MICHIGAN STATE UNIVERSITY | Extension

Establishing and maintaining landscape plantings on roadsides: Challenges and opportunities

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Michigan State University
Department of Horticulture
Department of Forestry

Program outline

- Why roadside plantings?
- Challenges to establishment and maintenance
  - Above ground
  - Below ground
- Improving establishment
  - Site preparation
  - Plant selection
- Continuing challenges

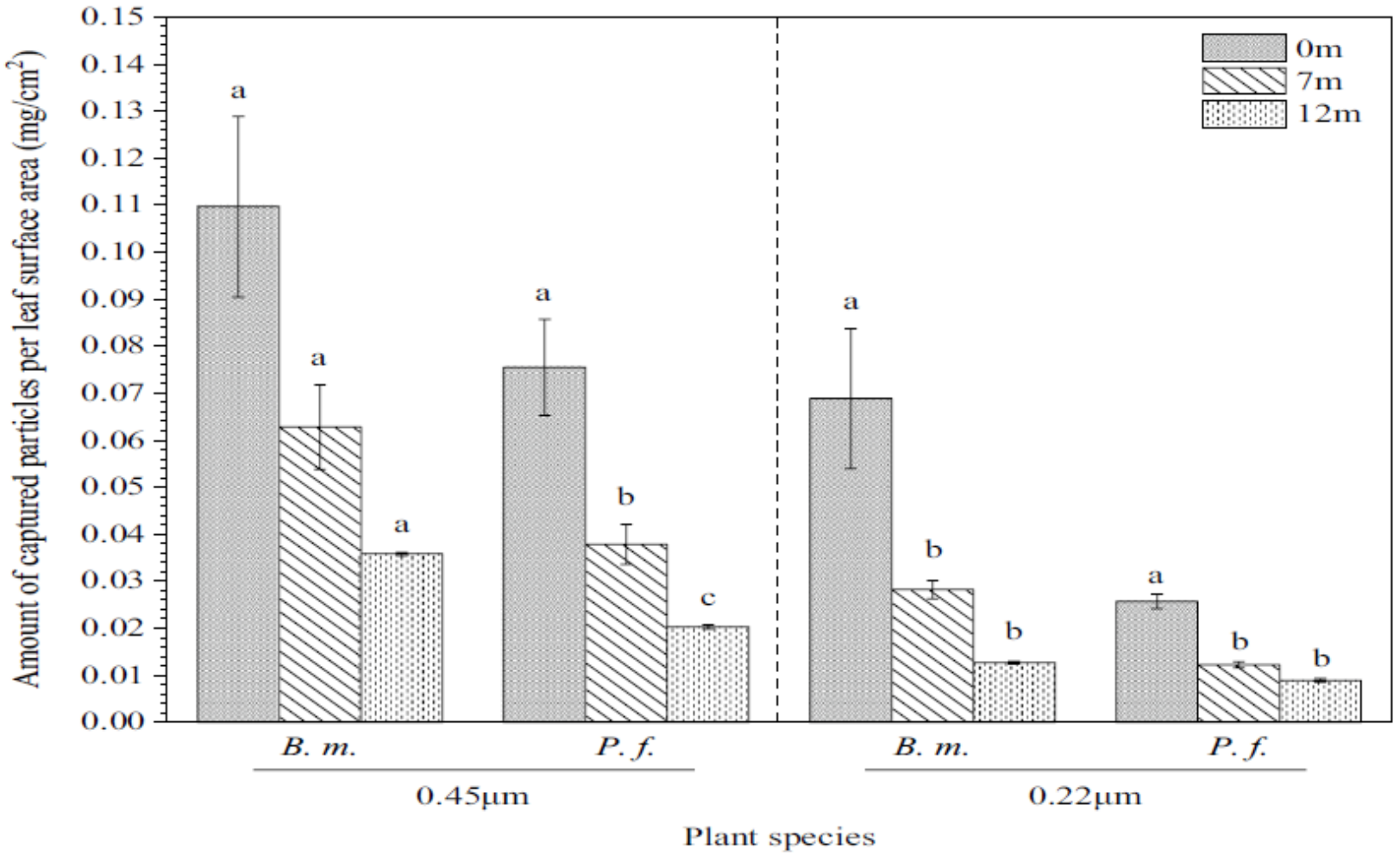
Why roadside plantings?

Lady Bird Johnson Wildflower Center

Pollution mitigation

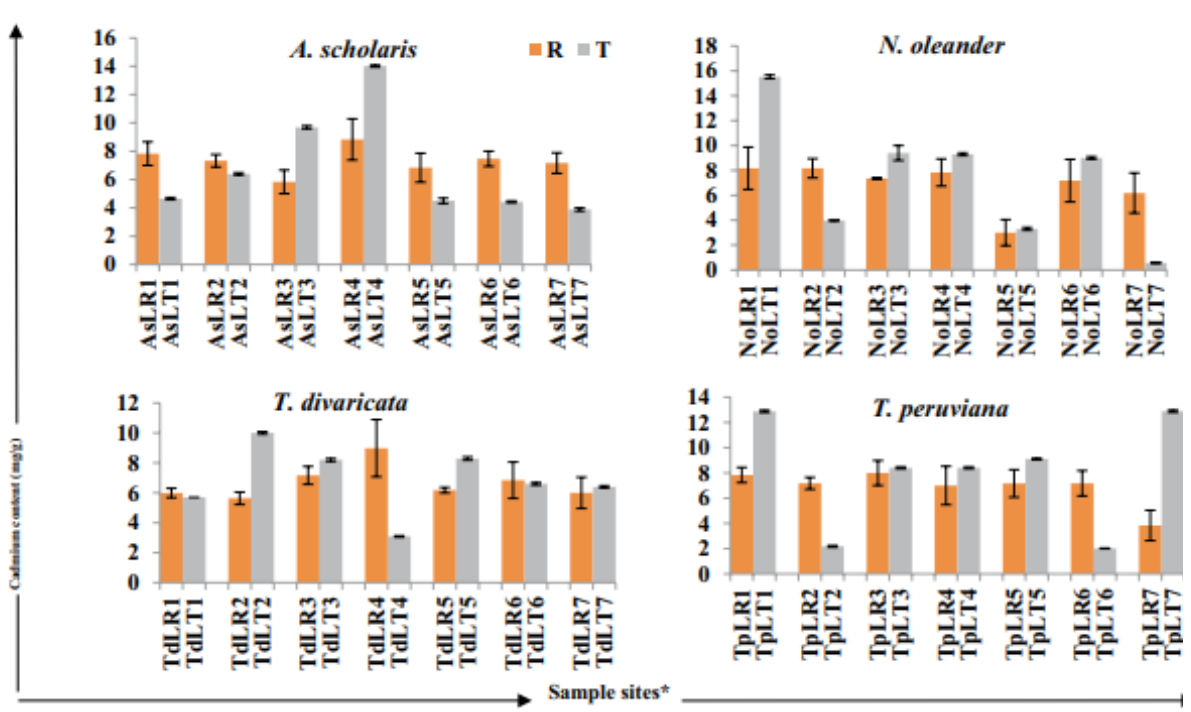
Freep.com

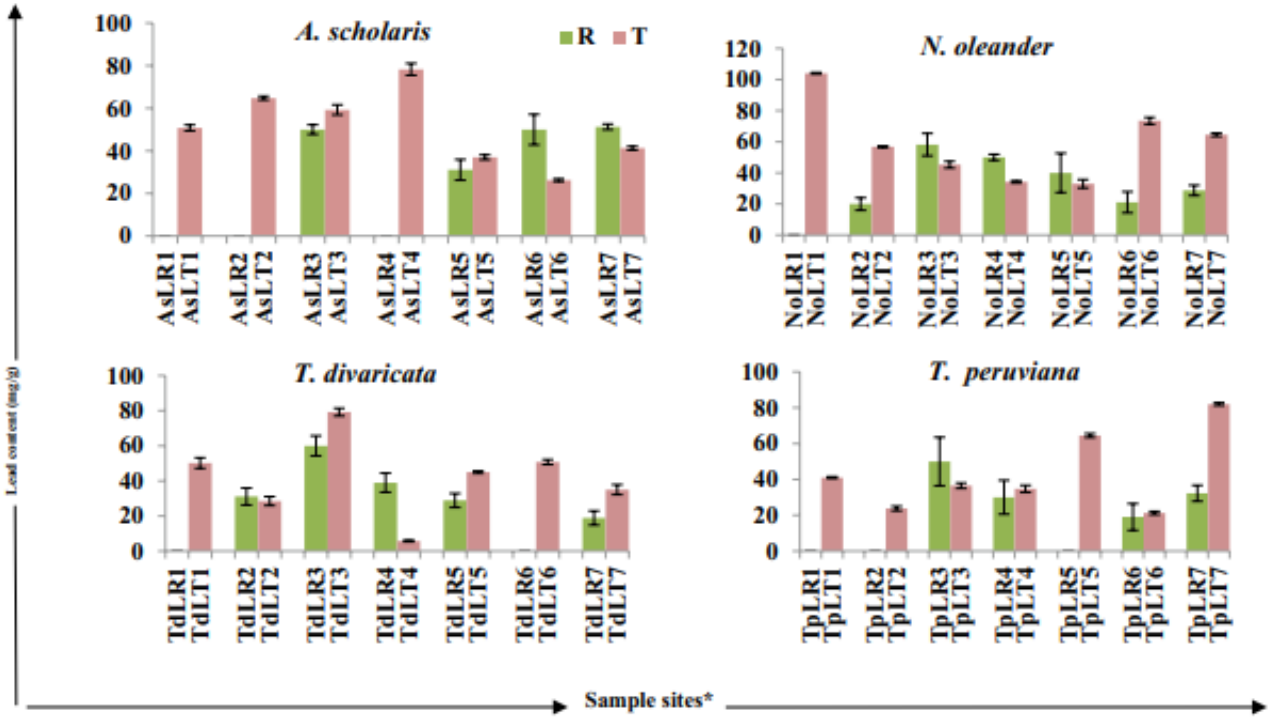
Pollution mitigation: Capture of fine particulates



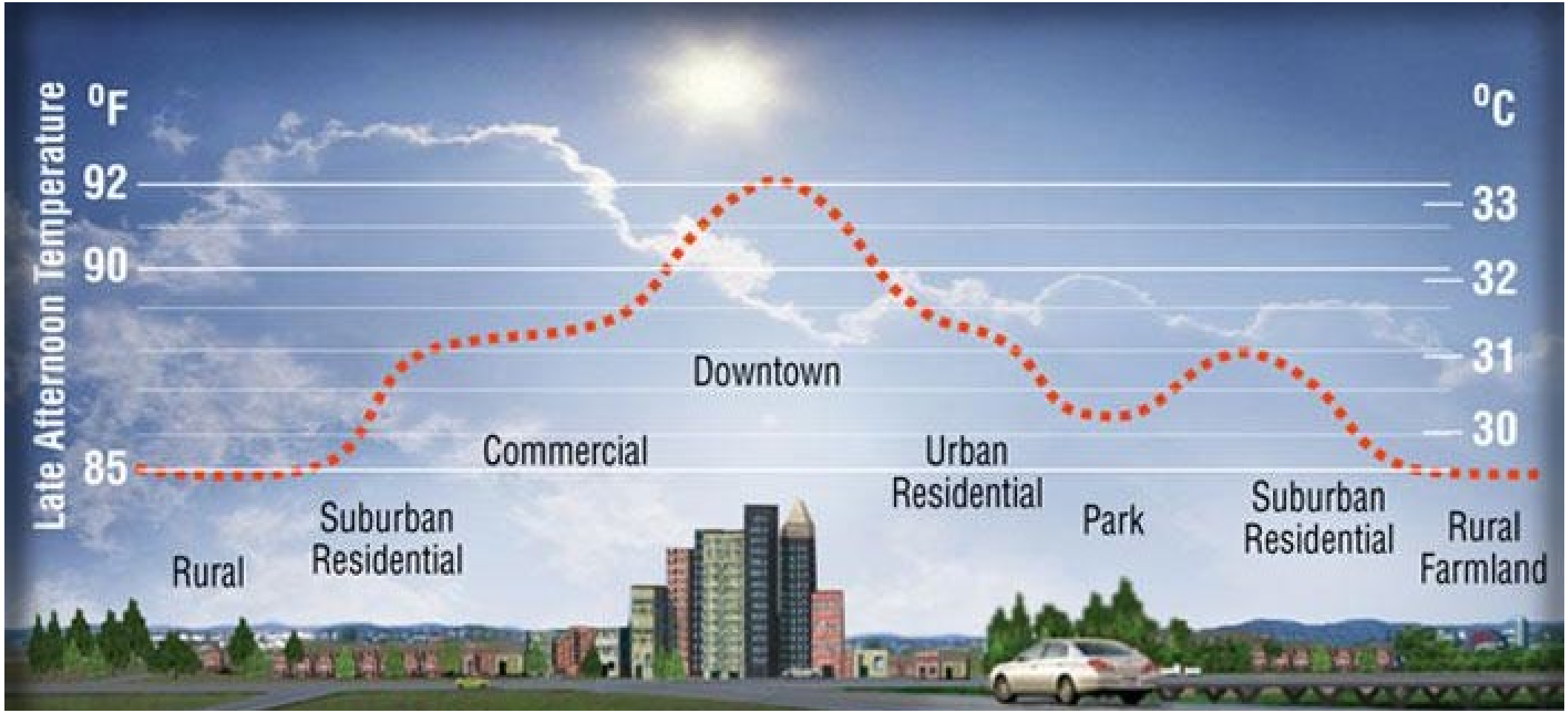
He et al., 2022

Cadmium and lead accumulation in roadside plants





Mitigation of Urban Heat Island Effects



Heat Island Group, Lawrence Berkeley National Laboratory

Driver safety

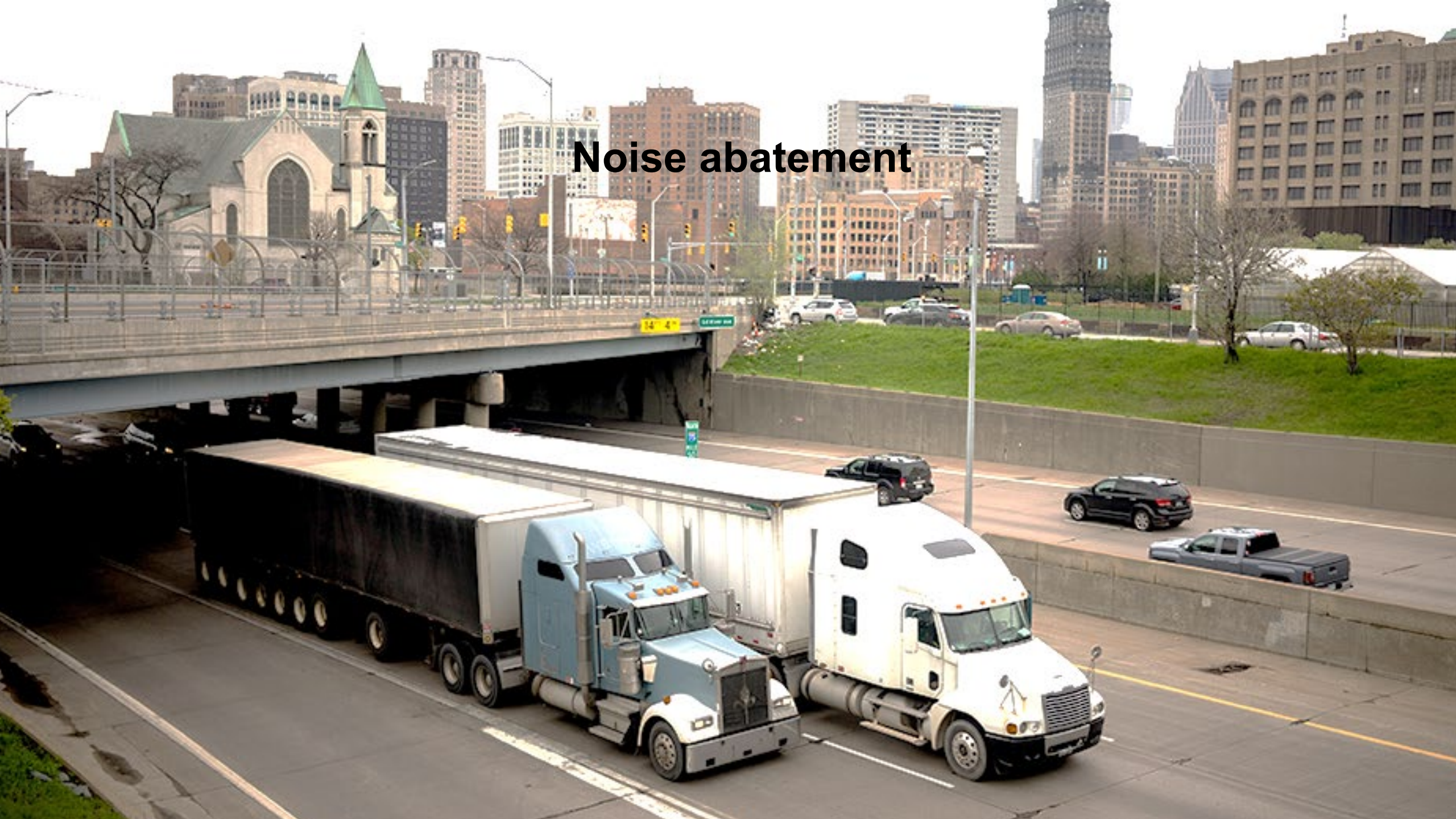
Driver safety: Reduced drive frustration

THE RESTORATIVE EFFECTS OF ROADSIDE VEGETATION
Implications for Automobile Driver Anger and Frustration

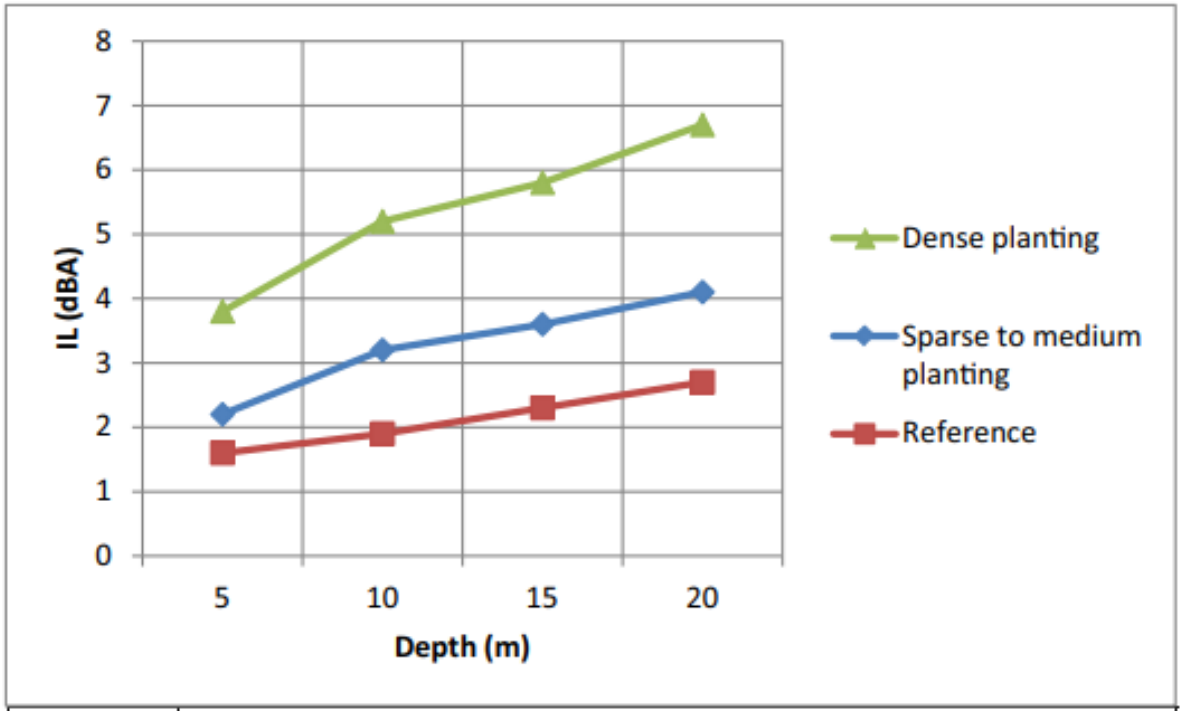
JEAN MARIE CACKOWSKI *is the managing editor of the* Journal of Planning Literature *and publishes the professional newsletter,* Research Design Connections.

JACK L. NASAR, *a professor of city and regional planning at The Ohio State University, edits the* Journal of Planning Literature, *wrote* The Evaluative Image of the City *(Sage) and* Design by Competition *(Cambridge), and edited* Environmental Aesthetics *(Cambridge) and* Directions in Person Environment Research and Practice *(Ashgate).*

Noise abatement



Noise abatement



Depth (m)	% difference between dense and sparse to medium planting schemes
5	42.11
10	38.46
15	37.93
20	38.81

Ow and Ghosh, 2017

Reduced maintenance

Above Ground Challenges

- Microclimate
  - High radiation load
  - Increased temperatures
- Contaminants
  - Vehicle emissions
  - Particulate matter
  - Salt
  - Litter

Salt of the earth?

- DOT's in the US apply 12-17 million tons of deicing salt annually

- Source: National Safety Council

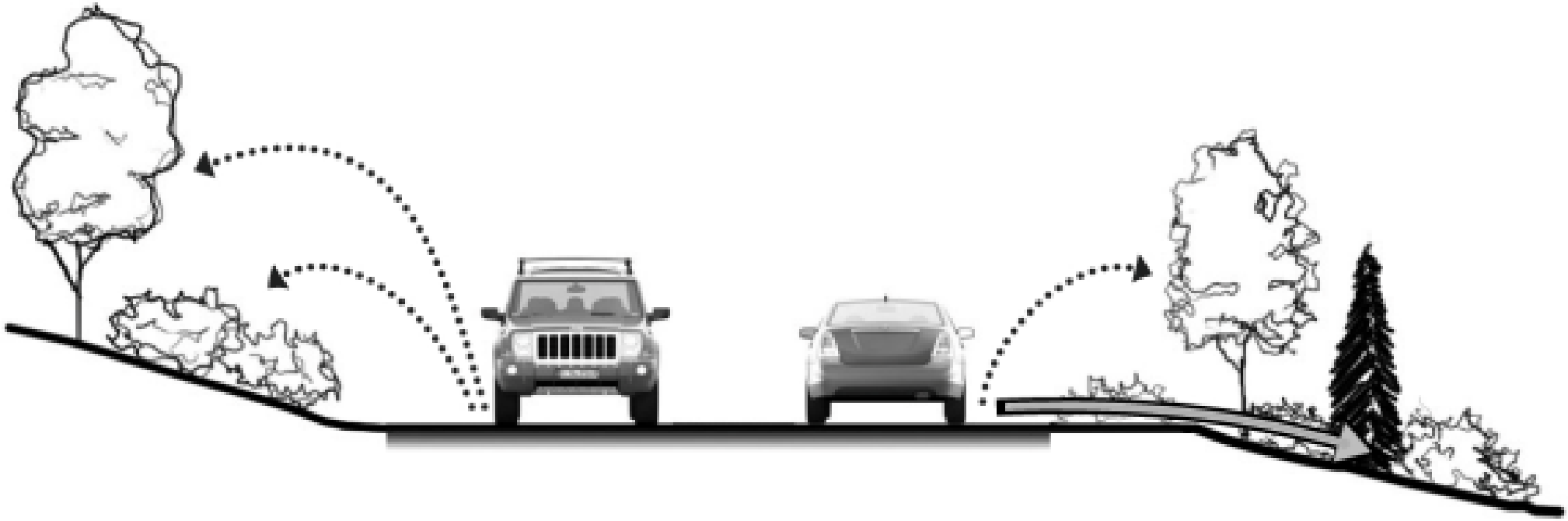
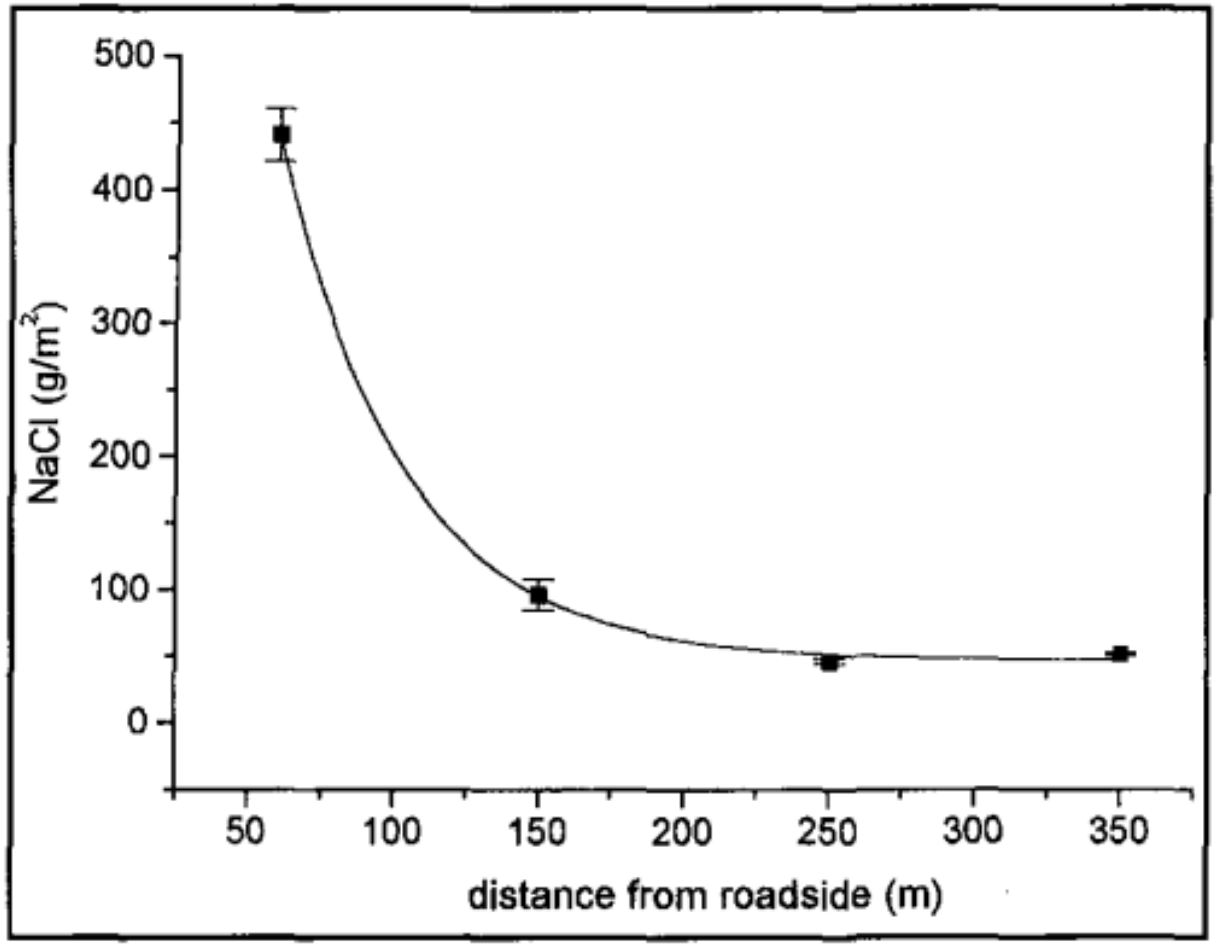


Figure 1. Vegetation elevated above roadway receives aerial salt deposition. Vegetation below roadway receives aerial salt and soil salt deposition.

Image: Rhode Island DOT

Deicing salt deposition as a function of distance from roadway



Pedersen et al. 2000. Journal of Arboriculture, 26(5), 238-245.

Salt impacts on plants

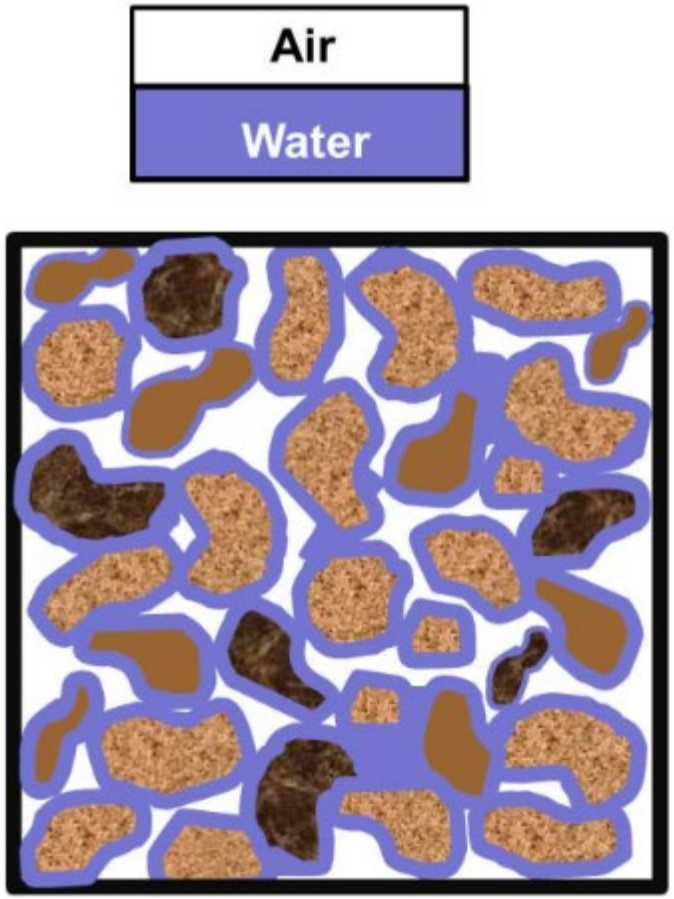
- Direct toxicity
- Osmotic stress
- Reduced cold hardiness
- Reduced nutrient uptake
- Loss of soil structure

Below Ground Challenges

- Soil Compaction
- Soil pH
- Low Organic Matter
- Loss of Soil Structure
- Low Nutrient Status
- Heavy Metals and other contaminants


VOLVO
BOMAG
BRONNER'S
CHRISTmas Wonderland

Soil compaction



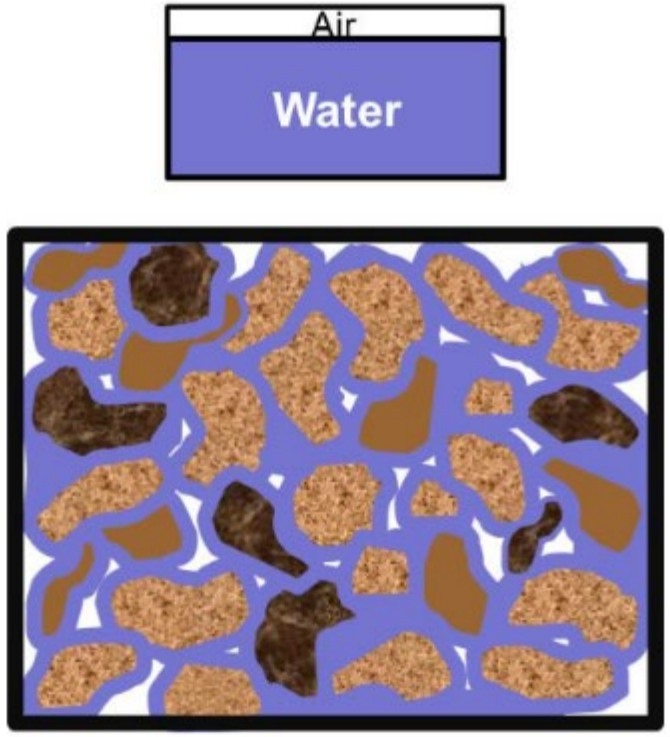


Image: University of Minnesota Extension

Soil structure

How do we get there...

from here.

Improving establishment of highway roadside plantings

- Modify environment
- Plant selection

Improving establishment of highway roadside plantings

- Modify environment
  - Above-ground – limited options
    - Reduce deicing salt use
    - Use alternative deicers
    - Physical barriers

Salt sensitive trees

- Red maples, Sugar maples, and Silver maples
- Lindens
- Pin oak
- Ironwood
- Hornbeam
- White pine
- Eastern redbud

Improving establishment of highway roadside plantings

- Modify environment
  - Below ground – soil modification
    - Amendments
    - Tillage

Efforts underway to improve roadside plantings across the U.S.

WSDOT research with WSU

Arboriculture & Urban Forestry 2016. 42(6): 418–427

ISA International Society of Arboriculture

ARBORICULTURE & URBAN FORESTRY
Scientific Journal of the International Society of Arboriculture

Urban Highway Roadside Soils and Shrub Plantings Enhanced by Surface-Applied and Incorporated Organic Amendments

Andy Bary, Rita L. Hummel, and Craig Cogger

Abstract. Degraded, highly compacted soils along roadsides present an inhospitable environment for trees and shrubs and lead

FDOT Bold Vision

Remediation Process

3 Step Process

Deep-ripping

Addition of Organic Amendment*

*Municipal compost used in Ontario trials
*Municipal compost and composted pulp and paper residuals used in Alberta trials

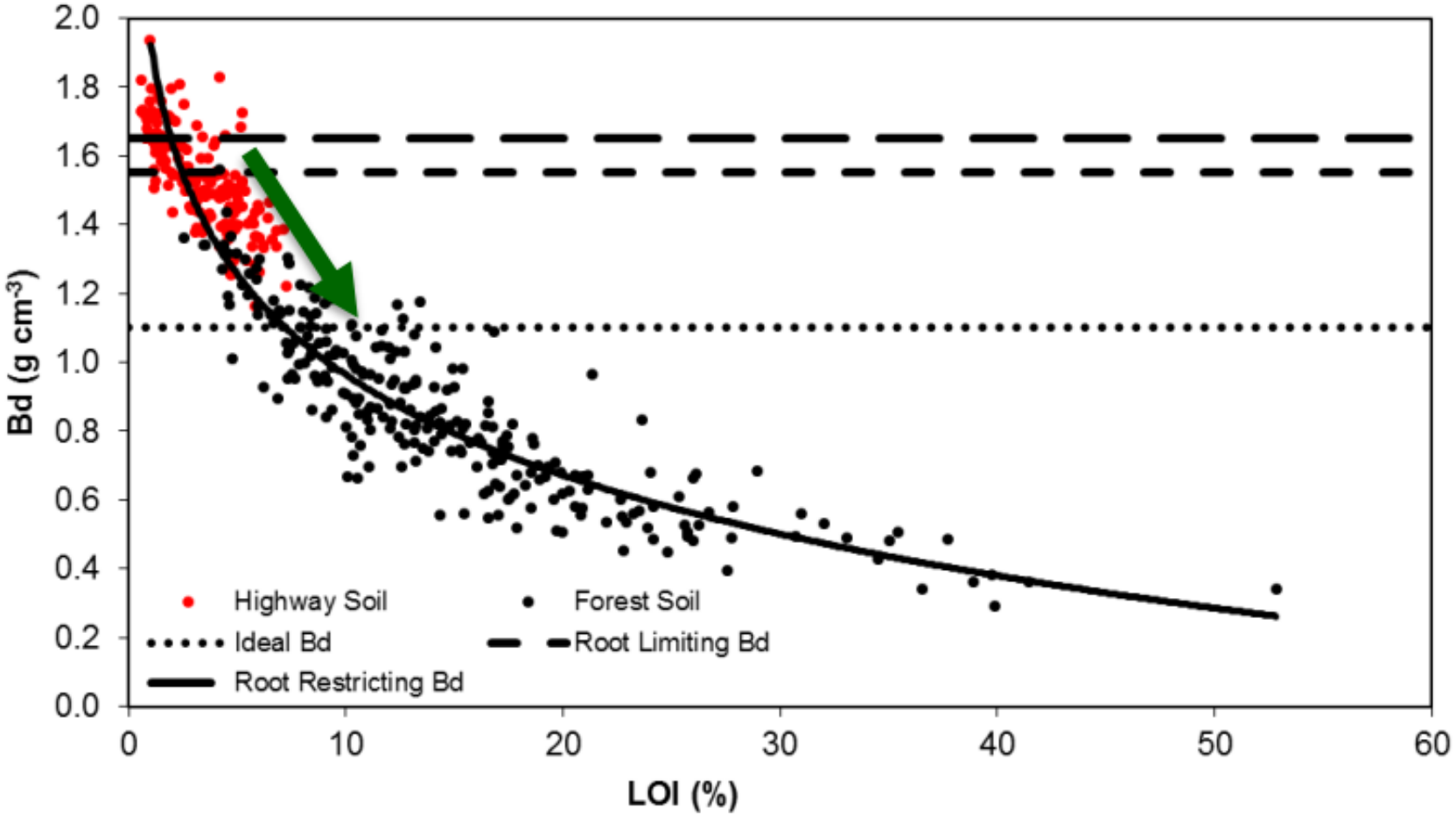
Incorporation of Organic Amendment

Source: Vineland Research and Innovation Centre

Scoop & Dump Technique

- **Apply 6-8” of compost to compacted soil**
- **Use backhoe bucket to dig down to 18”**
- **Mulched added every year to replenish organic matter**

Adding organic matter reduces soil bulk density

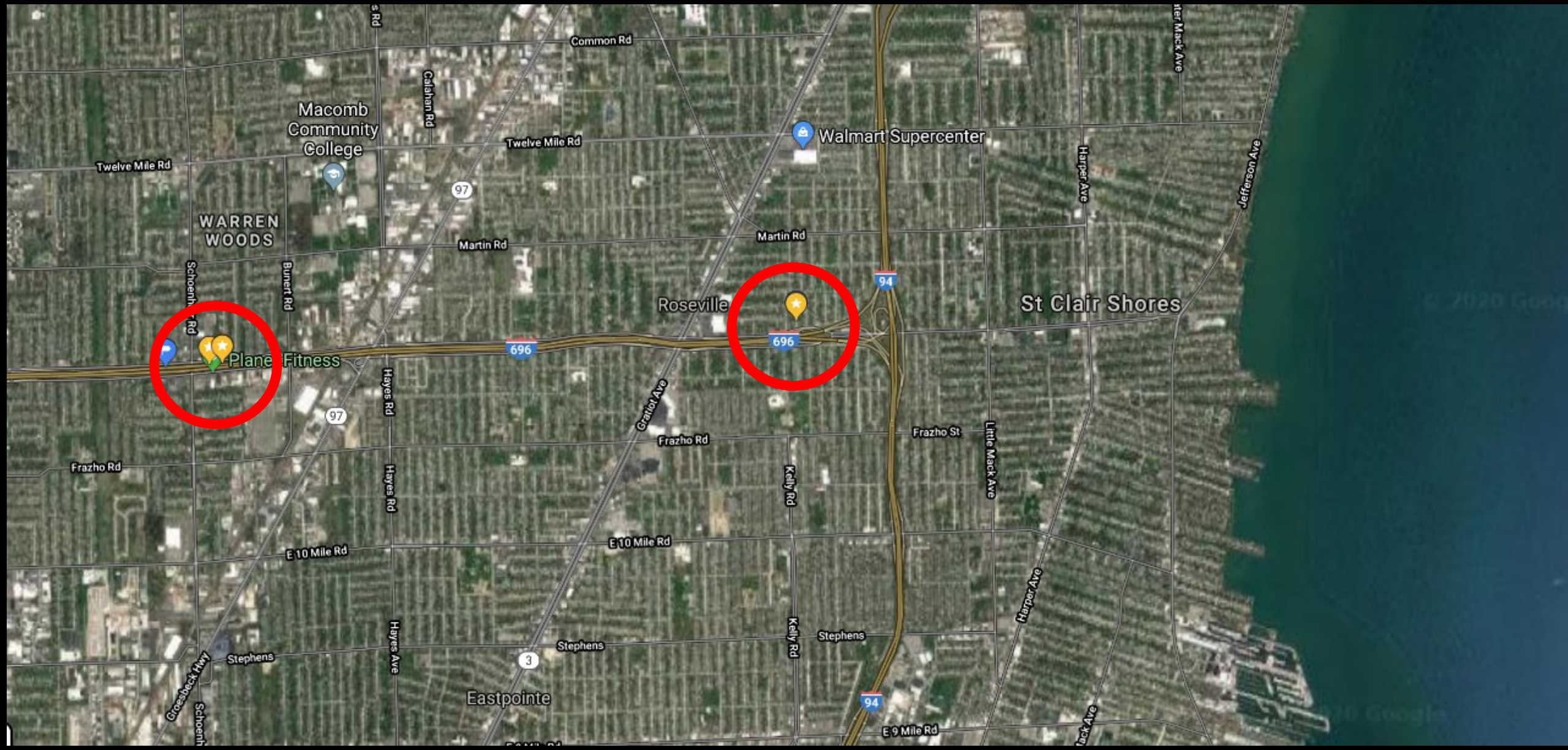


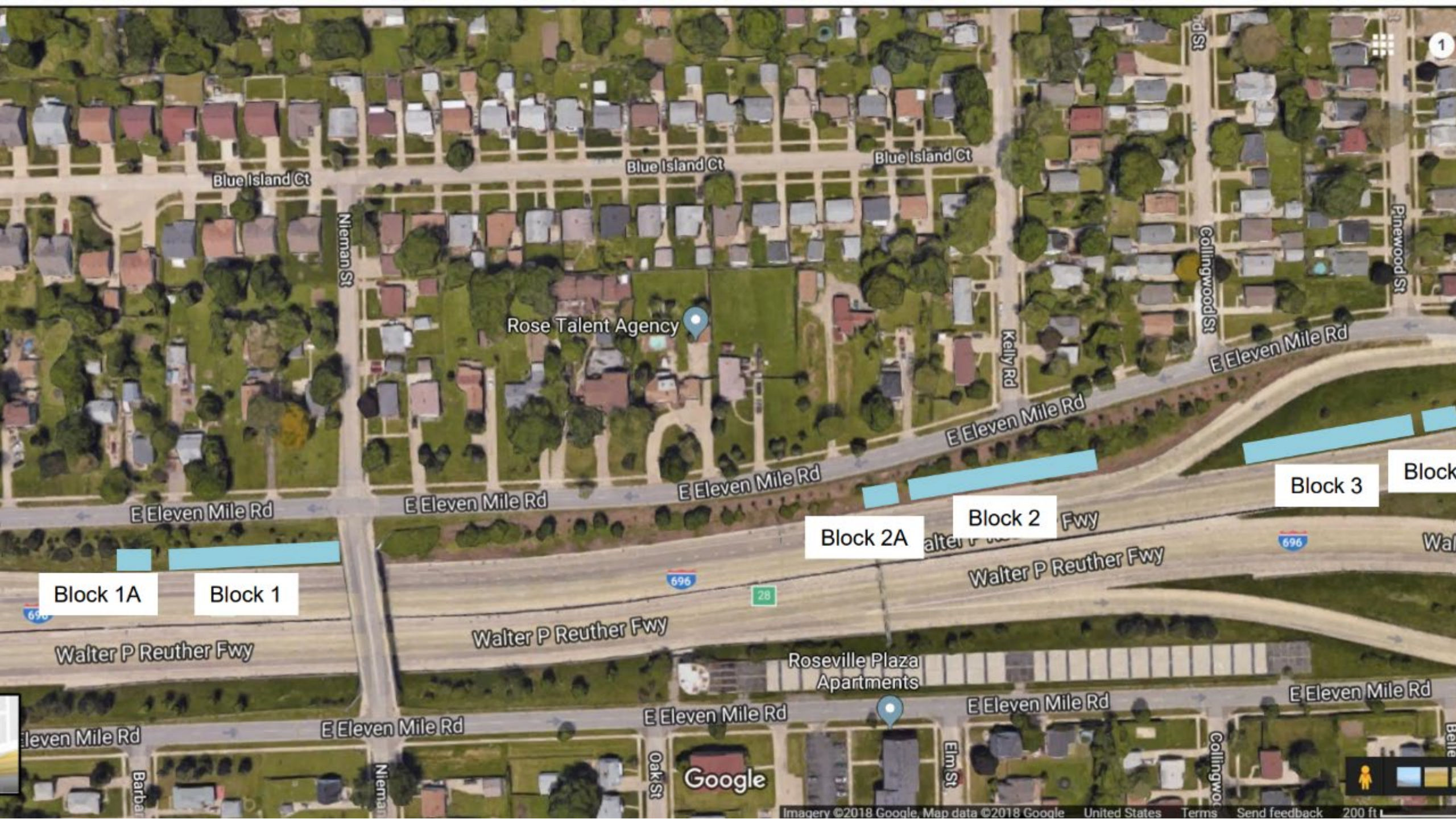
- Ideal soil bulk density is < 1.1 g cm^{-3}
- Root limiting soil bulk density is > 1.55 g cm^{-3}
- Root restricting soil bulk density is > 1.65 g cm^{-3}

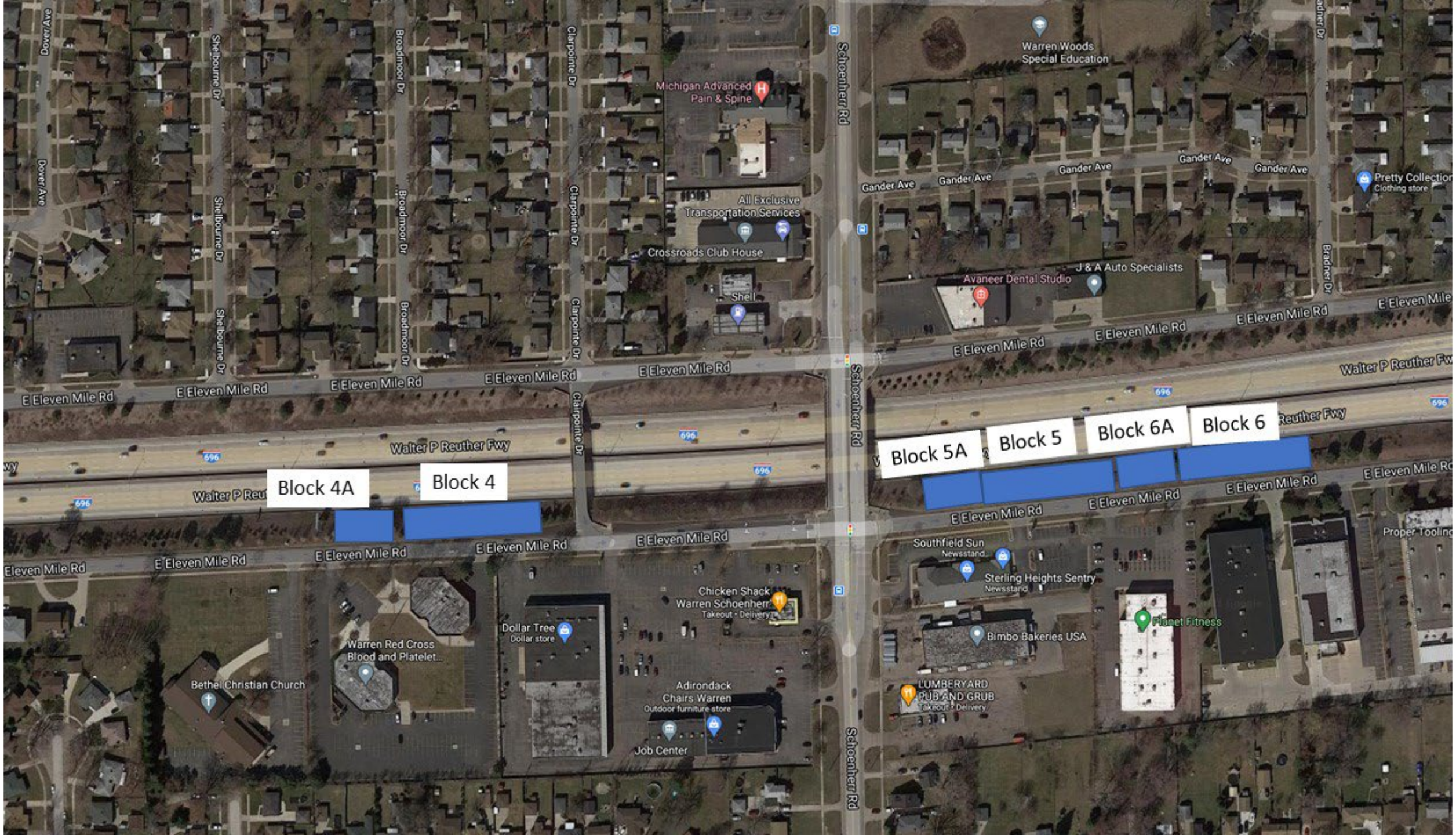
Project Goals

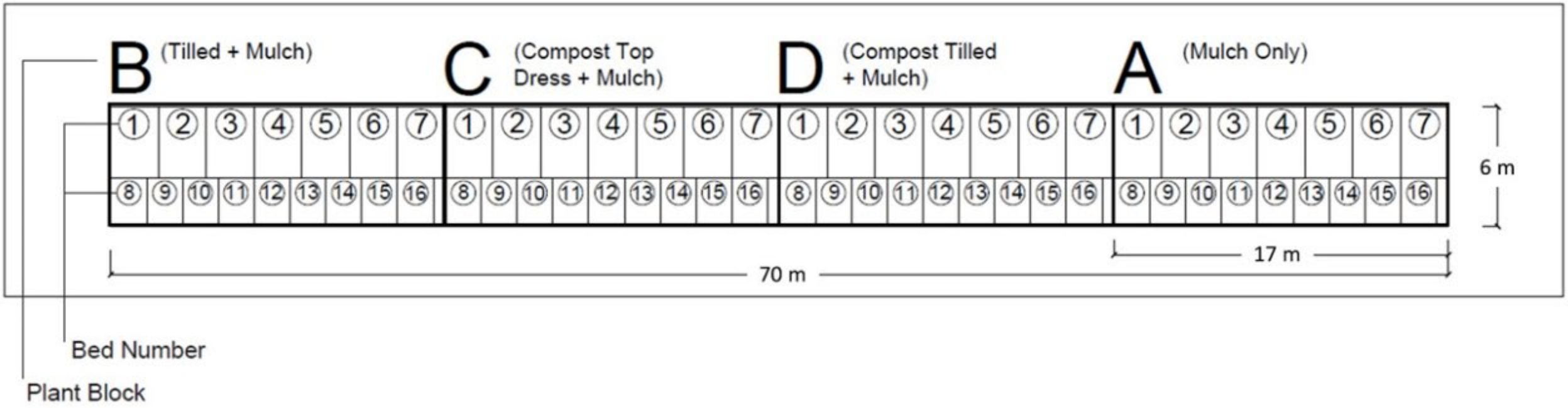
Identify planting practices that maximize planting establishment in this environment

Identify plants that perform well in urban highway conditions


Common Rd
Macomb Community College
Calahan Rd
Twelve Mile Rd
Walmart Supercenter
Harper Ave
Jefferson Ave
Twelve Mile Rd
97
WARREN WOODS
Martin Rd
Martin Rd
Schoenherr Rd
Bunert Rd
94
Roseville
St Clair Shores
696
696
Planet Fitness
Hayes Rd
97
Gratiot Ave
Frazho Rd
Frazho St
Little Mack Ave
Frazho Rd
Kelly Rd
Hayes Rd
E 10 Mile Rd
E 10 Mile Rd
Harper Ave
Stephens
Stephens
Stephens
Kelly Rd
Hayes Ave
3
Eastpointe
Groesbeck Hwy
94
E 9 Mile Rd


Blue Island Ct
Blue Island Ct
Blue Island Ct
Nieman St
Rose Talent Agency
Kelly Rd
Collingwood St
Pinewood St
E Eleven Mile Rd
E Eleven Mile Rd
E Eleven Mile Rd
E Eleven Mile Rd
E Eleven Mile Rd
Block 1A
Block 1
Block 2A
Block 2
Block 3
696
28
Walter P Reuther Fwy
Walter P Reuther Fwy
Walter P Reuther Fwy
Roseville Plaza Apartments
E Eleven Mile Rd
E Eleven Mile Rd
E Eleven Mile Rd
Oak St
Elm St
Google
Imagery ©2018 Google, Map data ©2018 Google
United States
Terms
Send feedback
200 ft


Block 4A
Block 4
Block 5A
Block 5
Block 6A
Block 6
E Eleven Mile Rd
Walter P Reuther Fwy
Schoenherr Rd
Clarpointe Dr
Broadmoor Dr
Shelbourne Dr
Dower Ave
Gander Ave
Bradner Dr
Warren Woods Special Education
Michigan Advanced Pain & Spine
All Exclusive Transportation Services
Crossroads Club House
Shell
Avaneer Dental Studio
J & A Auto Specialists
Pretty Collection
Clothing store
Southfield Sun
Newsstand
Sterling Heights Sentry
Newsstand
Bimbo Bakeries USA
Planet Fitness
LUMBERYARD PUB AND GRUB
Takeout · Delivery
Chicken Shack Warren Schoenherr
Takeout · Delivery
Dollar Tree
Dollar store
Warren Red Cross Blood and Platelet...
Bethel Christian Church
Adirondack Chairs Warren
Outdoor furniture store
Job Center
Proper Tooling


B (Tilled + Mulch)
C (Compost Top Dress + Mulch)
D (Compost Tilled + Mulch)
A (Mulch Only)
1 2 3 4 5 6 7
8 9 10 11 12 13 14 15 16
6 m
17 m
70 m
Bed Number
Plant Block

Perennials

- **Happy Returns Daylily** (*Hemerocallis* ‘Happy Returns’)
- **Hot Lips Turtlehead** (*Chelone lyonii* ‘Hot Lips’)
- **Six Hills Giant Nepeta** (*Nepeta* x *faassenii* ‘Six Hills Giant’)
- **Halfway to Arkansas Narrow Leaf Blue Star** (*Amsonia hubrichtii* ‘Halfway to Arkansas’)
- **The Blues Little Bluestem** (*Schizachryrium scoparium* ‘The Blues’)
- **Red Switch Grass** (*Panicum virgatum* ‘Rotstrahlbush’)
- **Bronze Veil Tufted Hair Grass** (*Deschampsia cespitosa* ‘Bronzeschleier’)

- **Pennsylvania Sedge** (*Carex pensylvanica*)
- **Blue False Indigo** (*Baptisia australis)*

Shrubs

- **Sugar Shack®**
  Buttonbush (*Cephalanthus occidentalis* ‘SMCOSS’)
- **Arctic Sun® Red Twig Dogwood** (*Cornus sanguniea* ‘Cato’)
- **Summer Wine® Ninebark**
  (*Physocarpus opulifolius* ‘Seward’)
- **Show Off Starlet® Forsythia** (*Forsythia* x ‘Minfor6’)
- **Dwarf Bush Honeysuckle** (*Diervilla lonicera* ‘Copper’)
- **Kodiak® Black Diervilla** (*Diervilla rivularis* ’SMNDRSF’)
- **Nikko Slender Deutzia** (*Deutzia gracilis* ‘Nikko’)


DEERE
210G

Creating the Plots

- Warren installed in Summer 2018
- Roseville installed in Fall 2018

Cover assessments

Cover assessments

Amsonia ‘Halfway to Arkansas’

Happy returns daylily *Hemerocallis*

Nepeta ‘Six hills giant’
Catmint

Cornus sanguinea
'Cato‘

Artic sun
redtwig dogwood

Diervilla lonicera 'Michigan Sunset‘ Dwarf Bush Honeysuckle

KODIAK® Black

PROVEN WINNERS®
COLOR CHOICE® FLOWERING SHRUBS

DIERVILLA

Diervilla rivularis 'SMNDRSF'
pp# 27,550, cbraf

Super tough

The beautiful solution to landscape challenges! Kodiak® Black diervilla grows happily just about anywhere. New growth emerges purple-black and contrasts with yellow flower clusters that appear all summer.

- Native to North America
- Long blooming
- Low maintenance
- Bloom color: Yellow
- Bloom time: Summer
- Hardy to USDA Zone 5

Full – part sun
3–4' tall and wide
Min. spacing: 4.5'

www.provenwinners-shrubs.com

SM24162

BUTTONBUSH

Cephalanthus occidentalis 'SMCOSS'
pp# 26,543, cbr# 5124

Irresistible fragrance

Amazing flowers! The big, spiky, spherical flowers of Sugar Shack® buttonbush pepper the plant in mid-summer and emit a honey scent. They mature into ornamental red seed pods. Half the size of typical buttonbush, so it's perfect for home landscapes.

- Native to North America
- Deer resistant
- Tolerates wet soils
- Bloom color: White
- Bloom time: Mid-summer
- Hardy to USDA Zone 4

PW PROVEN WINNERS® COLOR CHOICE® FLOWERING SHRUBS

Full – part sun
3–4' tall and wide
Min. spacing: 4'

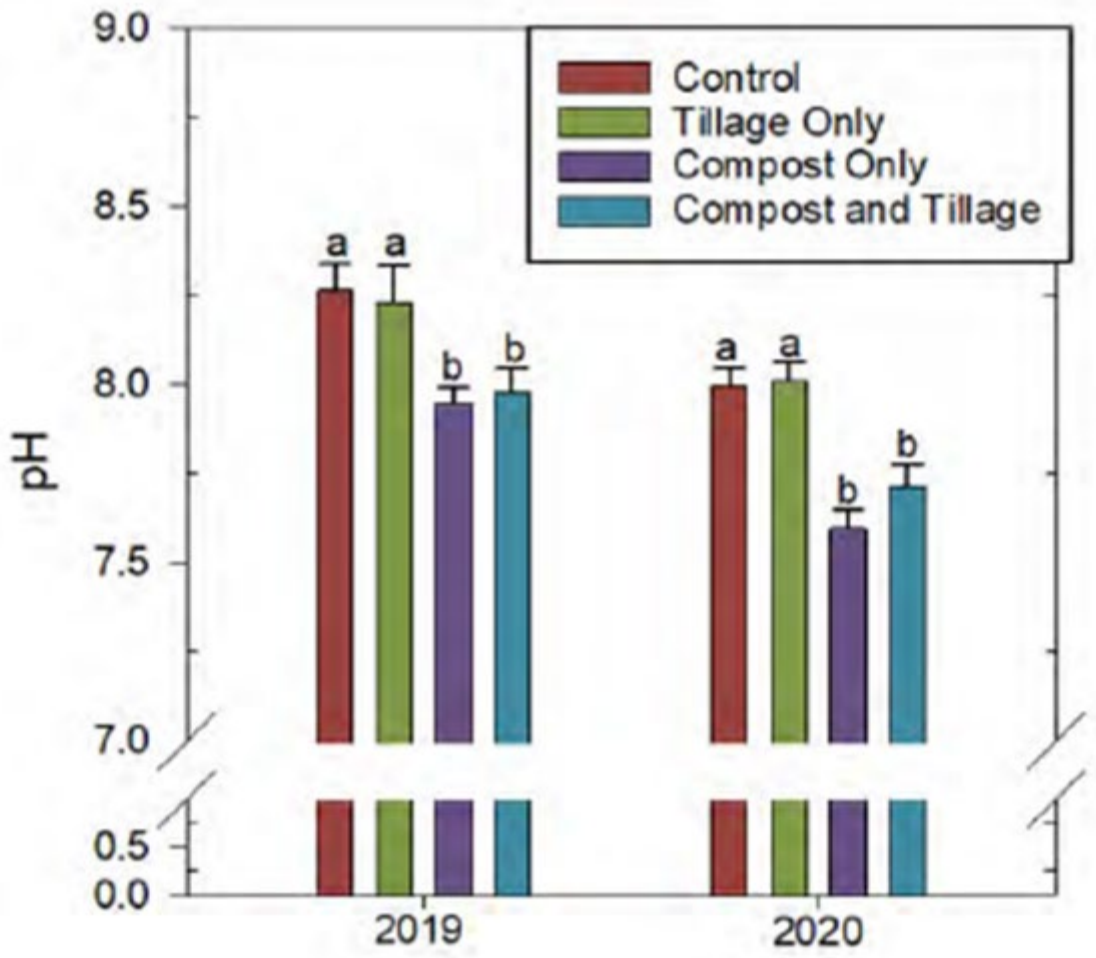
www.provenwinners-shrubs.com

SM09292

Physocarpus opulifolius 'Seward‘ Summer wine ninebark

Compost, not tillage, is driving site prep response

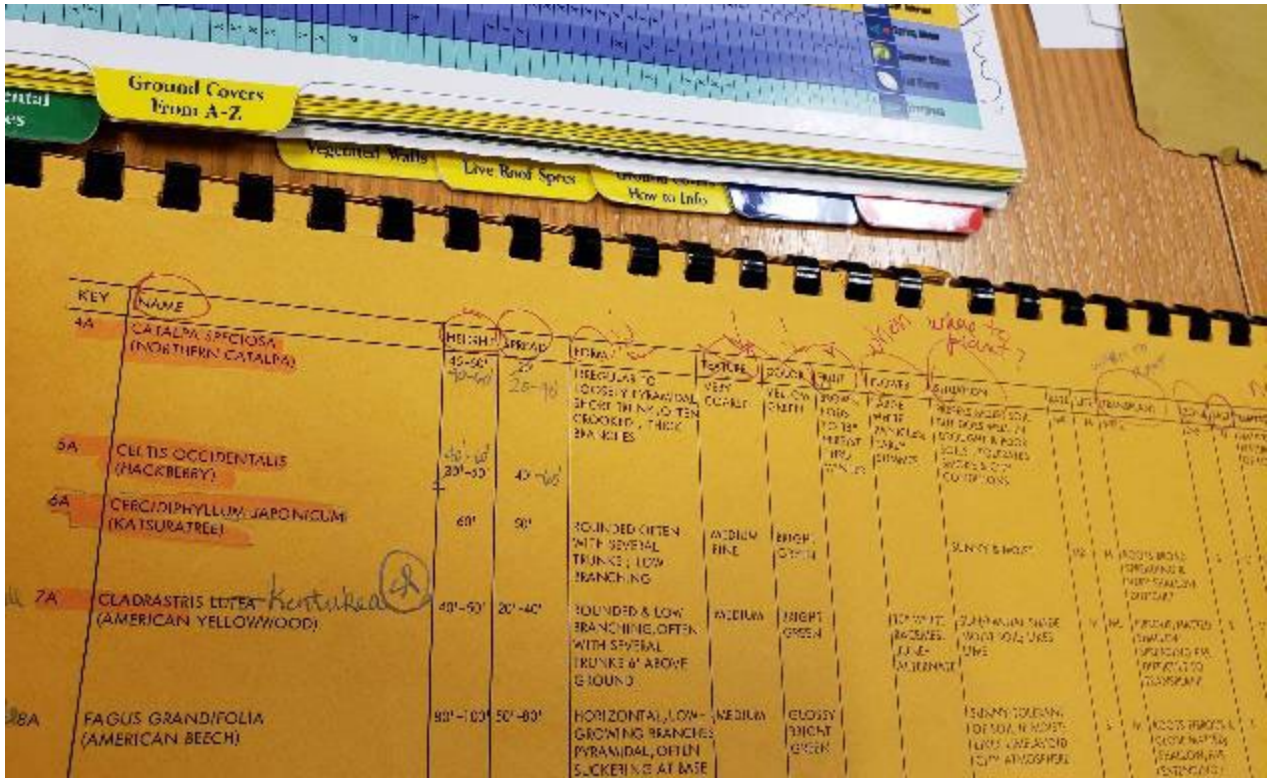
Compost addition reduced soil pH



Compost reduced soil bulk density

	Soil pH		Soil CEC (meq 100 g^{-1})		Bulk density ($g\ cm^{-3}$)	
Site preparation	2019	2020	2019	2020	0–15 cm	15–30 cm
Control	8.27a	8.00a	32.7a	29.3a	1.64a	1.75a
Tillage only	8.23a	8.02a	30.9a	28.3a	1.64a	1.82a
Compost only	7.95b	7.60b	36.7a	37.8b	*1.08b	1.77a
Compost + Tillage	7.98b	7.72b	36.6a	32.5ab	1.13b	1.74a

Previous MDOT Manual



- Hard-copy from the 1970's versions exist
  - Can only be shared via photocopy
- Out of date specifications and plant recommendations

MDOT Plant Selection Guide

Updated planting specifications and details

Michigan climatological information

Information on Michigan Ecoreigons

MDOT Plant Selection Guide

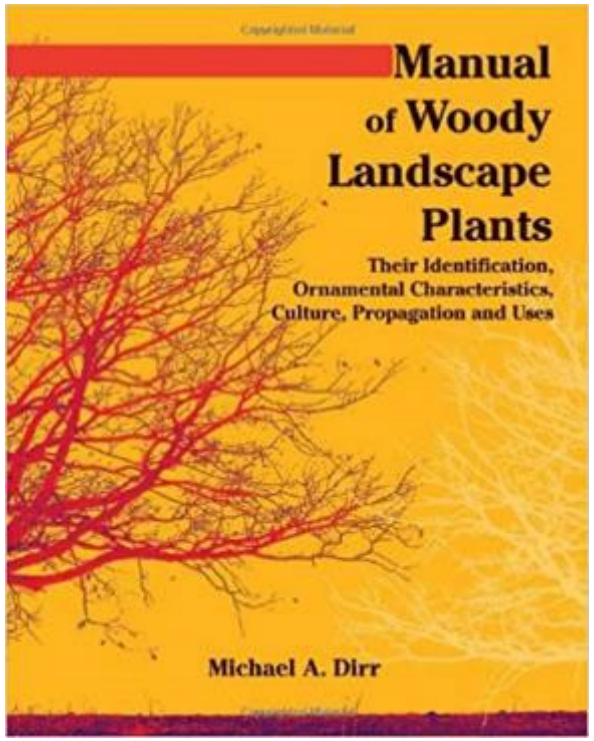
Genus	Species	Cultivar	Common Name	Light	Height	Spread	Bloom Time	Sandy Soi
Amsonia	hubrichtii		Blue Star	Full sun-part shade	2-3 ft	2-3 ft	Spring	
Amsonia	tabernaemontana		Blue Star	Full sun-part shade	2-3 ft	2-3 ft	Spring	
Chleone	glabra		White Turtlehead	Part Shade	2-3 ft	1.5-2.5 ft	Fall	
Chleone	lyonii		Pink Turtlehead	Full sun-part shade	2-4 ft	1.5-2.5 ft	Summer-fall	
Acheillea	millefolium		Yarrow	Full Sun	2-3 ft	2-3 ft	Summer	
Nepeta	X faassenii		Nepeta	Full sun to part shade	1-2 ft	1.5-3 ft	Summer	
Nepeta	racemosa		Catmint	Full sun to part shade	1 ft	1.5 ft	Spring-fall	
Perovskia	atriplicifolia		Russian Sage	Full sun	3-5 ft	2-4 ft	Summer-fall	
Geranium	sanguineum		Bloody geranium	Full sun-part shade	1 ft	1 ft	Summer	
Geranium	maculatum		Wild Geranium	Full sun-part shade	1.5-2 ft	1 ft	Spring	
Penstemon	barbatus		Beardtongue	Full sun	2-3 ft	1-1.5 ft	summer	
Phlox	subulata		Moss Phlox	Full sun	.5 ft	1 ft	Spring	
Liriope	muscari		Lily turf	Full sun-part shade	1-1.5 ft	0.75-1 ft	Summer	
Liriope	spicata		Creeping Liriope	Full sun-part shade	1 ft	2 ft	Summer	
Lavandula	angustifolia		English lavender	Full sun	1-3 ft	1-3 ft	Summer	
Echinacea	purpurea		purple coneflower	Full sun-part shade	2-5 ft	1-2 ft	summer	
Echinacea	paradoxa		Yellow coneflower	Full sun	2-3 ft	1 ft	Summer	
Salvia	X superba		Sage	Full sun	1 ft	1 ft	Summer	

- Plant information has been compiled for over 300 shrubs, ornamental grasses and perennials
- Exists as a filterable Excel spreadsheet

The Morton Arboretum

THE PURDUE Arboretum

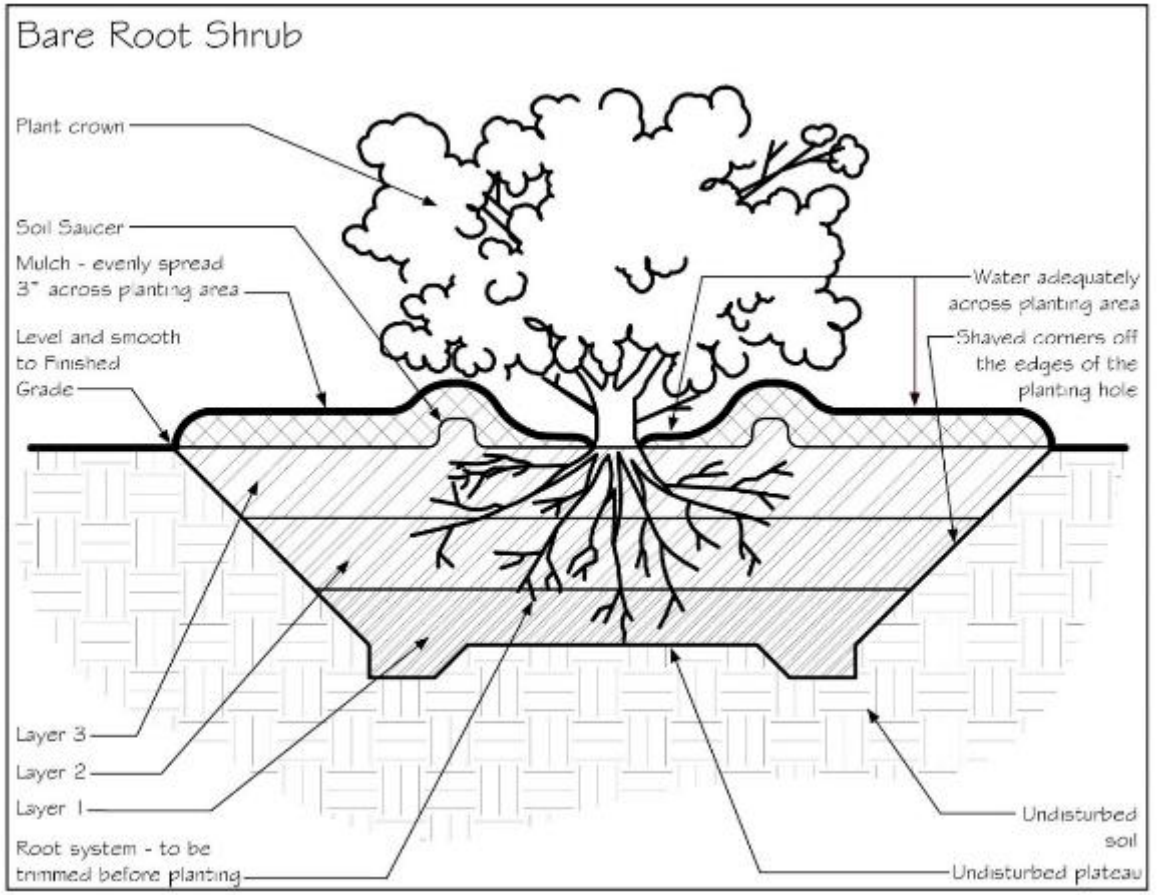
MISSOURI BOTANICAL GARDEN

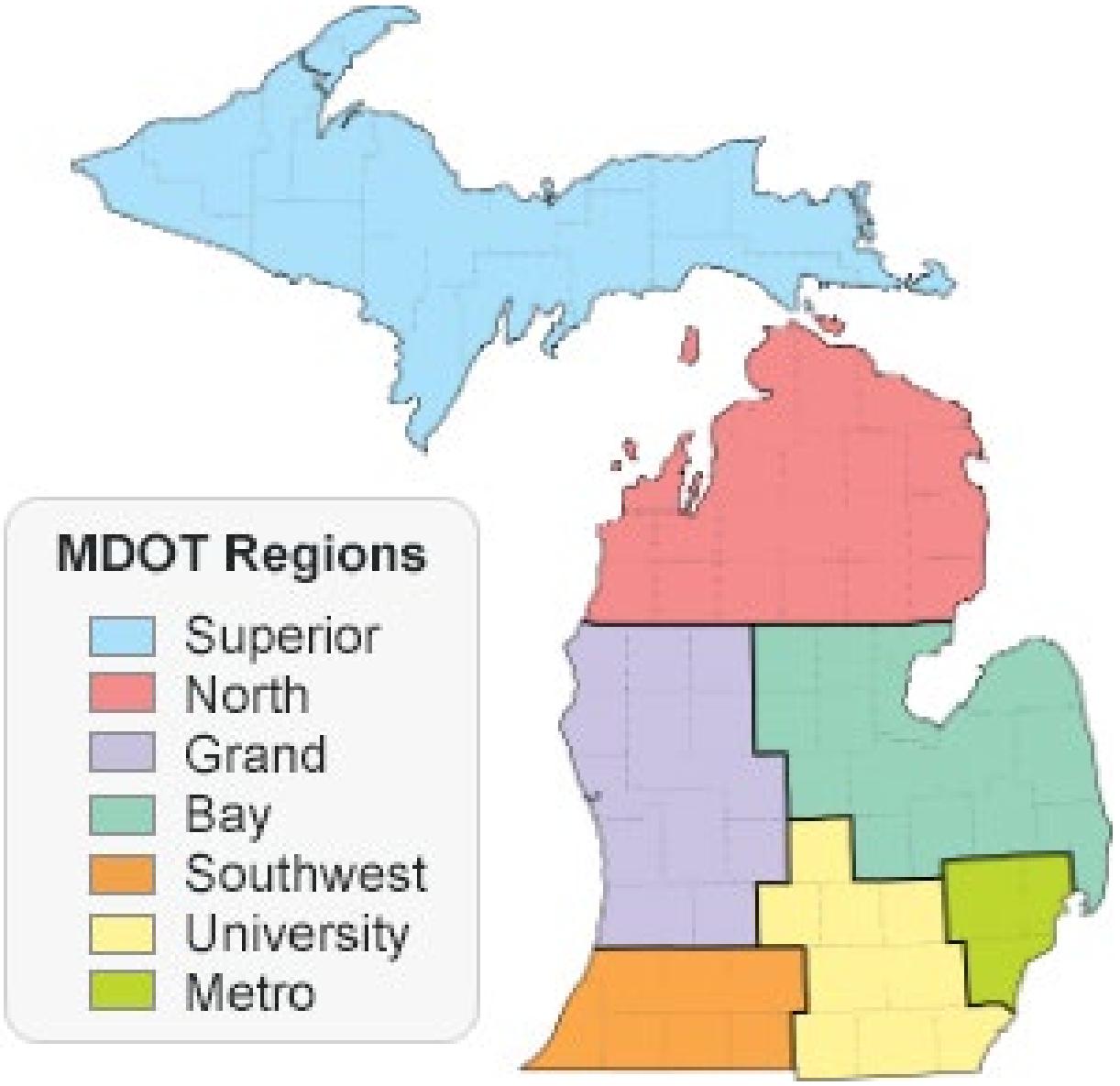


Database sources

Updated Planting Specifications and Details

- Planting specifications updated based on research findings
- New and clear planting details created for various B&B, container and bareroot plants
- Detailed information for selecting plants for a site





Michigan Climate Information

- Organized by MDOT's existing regions
- 1980-2010 climate normals from various cites around the state
- USDA Hardiness Zones
- Predicted Frost Free Dates

Looking ahead…


Roseville
NEXT 2 EXITS

Research support

Project GREEEN

Michigan Department of AGRICULTURE & Rural Development

Questions?