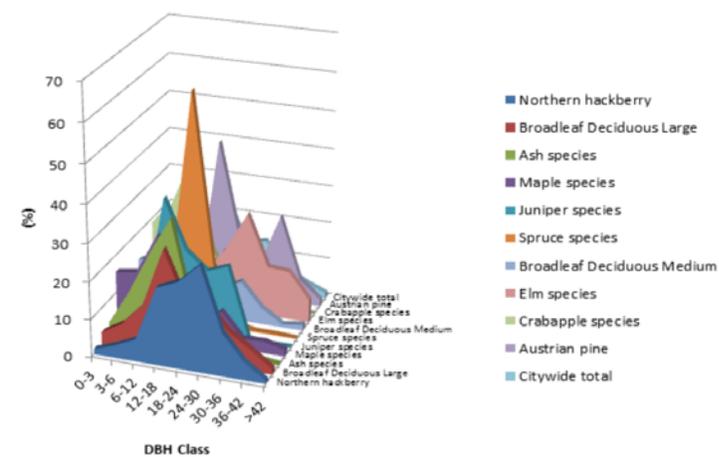
10/18/2012



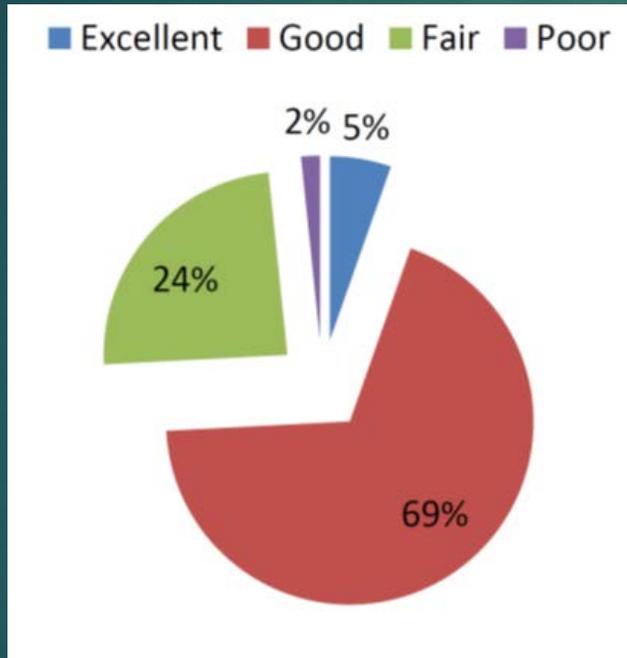
## North Platte

### Relative Age Distribution of Top 10 Public Tree Species (%)

10/22/2012



Tree Condition Classifications	
Excellent	Healthy, vigorous tree. No apparent signs of insect, disease, or mechanical injury. Little or no corrective work required. Form representative of species.
Good	Average condition and vigor for area. May be in need of some corrective pruning or repair. May lack desirable form characteristics of species.
Fair	General state of decline. May show severe insect, disease, or mechanical damage, but death not imminent. May require major repair in renovation.
Poor	No chance of correcting a declining condition, death imminent.



## Stocking Rate Math

3,240 inventoried street trees divided by 165.29 street miles = 19.6 trees/street mile

19.6 trees/street mile divided by 200 trees/street mile = 9.8% stocked  
(Actual) (Preferred)

200 trees/street mile X 142.92 street miles = 33058 trees if fully stocked

## Identifying Planting Vacancies

1. Look into community ordinances involving tree planting near streets
2. Visit planting site in question
3. Look for overhead power lines and surface obstacles (mailboxes, fire hydrants, etc.)
4. Locate underground obstacles (water lines, power lines, etc.)
5. If no issues found, identify proper tree species for the site



# EAB Readiness Planning

AMY SEILER

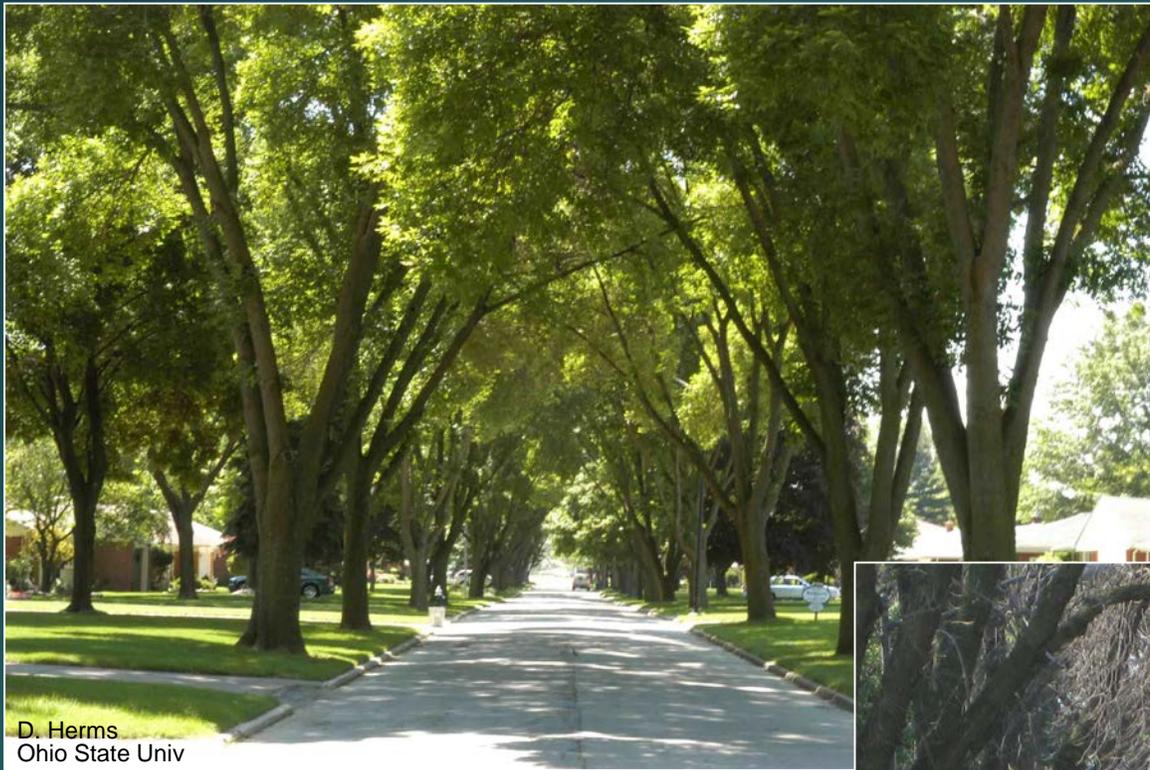
WESTERN COMMUNITY FORESTRY SPECIALIST

NEBRASKA FOREST SERVICE

# Emerald ash borer (EAB)

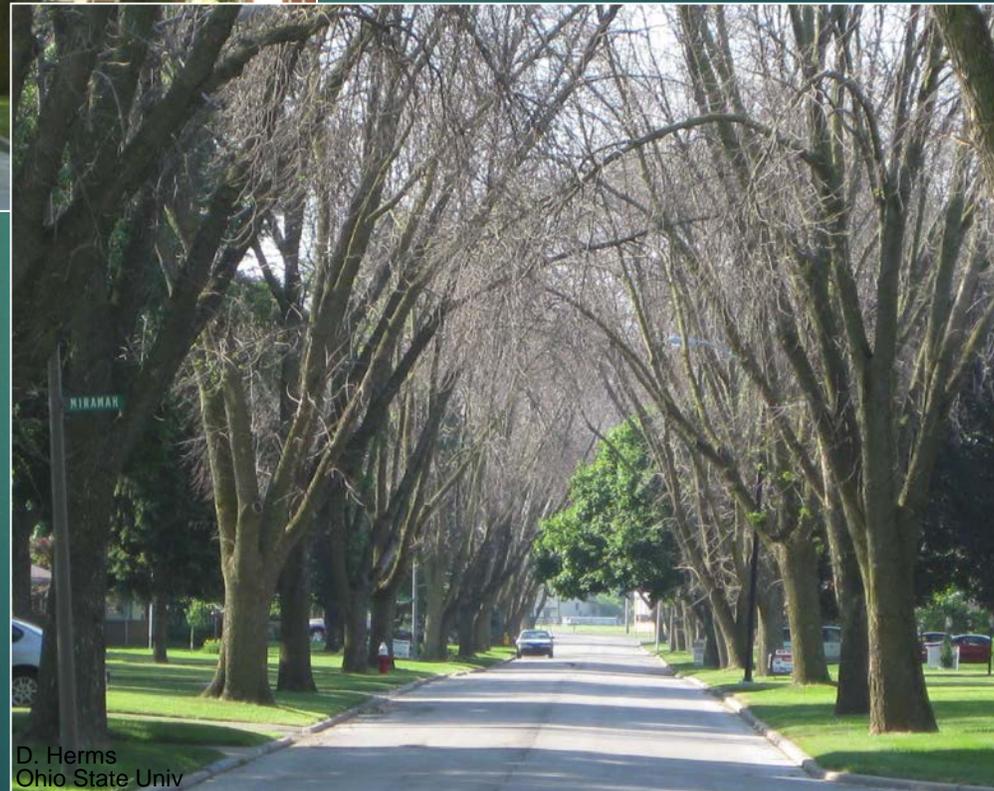


# EAB: aggressive tree killer



Ash-lined street

3 years later



# Host: Ash (*Fraxinus* spp.)

Green

*Marshall's Seedless*  
*Patmore*

White

*Autumn Purple*

Black

Blue



# Emerald Ash Borer Detections



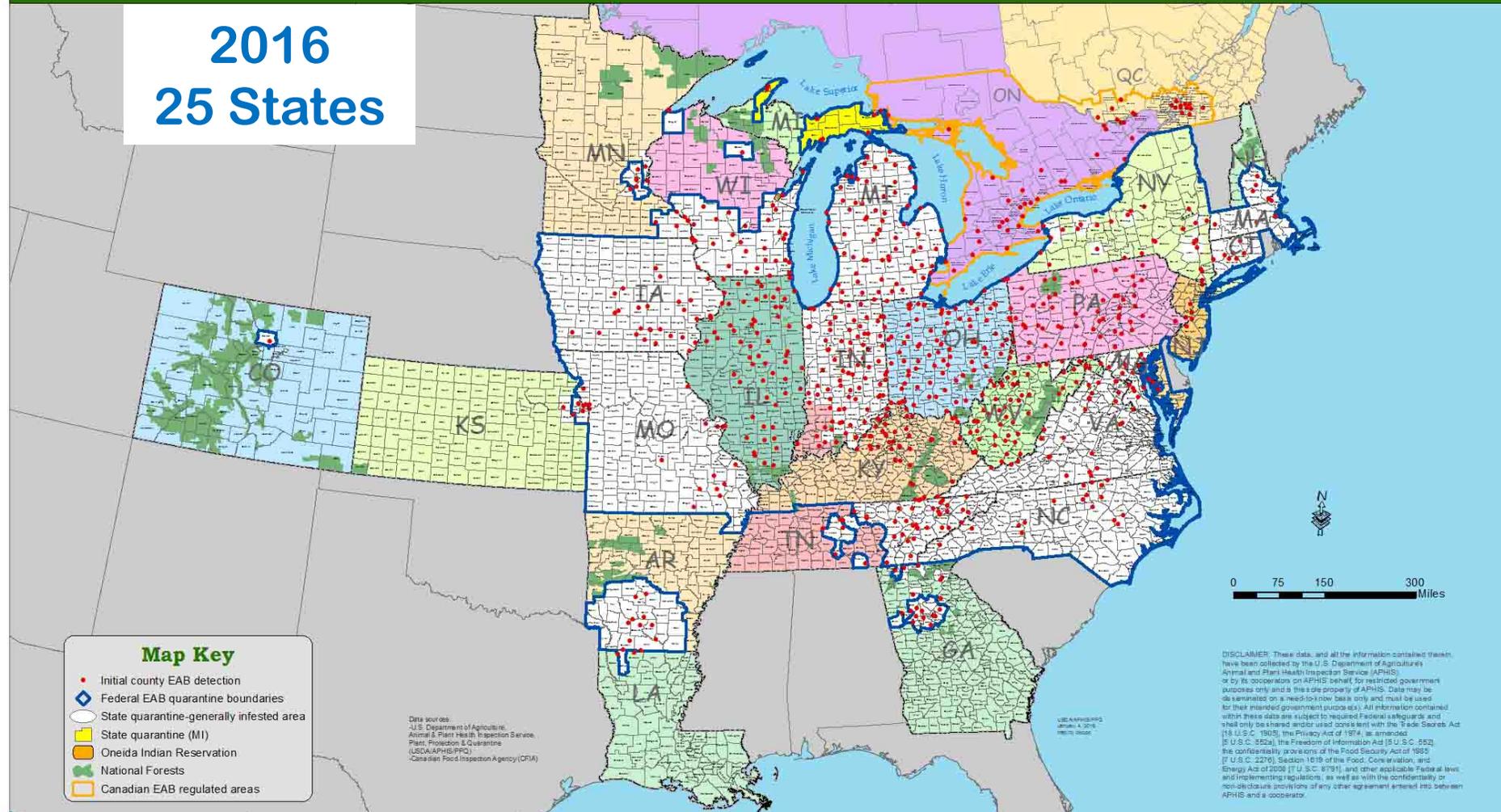
United States  
Department of  
Agriculture

## Cooperative Emerald Ash Borer Project

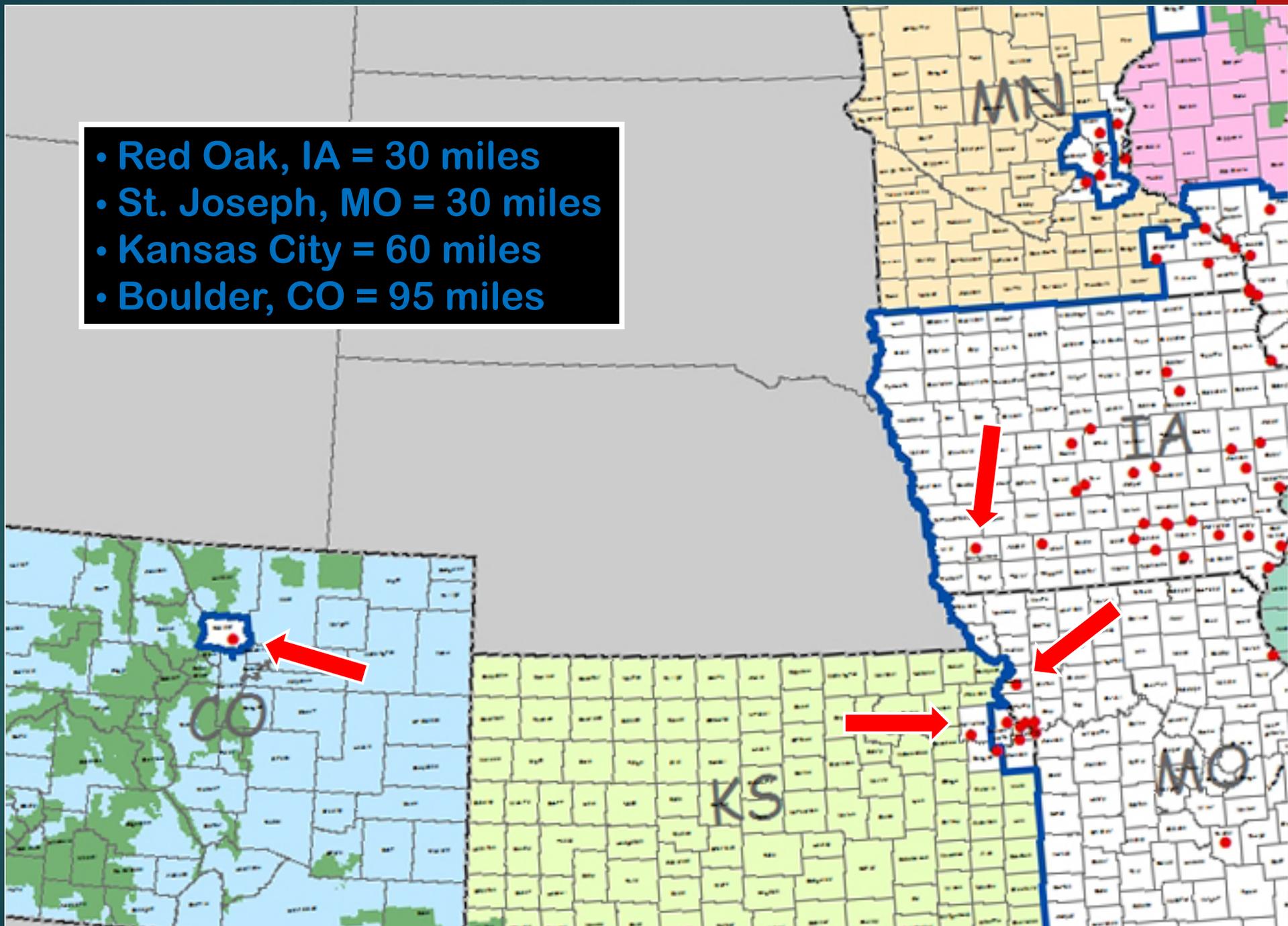
Initial county EAB detections in North America

January 4, 2016

2016  
25 States



- Red Oak, IA = 30 miles
- St. Joseph, MO = 30 miles
- Kansas City = 60 miles
- Boulder, CO = 95 miles



# Community Readiness Planning

- Inventory trees
  - ash #s
  - location
  - size
  - condition
- Write a management plan
- Remove marginal trees now
- Plant a diversity of trees
- Public awareness
- Consider treatments

Nebraska Forest Service

## **Emerald Ash Borer:** Readiness Planning for Nebraska Communities

*Is your community ready . . .*



Ash-lined street in 2006, Toledo, Ohio.

*. . . for this?*



Same street three years later—all ash trees dead.

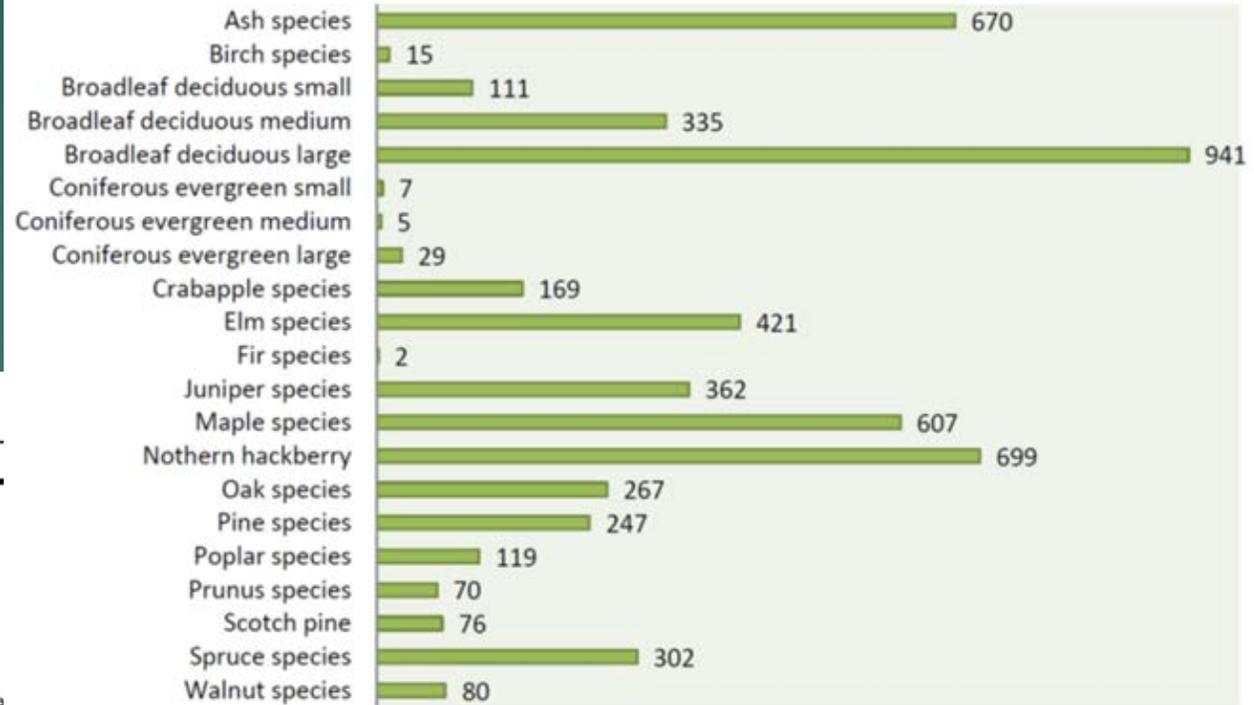
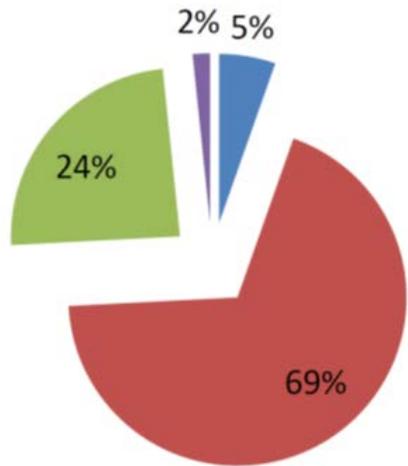
Emerald ash borer (EAB) is a pest of historical significance that will change the face of the landscape in your community. The Nebraska Forest Service can help you prepare!

FH22-2014

UNIVERSITY OF  
**Nebraska**

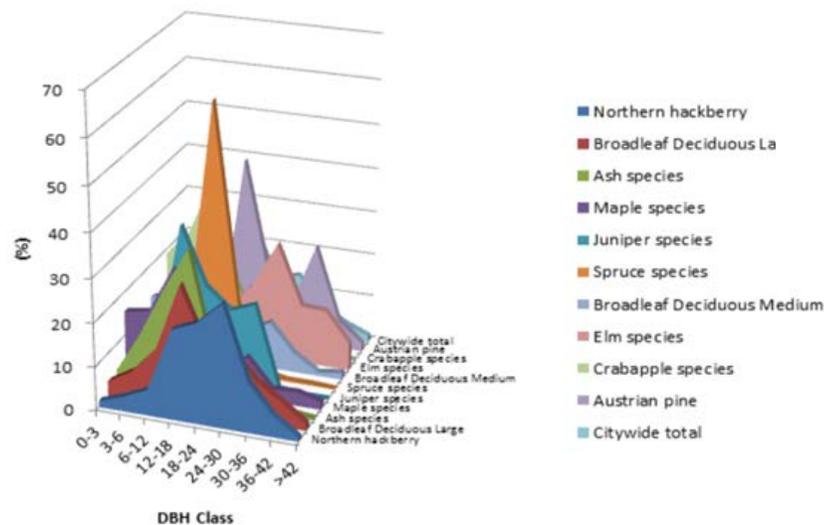
# Inventory

■ Excellent ■ Good ■ Fair ■ Poor



North Platte  
**Relative Age Distribution of Top 10 Public Tree Species (%)**

10/22/2012



Tree Condition Classifications	
Excellent	Healthy, vigorous tree. No apparent signs of insect, disease, or mechanical injury. Little or no corrective work required. Form representative of species.
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Fair	General state of decline. May show severe insect, disease, or mechanical damage, but death not imminent. May require major repair in renovation.
Poor	No chance of correcting a declining condition, death imminent.

# Develop a Preparedness Plan In Advance

- ▶ Removal of Fair and Poor Quality Trees in advance of EAB
- ▶ Determine what trees are to be treated
- ▶ Start planting diverse tree species NOW
- ▶ Begin a public awareness campaign
  - ▶ EAB will affect private property more than public property in the west
  - ▶ Public officials need to be made aware of cost to communities so they can start to budget accordingly

# Treatment

- ▶ Identify high-value ash trees and create a plan for protection
- ▶ Determine if you will treat some trees to slow the progression of tree death in communities

# Treatments: A Balancing Act

## Protect trees from EAB:

- Aggressive tree killer
- Valuable trees
- Early detection difficult

## Treatment Drawbacks:

- Required for lifespan
- Damage to trees
- Environmental effects
- Human exposure
- Monetary cost

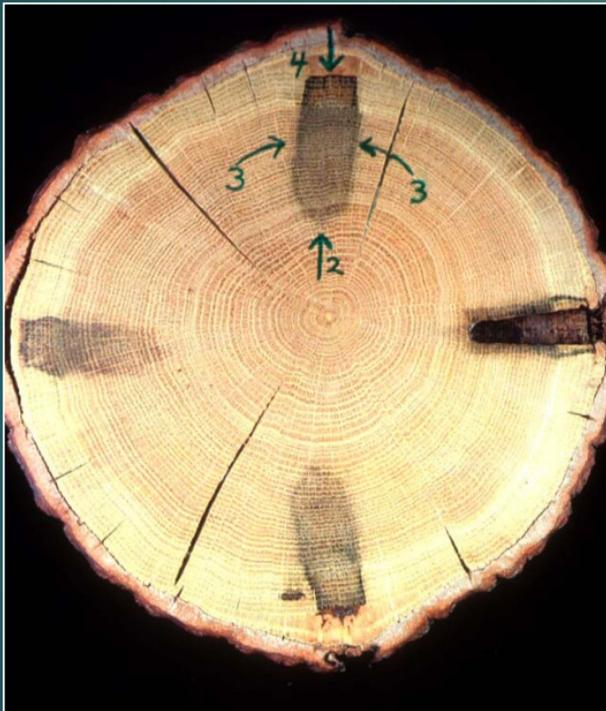




# Damage to Trees

All trunk injections cause damage:

- Holes made in trunk
- Chemical itself



# Be selective when deciding which trees to treat (if any)



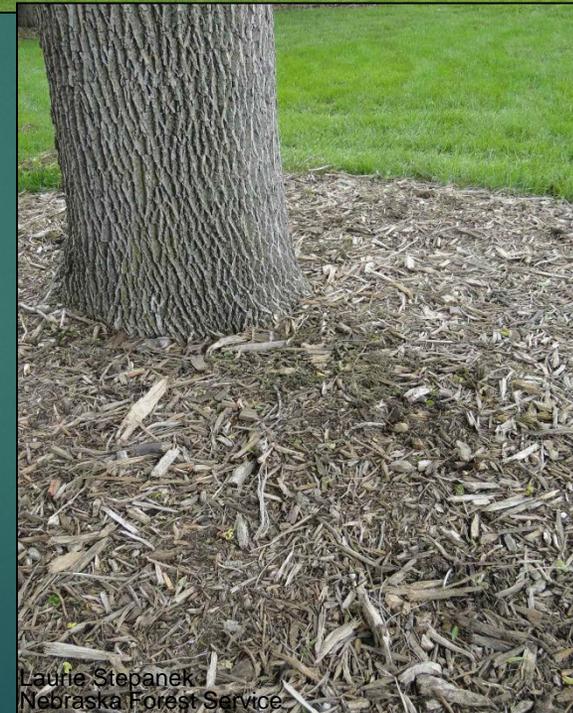
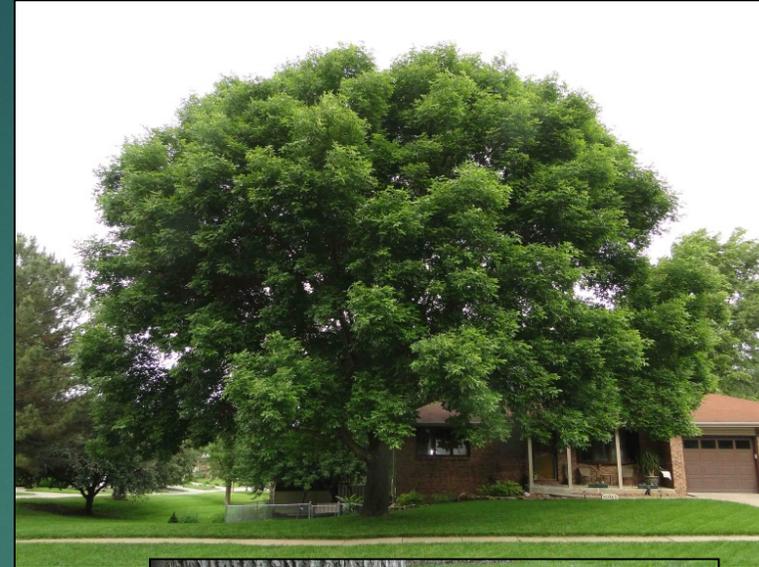
Laurie Stepanek  
Nebraska Forest Service



Laurie Stepanek  
Nebraska Forest Service

# Good Candidates for Treatment

- ✓ Within 15 miles of EAB
- ✓ High value
- ✓ Good location
- ✓ History of proper care:
  - ✓ Watering
  - ✓ Mulch
  - ✓ Protection of root zone



Laura Stepanek  
Nebraska Forest Service

# Good Candidates for Treatment

## Healthy trees:

- ✓ Better handle the damage caused by treatments
- ✓ Respond better to treatments



# Poor Candidates for Treatment

Thin crowns  
Branch dieback



# Poor Candidates for Treatment

Epicormic shoots  
(water sprouts, suckers)



## Poor Candidates for Treatment

Epicormic shoots  
(water sprouts, suckers)



# Poor Candidates for Treatment

Decay conks



## Poor Candidates for Treatment

Hollow stems

Decay

Large pruning cut not sealed



Laurie Stepanek  
Nebraska Forest Service



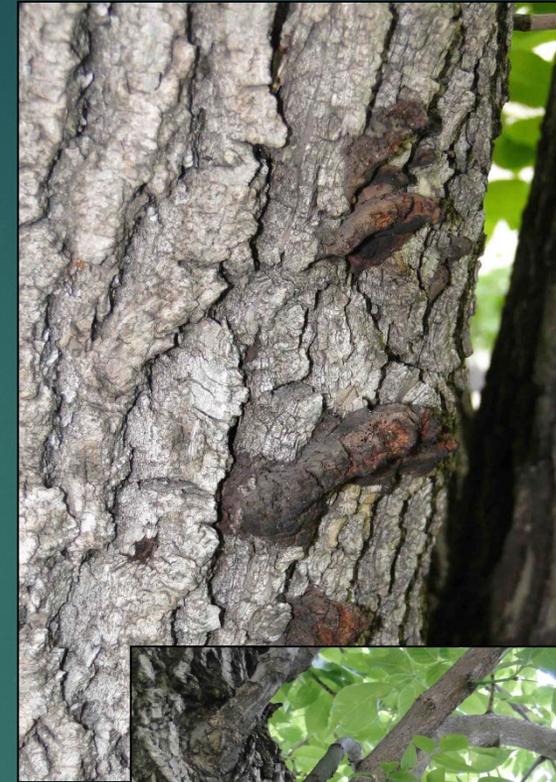
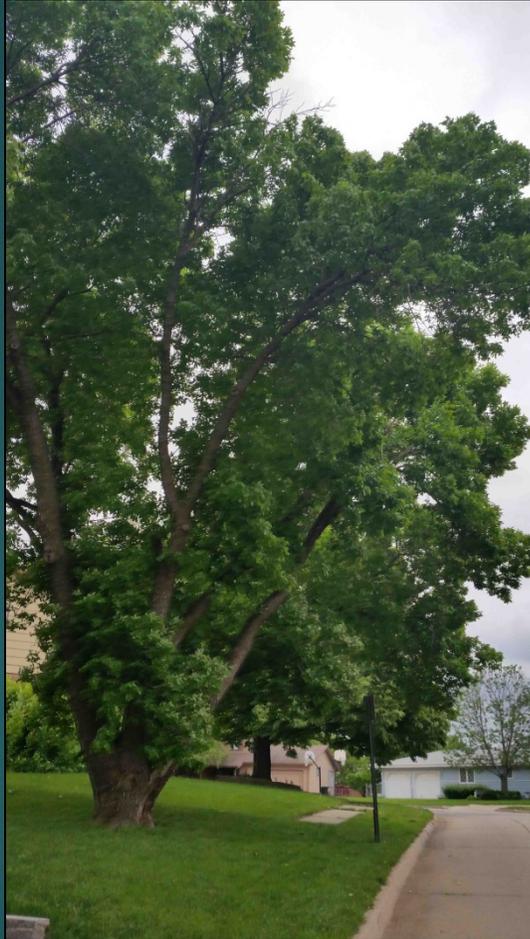
Laurie Stepanek  
Nebraska Forest Service

# Poor Candidates for Treatment

## Other borer activity



# Poor Candidates for Treatment



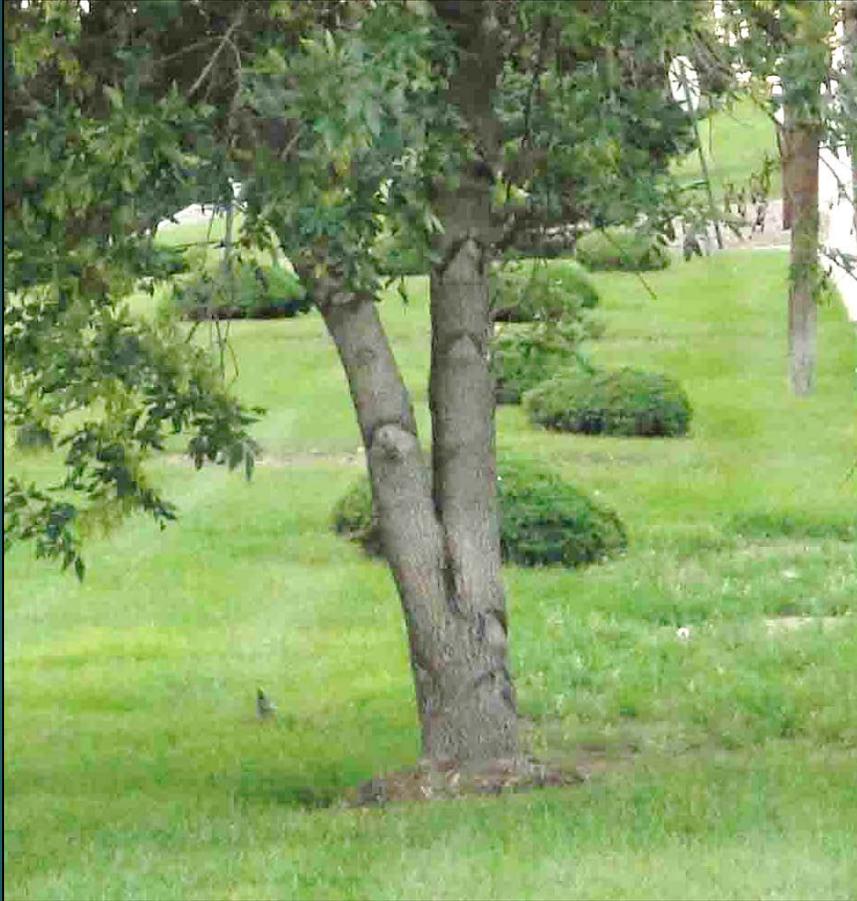
# Poor Candidates for Treatment

“Mower blight”



# Poor Candidates for Treatment

Included bark



## Poor Candidates for Treatment

Too close to sidewalk  
Overhead wires



# Poor Candidates for Treatment

Small tree



## Identify Marshalling Yards



## Removing Trees and Processing Woody Debris

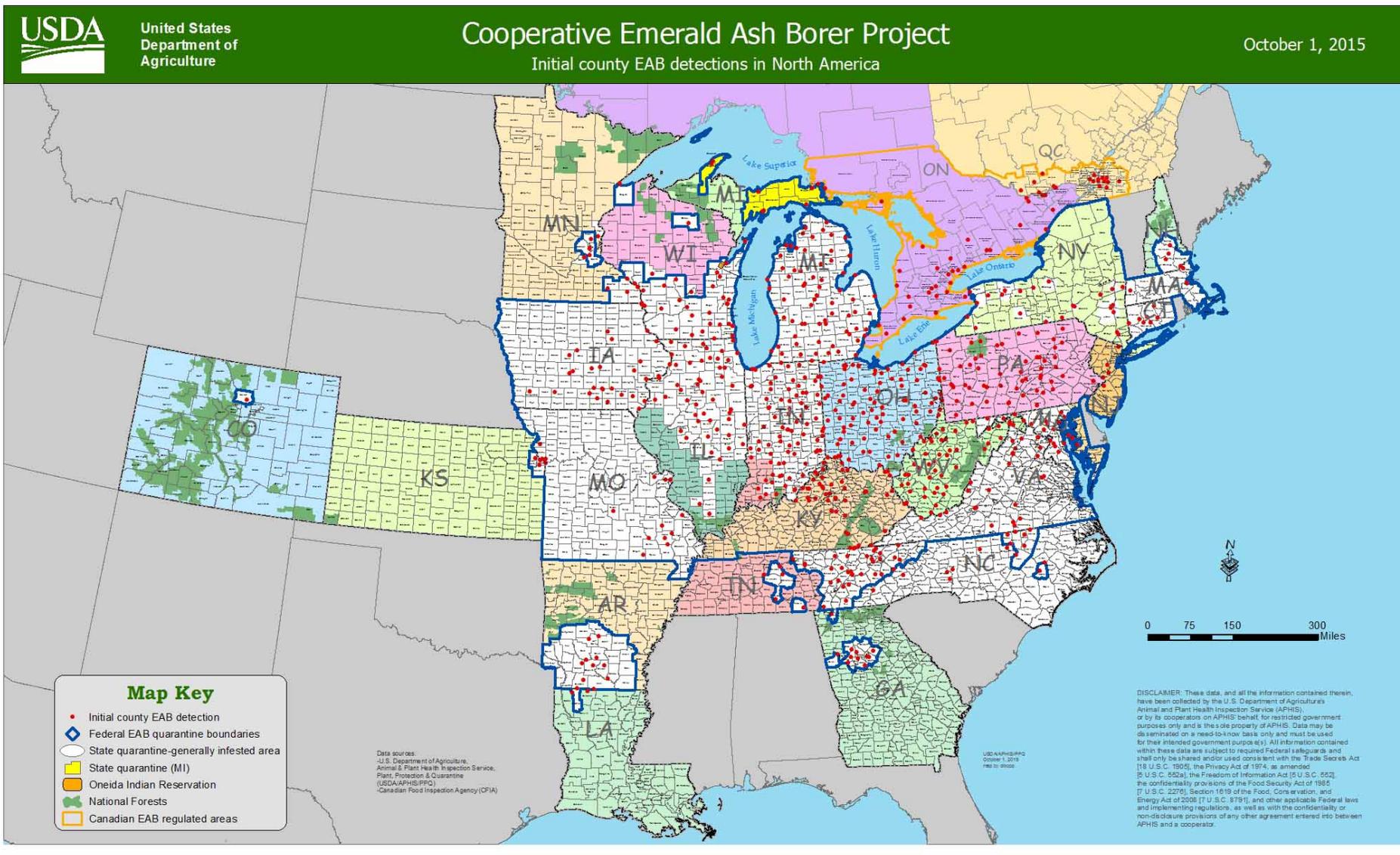


# Best times to remove infested trees: Fall, Winter, Early Spring



Dropping trees when adults are active (late spring to summer) causes adults to fly to new areas

# Quarantine area: the area from which regulated articles cannot move without certification



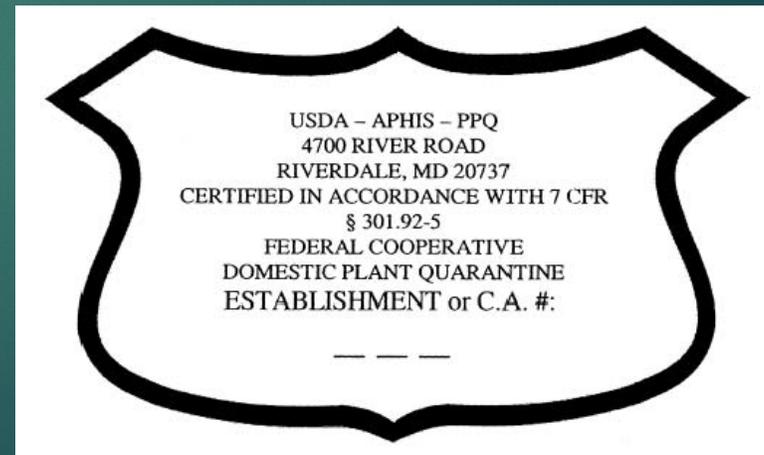
## Quarantined items:

- All life stages of EAB
- Ash nursery stock
- Ash limbs, branches, logs, lumber, chips, stumps, debris, etc.
- Firewood of all hardwood species
- Any other article presenting a risk of spreading EAB



# Compliance Agreement

- Legal document that describes requirements for handling regulated articles to prevent spread
- Federal (USDA) and State (Neb Dept of Ag)
- Regulatory official works with you to access your situation and provide necessary training
- Periodic inspections



# Compliance Agreement

Ash logs & lumber and all hardwood firewood

- heat treat to 60° C for 60 minutes
- 100% bark free + 1/2 inch wood
- kiln sterilization
- methyl bromide

# Compliance Agreement

Hardwood chips and mulch: Max: 1 x 1 inch

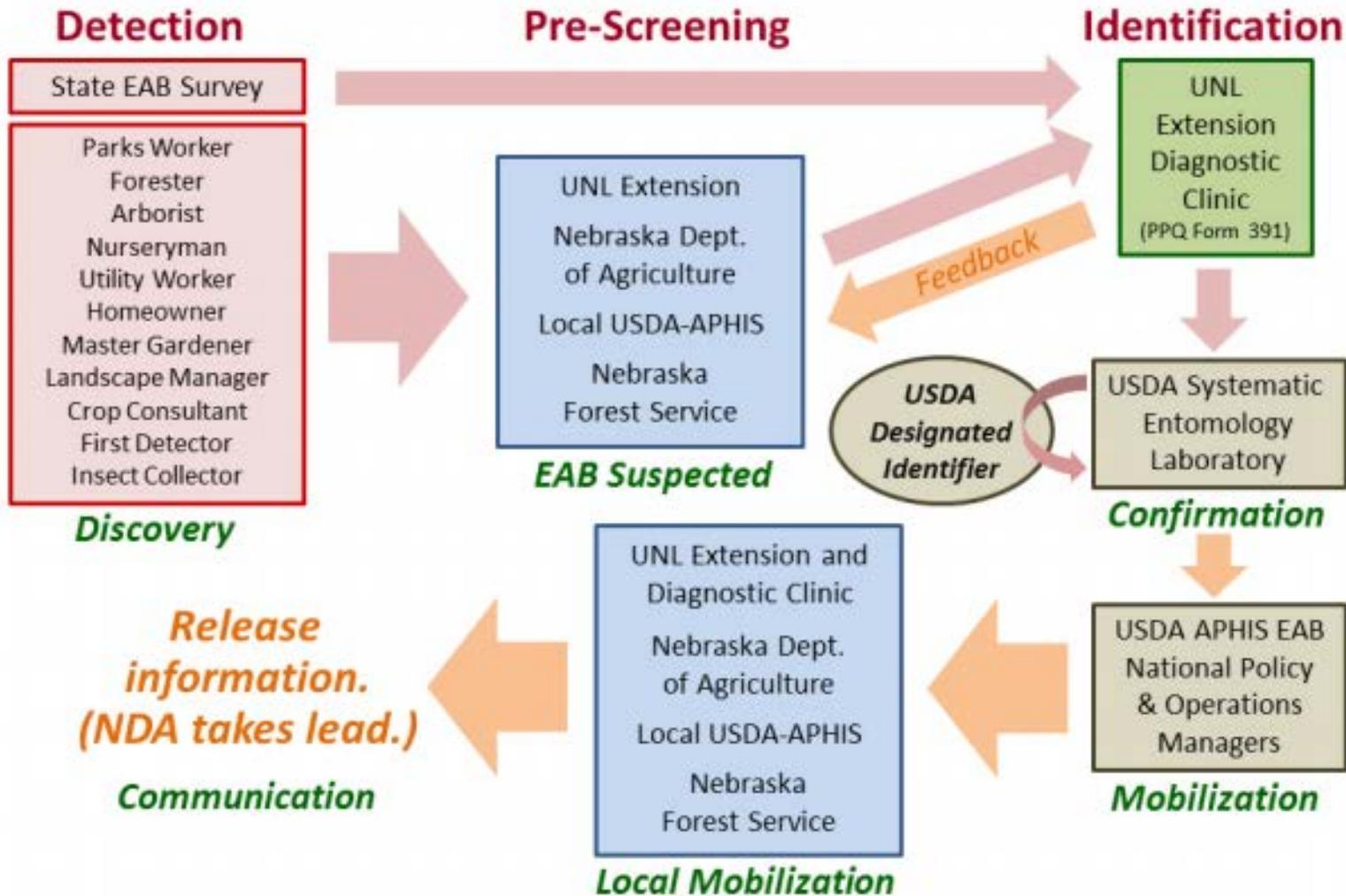
Ash nursery stock: No certification available

Neb Dept of Ag: 402-471-2351

USDA APHIS PPQ:

# Emerald Ash Borer Specimen: Chain of Custody and Communications

*Always maintain confidentiality until diagnosis has been officially confirmed.*



# Develop a Diverse City Tree List



# Public Awareness



### Emerald Ash Borer Look-Alikes

All insects are at the same scale.

There are many bright metallic-green insects in Nebraska, but the emerald ash borer beetle is only a half-inch long and strictly associated with ash trees.

Produced as a cooperative effort by University of Nebraska-Lincoln Extension, Nebraska Department of Agriculture, Nebraska Forest Service, and USDA-APHIS.

University of Nebraska-Lincoln Extension educational programs abide with the non-discrimination policies of the University of Nebraska-Lincoln and the United States Department of Agriculture.

Questions???



Special thank you to Laurie  
Stepanek for use of slides

# Planting with a Purpose

GRAHAM HERBST

NEBRASKA FOREST SERVICE



# Site# 1



# Site# 2



# Site# 3



# Site# 4

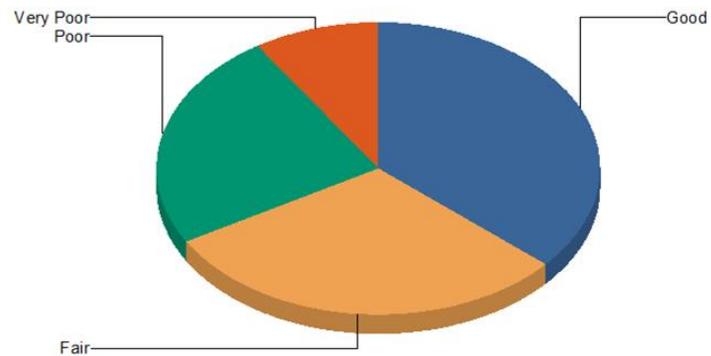


# Site# 5



## 144th Street

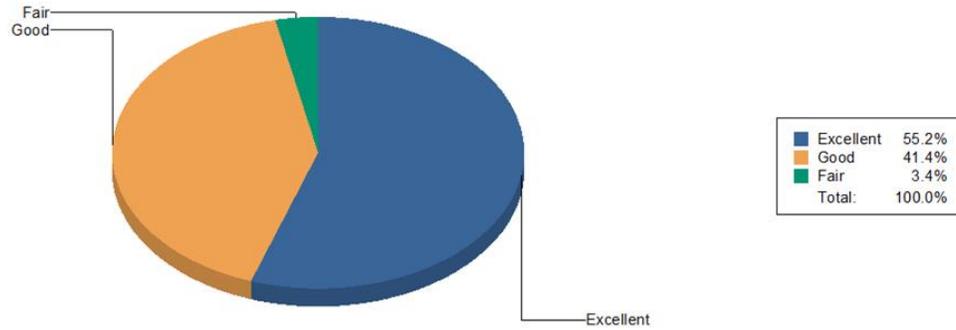
- Very high pH in median and shoulder; good in exterior ROW
- Low soil fertility
- Good species selection known for drought and salt tolerance
- Moderate to high compaction levels
- Adequate soil volume, salt levels
- Mower blight on 60% of median trees





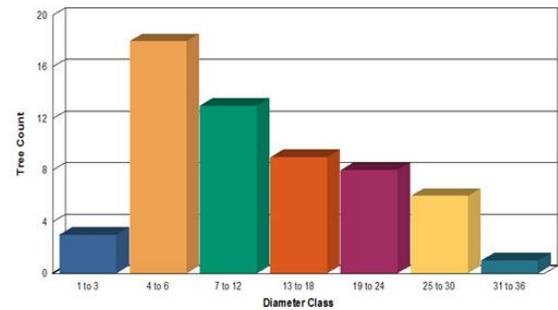
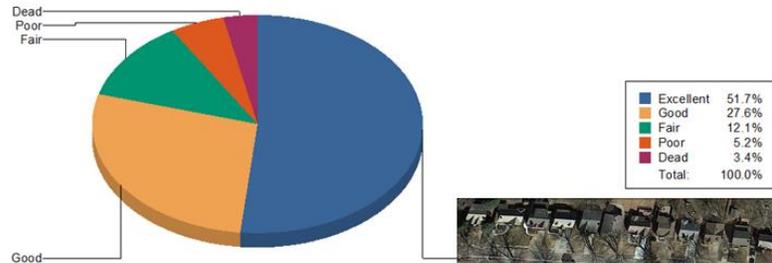
## Dodge st Median

- ~10 year old planting
- Amended soil; good fertility
- Mulched in association with perennials and **irrigated**
- Good species selection with honeylocust



# Happy Hollow Boulevard

- All trees; turf, no mulch, good soil volume
- 39% mower blight
- 17% deep planting
- Good age and species diversity
- Good soil organic matter, pH, and compaction
- 51% excellent condition



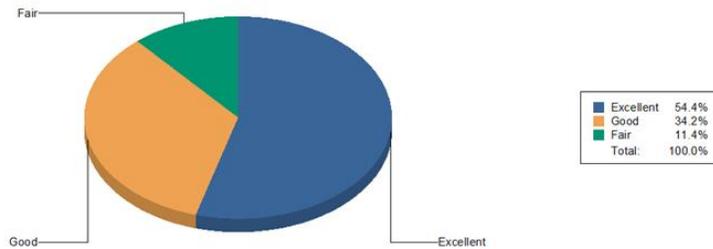
## Riverfront Drive

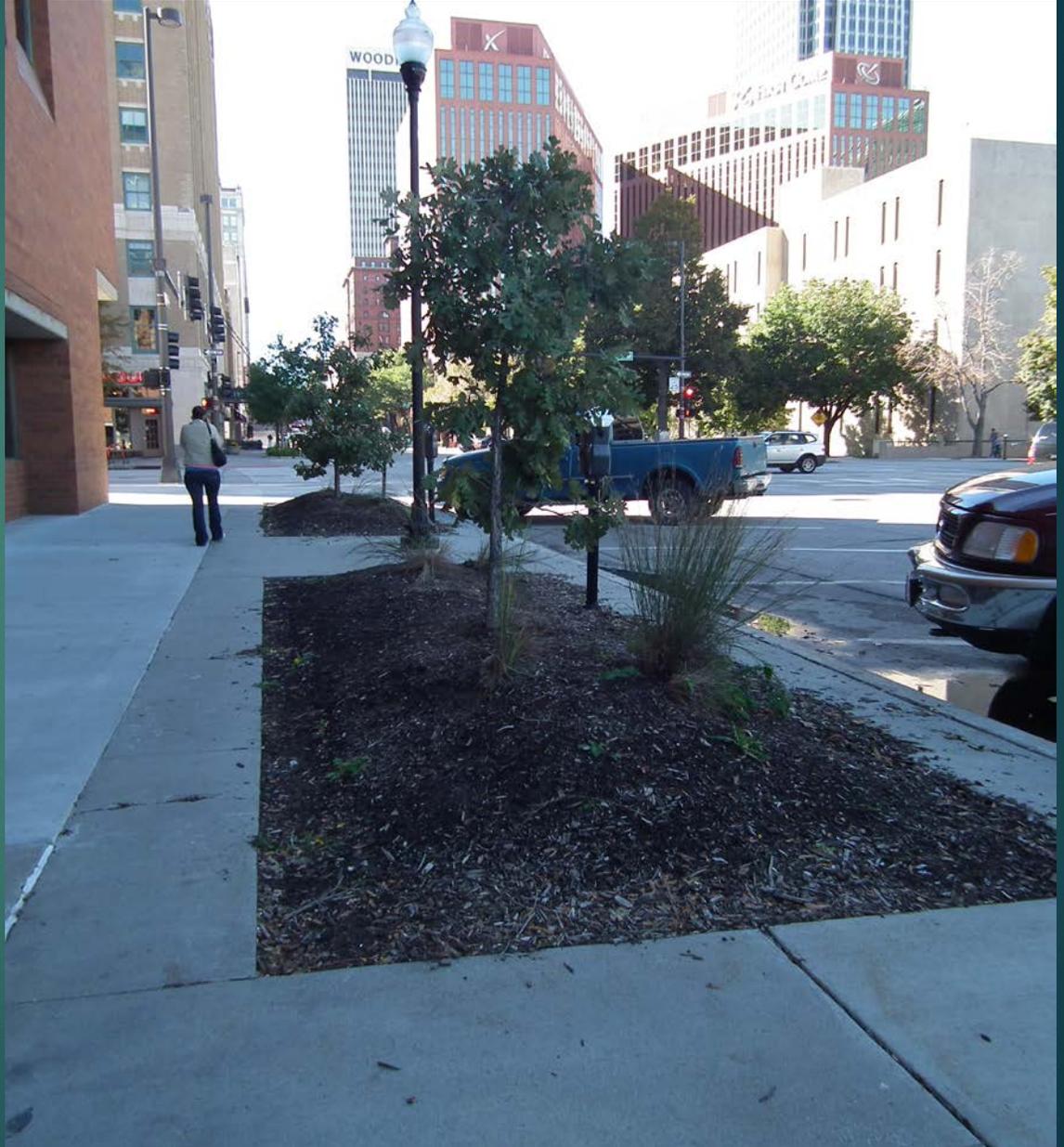
- Small diameter one-time mulch application
- Associated with irrigated turf; spray heads
- Over 70% planted deep
- Nearly 40% mower blight
- 55% of trees fair, poor or dead
- Extensive hail damage contributed to decline of thin-barked trees (maple)
- Good performance by oak species



## Downtown

- Good soil pH, high fertility
- Adequate soil volume after concrete cuts (over 25 sq ft)
- All trees mulched, some with perennial companion plantings
- 19% deep planting, NO mower blight
- Chinkapin oak, swamp white oak and hybrid elms all performing very well.

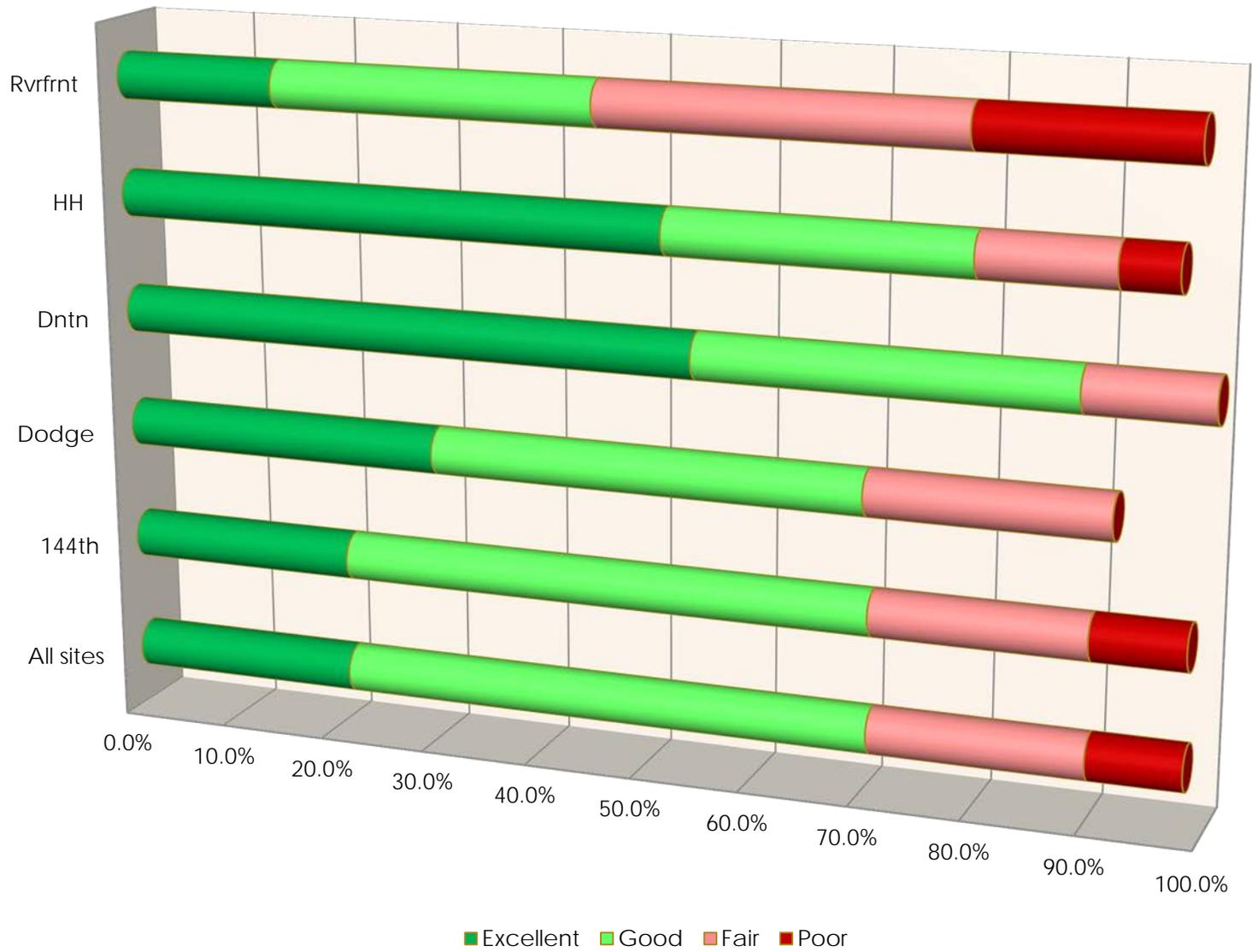




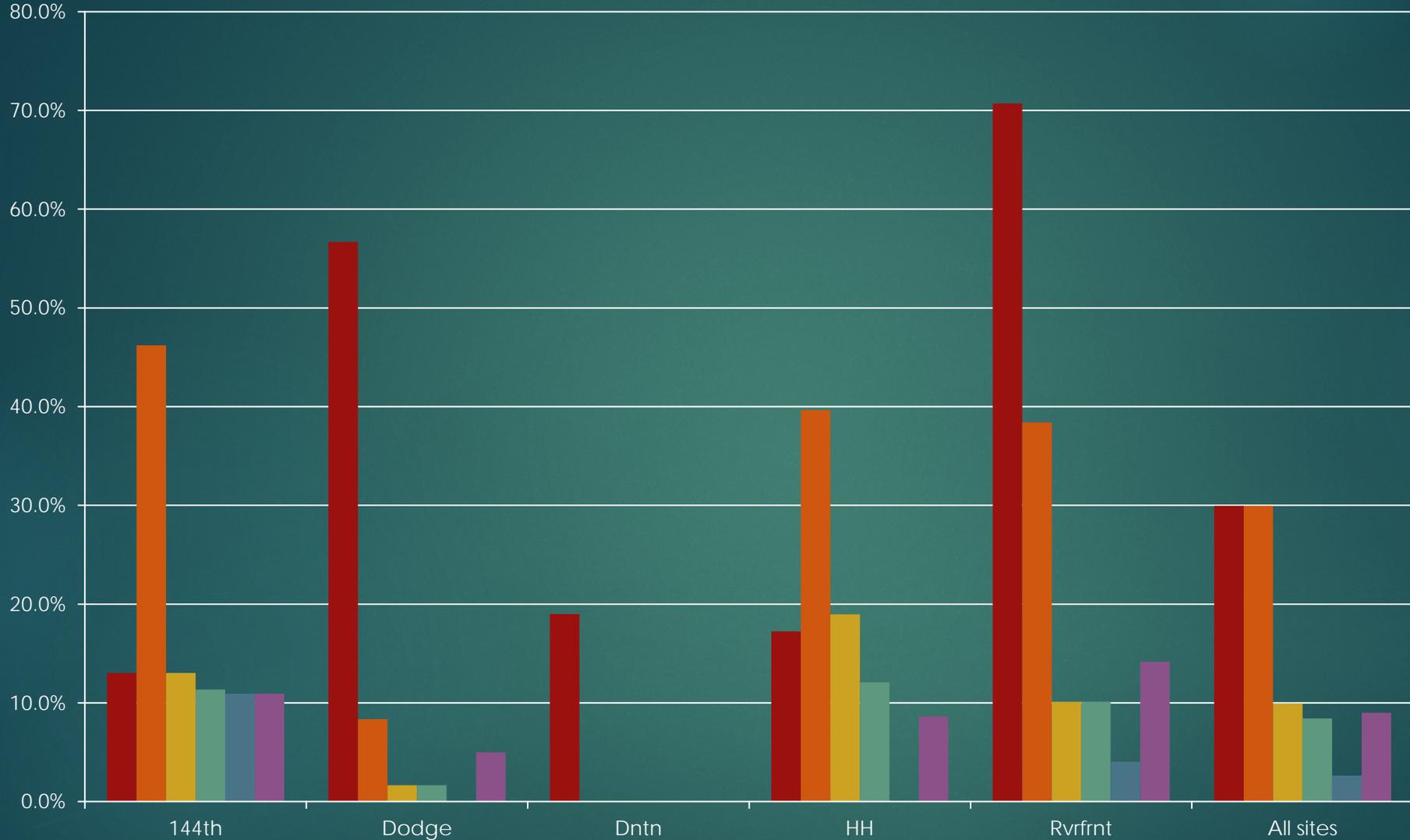
# Site Attribute Summary

	Soil	Water	Management	Groundcover	Grouping
<b>Site 1</b>					
Median	Negative	Negative	Negative	Negative	Negative
ROW	Negative	Negative	Negative	Negative	Positive
ExROW	Negative	Negative	Negative	Negative	Positive
<b>Site 2</b>					
ROW	Positive	Negative	Negative	Negative	Positive
ExROW	Positive	Negative	Negative	Negative	Positive
<b>Site 3</b>					
Median	Positive	Positive	Positive	Positive	Negative
<b>Site 4</b>					
ROW	Negative	Negative	Negative	Negative	Negative
<b>Site 5</b>					
ROW	Positive	Positive	Positive	Positive	Negative

# Site Condition Summary



# Site Defect Summary



- Deep planting
- Total Mech Dmg
- MD 10%
- MD 20%
- MD 30%
- MD +30%

## Soil quality and management:

Reduction of compaction through deep chiseling and addition of organic material (compost and annual hardwood mulch).

Opportunities exist to define criteria and standards of practice as to how best to increase organic level via amendments and cultivation.



# Soil analysis

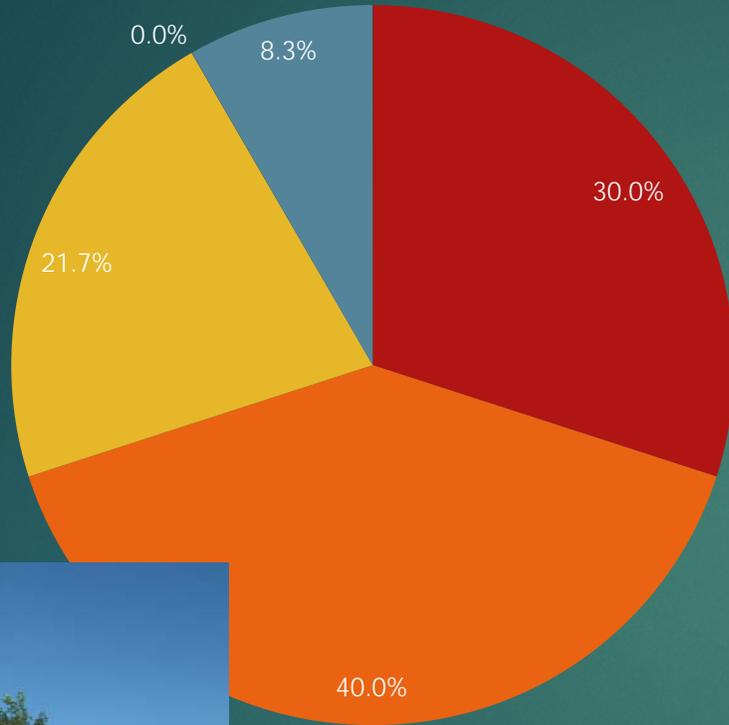
## SOIL ANALYSIS REPORT

INFO SHEET: 23063

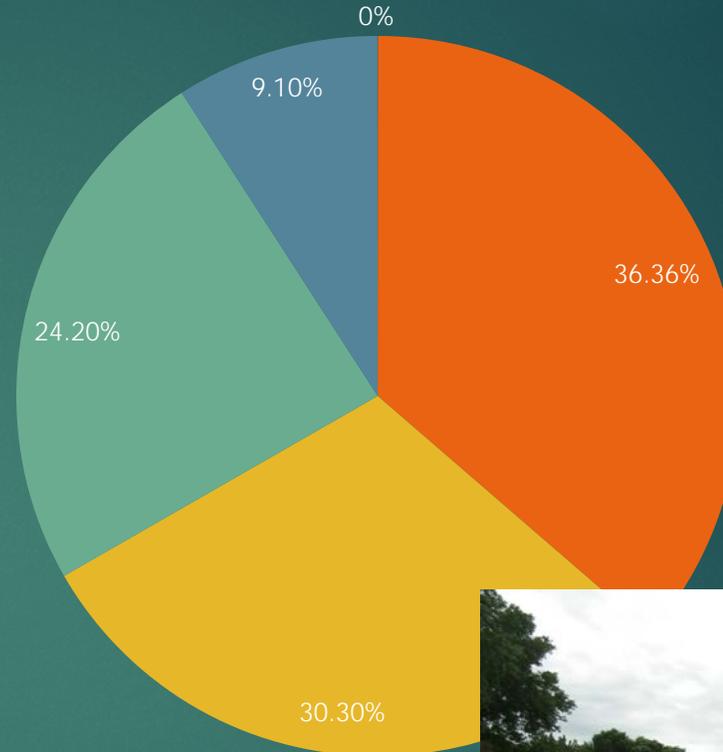
LAB NUMBER	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent RATE	PHOSPHORUS					NEUTRAL AMMONIUM ACETATE EXCHANGEABLE				pH		CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED)					
			P <sub>1</sub> (WEAK BRAY)		P <sub>2</sub> (STRONG BRAY)		OLSEN BICARBONATE P	POTASSIUM K	MAGNESIUM Mg	CALCIUM Ca	SODIUM Na	SOIL pH 1:1	BUFFER INDEX		% K	% Mg	% Ca	% H	% Na	
			ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE	ppm		RATE	ppm	RATE	ppm	RATE	ppm
*255*																				
05685	144TH MED	2.1 L	28 H	103 VH			260 VH	387 VH	3131 H	217 VH	8.3		20.5	3.3	15.7	76.4	0.0	4.6		
05686	DOWNTWN RW	3.1 M	395 VH	396 VH			412 VH	286 VH	1625 H	66 M	7.1		11.9	8.9	20.0	68.7	0.0	2.4		
05687	H HLW EX R	3.5 M	30 H	131 VH			235 VH	513 VH	2329 H	11	7.7		16.6	3.6	25.8	70.3	0.0	0.3		
05688	H HLW ROW	3.8 H	13 L	90 VH	7 L		264 VH	253 VH	2802 VH	25	7.7		16.9	4.0	12.5	82.9	0.0	0.6		
05689	RVR FRT RW	2.4 L	14 L	110 VH	8 L		189 H	333 VH	2728 H	181 VH	8.2		17.7	2.7	15.7	77.2	0.0	4.4		
05690	DODGE MED	6.4 VH	45 VH	107 VH			260 VH	232 H	2978 H	240 VH	8.2		18.5	3.6	10.5	80.3	0.0	5.6		
05691	144 EX ROW	3.3 M	17 M	76 VH	9 L		459 VH	569 VH	2828 H	32	7.3		20.2	5.8	23.5	70.0	0.0	0.7		
05692	144TH ROW	2.8 M	18 M	130 VH	6 L		309 VH	238 H	2346 H	645 VH	8.8		17.3	4.6	11.5	67.7	0.0	16.2		

LAB NUMBER	NITRATE-N (FIA)									SULFUR S ICAP	ZINC Zn DTPA	MANGANESE Mn DTPA	IRON Fe DTPA	COPPER Cu DTPA	BORON B SORB. DTPA	EXCESS LIME RATE	SOLUBLE SALTS 1:1								
	SURFACE			SUBSOIL 1			SUBSOIL 2										Total lbs/A	ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE
	ppm	lbs/A	depth (h)	ppm	lbs/A	depth (h)	ppm	lbs/A	depth (h)								ppm	RATE	ppm	RATE	ppm	RATE	ppm	RATE	mmhos/cm
*255*																									
05685	1	2	0-6							2							L	0.3	L						
05686	21	38	0-6							38							L	0.3	L						
05687	7	13	0-6							13							L	0.3	L						
05688	3	5	0-6							5							L	0.3	L						
05689	1	2	0-6							2							L	0.6	L						
05690	6	11	0-6							11							L	0.5	L						
05691	4	7	0-6							7							L	0.3	L						
05692	12	22	0-6							22							L	0.8	L						

# Dodge Street Median Condition



# 144th Street Median Condition



- Excellent
- Good
- Fair
- Poor
- Dead



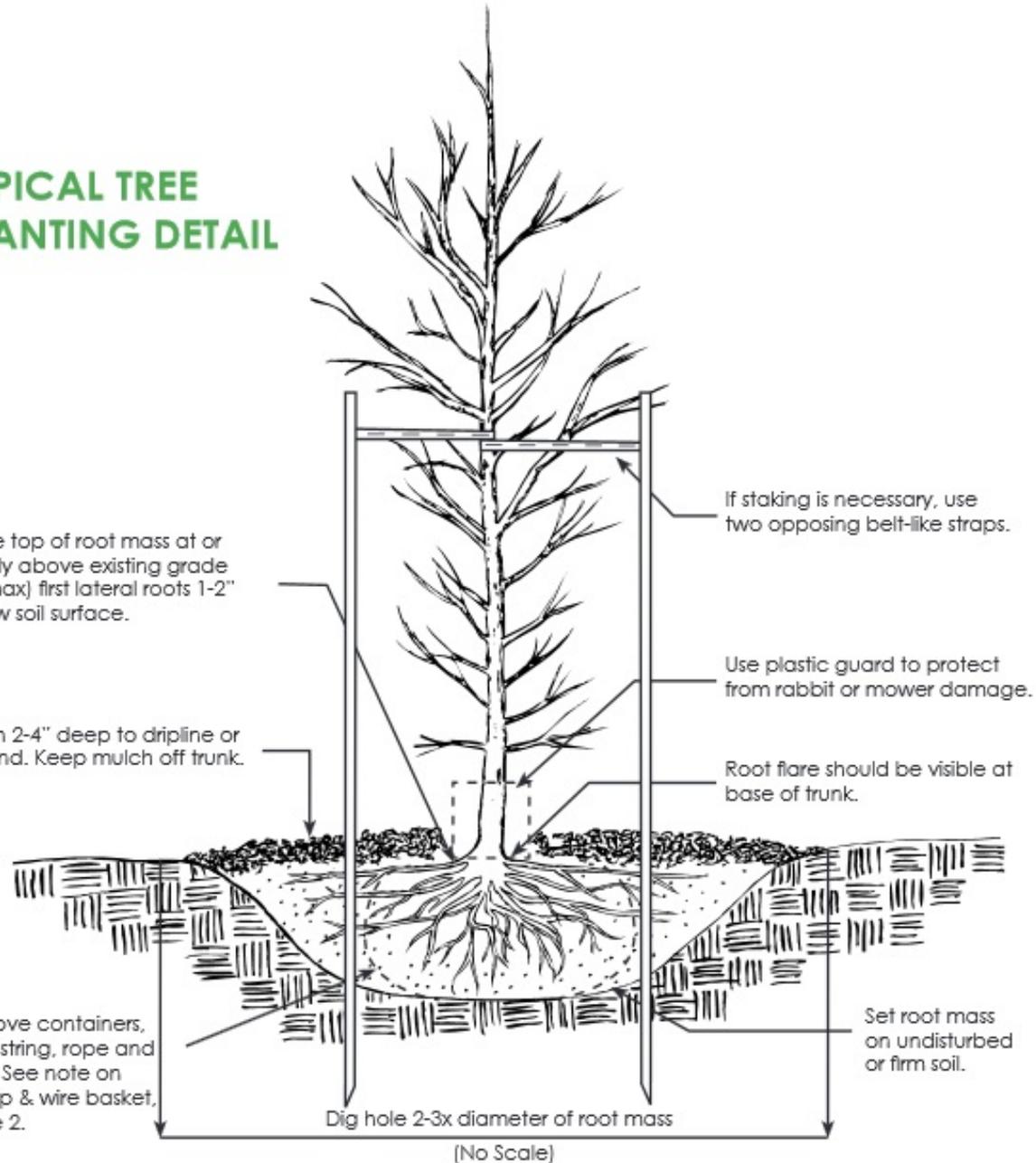
# Planting:

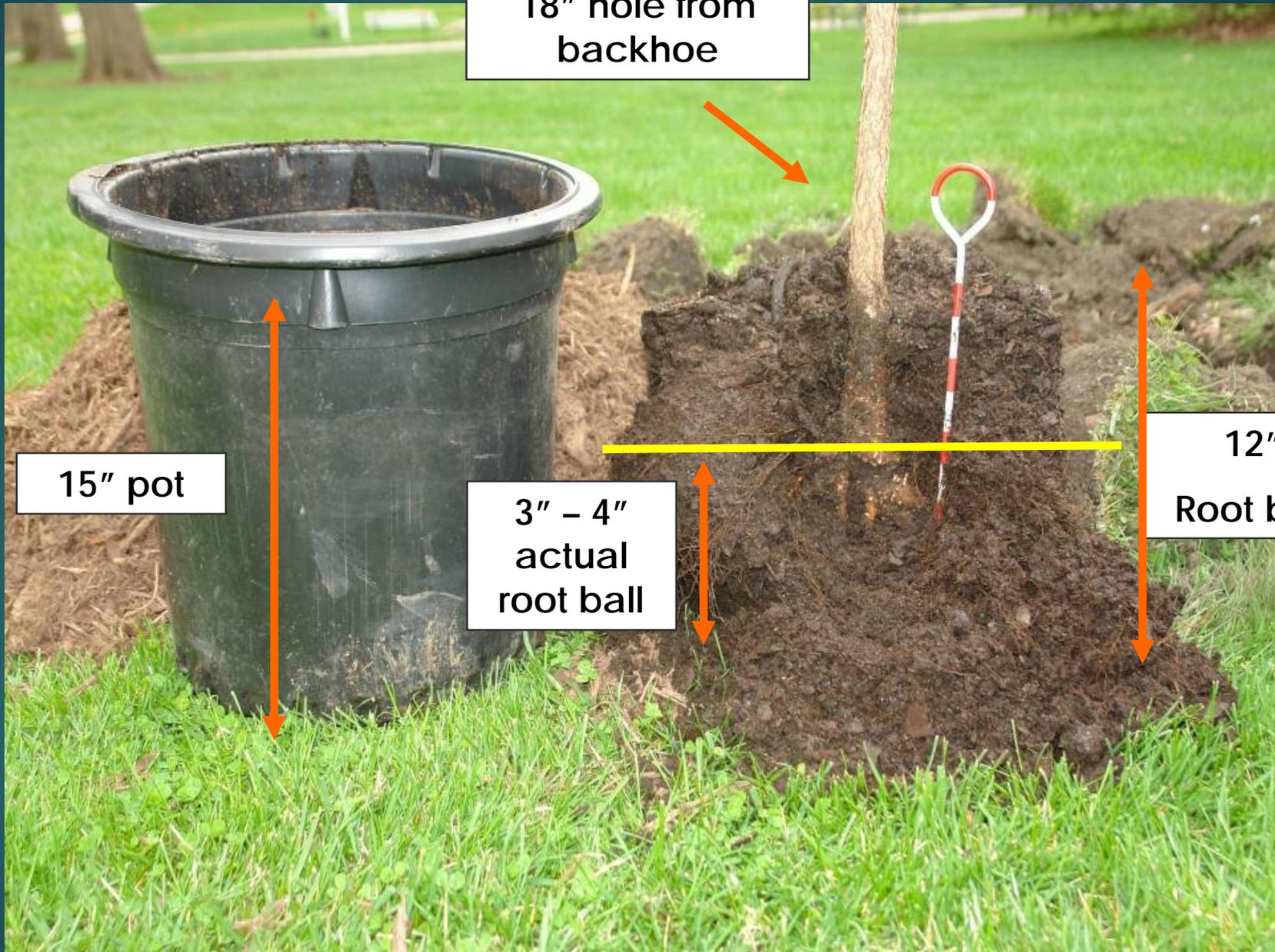
## TYPICAL TREE PLANTING DETAIL

Place top of root mass at or slightly above existing grade (2" max) first lateral roots 1-2" below soil surface.

Mulch 2-4" deep to dripline or beyond. Keep mulch off trunk.

Remove containers, wire, string, rope and tags. See note on burlap & wire basket, page 2.





18" hole from backhoe

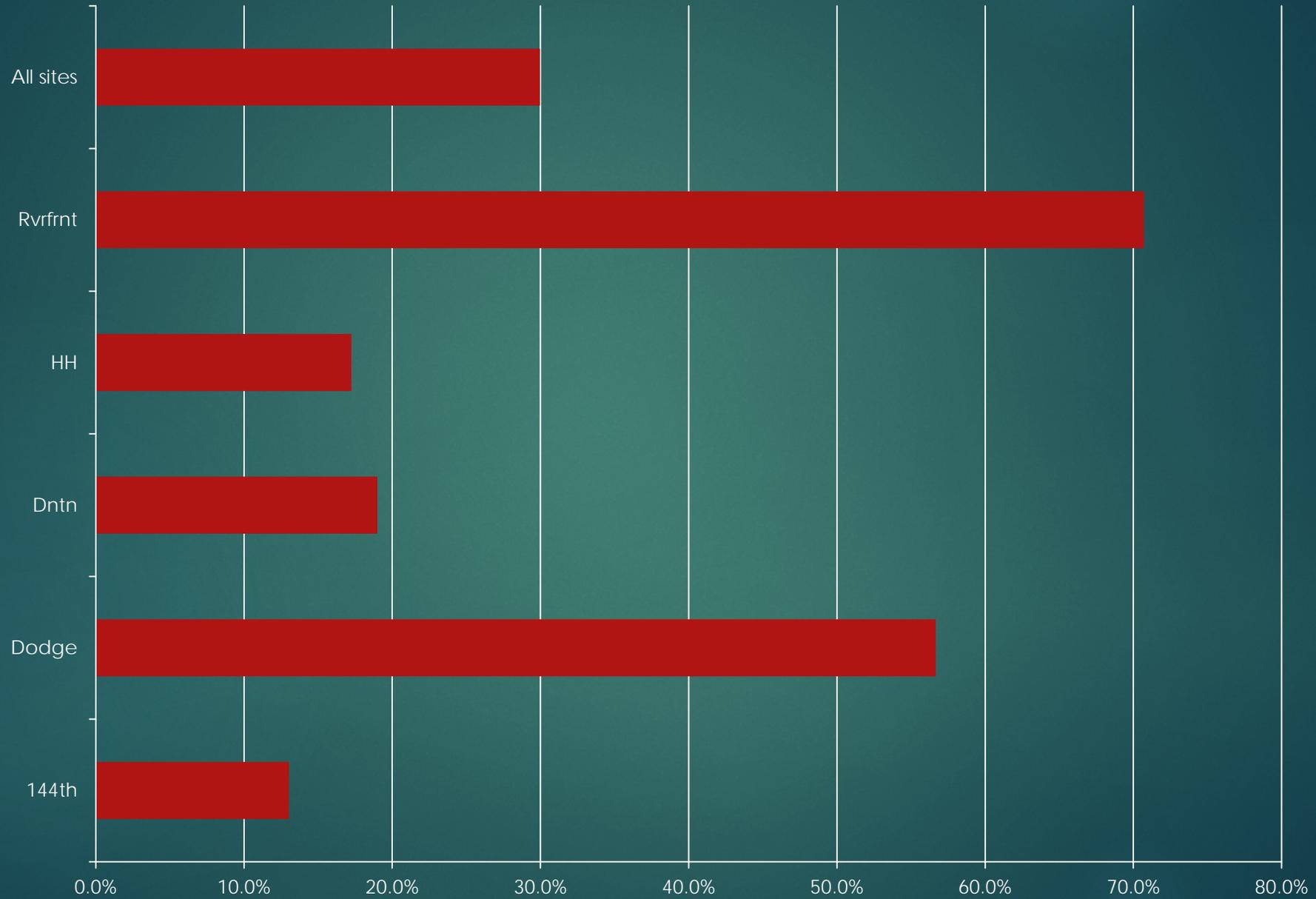
15" pot

3" - 4" actual root ball

12" Root ball



# Deep planting



## Water:

Drip irrigation

Supplemental watering

Gator bags or similar methods.





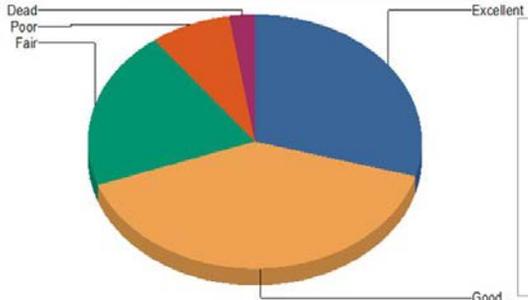
## Cultural impacts:

Mowers and other equipment must be kept from tree planting areas and this is best achieved through a mulching and herbicide program in conjunction with physical barriers and design attributes of turf associates.

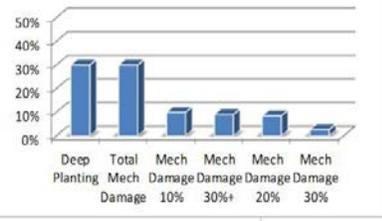


# Site Defects and Street Proximity

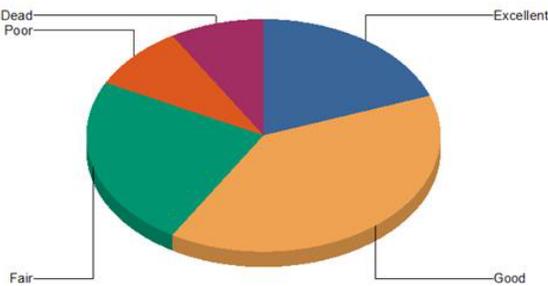
**Condition—All sites**



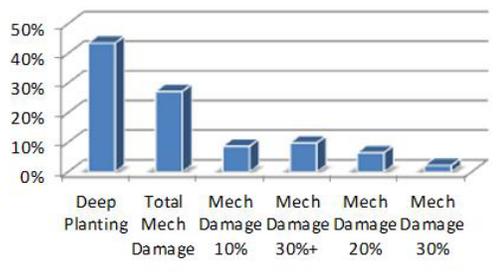
**Defects - All Sites**



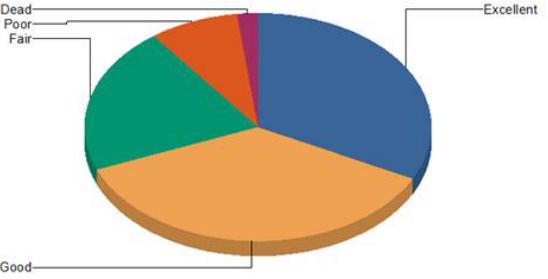
**Median condition—All sites**



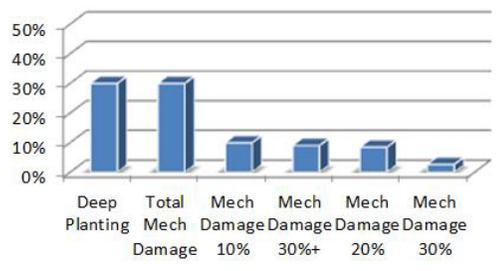
**Defects - Median**



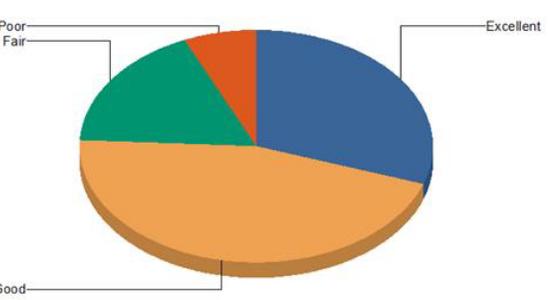
**ROW condition—All sites**



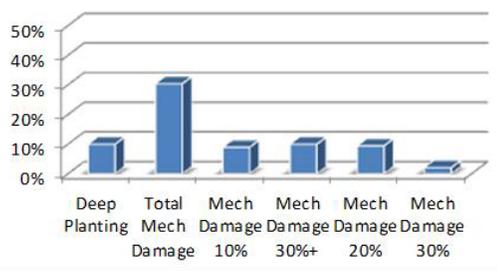
**Defects - ROW**



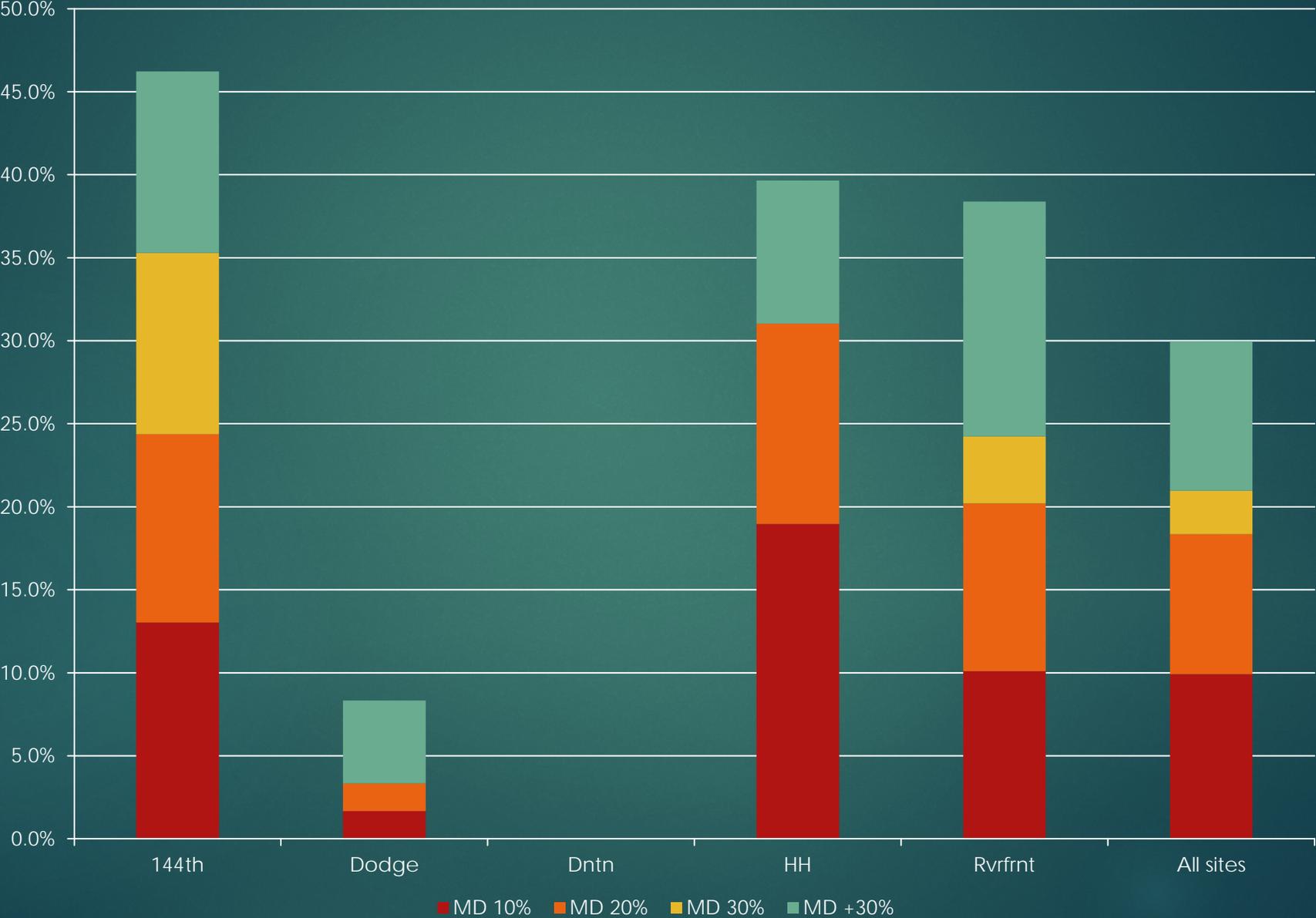
**ExROW Condition—All sites**



**Defects - ExROW**



# Mechanical Damage by Site



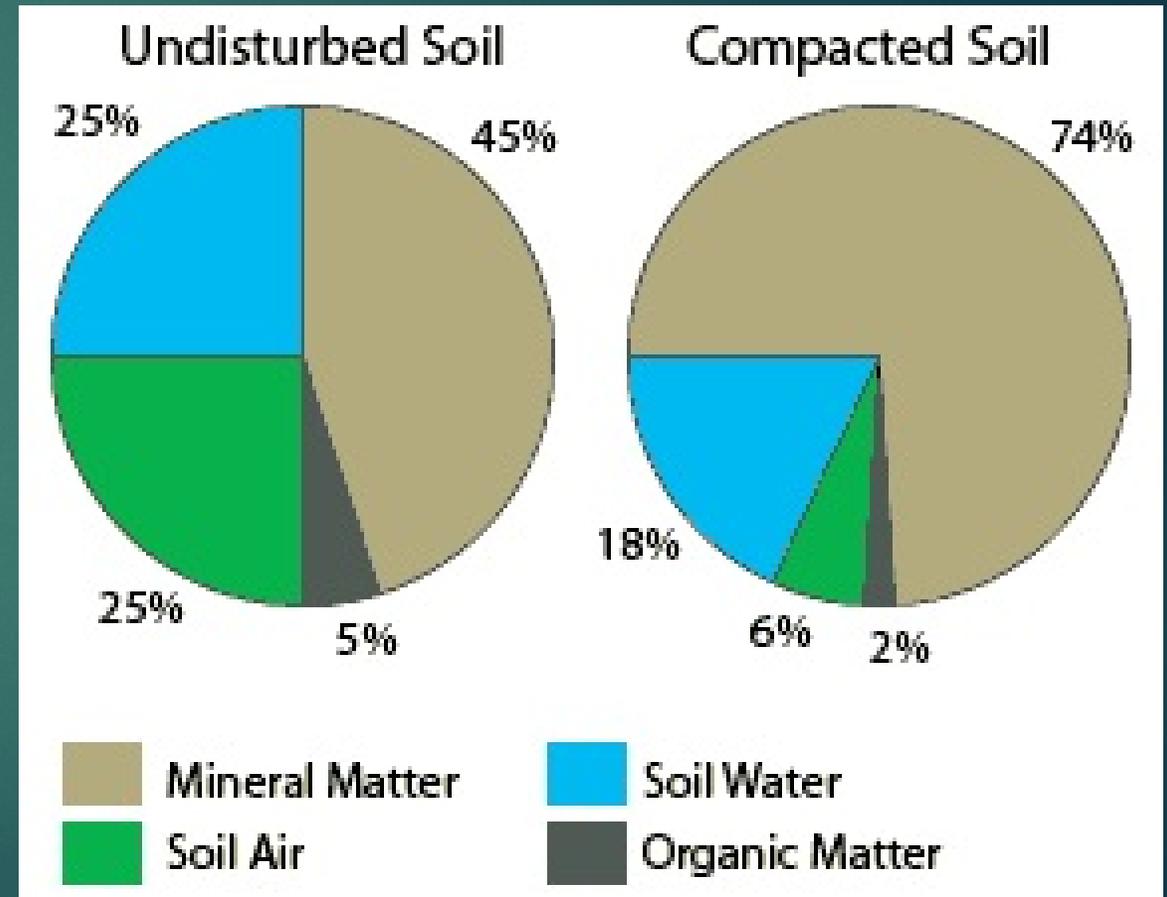
## Ground cover requirements:

Mulching and mulch maintenance is a requirement for planting success. Long term improvements can also be achieved with soil quality and water availability through an appropriate mulching program.



Staking





# Turf/Tree Interface

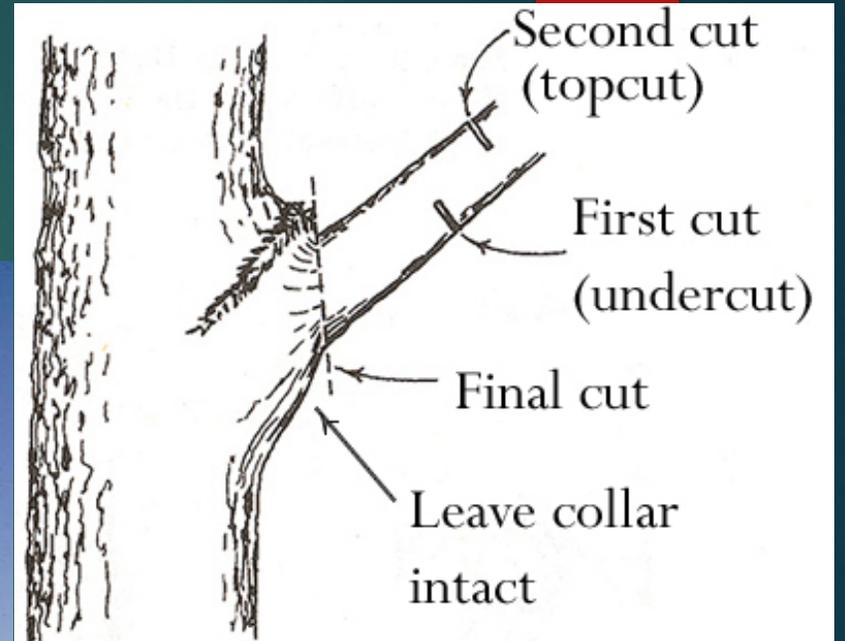
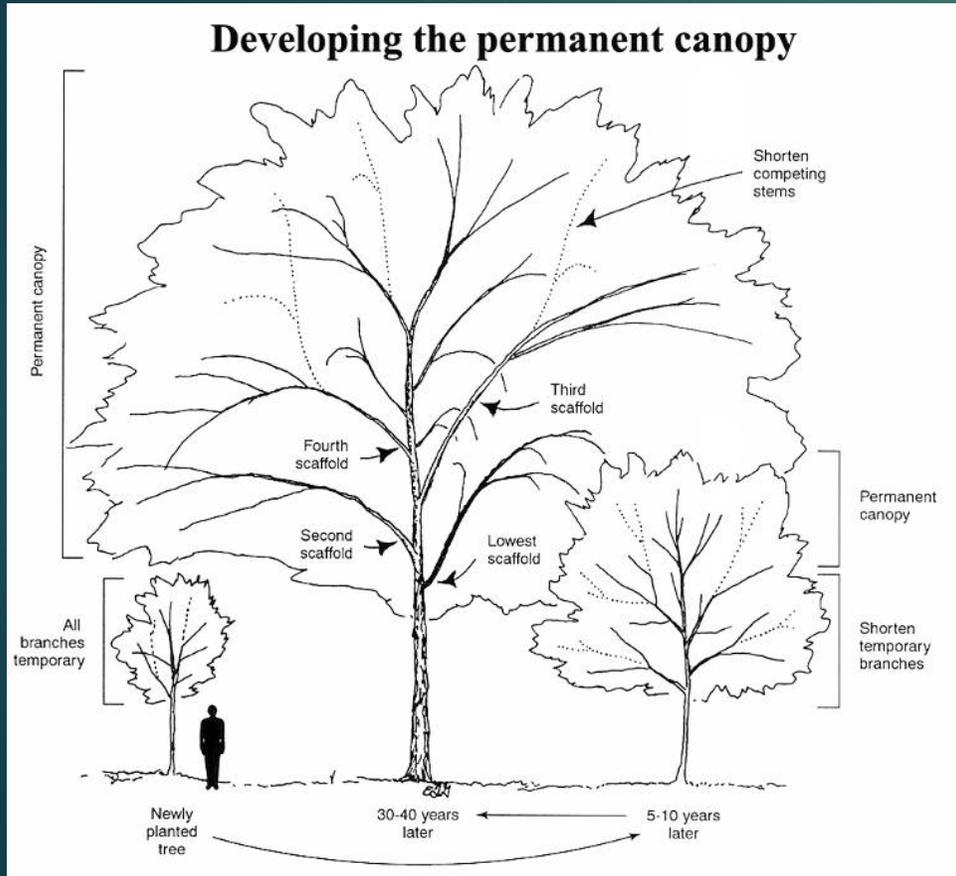


# Group Planting:





# Pruning and beyond.....



Thank you!

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402.444.7875

