Emerald Ash Borer:

Public Health, the Urban Canopy, and Biochar

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Photo: University of MN Extension

City of Minneapolis
Health Department

MDEWAKANTON

Minneapolis Park & Recreation Board

Project Partners

- City of Minneapolis Health Department (MHD)
- Shakopee Mdewakanton Sioux Community (SMSC)
- Minneapolis Parks and Recreation Board (MPRB)
- University of Minnesota Department of Forest Resources (U of M)

Emerald Ash Borer

Photo: University of MN Extension

Photo: City of Clive, IA

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- Non-native invasive species
- Targets Ash trees
- 998M Ash trees in Minnesota
- Largest Ash concentration in US
- 100% tree stand mortality within 6 years

Photo: University of MN Extension

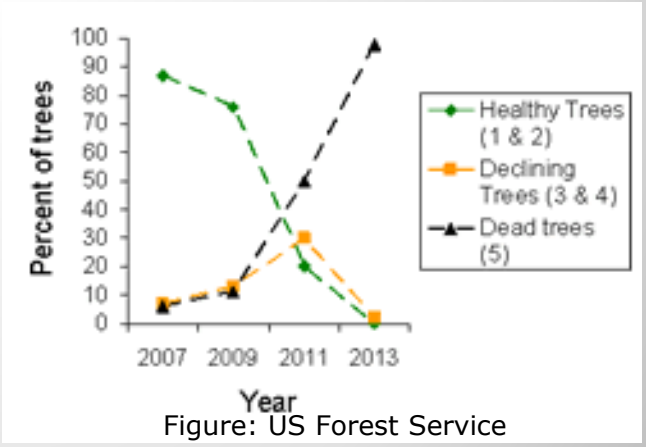

Figure: US Forest Service

Emerald Ash Borer (EAB)

EAB in Minneapolis

- 2010 EAB first detected in Minneapolis
- 40,000 public Ash trees
- 200,000 private Ash trees
- 21% of Minneapolis urban canopy
- No EAB treatment recommended
- Unknown effects on pollinators

Minneapolis EAB Plan

- MPRB eight year EAB plan
- Remove 5,000 public Ash trees per year
- Remove only 20% per block per year
- Diversify replacements
- Ramping up from 2,000 to 10,000 trees planted per year

EAB and Public Health

Tree Air Quality Benefits

- Temperature reduction
- Removal of air pollutants
- Emissions of VOCs and tree maintenance
- Energy effects on buildings

Source: Nowak, 2002

EAB and Public Health

- Increased mortality in EAB infested counties (Donovan et al, 2013)
- Respiratory mortality up 6.8 deaths per year/100,000 (Donovan et al, 2013)
- Cardiovascular mortality up 16.7 deaths per year/100,000 (Donovan et al, 2013)
- Heat Island
- Ozone
- Fine particulates
- Stress

Public Health Problem

- Little trees do less than big trees
- Boulevard is a harsh environment
- Loss of run-off and pollution reduction
- Loss of energy savings/cooling
- Loss of aesthetics
- Benefits valued at $126/tree/year

- How do we get little trees to successfully become big trees?

Biochar Amendment Cooperative Research Project

- Memorandum of Understanding to develop biochar/compost soil amendment
- SMSC Organics Recycling Facility
- Five community gardening demonstration sites

City of Minneapolis
Health Department

MDEWAKANTON

MHD/SCMC Partnership

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- MHD and SMSC partnership with MPRB
- Developed pilot study with the U of M Forest Resources Unit
- Goal – Evaluate effect of biochar/compost amendment on tree survival and long-term performance

Biochar Amendment Cooperative Research Project

Project Design

Biochar analysis

Moisture (time of analysis)	8.1	% wet wt.
Organic Carbon	65.2	% of total mass
Hydrogen/Carbon (H:C)	0.74	Molar Ratio
Total Ash	17.4	% of total mass
Total Nitrogen	0.81	% of total mass
pH value	8.42	units
Electrical Conductivity	0.542	dS/m
Liming	5.6	%CaCO3
Carbonates (as-CaCO3)	2.3	%CaCO3
Butane Act.	1.6	g/100g dry
Surface Area Correlation dry	185	m2/g

Feedstock White Oak

Biochar Source: Energy Americas Solution, LLC

Biochar nutrients

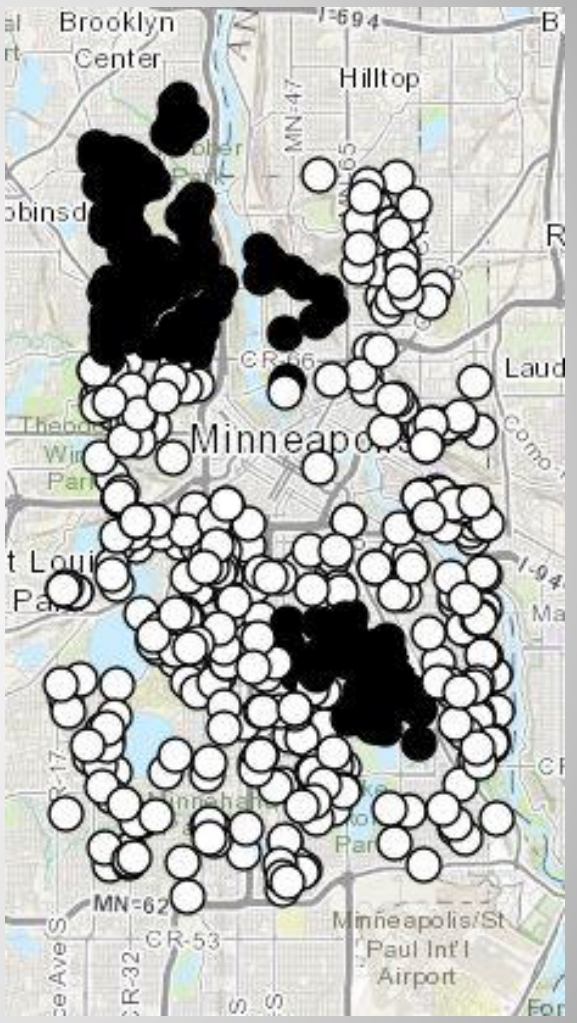
Available (K)	4672 mg/kg
Total (P)	244 mg/kg
Total (K)	3976 mg/kg
Available (P)	169 mg/kg
Ammonia (NH4-N)	0.44 mg/kg
Nitrate (NO3-N)	0.25 mg/kg
Organic (Organic-N)	8122 mg/kg
Volatile Matter	82.6 percent

Composted manure

Moisture content	40.6	% net weight
Organic matter content	46.5	% dry weight
pH	7.53	units
Soluble salts	5.6	dS/m
Particle size	100	% < 9.5 mm
Nitrogen	0.96	% dry weight
Phosphorus	0.50	% dry weight
Potassium	0.84	% dry weight
Calcium	1.9	% dry weight
Magnesium	0.6%	dry weight

Trees

- Totally randomized study
- 440 boulevard trees
- 11 species
- 10 cultivars, 1 seedling
- Bare root
- 1.75” diameter



Scientific Name	Common Name	Height	Spread	Type
Gymnocladus dioicus 'Espresso'	Espresso Kentucky Coffeetree (Male Seedless)	50-60ft	40-50ft	Shade Tree
Malus 'Prairifire'	Prairie Fire Crabapple	15-20ft	10-15ft	Small Ornamental
Platanus x acerifolia 'Bloodgood'	Bloodgood London Planetree	60-70ft	50-60ft	Shade Tree
Quercus bicolor	Swamp White or Bicolor Oak	50-60ft	30-40ft	Shade Tree
Syringa reticulata 'Ivory Silk'	Ivory Silk Japanese Tree Lilac	20-25ft	15-20ft	Small Ornamental
Tilia cordata 'Glenleven'	Glenleven Littleleaf Linden	50-60ft	40-50ft	Shade Tree
Ulmus americana 'Princeton'	Princeton American Elm	70-80ft	30-50ft	Shade Tree
Ulmus americana 'Valley Forge'	Valley Forge American Elm	70-80ft	30-50ft	Shade Tree
Ulmus 'Morton'	Accolade Hybrid Elm	50-60ft	40-50ft	Shade Tree
Ulmus 'Morton Glossy'	Triumph Hybrid Elm	50-60ft	40-50ft	Shade Tree
Ulmus 'Patriot'	Patriot Hybrid Elm	50-60ft	40-50ft	Shade Tree

Tree Types

Treatments

- 5:1 compost/biochar mixture
- 8 replicates per treatment

Treatment rates:

a. 44 quarts biochar/compost
b. 22 quarts biochar/compost
c. 44 quarts compost
d. 22 quarts compost
e. Control

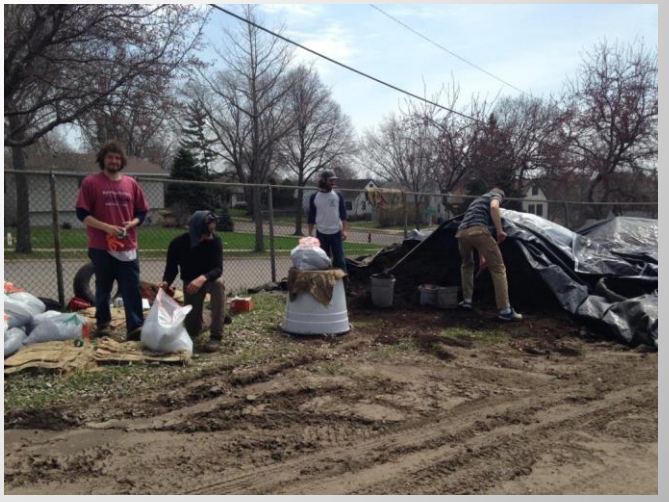
First Year Information Collected

- Geographic location including house number and street name or number
- Street orientation (N-S or E-W)
- Street use classification (arterial or residential)
- Boulevard width
- Stem caliper of tree (15cm and 30cm)

Follow-up Data Collection

Data collected					
	Year 1	Year 2	Year 3	Year 4	Year 5
Mortaility					
Stem Caliper Increase					
Soil Compation 15 cm and 30 cm					
Stem/Crown condition rating					

Data subsequently collected at five year intervals



Mixing

Planting

Finishing

Continued Action

- Full report at end of year five
- Preliminary reporting at the ends of years one and three
- Scaling and integration
- Multi-community expansion
- Clean Air Minnesota

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