Urban and Community Forest Management Plan

City of West Fargo, North Dakota

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INTRODUCTION

The City of West Fargo is currently in the process of developing and growing its Forestry Program. As part of that development, an urban and community forest plan is needed to help in guiding the program. Laid out in the plan are some of the keys items that will be assessed and implemented as the program moves forward. The plan is designed to be a guide and can/will be edited and adjusted as things progress.

The urban forest in the City of West Fargo represents a considerable economic and environmental asset to the community. An urban and community forestry plan will allow for prioritization, scheduling, and budgeting for the City. Improved tree health and survival will result in long term benefits and reduce public liability by elimination of hazardous conditions.

Urban and community forestry is an emerging field and has come a long way from the way it was handled when our community was first started. With the advances in arboriculture and the natural sciences in the past several decades, we can now do things that were not possible when the City was formed. With new tree varieties more suited for our climate and more advanced research being done every day, the opportunity arises for the City of West Fargo to have a healthy and diverse urban forest.

Technology has played a huge role in the recent years and will continue to in the future. With programs like GIS and I-Tree, technology is being used more and more every day in the forestry field. Integrating this technology into the program will help the department work more efficiently and effectively.

A healthy urban forest can dramatically improve the livability of a community. Tree lined streets and canopied parks are not only inviting, but are natural providers of important aspects of the quality of life. We rely on them to clean our air, provide dynamic buffers, reduce noise, conserve our soil, and add visual quality of our community.

"The mission of the West Fargo Forestry Department is to promote and maintain a safe and healthy urban forest that enhances the visual appeal and environmental quality of the City of West Fargo. The West Fargo Forestry Department accomplishes this mission through public education to make the citizens aware of the great importance of tree planting and maintenance."

HISTORY & GEOGRAPHY

The City of West Fargo is located along the Sheyenne River in Eastern North Dakota, in a region known as the Red River Valley. The City borders Fargo to the east, Horace to the south, and has the Sheyenne Diversion bordering the west end. Currently the City has a population of around 30,000 with a projected build out population of 45,000. "A City on the Grow" has been the motto of the City for the past decade while the City has seen unprecedented growth. The City of West Fargo is a family oriented community with active school and park districts.

The history of the urban forest however is not as impressive. The few species that were planted, as the City originated, were primarily monoculture and very susceptible to disease and insects. The primary street trees that were planted were ash, elms and oaks, because very few species could be grown in the cold climate of the northern plains at the time.

The City of West Fargo is broken up into several different areas, depending on the age of the subdivision or community. The older parts of town have large mature trees, while the newer and developing areas have very young and immature trees. Some of the oldest, largest and most prevalent trees are along the Sheyenne River corridor that cuts through town. This corridor runs the entire length of the town from south to the north.

A couple other things also change from subdivision to subdivision, and that is the planning and engineering aspects of a community. Older parts of town are laid out in a grid and primarily only have City owned trees in the boulevards. The newer subdivisions have center medians, roundabouts, bump-outs, bike path corridors as well as boulevard trees. All of which provide the opportunity to plant more trees then previously, but it also adds to the work required by City staff to maintain them.

City of WEST FARGO a city on the grow

CLIMATE AND SOILS

The City of West Fargo is located in Zone 4 of the USDA zone hardiness map (see image 1). This creates some challenges for the department as it restricts the use of some readily available and popular trees. The zone uses a –20° through –30° average annual low to help in picking trees suitable for the climate.

The area also averages about 22.6 inches of precipitation during the year, some of which falls during the winter and is often unusable by vegetation. The severe summer and winter winds can also be problematic to newly planted trees and older declining trees. The primary wind direction during the winter is the northwest and during the summer, south winds prevail (see image 2).

The soils in the City of West Fargo are also a driving factor in the selection of tree species that grow here. The City is primarily composed of Fargo Silty Clay, which is a level, deep, poorly drained soil on glacial lake plains. Typically, the surface layer is black silty clay about 10 inches thick. The subsoil is silty clay about 12 inches thick, with a dark gray color. The next layer, which extends to a depth of 30 inches, is dark grayish brown silty clay. The soil is slowly permeable and runoff is very slow. The soils around the City are also alkaline. They have a high pH and poor soil structure. In addition to the clay soils in the area, there are also some small areas (primarily along the river) that are more of a silty loam and have better drainage, providing a much better growing environment for trees.

See Attachment 1 for soils map

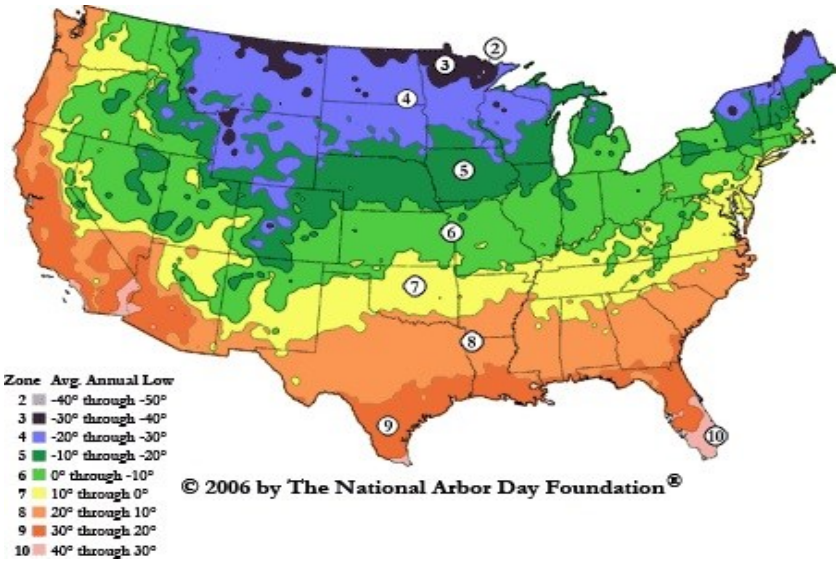


Image 1

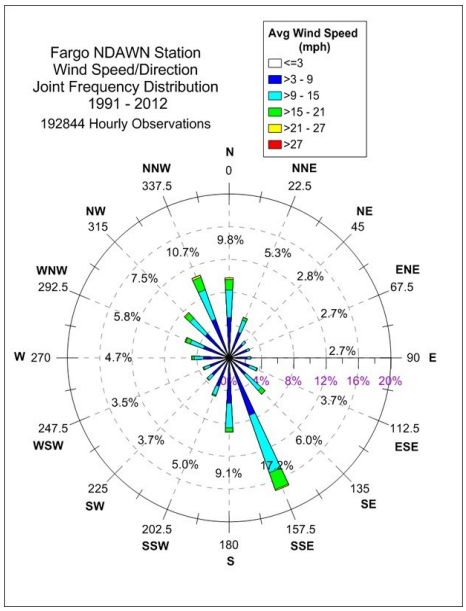


Image 2

TREE INVENTORY

West Fargo last conducted a complete street tree inventory in 2007. The results showed the overwhelming amount of Green Ash and a very low percentage of other species. This inventory showed that the City of West Fargo has to try and diversify its urban forest in all the newer developments, as well as start replacing older Ash trees with different species. The charts below show percentage of species and total number. (see Image 1 and 2) The inventory collected data on a total of 10,566 street trees.

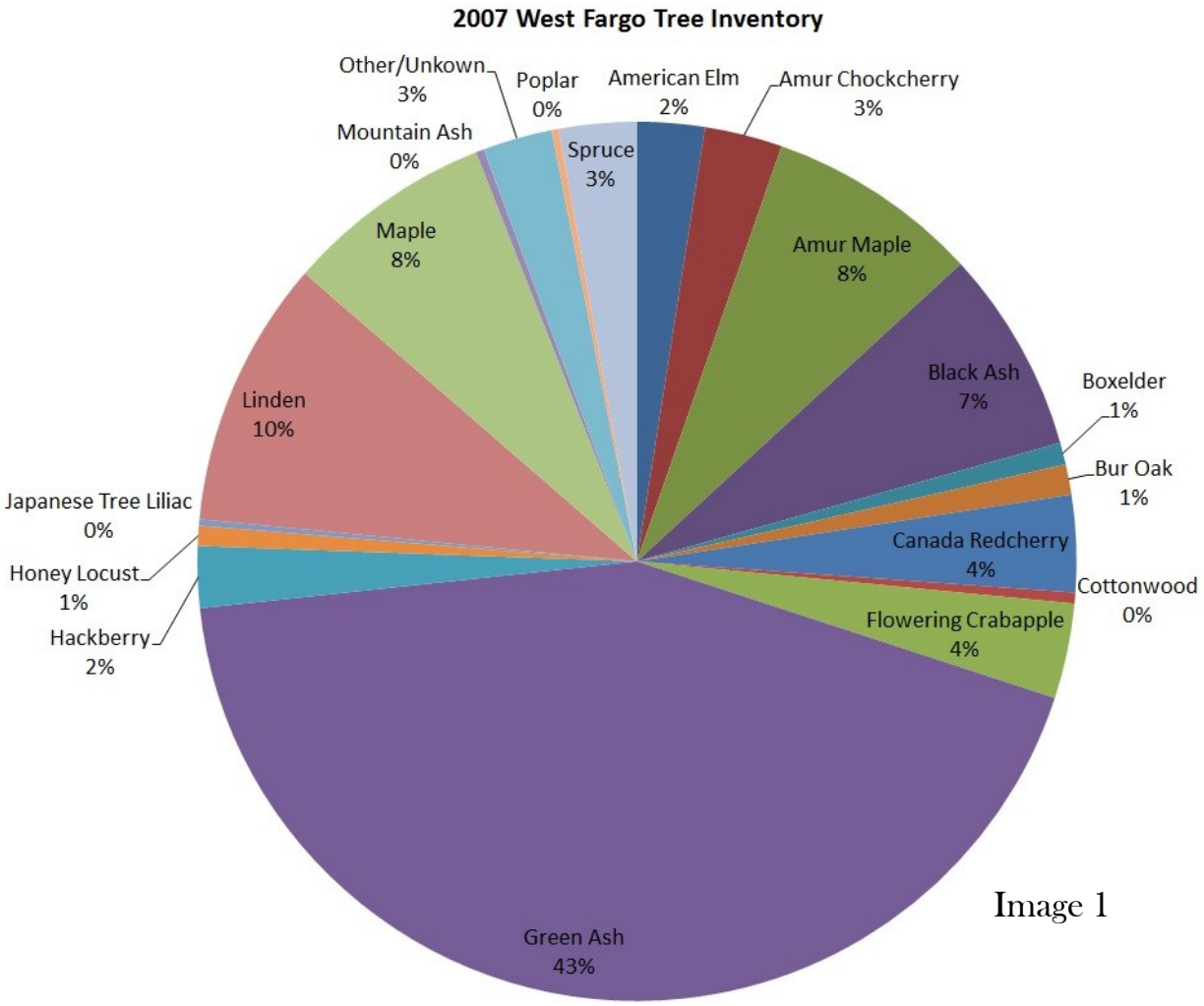


Image 1

	American Elm	Amur Chockcherry	Amur Maple	Black Ash	Boxelder	Bur Oak	Canada Redcherry	Cottonwood	Flowering Crabapple	Green Ash	Hackberry	Honey Locust	Japanese Tree Liliac	Linden	Maple	Mountain Ash	Other/Unkown	Poplar	Spruce
Number	262	302	828	790	85	118	376	42	370	4572	239	78	24	1040	809	32	270	27	302

Image 2

SUBDIVISONS

For the purposes of this plan, the City is divided up into subdivisions. These divisions will be addressed individually for their urban forestry needs. (see image 1)

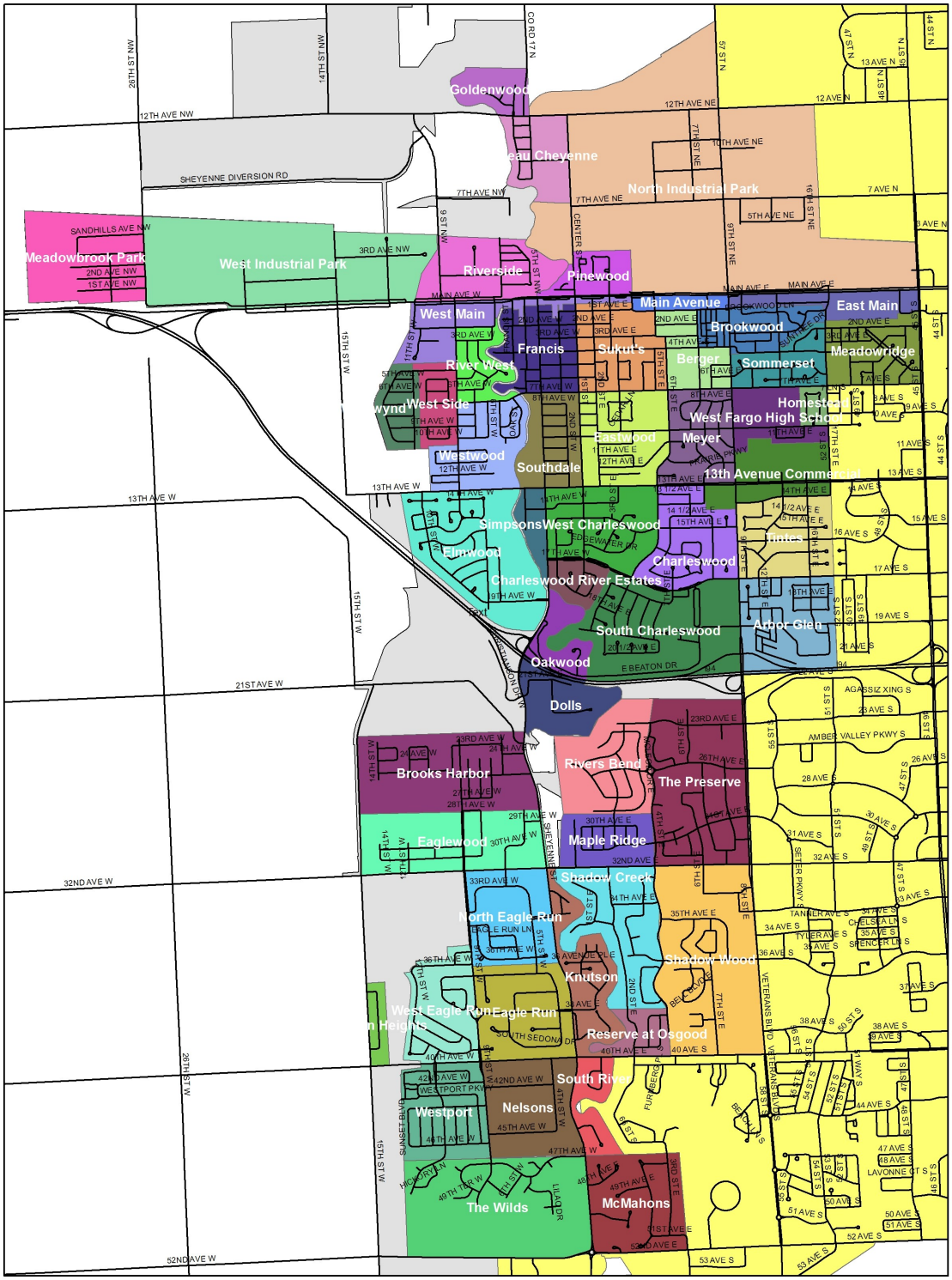


Image 1

TREE PLANTING

With the City of West Fargo's growth and new subdivisions, going in every year, the City consistently has new trees to take care of. Each year, any new street that is installed has the opportunity for new street trees. This includes any City maintained areas such as round-abouts, medians, lift stations and bike path areas. As part of this process the City of West Fargo Forestry department reviews engineering plans. These plans are then checked for spacing, species and overall layout.

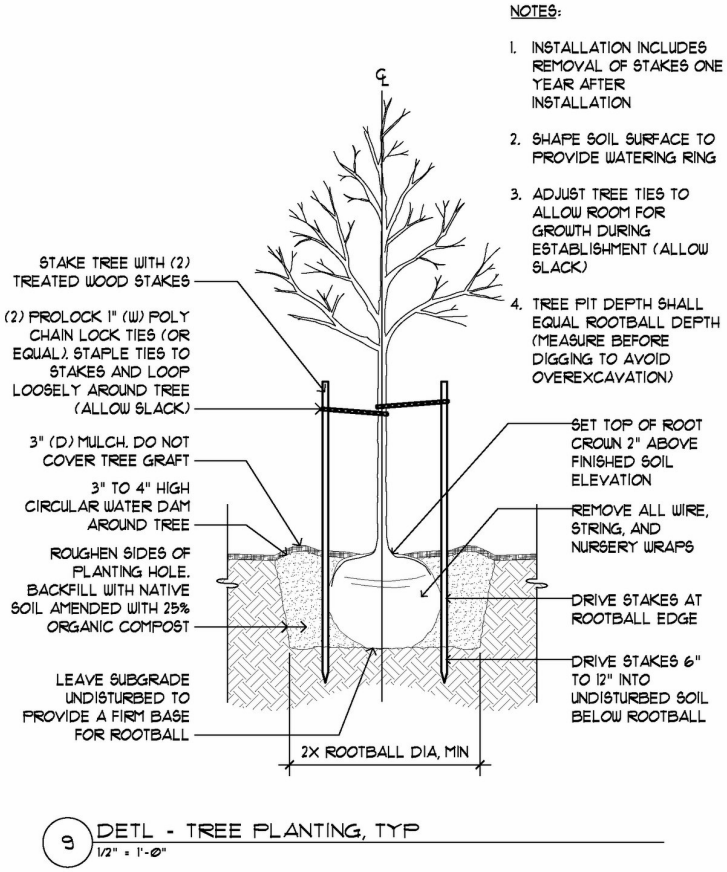
The City has, each year, an opportunity to receive grant money from state services. These grants may include forestry grants, transportation enhancement grants or others. These grants are and will be used to help "fill in the gaps" of areas around town that have few or no trees, or an overall improvement to an existing area.

Also included in the budget is a line item for tree plantings. This item is used by the forestry department to install trees throughout the City. The amount of this item has varied over the years, and can be better utilized when the forestry department plants its own trees, instead of contracting them out.

<u>Other Requirements</u>

- Size: diameter no less then 1 1/4"
- Spacing: 12' from driveways, 40' from intersections and 25' from other trees.
- Sidewalks must have 8' height clearance
- Streets and alleys must have a 14' height clearance

The City follows ISA standards and specification for tree planting.



TREE TYPES

The City of West Fargo has a limited number of trees that can be planted due to the hardiness zone and soil type. Over the years, the City has developed a planting permit with a list of trees that the City has identified will grow well in our area. The list is updated regularly as new varieties arise. These are the only allowable species that the forestry department will allow residents to plant in the boulevard. See list below:

- Honey Locust (thornless only)
- Hackberry
- Thornless Hawthorne
- Amur Chokecherry
- Lindens (any variety)
- Oak (Prairie Stature, Bur, Swamp)
- Flowering Crabapple (any fruitless varieties)
  or Red Splendor and Radiant only
- DED resistant Elms
  (Accolade, Cathedral, or Discovery)
- Ironwood
- Prairie Gem Pair
- Maple (any variety)
- Japanese Tree Lilac
- Amur Maple (tree form only)
- European or American Mountain Ash
- Kentucky Coffeetree
- Corktree
- Prairie Horizon Alder

Other species, approved for this area, can be planted on private property at the owners discretion. Other requirements may be required from other City departments.

CONDITION ASSESSMENT

A condition assessment is defined as a process where a qualified group of trained forestry professionals performing an analysis of the condition of trees that may vary in terms of age, shape, growth, and overall health . The condition assessment will be done in each subdivision, see page 7. The condition assessment is one of the key items that determine where the forestry department will be focusing its work. The results of each assessment will be compared to others to determine their priority.

The assessment will give a numeric value to each subdivision, classifying its overall forestry health. The tree will be given a rating of 1 through 5, with a 5 being the most work needed. Each subdivision will be averaged for the trees located in it. This will give one overall rating that can then be used to prioritize service areas.

The condition assessment will be done via a windshield survey, which will provide a brief snapshot of the subdivision. This will be more efficient and should take less time then a manual assessment. **See Attachment 2**

Condition Assessment

Points	Rating	Condition
1	Excellent	No work needed, tree can be left as is
2	Good	Minor pruning street and sidewalk
3	Fair	Minor pruning and minor disease (black knot)
4	Deficient	Major pruning
5	Poor	Damaged and/or diseased, poor health, possible removal

MANAGEMENT NEEDS

The urban forest in the City of West Fargo is unique in that there are really two different urban forests. The older section of town has greater needs and requires more work. The newer sections of town have smaller trees, less maintenance, but requires more planting and staking. Overall, there needs to be a balance between trimming and caring for older trees, and planting and watering of younger trees. Below are the management needs for both mature trees and newly planted trees.

Mature Trees

1. Pruning: Trees that have low hanging branches, clearance issues with sidewalks, streets and alleys. Possible crown reduction
2. Diagnosis: Trees that have disease or health issues. Private and public trees. Can be possible candidates for replacement or treatment.
3. Removal: Trees that are hazardous to the public, safety hazards. Monoculture areas, replaced after decline due to age, diversity.
4. Treatment: Trees that have a disease that can be controlled by treatment.

Young Trees

1. Proper Planting: Trees installed by private contactors are monitored at the time of planting to ensure proper planting. Preventing death, girdling, or other health problems in the future. Right tree for the right place. Proper staking, mulch and depth.
2. Watering: Providing newly planted trees with proper amount of water.
3. Monitoring: Checking newly planted trees for health issues, checking warranties. Managing corridors and green spaces.
4. Staking: Providing residents with the proper spacing and location of boulevard trees.

DISEASE AND INSECTS

Diseases and insect infestation can have severe and deadly effect on an urban forest. The areas most susceptible are those with little variety or monoculture areas. These areas allow the transfer of diseases and/or inspects from a neighboring tree of the same species. The older areas in West Fargo are more susceptible to this, as they have only a few primary street trees, Ash and Elm. Listed below are those of concern.

Dutch Elm Disease or DED

Dutch elm disease is one of the most destructive shade tree diseases in North America. The disease affects American Elms (and other elms) killing the individual branches and eventually the entire tree within one to several years. The disease is most often carried by the elm bark beetle. At the time of the last inventory, West Fargo had 262 elms on the boulevard. These elms need to be monitored for the disease, as well as those elms on private property, per city ordinance. Response plan currently in place.

Emerald Ash Borer or EAB

The emerald ash borer is a green beetle native to Asia and Eastern Russia. It is an invasive species in North America. The emerald ash borer presents a very severe danger to the urban forest of West Fargo, as Ash make up about 50% of the boulevard trees and a greater amount of those on private property. The Sheyenne River corridor is also composed of a huge number of ash trees. None of the insects has been found in North Dakota to date, but cases in Minnesota and Wisconsin have worsened. A response plan will be developed in preparation.

Asian Long-horned Beetle or ALB

The Asian long-horned beetle is a species native to eastern China, Japan, and Korea. This species has now been accidentally introduced into North America. The beetle effects maples, elms, ash and others as it spreads. After a tree has been occupied by generations of the beetles, larval feeding can disrupt the tree's vascular tissues, encourage fungal growth, and cause structural weakness, any of which might kill the tree. A response plan will be developed in preparation.

Other disease and insect issues may arise that require advanced planning and/or treatment. These plans will be developed as the need arises.

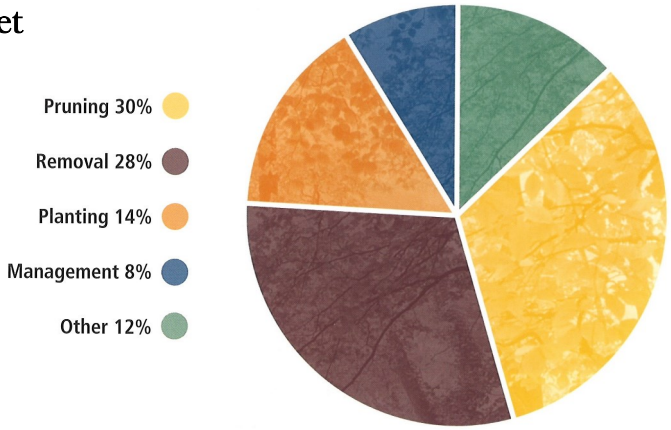
Budget

Public tree management is often viewed as a luxury and not an important enough item for a large budget, compared to police, fire, and water/sewer departments. However, the urban forest can provide some aesthetics, energy, and health benefits often unnoticed by most of the general public.

The level of funding that is allocated for resources can determine an urban forestry program's viability and sustainability. With sufficient financial resources to secure services, equipment, management and staff, an urban forestry program can fulfill its mission, respond to change and challenges, and best serve the public.

The National Arbor Day Foundation requires that a community forestry program be supported by an annual budget of at least $2 per capita as one qualification for its Tree City USA program. A common generalization is that a more realistic average is $5 per capita. The City of West Fargo's goal for the forestry department is to provide a "Routine Management Approach". This level of service addresses most emergency and request-driven work, but also has the resources to begin routine tree maintenance and scheduled planting programs. The West Fargo Forestry budget is adjusted each year to provide such service. Below is the Average National Urban Forest Budget Allocation.

See Attachment 3 for the 2015 Forestry Budget



Staffing

Generally, an urban forestry program has both supervision and operational employees who are supported by administrative employees within the public works department. The ISA and USDA Forest Service recommends 4 employees for a community with a population between 25,000 to 50,000.

Currently the City of West Fargo Forestry Department includes; 1 Program Coordinator, 1 Forester, 1 Arborist and 10 seasonal part time employees.

The City of West Fargo Public Works Department maintains all city owned pieces of property including trees and vegetation on them. The properties include items such as lift stations, ponds, bike paths and street corridors. These properties all have opportunities to help improve the urban forest of West Fargo.

Lift Stations

The City has 109 total lift stations, wells and towers to maintain. Each site has some form of tree and/or shrubs to be cared for or has the opportunity for them to be planted. Trees and vegetation on these sites is important, not only as a screen, but also to provide some aesthetics to areas they are in.

Goal: Improve and/or add trees and landscaping to each lift station, well and tower

Ponds

The City owns and maintains a total of 35 dry or wet retention ponds within city limits. Most of these ponds currently have, or the potential too have, large areas of greenspace, parks and trees around them. The City can use this as additional places to improve diversity and showcase some varieties (ex. Sheyenne Arboretum).

Goal: Improve greenspace around ponds

Bikepaths

The City owns and maintains approximately 30 miles of bikepath throughout the city. Large sections of the bikepath system have parks and/or greenspace along them. Most of the trees are installed, as part of the city projects, just needs maintenance. Any open space along them can be considered an opportunity to plant new trees.

Goal: Maintain existing trees along paths and greenspace, improve some areas

Street Corridors

The City of West Fargo maintains a large amount of right-of-way space, roundabouts and medians throughout the city. These corridors have a large number of trees planted along them, or in their medians. These trees are at higher risk for damage, due to traffic accidents and wintertime salts.

Goal: Maintain all existing trees, improve some areas

ANSI A300 Standards

ANSI A300 standards are the generally accepted industry standards for tree care practices. They are voluntary industry consensus standards developed by TCIA (Tree Care Industry Association) and written by a committee called Accredited Standards Committee A300. Their mission is to develop consensus performance standards based on current research and sound practice for writing specifications to manage trees, shrubs, and other woody plants.

These standards will be the guiding support for the City of West Fargo's Forestry Program

The standards are divided into parts:

Part 1: Pruning

Part 2: Soil Management

Part 3: Supplemental Support Systems

Part 4: Lightning Protection Systems

Part 5: Management

Part 6: Planting and Transplanting

Part 7: Integrated Vegetation Management

Part 8: Root Management Standard

Part 9: Tree Risk Assessment

Example: ANSI A300 Part 6 Planting and Transplanting

Landscape Tree Appraisal

A Landscape Tree Appraisal is a way of determining the value of a tree in a community. One of the most widely used and accepted landscape tree appraisal methods was developed by Purdue University Cooperative Extension Service. The "Trunk Formula Method" takes into account various aspects of the tree, location and species to determines a monetary value for the tree.

Value = Basic Tree Cost x Species Rating % x Condition Rating % x Location Rating %

See Attachment 4 for complete Trunk Formula Method

SHORT TERM ACTION ITEMS

The City of West Fargo will implement a series of short term action items that will address the immediate needs of the urban forest. These items include:

1. Remove hazard trees on public right-of-ways
2. Trim trees to clear signs, street lights, traffic signals, pedestrian and vehicular traffic and buildings
3. Perform systematic trimming of trees containing hazardous defects
4. Plant new street trees in areas containing none
5. Establish a routine systematic trimming cycle for all trees along the City of West Fargo's right-of-ways
6. Monitor trees on an annual basis for structural and disease problems
7. Improve species diversity in new plantings
8. Implement Dutch Elm Disease Plan
9. Implement the Emergency Storm Response Plan
10. Stake new tree locations in residential areas for proper planting (tree permit)
11. Monitor and care for newly planted trees on city projects
12. Work with the Planning and Zoning Department to help implement their landscape standards reviews on new commercial sites
13. Work with residents to diagnose and provide recommendations for trees with disease, growth problems, insects and other issues on private property
14. Implement public education program and Arbor Day celebration
15. Update tree inventory
16. Develop a residential tree chipping program
17. Develop a Emerald Ash Borer Response Plan

LONG TERM ACTION ITEMS

The City of West Fargo will implement a series of long term action items that will address the long term needs of the urban forest. These items include:

1. Identify potential partners for urban and community forestry program
2. Improve the urban forest diversity
3. Increase public education and involvement in the planning, care and maintenance of the urban forest
4. Increase the fiscal budget as the urban forest grows and requires more attention
5. Increase the number of trees planted on public and private lands
6. Update the tree inventory annually
7. Provide training to in house personnel on all phases of urban tree care
8. Develop working partnerships with local and regional utilities, to improve organization and effectiveness of operations
9. Develop long term maintenance plan for all plantings and landscape amenities on West Fargo property and right-of-way
10. Update Urban and Community Forest Master Plan

EQUIPMENT

The equipment provided and utilized can improve efficiency and safety for the forestry workers. Property safety gear and training on that gear is provided by the City of West Fargo. All equipment that is used, workers are certified on and all proper procedures are followed.

Current Forestry Equipment

- 2 Pickup Trucks
- 1 Watering/Spraying Truck
- 1 Aerial Lift Truck
- 1 Hydroseeder
- 1 Toolcat and Attachments
- 1 Wood Chipper
- 1 ATV with Sprayer

Other Forestry Equipment

- 4 Pickup Trucks (Seasonal)
- 6 Zero Turn Mowers
- Multiple Large Mowers
- Multiple Tractors
- Multiple Trailers
- Mini Excavator

Some other pieces of equipment that would benefit the forestry department include:

- Stump Grinder
- Tree Spade (Currently have access to Park Departments)

Urban forest managers across the country have found that public education is the true key to reaching the goals of an urban forestry program. The West Fargo Public Works Department will be able to effectively achieve urban forest management goals by educating citizens, elected officials, and other community groups.

Some of the current public relation activities:

- Participate in Tree City USA
- Annual Arbor Day Celebration
- National Night Out Event
- Partnership with West Fargo Schools
- Partnership with NDSU Extension
- Partnership with ND Forest Service
- Partnership with West Fargo Parks
- Forestry Website
- Annual Workshops
- International Society of Arboriculture (ISA) Memberships
- North Dakota Urban and Community Forestry Association (NDUCF) Memberships

Some of the goals for the program:

- Increase Public Education on Website
- Develop Brochures for Residential Tree Planting
- Develop Brochures for Residential Tree Maintenance and Pruning
- Improve Attendance at Workshops and Events
- Increase Forestry Awareness of Disease and Insects
- Improved Contact with Residents

Being developed in coordination with sanitation and streets departments....

When catastrophic disasters, such as, floods, tornadoes, ice storms, and straight-line winds hit, they can have devastating effects on an urban forest. Trees and vegetation can account for approximately 30 percent of the debris.

Part of the Public Works Department, the Forestry Department would have an important role of any natural disaster clean up. The department will work with police, fire, street, sanitation, and sewer/water departments to ensure proper procedures and safety during and after an event.

Some of the cleanup tasks include collecting and disposing of debris, broken and/or hanging limbs, uprooted trees, blocked roadways, power outages and hanging lines, and personal/public property damage. Most of these activities can be done more efficiently and safely with the help of forestry workers.

Response Plan Items

- Tree inventory: provide locations and species of existing trees
- Support for emergency workers: clear snow emergency routes (trees and debris) for access throughout the entire city for police, fire and ambulance services
- Continued cooperation with city emergency management officials
- Train and instruct city workers on proper chainsaw procedures
- Train and instruct city workers on safety equipment/procedures
- Utilize sanitation, street, sewer and water department equipment
- Collect contractors list for additional needed help

Attachment 1

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
1	Fargo-Enloe silty clays
2	Tonka silt loam
3	Parnell silty clay loam
4	Perella silty clay loam
5	Dovray silty clay
6	Parnell silty clay loam, ponded
9C	Nutley-Fargo silty clays, 1 to 9 percent slopes
10	Fargo-Ryan silty clays
11	Nahon silt loam, 0 to 2 percent slopes
12	Hegne-Enloe silty clays
14B	Barnes-Buse loams, 3 to 6 percent slopes
14C	Barnes-Buse loams, 6 to 9 percent slopes
14D	Barnes-Buse loams, 9 to 15 percent slopes
15	Emrick-Heimdal loams, 1 to 3 percent slopes
15B	Heimdal-Emrick loams, 3 to 6 percent slopes
15C	Heimdal-Esmond loams, 6 to 9 percent slopes
15D	Esmond-Heimdal loams, 9 to 15 percent slopes
16B	Barnes-Sioux loams, 3 to 6 percent slopes
16C	Barnes-Sioux loams, 6 to 9 percent slopes
16D	Barnes-Sioux loams, 9 to 15 percent slopes
17B	Barnes-Svea loams, 2 to 5 percent slopes
18	Bearden silty clay loam
19	Colvin silty clay loam, saline
20	Bearden silty clay loam, saline
22	Bearden-Perella silty clay loams
23F	Buse-Barnes loams, 15 to 35 percent slopes
24	Cashel silty clay
25	Cashel silty clay, channeled
26	Colvin silty clay loam
27	Divide loam
29	Fargo silty clay, saline
31B	Embden fine sandy loam, gravelly substratum, 1 to 6 percent slopes
32	Fargo silty clay, 1 to 3 percent slopes
35	Fairdale silty loam, 1 to 3 percent slopes
36	Fargo silty clay
37	Fargo silty clay, depressional
38	Fargo silty clay loam
39	Galchutt silt loam
40	Fargo-Hegne silty clays
41	Hegne-Fargo silty clay loams
43	Gardena silt loam
46	Gardena-Glyndon silt loams, 0 to 3 percent slopes
47	Fargo silty clay, smooth surface
48	Glyndon silt loam, 0 to 3 percent slopes
49	Glyndon silt loam, saline, 0 to 3 percent slopes
50	Hamerly-Tonka loams, 0 to 3 percent slopes
50B	Hamerly loam, 3 to 6 percent slopes
51	Hamerly loam, saline, 0 to 3 percent slopes
54	Lamoure silty clay loam
55	LaDelle silty clay loam
57	Fairdale silt loam, channeled
58B	Maddock fine sandy loam, 1 to 6 percent slopes
59	Overly silty clay loam, 0 to 3 percent slopes
59B	Overly silty clay loam, 3 to 6 percent slopes
61	Perella-Bearden silty clay loams
62	Overly-Bearden silt loams, 0 to 3 percent slopes
63B	Renshaw - Sioux loams, 1 to 6 percent slopes
63C	Sioux gravelly sandy loam, 3 to 9 percent slopes
64	Pits, gravel
65	Svea-Barnes loams, 0 to 2 percent slopes
66	Wyard-Hamerly loams, 1 to 3 percent slopes
67	Galchutt fine sandy loam
71	Vallers loam
72	Wahpeton silty clay
73	Rauville silty clay loam
76	Wyndmere silt loam, 0 to 3 percent slopes
76B	Wyndmere silt loam, undulating
77	Vallers loam, saline
78B	Svea-Buse loams, 3 to 6 percent slopes
80	Wyndmere-Tiffany loams, 0 to 3 percent slopes
82	Glyndon-Tiffany silt loams, 0 to 3 percent slopes
83	Galchutt-Fargo silty clay loams
84	Bearden-Lindaas silty clay loams
85	Fairdale Variant silt loam

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 66, 15B

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

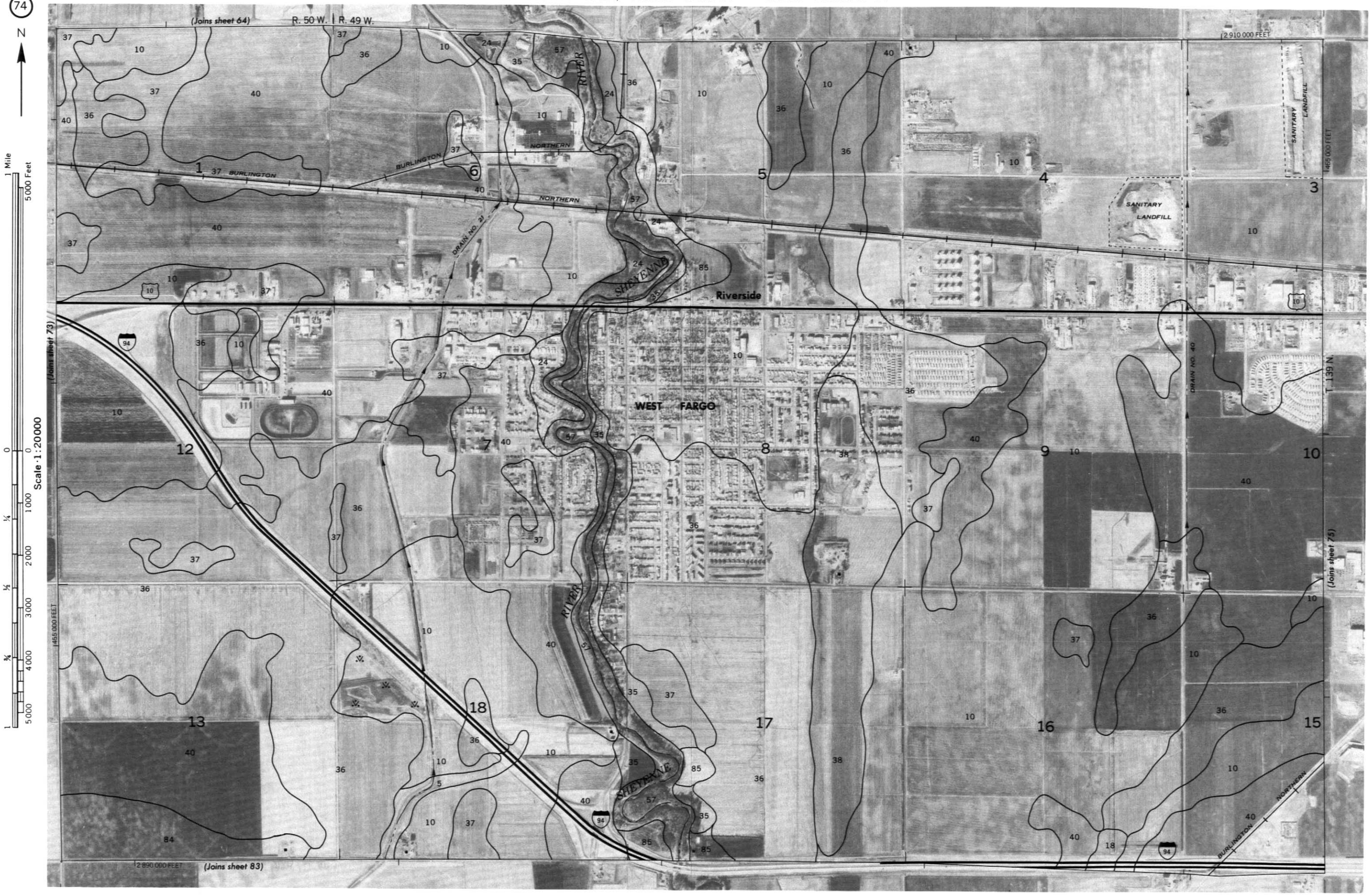
GULLY

DEPRESSION OR SINK

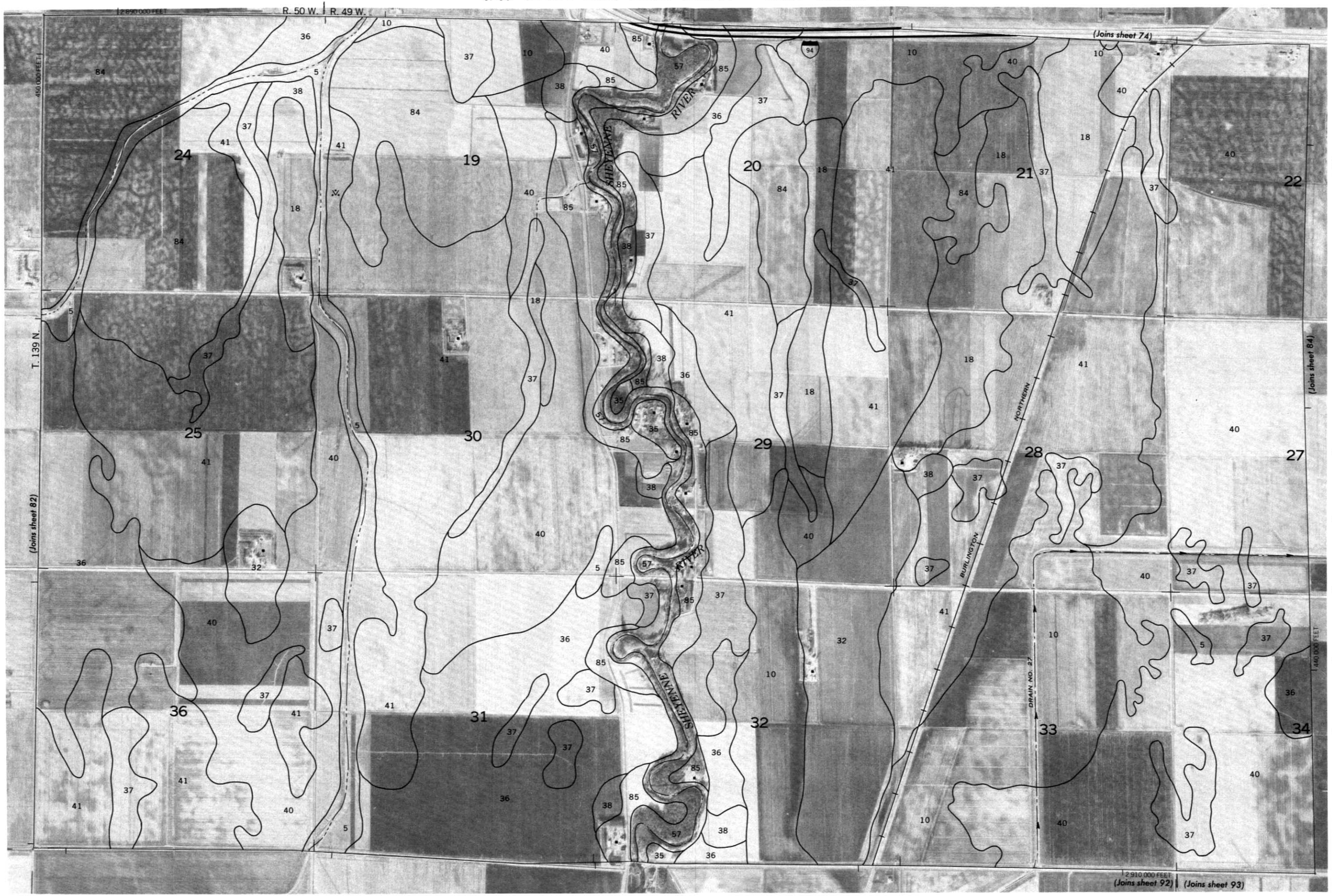
SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Tonka soil spot (up to 3 acres)
- Borrow land (up to 10 acres)
- Parnell soil spot (up to 3 acres)



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



CASS COUNTY AREA, NORTH DAKOTA NO. 83

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Attachment 2

THE RELIABILITY OF A WINDSHIELD SURVEY TO LOCATE HAZARDS IN ROADSIDE TREES

By C.J. Rooney[1], H.D.P. Ryan[2], D.V. Bloniarz[3], and B.C.P. Kane[4]

Abstract. Hazardous conditions in roadside trees are a constant concern for municipal arborists. Due to fiscal constraints, many municipalities desire an accurate and efficient method to inspect their tree populations. This case study shows that a windshield survey can be used to find hazardous conditions in roadside trees, using a simple system and an experienced Certified Arborist. In addition, the case study showed that the percentage of detected hazardous conditions increased as the conditions became more severe. The percentage of hazardous tree conditions found using a windshield survey in developed sample areas far exceeded those found in undeveloped sample areas.

Key Words. Windshield survey; hazard trees; municipal forestry; risk management.

Many municipalities are struggling financially. With budget shortfalls and increasing costs it is becoming more difficult for municipalities to deliver necessary services. Trees are often on the losing side when poor economic circumstances reduce municipal budgets, because tree planting and maintenance are not considered as important as other services. Unfortunately, many municipalities allocate neither the funding nor the time to take care of their trees properly, and at the same time society is becoming more litigious (Smiley and Fraedrich 1991). Such considerations prompt municipalities toward greater efficiency in community tree management. A consequent benefit of such an increase in efficiency is protecting the community from litigation. A community should exert a reasonable amount of effort toward caring for and inspecting their trees for hazards.

The objective of this case study was to compare a windshield survey for hazard trees to a traditional individual hazard tree inventory. Specifically, the case study investigated the accuracy and efficiency of both methods and attempted to identify conditions or situations that would favor one method over the other.

The hypothesis for the project is that windshield surveys can be reliably used to assess tree defects compared to a traditional walking inspection. To test the hypothesis, a windshield inventory of all town-maintained roads was conducted, then a traditional walking inspection of randomly selected samples of the trees was conducted.

A windshield survey is a method of evaluating trees whereby an arborist is driven along a community's roads recording certain tree characteristics. A windshield survey can save time over walking because the arborist is driven along a community's roads. Windshield surveys are most efficient when the arborist is looking for one or two particular tree characteristics. Windshield surveys have been and continue to be used in many cities and towns throughout the United States. The Urban Forestry Department in Cincinnati, Ohio, U.S., uses a windshield survey to inventory trees that records the species, size, and condition of the city's trees (Sandfort 2001). The main purpose of the type of windshield survey used in this case study was to identify hazardous tree conditions throughout the community and prioritize them based on probability of target impact, size of defective tree part, probability of failure of defective part, and tree species.

Many sources recommend annual inspections of trees (Grey and Deneke 1978; Kane et al. 2001; Lilly 2001). In a residential setting, tree inspections can include checking tree health and damaged or loose support cables. For a municipality, an annual tree inspection's main goal is to find tree hazards. Within a year, a tree's structural and physiological condition can change quite easily; weather, humans, insects, and diseases can be major factors that cause changes. Annual inspection of high-use areas such as heavily traveled roads or high-use public parks should help keep an arborist aware of changing situations. The results of an annual inspection can help an arborist plan and schedule upcoming maintenance. An annual inspection can also document that there is a systematic and standardized inspection protocol for assessing the community's trees. The standardized protocol for hazard assessment is necessary because a number of lawsuits have demonstrated that municipalities are directly responsible for the upkeep and the inspection of their trees.

WINDSHIELD SURVEY ISSUES

A municipality's options for inspecting the trees for hazardous conditions are (1) do nothing, (2) conduct a thorough walking inspection, (3) conduct a windshield survey, or (4) use a combination of techniques. Given the climate of litigation in the United States and recent court rulings as well as for concerns about public safety, it would be unwise not to inspect the trees, although many communities choose this option. Conducting a thorough, up-close inspection of all the trees in a community is not always feasible for many municipalities due to financial constraints. For instance,

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contractors in New England often charge approximately $5 per tree to inspect for hazards. In addition, many municipalities lack the skilled labor needed to undertake a thorough inspection in-house. Conducting a windshield survey of certain areas presents another option for the municipality to save time and money.

The main problem with choosing the windshield survey option is that no one has examined the method's reliability at identifying roadside hazardous tree conditions. Many professionals in the tree care industry have questioned the validity of this hazard tree inspection method. The U.S. Park Service's *Hazard Tree Guidelines* note that "… the obvious limitations of the effectiveness of this method may not allow it to be very persuasive in a court of law, and only a thorough documentation of findings will lend any credence to this method" (National Park Service 1991). Many urban foresters and arborists feel that in certain situations a windshield survey will not work effectively. For instance, it may not work well in congested urban areas where the arborist's visibility may be poor or where the surrounding traffic conditions are difficult, causing some hazardous conditions to be missed. Other professionals feel that in any type of roadside situation, this method is unacceptable for a thorough hazard tree survey. This is due to the inability to effectively examine the tree from every angle and the inability to get close to the tree. "Subtle defects such as narrow cracks or girdling roots, even if they occur on the side facing the road, may go undetected simply because they cannot be readily seen from the road" (Pokorny 2003, p. 28).

METHODOLOGY

The community chosen for this case study was South Kingstown, Rhode Island, U.S. Located on the Atlantic coast in the southern part of the state, the town has vegetation types ranging from seaside scrublands in the southeast to mixed oak forest in the northwest. The town's population is approximately 28,000 people, and the town has approximately 217 km (135 mi) of maintained roads. The town employs a part-time tree warden, and the total population of municipally maintained trees in the town is estimated to be 15,000 to 20,000. At the time of this case study, winter 2002–2003, the town had not yet implemented an annual hazard tree inspection program.

South Kingstown was ideal for testing the windshield survey method because it contains a variety of roadside environments. The town has a wide range of street and neighborhood settings, ranging from rural to urban. The variety of street and neighborhood layouts creates a similar variety of planting locations. Additionally, South Kingstown's tree population varies greatly. Trees managed by the town exhibit diverse conditions, species, and sizes, and some trees are extremely hazardous. The variety of neighborhoods and tree species, sizes, and conditions helped to test the effectiveness of a windshield survey over the range of variables.

Windshield Survey

The windshield survey of 100% of town roads was intended to accomplish several things. First, it provided the data set for comparison with the traditional walking inspection. Once the sample areas within the town were determined, the windshield survey dataset was broken down to the specific randomly selected areas and then comparisons would be made.

Second, the windshield survey was used to collect hazard tree data that would be given to the town's tree warden and the local electric company once the project was completed. Those data would be used to remediate hazard trees.

The windshield survey was also used to identify land use and road type. Roads, or road segments as necessary, were classified as, "developed," "undeveloped," or "no town trees present." Each classification had distinct characteristics. A developed road or road segment had town trees growing in front of homes or businesses with lawns, in utility planting strips between the road and sidewalk, or in planting pits in a sidewalk. An undeveloped road or road segment had no sidewalk or maintained lawn and had a woodland setting or an old stone wall delineating the setback distance. A road or road segment with no town trees present, or if the existing town trees were not worth resurveying due to their small size, would be classified as "no town trees." Such areas included new developments and older neighborhoods where the only trees were set back on private property. These areas were eliminated from the study. Each of the road types was used to create a stratified category to help determine sampling areas.

Prior to commencing the windshield survey, the following protocols were established:

1. Because the major objective of this windshield survey was the identification of hazardous conditions, it was conducted after leaf drop.
2. A pick-up truck or SUV was used to drive the inspector during the windshield survey.
3. The person who conducted the survey is an ISA Certified Arborist and a Rhode Island licensed arborist who sat in the front passenger seat during the surveys; prior to surveying, he had received training in locating and identifying tree defects.
4. Aside from a clean driver's license, the driver did not need any special qualifications, although familiarity with town roads was helpful.

A personal digital assistant (PDA) was used to record all of the survey data, and Pendragon Forms® software was used to create a data collection form. The PDA was chosen because of its ability to synchronize with a desktop computer for quick data importation. A PDA also has the ability to store lists. This saves time by allowing the surveyor to pick a particular item from a list, instead of repeatedly typing each item.

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The following data were collected for each hazard tree: tree genus and species, location, target, and tree defect. For each tree containing a hazardous condition, a hazard rating was given. The hazard rating system that was used was first developed by Pokorny in 1998 and modified by Ryan and Bloniarz in 2001 (Kane et al. 2001). The hazard rating was determined by four variables and ranged from 12 (severe hazard) to 3 (very small hazard). Tables 1, 2, and 3 describe thresholds for three of four variables used to determine hazard ratings, probability of target impact (Table 1), size of the defective part (Table 2), and probability of failure (Table 3). The fourth variable is species rating, which is based on a scale of 0 to 2 (the higher value increasing the hazard rating). Species rating is based on the collective experience of the authors (over 75 years) assessing tree risk and observing tree failures in New England. Species rating allowed the inspector to increase the hazard rating for common street trees that are prone to failure in New England, such as horsechestnut (*Aesculus hippocastanum*) and Bradford pear (*Pyrus calleryana* 'Bradford').

The scores for each variable were recorded and totaled for each tree, the total ranging from 3 to 12. Trees with a hazard rating less than 6 were not recorded because they did not pose an immediate threat and were not hazards.

For the project, only trees that were within town rights-of-way were examined, so it was important to know the location and widths of all the rights-of-way. That information was acquired from the highway department.

One final logistical concern was the relative use of roadways during different days and times. For example, streets on which schools are located cannot be inventoried at certain times because there is risk of traffic accidents.

If there were trees on both sides of the road, the inspector was driven up and down the road. If the trees were on one side only, it was necessary to cover the street in one direction only. The inspector indicated to the driver where to go, how fast to drive, and when to stop completely for the inspector to gather the tree information.

Once the windshield portion of the study was completed, a traditional walking survey was conducted for comparison. First, the resurvey sample areas were determined by taking random samples from each of the two stratified categories. Next, these sample areas were walked, and each tree was inspected. Care was taken to observe each tree from every angle. Following these inspections the two methods were compared.

Table 1. Probability of target impact (1 to 3 points).

Occasional use (1 point)
- low-use roadways (i.e., dead-end roads, turnarounds)

Intermittent use (2 points)
- roadway intersections in high-use areas
- parking lots adjacent to moderate- and low-use areas
- dispersed picnic areas

Frequent use (3 points)
- high-use roadway
- all buildings and residences
- schoolyards
- specially marked handicap-access areas
- parking lots

Table 2. Values for the size of the defective part (1 to 4 points).

1 point:	parts less than 5.1 cm (2 in.) in diameter
2 points:	parts from 5.1 to 25.4 cm (2 to 10 in.) in diameter
3 points:	parts from 25.5 to 50.8 cm (10 to 20 in.) in diameter
4 points:	parts greater than 50.8 cm (20 in.) in diameter

Table 3. Probability of failure (1 to 3 points).

Low: Some minor defects present (1 point)
- minor branch dieback
- minor defects or wounds

Moderate: One to several moderate defects present (2 points)
- stem decay or cavity within safe shell decay
- weak union with in-rolled bark
- defects(s) affecting less than 50% of tree's circumference
- leaning tree (away from target area; greater than 45-degree angle) without new root lifting

High: Multiple or significant defects present (3 points)
- stem decay or cavity at shell safety limits
- multiple cracks or a single crack that goes completely through the stem
- weak union with crack or decay
- defect(s) affecting more than 50% of tree's circumference, with decay present
- leaning tree (toward target area; greater than 45-degree angle) with recent root lifting or soil mounding
- dead or lodged branches; dead trees

RESULTS

Windshield Survey Findings

The 100% windshield survey encompassed 214 km (133 mi) of town-maintained roads. The survey took 72.5 hours and was conducted over the course of 20 nonconsecutive days. The survey yielded a total of 1,116 trees with hazard ratings between 6 and 12. Table 4 shows the distribution of trees per hazard rating and the percentage of each rating category relative to the total. Most of the hazard trees (92%) were rated between 6 and 10, with only 8% of the hazard trees rated 11 and 12. The vehicle used for the windshield survey was driven at an average speed of 3.06 km/h (1.9 mph) during the entire survey.

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Table 4. Frequency distribution of trees per hazard rating and mean rating for trees found during the windshield survey.

Hazard rating	Number of trees	Percentage of total	Cumulative percentage
6	147	13%	13%
7	252	23%	36%
8	226	20%	56%
9	247	22%	78%
10	158	14%	92%
11	68	6%	98%
12	18	2%	100%
Trees found	1116		
Mean score	8.3		

Comparison of Windshield and Walking Surveys

The total number of trees surveyed by walking was 329. Table 5 shows the number of hazard trees found by the walking survey by rating category. Table 5 also shows the number of hazard trees in each rating category found by the windshield survey expressed as a percentage of hazard trees found by the walking survey.

Table 5. Comparison of windshield and walking survey hazard trees by hazard rating.

Hazard rating	Total hazard trees found by by walking survey	Percentage of walking survey hazard trees found by windshield survey
7–12	94	58%
8–12	55	69%
9–12	30	79%
10–12	17	89%

Developed/Undeveloped Analysis

For developed areas, the number of hazard trees found by the windshield survey expressed as a percentage of hazard trees found by the walking survey ranged from 66% at hazard rating ≥ 7 to 100% for hazard rating ≥ 10 (Table 6). Hazard ratings were generally lower in undeveloped sections.

Table 6. Number of hazard trees found by windshield survey expressed as a percentage of hazard trees found by walking survey, arranged by area. Developed and undeveloped areas are explained in the text. There were insufficient trees rated ≥ 10 in undeveloped areas to provide a percentage.

Hazard rating	Developed areas	Undeveloped areas
7–12	66%	49%
8–12	81%	50%
9–12	96%	50%
10–12	100%	n/a

DISCUSSION

The windshield survey of the town took longer than anticipated. This was due to many factors, including bad weather, available volunteer time, and the high number of hazard trees that were ultimately identified.

Comparing the windshield surveys and the walking survey indicates that as the tree hazard became more severe, the chance of finding it by using a windshield survey increased. This result lends a degree of confidence in using windshield surveys to identify hazard trees, but only in cases of high hazards. Considering that in many situations, a community can remedy only the most severe hazards, the windshield survey could be an effective method for assessing community trees for hazard.

In the developed sample areas, the percentage of high hazard trees found using the windshield survey was higher than in undeveloped sample areas. This could occur for many reasons. The developed sections usually had trees that stood by themselves on the side of the road, which facilitated inspection. The inspector could examine these trees continuously, which enabled him to have a longer look at the same tree without having to examine another. In many cases, nearly the entire structure of the tree could be seen in developed areas because of the cleaner roadside environment. In undeveloped wooded areas, leaf piles, brush, or vines obstructed a complete view of the tree. The less-obstructed view in developed areas may have allowed more hazards to be identified.

Several factors affected the windshield survey. First, the drivers improved each time they volunteered because the inspector and driver learned to work together. Primary concerns included the inspector deciding whether it was necessary to slow down as the vehicle approached a questionable tree. After repeated surveys, volunteer drivers and the inspector worked better together. In some cases, the driver would anticipate the next tree to examine and would slow down accordingly. A second factor that affected the windshield survey was inclement weather. During winter 2002–2003, South Kingstown received more snow than in the previous three winters combined, accumulating 143 cm (56 in.). The snow made surveys much more difficult. This factor is important for communities that receive high snowfall. Because the root flare needs to be seen during surveying, a snow pack would prohibit the examination of this area. A third factor that affected the windshield survey was driving speed. The speed at which surveys were completed was directly related to the traffic in the area, tree density, and quality of the trees. The speed at which surveys were conducted was inversely proportional to the amount of vehicular and pedestrian traffic. Survey speed was also inversely proportional to the number of trees on the street. The presence of multiple targets and severe defects similarly slowed surveying.

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The surveyed community had many poor-quality trees with multiple hazardous conditions. This dramatically slowed progress in some areas. The community was chosen because it was thought that the town's tree population would have enough hazard trees to effectively test the project's windshield survey, unfortunately the community had even more than anticipated. A windshield survey of a community that continuously maintains their trees will progress much faster.

CONCLUSIONS

This study showed that hazardous conditions can be discovered using a windshield survey in the community studied. For this study, minimal training was conducted for the drivers and inspector, and some of the missed hazardous tree conditions presumably would have been discovered with more practice and experience. The proper training of drivers is needed to ensure that trees are not passed without examination.

The main factor in deciding when and where to use the windshield survey is efficiency. These following conditions can assist in determining when it is appropriate to use windshield surveys. The windshield survey worked well in low-traffic areas. In high-traffic, areas the drivers and surveyor became concerned about the traffic. This caused some disruptions of the survey. In high-traffic areas, walking or using other means, such as a bicycle to move from tree to tree, would be advisable.

Another consideration is the degree of maintenance the trees receive and their average condition. Some of the roads in South Kingstown had many trees in poor shape and with many hazardous conditions. This dramatically slowed the survey. If the trees are not well maintained, a thorough inventory may be the best choice. If the trees are reasonably maintained, the windshield survey could be used just to locate quickly developing hazardous conditions such as hanging branches or recent storm damage, or for an annual update of streetside conditions.

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Résumé. Les conditions de risques des arbres de rues sont un sujet constant de préoccupation pour les arboriculteurs municipaux. En raison de contraintes fiscales, plusieurs municipalités veulent une méthode précise et efficace pour inspecter leur population d'arbres. Cette étude de cas présente une méthode d'inventaire au moyen d'une auto qui peut être utilisée pour détecter les situations à risques sur les arbres de rues, et ce en utilisant une méthodologie simple et l'expérience d'un arboriculteur certifié. De plus, cet exemple de cas permet de démontrer que le pourcentage de conditions dangereuses détectées s'accroît lorsque la condition des arbres devient plus sévère. Le pourcentage d'arbres dangereux détectés au moyen d'un inventaire en auto était plus important dans les secteurs d'échantillonnage de zones développées que lorsque l'on était dans les secteurs d'échantillonnage de zones non développées.

Zusammenfassung. Die Gefahrbringenden Zustände von Straßenbäumen sind eine ständige Sorge für die städtische Baumpflege. Wegen finanzieller Einschränkungen haben viele Stadtverwaltungen den Wunsch nach einer akkuraten und effizienten Methode, die Bäume zu überwachen. Diese Fallstudie zeigt, dass eine Windschutzstudie genutzt werden kann, um die Gefahrbringenden Zustände von Straßenbäumen aufzuzeigen, indem ein einfaches System und ein qualifizierter, erfahrener Baumpfleger einbezogen werden. Zusätzlich zeigte die Fallstudie, dass der Prozentsatz von aufgezeigten Gefahrbringenden Bäumen anstieg, als die Zustände ernster wurden. Der Prozentsatz von aufgezeigten Gefahrbringenden Bäumen durch die Windschutzstudie in entwickelten Probeflächen überstieg weit die der gefundenen Bäume in unentwickelten Probeflächen.

Resumen. Las condiciones de riesgo con árboles en las carreteras son una preocupación constante para los arboristas municipales. Debido a obligaciones fiscales, muchas municipalidades desean precisar y hacer eficiente el método para inspeccionar sus poblaciones de árboles. Este caso de estudio muestra que un relevamiento rápido, desde un vehículo, puede ser usado para encontrar condiciones peligrosas en árboles de las carreteras, usando un sistema simple y un arborista certificado con experiencia. Además, el caso de estudio mostró que el porcentaje de situaciones riesgosas detectadas incrementó a medida que estas condiciones fueron más severas. El porcentaje de condiciones riesgosas con los árboles encontrados, usando un inventario rápido en áreas de muestreo, excedió al de áreas sin desarrollo.

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Attachment 3

CITY OF WEST FARGO, ND
Expenditure Budget Report -- MultiYear Actuals
For the Year: 2015

2210 FORESTRY

Account Object	Actuals 2011	2012	2013	2014	Current Budget 2014	% Exp. 2014	Prelim. Budget 15	Budget Changes 15	Final Budget 15	% Old Budget 15
428000 FORESTRY										
110 PERMANENT EMP SALARIES					0	0%	30,860	_____	30,860	*****%
$30,860 Grade 30-addition of full-time forestry person										
114 PART TIME SALARIES	46,676	47,429	53,462	50,181	56,000	90%	56,000	_____	56,000	100%
220 SOCIAL SECURITY	3,571	4,468	4,403	4,527	3,825	118%	6,645	_____	6,645	174%
$2,361 SS for new forestry person										
$4,284 ss for part-time forestry help										
230 RETIREMENT					0	0%	4,710	_____	4,710	*****%
$4,710 Retirement for new full-time forester										
250 UNEMPLOYMENT			405		0	0%	_____	_____	0	0%
320 HEALTH INSURANCE					0	0%	13,308	_____	13,308	*****%
$13,308 Insurance for new full time forester										
340 TRAVEL & EDUCATION				805	1,000	81%	1,000	_____	1,000	100%
360 MISC PRINTING & MAILING	440	380	1,019	746	1,000	75%	1,000	_____	1,000	100%
373 IN SERVICE TRAINING	910	894	766	1,187	1,000	119%	1,000	_____	1,000	100%
387 MEDICAL/VACCINES				473	0	***%	_____	_____	0	0%
410 OFFICE SUPPLIES	58	167	143	114	200	57%	200	_____	200	100%
426 MACHINERY-EQUIP/PARTS	759	375	1,011	1,065	1,000	107%	1,000	_____	1,000	100%
427 REPAIRS	723	211	114	524	500	105%	500	_____	500	100%
446 TREE PURCHASE	6,065		1,048		0	0%	_____	_____	0	0%
667 MEMBERSHIPS				25	0	***%	_____	_____	0	0%
870 CAPITALIZED ASSETS - OVER					0	0%	48,761	_____	48,761	*****%
$48,761 Equipment - new forestry position										
Account:	59,202	53,924	62,371	59,647	64,525	92%	164,984	0	164,984	256%
Fund:	59,202	53,924	62,371	59,647	64,525	92%	164,984	0	164,984	256% %
Grand Total:	59,202	53,924	62,371	59,647	64,525		164,984	0	164,984	

Attachment 4

PURDUE UNIVERSITY

PURDUE EXTENSION

FNR-473-W

EXPERT REVIEWED

Tree Appraisal

Author

Lindsey Purcell,

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Trees provide many benefits and value to property owners in functional, aesthetic, social, environmental — and even economic — ways. Value may be defined as the present worth of future benefits. Many of these benefits can be quantified by a dollar figure, and it is the responsibility of an appraiser to assign monetary value. Appraising trees and living landscape components can be challenging, and requires training, expertise and experience.

The methods used to value trees are published in *The Guide for Plant Appraisal, 9th Edition,* authored by the Council of Tree and Landscape Appraisers (CTLA). The guide is endorsed by all the major arboriculture, horticulture and real estate industry organizations. When conducting an appraisal, be sure to use the current edition. The guide describes the various appraisal processes and gives examples of each. Although it is a good tool for the valuation of plants, it is only a guide and the procedures involved require care and experience.

The purpose of an appraisal is defined by the clients' needs. These needs may include tort claims, insurance claims, tax deductions, real estate assessment and proactive planning. An appraisal estimates the defined value of personal property, including plants. The tree appraisal process is used to develop a supported estimate of current value.

Unfortunately, most appraisals are done after trees have been removed or damaged. This situation requires additional investigation and might include determining pre-casualty value or sampling on a local basis. The best time to conduct an appraisal is prior to any incident or damage. This is rarely done, however. If available, previous site records, tree assessments, site reviews, images and even a witness can help determine the tree's pre-damage condition. With all the facts gathered, it is the duty of the appraiser to determine the appropriate method and provide an unbiased valuation. The appraiser should document all activities related to the process, from initial contact with the client — including establishing the background information on the tree — to inspecting the site and formulating values.

Regardless of the appraisal method used, there are some primary factors to consider. The four major elements involved in properly assessing the value of a tree are size, species, condition and location. A thorough understanding of each is imperative; otherwise, the appraisal will lack credibility and significance for the case.

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Tree condition or health is an important rating determination.

Location is one factor in determining a tree's value.

The **species** rating is a comparative value given to the tree or plant based upon its individual characteristics. Consideration is given to the plant's assets and its inherent qualities. This rating is provided by a council of experts in the area and will vary within regions around the country. Additionally, there can be variations in ratings within the state, relative to hardiness zones. Adjustments will be necessary based on subjective observation. Check the local chapter of the International Society of Arboriculture for more information on the ratings for your state.

The **condition** of the tree is a subjective determination made by the appraiser during the inspection. It is an assessment of the tree's structural integrity and health at the time of appraisal. Thought should be given to rooting, branching, health and vigor, any damage or wounds, and evidence of pest infestation. It is important to note the current condition as the most reasonable gauge for the rating determination.

The **size** of the plant is measured using common tools and industry standards. A diameter tape or tape measure can be used to measure trunk size, and is typically recorded as the diameter at 4.5 feet above grade, or shoulder height. Consult with the appraisal guide on proper sizing procedures.

The **location** factor involves the landscape value of the site and the placement of the tree on the property. Consider the location of the property, overall quality of the landscape, hardscape and related elements. Understand the tree's contribution to the site, its function and the aesthetics to determine how effectively the placement of the tree provides these benefits.

A diameter tape aids in calculating tree size.

After the primary plant and site assessments have been completed, determination of the proper approach is necessary. *The Guide for Plant Appraisal* details three basic methods for plant valuation: cost, income and market approaches. The approach chosen depends on the kind of property, purpose of the appraisal and quality of information for analysis. It may be necessary to use other methods, or a combination of approaches, in the appraisal process to verify the results.

The **Cost Approach** considers the amount in dollars to either repair damage to the tree or replace the tree. There are various methods to use within this approach:

Replacement Cost estimates the cost of replacing a tree in the same location with the same species and, if possible, of similar size. However, in most cases a tree is too large to be replaced by a single tree and still be of equal value. In those cases, appraisers may designate several smaller trees deemed collectively to be equivalent to the original tree. This becomes a matter of calculating the value of the replacement trees and their associated costs. Often, some type of settlement is involved in the negotiations, as well. This usually is found to be the most accurate determination of market value of the tree.

Trunk Formula (TFM) defines value in comparison to other trees of the same species. However, it does not necessarily provide adequate market value of the tree. The TFM often is used when the tree is too large to be replaced with typical nursery stock, and can be a good representation of overall value to the property. The basic value of a tree is the sum of two factors: the cost of transplanting the largest normally available tree of the same or comparable species, and the increase in value because of the larger size of the tree being appraised compared to the size of the replacement tree. An example can be found at the end of this publication.

The formula used in the process is stated as:

Value = Basic Tree Cost x Species Rating % x Condition Rating % x Location Rating %

- **Basic Tree Cost** is the Replacement Tree Cost + (Base Price x Adjusted Trunk Area, or ATA). Base price is determined to be $65 for Indiana. ATA is the area of the tree trunk in square inches measured at standard height of 4.5 feet, less the area of the largest available transplantable tree, which is determined to be $800 in Indiana. A table of conversions from Diameter at Breast Height, or DBH, to ATA is available in the CTLA guide.
- **Species** rating is the factor assigned to a given tree species, based on the list provided in this publication. This subjective rating is based on individual qualities and traits, which may vary geographically within the state because of local climate and environmental influences.
- **Location** rating is a value determined by the tree's placement in the landscape and the overall area in which the property is located. It is derived by the following equation: (Site % + Contribution % + Placement %) ÷ 3
- **Condition** rating is determined by establishing the overall health and structural integrity of the tree. An assessment of condition includes roots, trunk and canopy. The appraiser and the appraisal situation determine the amount of detail in this assessment.
- **Replacement Tree Costs** are the cost of the tree, cost of transporting the tree to the site, planting it in the same location as the appraised tree and monitoring it during the maintenance period. This cost is subjective to location.

Example: A residential site located on Main Street has a Black Walnut, *Juglans nigra*, located in the rear of the site, near the garage. The tree measures 33 inches DBH, and is in good condition. The tree owners wish to have it appraised to determine the value of the tree on their property.

Using the Trunk Formula Method as defined by the Council of Tree and Landscape Appraisers as

Value = Basic Tree Cost x Species Rating % x Condition Rating % x Location Rating %

the formula can be expanded to determine the values for each component as:

V = (RC + ((BP x (ATA – ATr)) x SR x CR x LR

V = Value of appraised plant.

RC = Replacement Cost for the average largest transplantable sized tree that a nursery can provide in this area. This has been determined to be $800 for Indiana.

BP = Base Price per square inch dollar value of a tree. For Indiana, this has been determined to be $65.

ATA = Adjusted Trunk Area value at DBH in square inches of the tree. This number is available from the chart provided in the CTLA guide.

ATr = Adjusted Trunk replacement value at DBH in square inches of the average largest transplantable sized tree that a nursery can provide in Indiana. This has been found to be 4 inches, which has a trunk area of 13 square inches.

SR = Species Rating value between .00 and 1.00, which can be determined by using the table provided. This is a subjective value, which can be adjusted to a higher or lower value, depending on the location in the state.

LR = Location Rating value between .00 and 1.00, and determined by rating the placement of the tree in the landscape. This value is an average of site, contribution and placement ratings.

CR = Condition Rating value between .00 and 1.00 for the tree, and determined by assessment of overall tree health and structure.

Using the information provided and subjectively rating the tree for appraisal, the formula values would be:

Appraised Value = $800 + (($65 x (835 in^2 – 13 in^2)) x .50 x .88 x .70

Appraised Value = $16,703 based on the assessment of the tree and property. This is the worth of the tree in relation to the property, site and location.

Cost of Repair calculates the cost to perform maintenance on the affected tree in order to repair damage. It includes wound treatment, cabling, bracing, pruning, pest management and associated cultural practices to improve health, such as supplemental irrigation, mulching and fertilization.

Cost of Cure is similar to Cost of Repair. This method is used to determine the cost of treatment that will return the property to the closest approximation of its original condition. This often is called "years to parity" and is a very detailed, intricate approach requiring diligence in the assessment and calculation of repairs. Both Cost of Repair and Cost of Cure approaches account for tree and debris removal, the replacement process and post-restoration maintenance.

The **Income Approach** is preferred when a property or segment of a property might provide income benefits. There are various methods within this approach, which includes crop values, forest appraisal and rental value.

Market Approach is based on market information derived from an investigation of property sales. The market approach will determine the market value of a property with and without the trees or their damage. This method may employ more than one approach to reach valuation. This is only one value indicator, and perhaps is best utilized as a reasonability check.

The appraisal method chosen will have a profound effect on the final value attributed to a tree or landscape. Results should be reasonable in relationship to the value of the property where it resides. Similar trees in different areas could have much different values. Studies have estimated that trees may account for up to 20 percent of the value of a residential property. In other circumstances, much lower values could result, depending on location and other factors.

There are several considerations that influence inspection and appraisal processes, and how characteristics translate into value. Laws governing appraisals dictate which method may be allowed in particular applications. Important, detailed discussions of tree appraisals can be found in the *Guide for Tree Appraisal*. The appraiser may assume the role of mediator, arbitrator, consulting expert or expert witness. In all situations, an appraisal might be a target for lawsuits. The appraiser should maintain proper insurance for protection. When an *expert* opinion is necessary, as for an insurance or legal claim, it is wise for the tree owner to consult with a professional arborist. Experience is critical to proper valuation of a tree.

Table 1. Species Rating for Landscape Trees — This list contains a sample of plants in the landscape that grow in Indiana, including native and non-native selections. This is not meant to be inclusive but, rather, representative of the majority of species found commonly in the urban forest. The ratings represent comparative values for species found in Indiana with consideration given to the following:

• Hardiness • Durability (structural integrity)
• Longevity • Biotic tolerance

These ratings do not take into consideration factors such as maintenance requirements, nonstructural tree characteristics (e.g., aesthetics) and site adaptability. Such factors are more appropriately considered in the rating of the tree's CONDITION AND LOCATION CLASSES.

NOTE: The values contained in the Species Rating Guide should not be used without following the procedures identified and explained in the *Guide for Plant Appraisal, 9th Edition*, authored by the Council of Tree and Landscape Appraisers, and published by the International Society of Arboriculture.

Scientific Name, Common Name	Notes	Rating
Abies concolor, White or Concolor Fir		80
Acer campestre, Hedge Maple		60
Acer xfreemanii, Freeman Maple		70
Acer ginnala, Amur Maple		60
Acer griseum, Paperbark Maple		70
Acer miyabei, Miyabe Maple		80
Acer negundo, Boxelder		20
Acer nigrum, Black Maple		80
Acer palmatum, Japanese Maple		70
Acer platanoides, Norway Maple	Invasive species	20
Acer pseudoplatanus, Sycamore Maple		70
Acer rubrum, Red or Swamp Maple		60
Acer saccharinum, Silver Maple		40
Acer saccharum, Sugar Maple	Improved cultivars	80
Acer saccharum, Sugar Maple	Improved cultivars	80
Acer tataricum, Tartarian Maple		70
Acer triflorum, Three-Flowered Maple		80
Acer truncatum, Purpleblow Maple		70
Aesculus xcarnea, Red Horsechestnut		70
Aesculus glabra, Ohio Buckeye		60
Aesculus hippocastanum, Common Horsechestnut		60
Aesculus pavia, Red Buckeye		70
Ailanthus altissima, Tree of Heaven	Prohibited-noxious species	20
Albizia julibrissin, Mimosa or Silk Tree		20

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Alnus glutinosa, European Black Alder	Invasive species	20
Alnus incana, White Alder		70
Alnus rugosa, Speckled Alder		70
Amelanchier, Serviceberry		70
Asimina triloba, Common Pawpaw		50
Betula alleghaniensis (lutea), Yellow Birch		50
Betula lenta, Sweet Birch		50
Betula nigra, River or Red Birch		70
Betula papyrifera, Paper Birch		40
Betula pendula, European White Birch		20
Betula populifolia, Gray Birch		40
Carpinus betulus, European Hornbeam		70
Carpinus caroliniana, American Hornbeam (Blue Beech)		70
Carya sp., Hickory	Various species	70
Castanea dentata, American Chestnut		20
Castanea mollissima, Chinese Chestnut		60
Catalpa sp., Catalpa		40
Celtis laevigata, Sugar Hackberry	Southern locations	70
Celtis occidentalis, Common Hackberry		70
Cercidiphyllum japonicum, Katsura Tree		80
Cercis canadensis, Redbud		60
Chionanthus virginicus, Fringetree		60
Cladrastis lutea (kentukea), Yellowwood		60
Cornus alternifolia, Pagoda Dogwood		70
Cornus florida, Flowering Dogwood		60
Cornus kousa, Kousa Dogwood		70
Cornus mas, Cornelian Cherry Dogwood		70
Cornus officinalis, Japanese Cornel Dogwood		70
Corylus colurna, Turkish Filbert		80
Cotinus coggygria, Common Smoke Tree		60
Cotinus obovatus, American Smoke Tree		70
Crataegus crus-galli, Cockspur Hawthorn		80
Crataegus laevigata, English Hawthorn		40
Crataegus mollis, Downy Hawthorn		50
Crataegus phaenopyrum, Washington Hawthorn		70
Crataegus xlavallei, Lavalle Hawthorn		60
Crataegus 'Vaughn,' Vaughn Hawthorn		60
Crataegus viridis 'Winter King,' Winter King Hawthorn		70
Diospyros virginiana, Common Persimmon	Male	70
Diospyros virginiana, Common Persimmon	Female	50
Elaeagnus angustifolia, Russian-Olive	Invasive species	20
Eucommia ulmoides, Hardy Rubber Tree		50

Fagus grandifolia, American Beech		80
Fagus sylvatica, European Beech		70
Fraxinus americana, White Ash	Rating subject to EAB and treatment protocol	70
Fraxinus excelsior, European Ash	Rating subject to EAB and treatment protocol	60
Fraxinus pennsylvanica, Green Ash	Rating subject to EAB and treatment protocol	60
Fraxinus quadrangulata, Blue Ash	Rating subject to EAB and treatment protocol	70
Ginkgo biloba, Ginkgo	Male	90
Ginkgo biloba, Ginkgo	Female	60
Gleditsia triacanthos, Honeylocust		70
Gleditsia triacanthos f. inermis, Thornless Honeylocust	Improved cultivars	50
Gymnocladus dioica, Kentucky Coffeetree	Male	80
Gymnocladus dioica, Kentucky Coffeetree	Female	60
Halesia carolina, Carolina Silverbell		70
Ilex opaca, American Holly		70
Juglans cinerea, Butternut		30
Juglans nigra, Black Walnut		40
Juniperus chinensis, Chinese Juniper		60
Juniperus virginiana, Eastern Red Cedar		60
Koelreuteria paniculata, Golden Raintree		60
Larix decidua, European Larch		60
Larix kaempferi, Japanese Larch		60
Larix laricina, American Larch		50
Liquidambar styraciflua, Sweetgum	Seedless varieties	80
Liriodendron tulipifera, Tuliptree		70
Maclura pomifera, Osage-Orange	Invasive species	20
Magnolia acuminata, Cucumbertree Magnolia		70
Magnolia grandiflora, Southern Magnolia		60
Magnolia kobus, Kobus Magnolia		60
Magnolia xloebneri, Loebner Magnolia	Improved cultivars	70
Magnolia xsoulangiana, Saucer Magnolia		70
Magnolia virginiana, Sweetbay Magnolia	Southern locations	70
Malus, Crabapple	Cultivar-dependent	80
Metasequoia glyptostroboides, Dawn Redwood		60
Morus sp., Mulberry		40
Nyssa sylvatica, Sourgum (Black Tupelo)		80
Ostrya virginiana, Ironwood (Hophornbeam)		80
Oxydendrum arboreum, Sourwood		60

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Paulownia tomentosa, Paulownia (Princess Tree)	Invasive species	20
Phellodendron amurense, Amur Corktree	Invasive species	20
Picea abies, Norway Spruce		70
Picea glauca, White Spruce		70
Picea glauca var. *Densata,* Black Hills Spruce		70
Picea omorika, Serbian Spruce		70
Picea pungens, Colorado Spruce		70
Pinus banksiana, Jack Pine		40
Pinus bungeana, Lacebark Pine		70
Pinus cembra, Swiss Stone Pine		70
Pinus echinata, Short Leaf Pine		50
Pinus nigra, Austrian or Black Pine		40
Pinus ponderosa, Ponderosa Pine		60
Pinus resinosa, Red Pine		50
Pinus strobus, Eastern White Pine		70
Pinus sylvestris, Scotch Pine		40
Platanus xacerifolia, London Planetree		60
Platanus occidentalis, Sycamore		70
Populus alba, White or Silver Poplar		30
Populus deltoides, Cottonwood	Male	50
Populus deltoides, Cottonwood	Female	30
Populus euroamericana, Hybrid Poplar		50
Populus grandidentata, Bigtooth Aspen		50
Populus nigra 'Italica,' Lombardy Poplar		20
Populus tremuloides, Quaking Aspen		50
Prunus americana, Wild Plum		50
Prunus armeniaca var. *mandshurica,* Manchurian Apricot		50
Prunus avium, Sweet Cherry		40
Prunus cerasifera, Purple Leaf Plum		40
Prunus maackii, Amur Choke Cherry		60
Prunus padus, European Bird Cherry		40
Prunus persica, Common Peach		40
Prunus sargentii, Sargent Cherry		70
Prunus serotina, Black Cherry		50
Prunus serrulata, Japanese Flowering Cherry		40
Prunus subhirtella var. *pendula,* Weeping Cherry		40
Prunus virginiana, Choke Cherry		40
Psuedotsuga menziesii, Douglasfir		80
Pyrus calleryana, Callery Pear	Invasive species	20
Quercus alba, White Oak		90
Quercus acutissima, Sawtooth Oak		70
Quercus bicolor, Swamp White Oak		80
Quercus coccinea, Scarlet Oak		70

Quercus ellipsoidalis, Hill's or Northern Pin Oak		60
Quercus falcata var. *pagodaefolia,* Cherrybark Oak	Southern locations	70
Quercus imbricaria, Shingle Oak		70
Quercus macrocarpa, Bur Oak		90
Quercus michauxii, Swamp Chestnut Oak		70
Quercus muehlenbergii, Chinquapin Oak		80
Quercus palustris, Pin Oak		60
Quercus phellos, Willow Oak	Southern locations	70
Quercus prinus, Chestnut Oak		70
Quercus robur, English Oak	Southern locations	80
Quercus rubra, Red Oak		70
Quercus shumardii, Shumard Oak		70
Quercus velutina, Black Oak		60
Rhamnus cathartica, Common Buckthorn	Invasive species	20
Robinia pseudoacacia, Black Locust	Invasive species	20
Salix alba 'Tristis,' Weeping Willow		40
Salix matsudana 'Tortuosa,' Corkscrew Willow		30
Salix nigra, Black Willow		40
Sassafras albidum, Common Sassafras		70
Sophora japonica, Japanese Pagoda Tree	Southern locations	70
Sorbus americana, American Mountain Ash		40
Sorbus alnifolia, Korean Mountain Ash		50
Sorbus aucuparia, European Mountain Ash		50
Syringa pekinensis, Peking Lilac		70
Syringa reticulata, Japanese Tree Lilac		70
Taxodium distichum, Baldcypress		90
Thuja occidentalis, White Cedar Arborvitae		70
Thuja orientalis, Oriental Arborvitae		60
Tilia americana, American (Basswood) Linden		70
Tilia cordata, Little Leaf Linden		60
Tilia xeuchlora 'Redmond,' Redmond Linden		80
Tilia tomentosa, Silver Linden		70
Tsuga canadensis, Canadian Hemlock		80
Ulmus, Hybrid Elms		70
Ulmus americana, American Elm		30
Ulmus carpinifolia, English Elm		30
Ulmus parvifolia, Chinese or Lacebark Elm		70
Ulmus pumila, Siberian Elm		40
Ulmus rubra, Slippery or Red Elm		20
Ulmus thomasii, Rock Elm		30
Viburnum prunifolium, Blackhaw Viburnum		70
Viburnum sieboldii, Siebold Viburnum		60
Zelkova serrata, Japanese Zelkova		60

Table 2. Condition Rating for Landscape Trees — Each plant can have any combination of the following health or structural issues, and others. The expression of symptoms and signs is subjective. The appraiser should consider the individual species characteristics and use existing circumstances as a reasonable scale for condition determination. This table is a general representation to assist in formula values.

Condition Rating	Tree Structure Consider root condition/formation, trunk condition and branch assembly and arrangement	Tree Health Consider crown indicators including vigor, density, leaf size, quality and stem shoot extensions	Formula Values
Excellent	Root plate undisturbed and clear of any obstructions. Root flare has normal development. No visible trunk defects or cavities. Branch spacing/structure and attachments are free of any defects.	Perfect specimen with excellent form and vigor, well-balanced crown. Trunk is sound and solid. No apparent pest problems. Normal to exceeding shoot length on new growth. Leaf size and color normal. Exceptional life expectancy for the species.	1.0-.90
Good	Root plate appears normal; only minor damage may be found. Possible signs of root dysfunction around trunk flare. Minor trunk defects from previous injury, with good closure; less than 25% of bark section missing. Good branch habit, minor dieback with so me signs of previous pruning. Codominant stem formation may be present. Minor corrections required.	Imperfect canopy density in few parts of the tree, 10% or less, lacking natural symmetry. Less than half normal growth rate and minor deficiency in leaf development. Few pest issues or damage, controllable. Normal branch and stem development with healthy growth. Typical life expectancy for the species.	.90-.75
Fair	Root plate reveals previous damage or disturbance and dysfunctional roots may be visible around main stem. Evidence of trunk damage or cavities with decay or defects present. Less than 30% of bark sections missing on trunk. Codominant stems are present. Branching habit and attachments indicate poor pruning or damage, which requires moderate corrections.	Crown decline and dieback up to 30% of the canopy. Overall poor symmetry. Leaf color somewhat chlorotic with smaller leaves. Shoot extensions indicate some stunting and stressed growing conditions. Obvious signs of pest problems contributing to lesser condition. Some decay areas found in main stem and branches. Below average life expectancy.	.75-.50
Poor	Root plate disturbance and defects indicate major damage with girdling roots around the trunk flare. Trunk reveals more than 50% of bark section missing. Branch structure has poor attachments, with several structurally important dead or broken. Canopy reveals signs of severe damage or topping, with major corrective actions required.	Lacking full crown, more than 50% decline and dieback, especially affecting larger branches. Stunting obvious with little evidence of growth on smaller stems. Leaf size and color reveals overall stress in the plant. Insect or disease infestation may be severe. Extensive decay or hollow. Life expectancy is low.	.50-.30

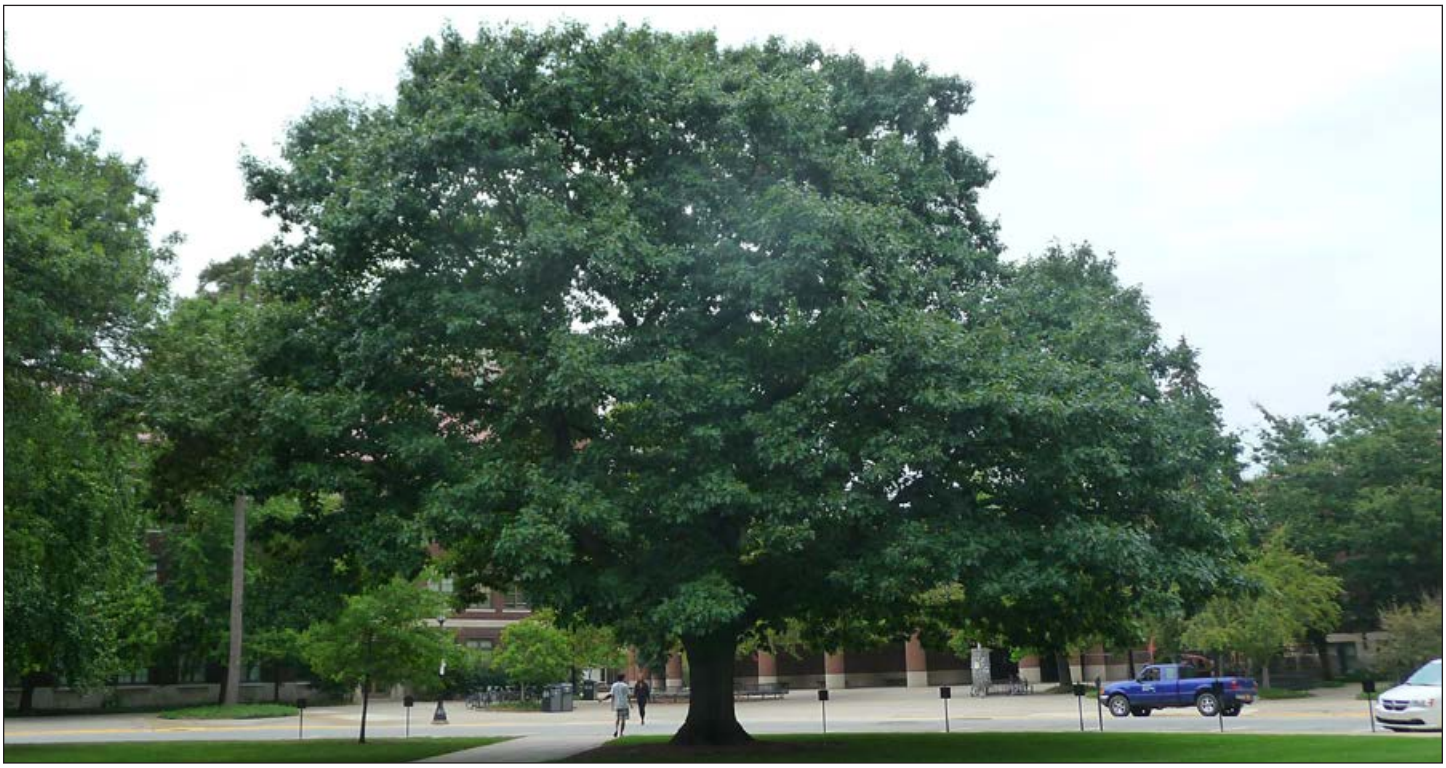

Table 3. Location Rating for Landscape Trees — Representative factors that influence location ratings and suggests formula values for various sites and applications.

Location Rating	Site Position The general appearance and quality of the site in relation to the market value in the area; overall site appearance	Site Contribution The functional and aesthetic attributes the plant has on the site overall in terms of appeal and purpose	Site Placement The effectiveness of realizing benefits and the influence of the plant on contribution to the site	Formula Values
Excellent	Arboretum Well-maintained residential area Historical district Designated parks and recreation areas	Air filtration Water purification Noise abatement Erosion control Windbreaks Shade/cooling effects Specific plant aesthetic factors Structural accents Framing views Space definition Privacy Traffic management Create vistas Screening	Specimen trees in a functional landscape design Single, historic or specimen tree Outstanding aesthetic value in the landscape	1.0-.90
Good	Suburban residential areas Golf course School/corporate campus Green spaces/memorials Cemetery Scenic parkways		Considerable element in the landscape for design quality or function Plants in a windbreak, screen or other integral planting Planting allows maximum functional benefits	.90-.75
Fair	City streets/boulevards Rural residential areas Urban streets Industrial/commercial areas		Well-spaced planting site Tree installation in planting pits or lawn strips Mass, unplanned plantings on a site	.75-.50
Poor	Streets/roadways in rural areas Woodlots, managed Freeways/interstates Countryside, naturally occurring woodlands Woodlots, unmanaged		Trees with utility interaction Improper spacing with infrastructure conflicts Species with fruit or leaf litter issues Invasive species	.50-.30

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