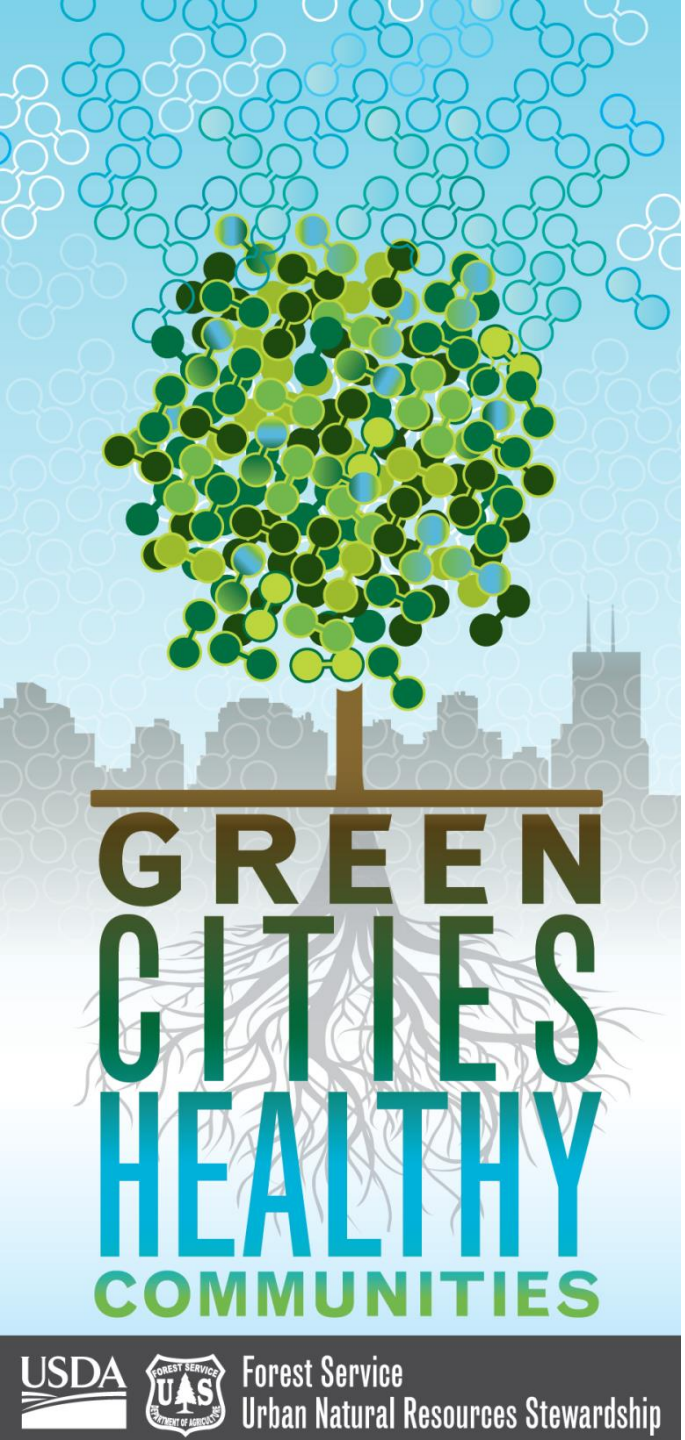

USDA Forest Service

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Emerald Ash Borer: Status, management options, and cost calculators

Deborah McCullough

Professor

Michigan State University

Cliff Sadof

Professor

Purdue University

Richard Hauer

Professor

University of Wisconsin – Stevens Point

e-mail… Hauer UWSP … for a copy of today's talk

Emerald Ash Borer: Status, management options, and cost calculators

Richard J. Hauer, Ph.D

Professor of Urban Forestry

College of Natural Resources, University of Wisconsin – Stevens Point

Wednesday, April 8, 2015

College of Natural Resources
University of Wisconsin-Stevens Point

USDA Forest Service
URBAN FOREST CONNECTIONS
webinar series

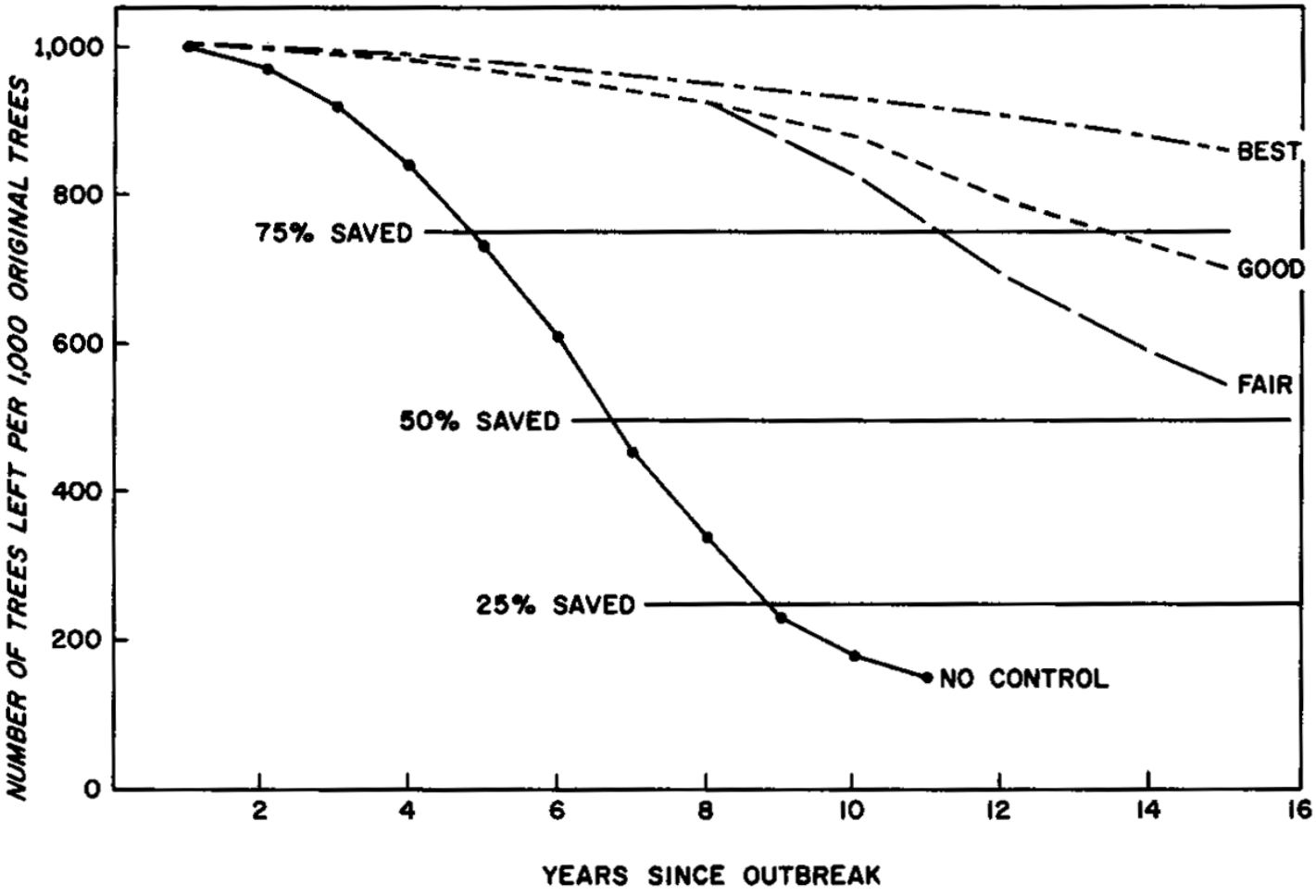
“Whether you like it or not, it will cost you money!” Mark Stennes

American Elm (*Ulmus americana*): The Tolerant One

The Actors are Showing the Play

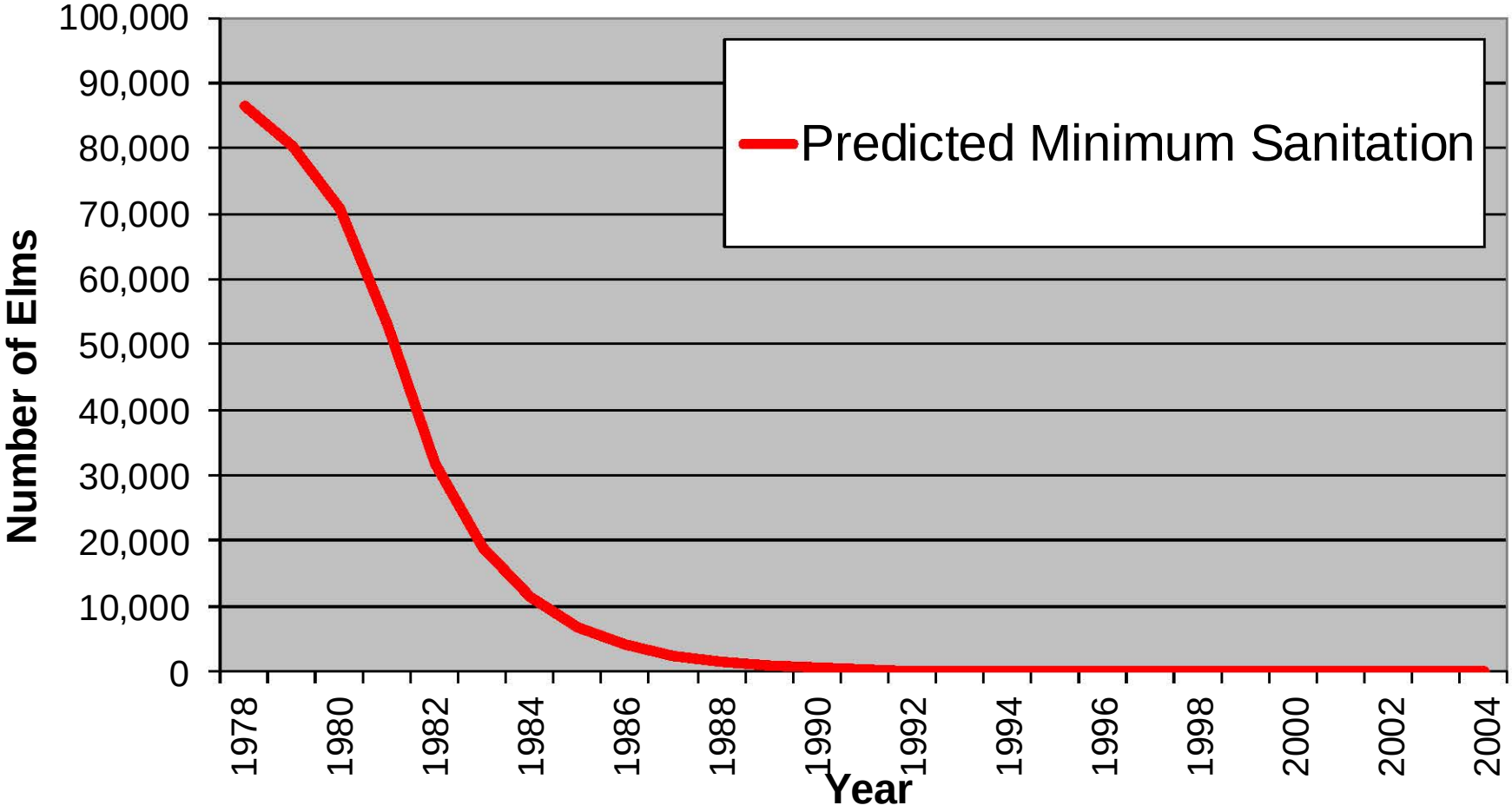
Whether You Like it or Not, DED Will Cost You Money

Figure 2. Projected elm tree losses from Dutch elm disease under varying levels of control. (From Cannon and Worley 1976)



How much will it cost? A DED Example circa 1970's

Figure 7. A quarter-century of DED management in Minneapolis, MN compared to predicted results of Baughman (1985) under two levels of sanitation.



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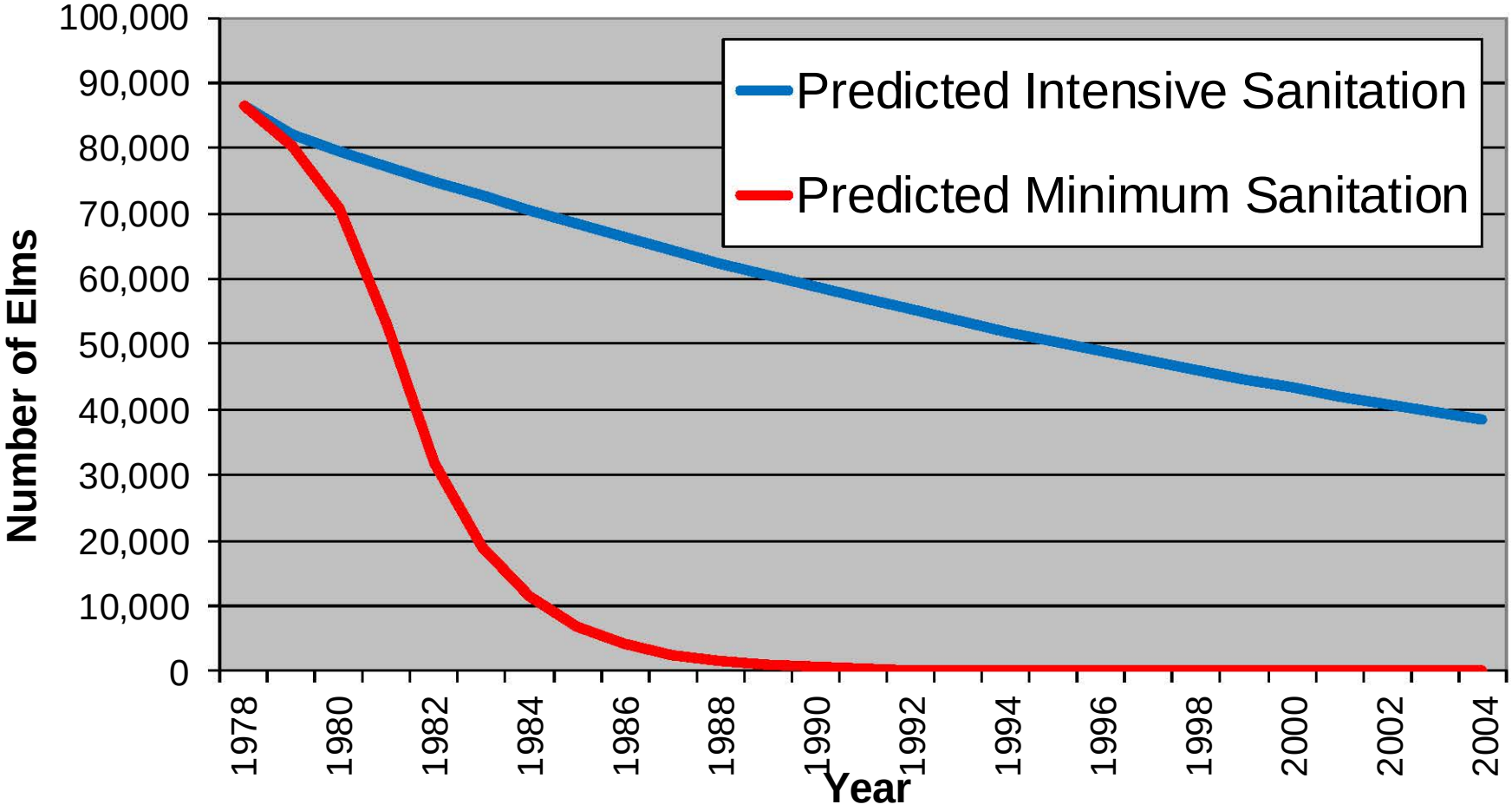

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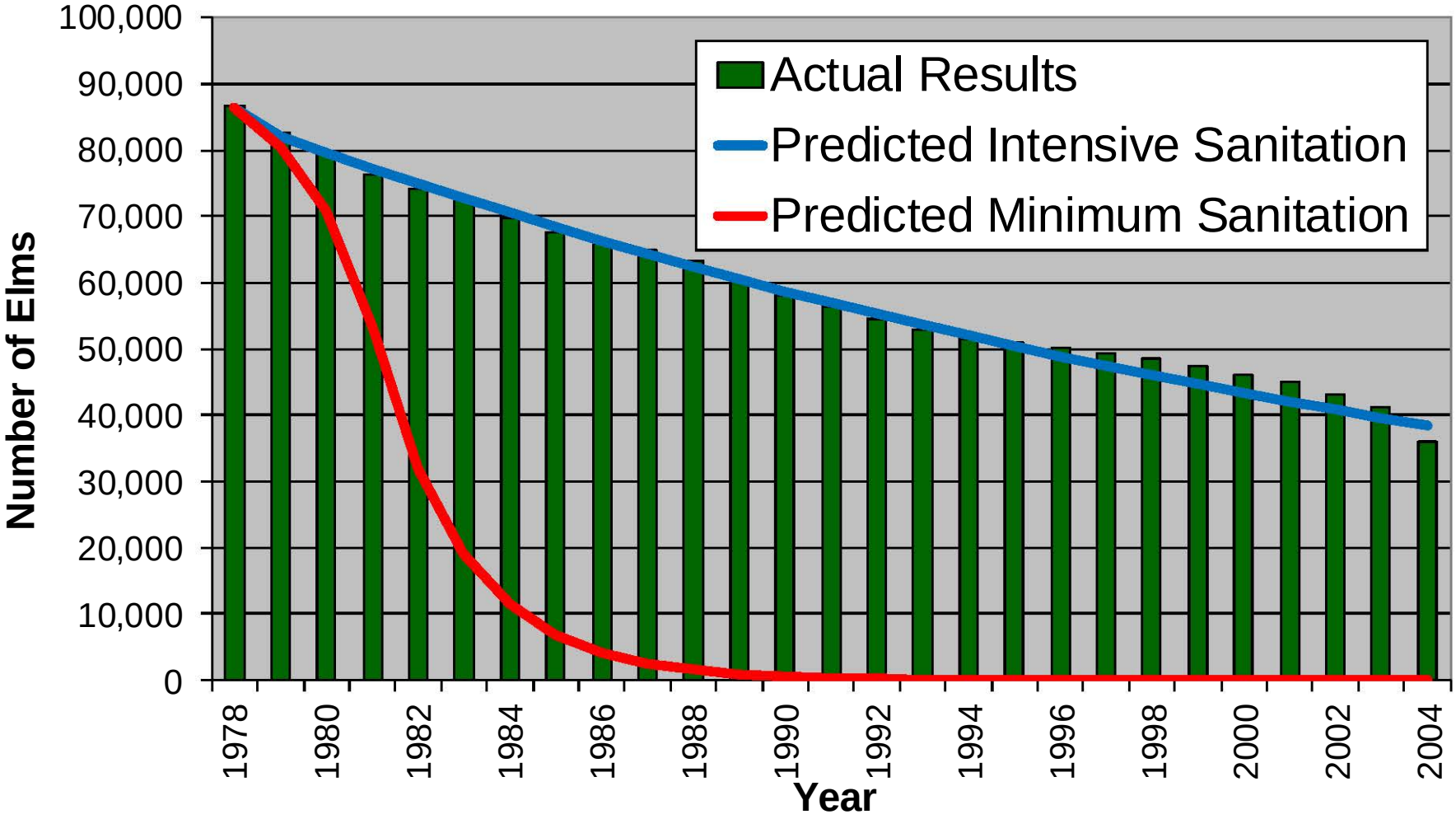
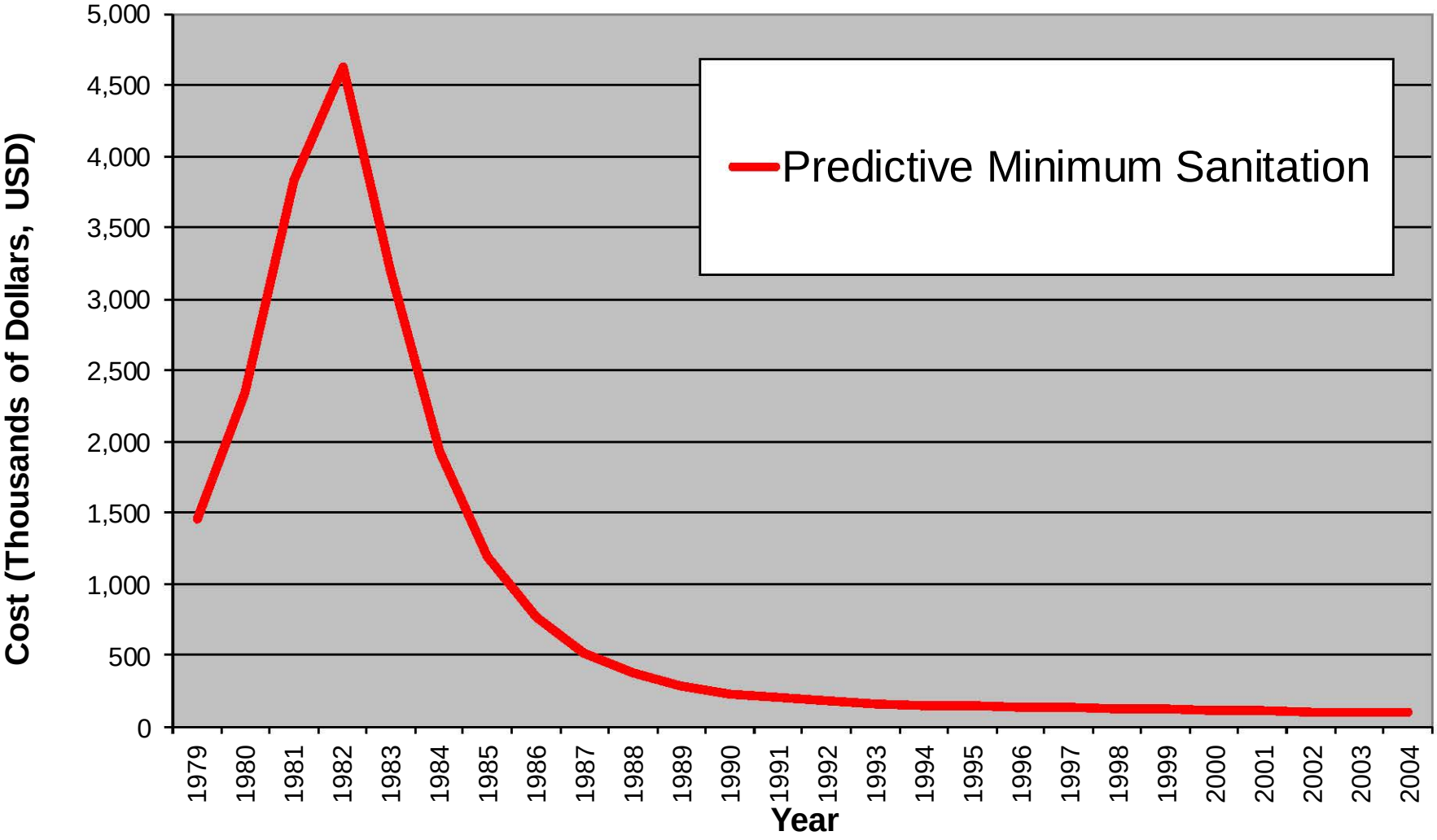


Figure 8. A quarter-century of DED management in Minneapolis, MN compared to predicted results of Baughman (1985) under two levels of sanitation.



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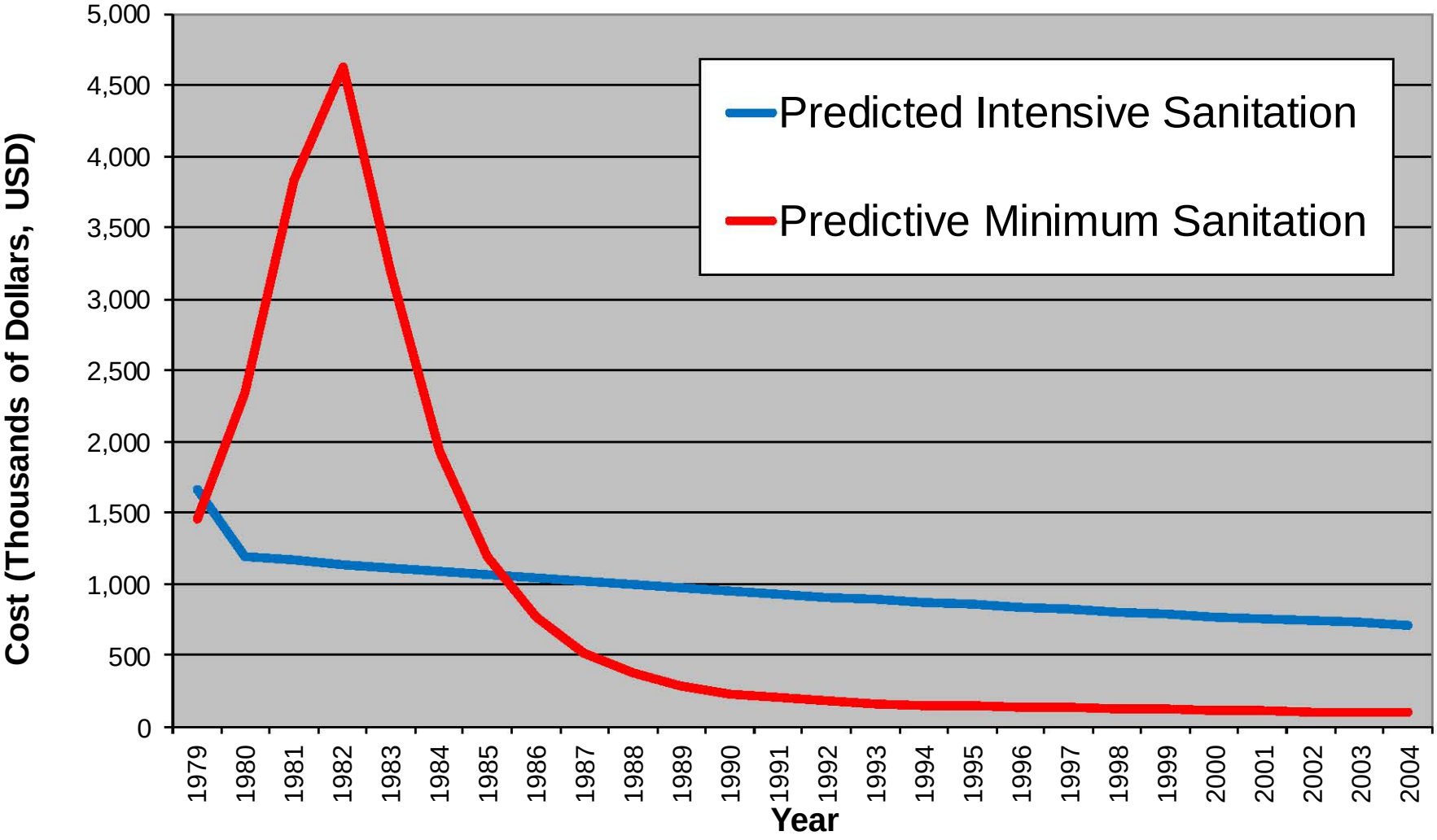

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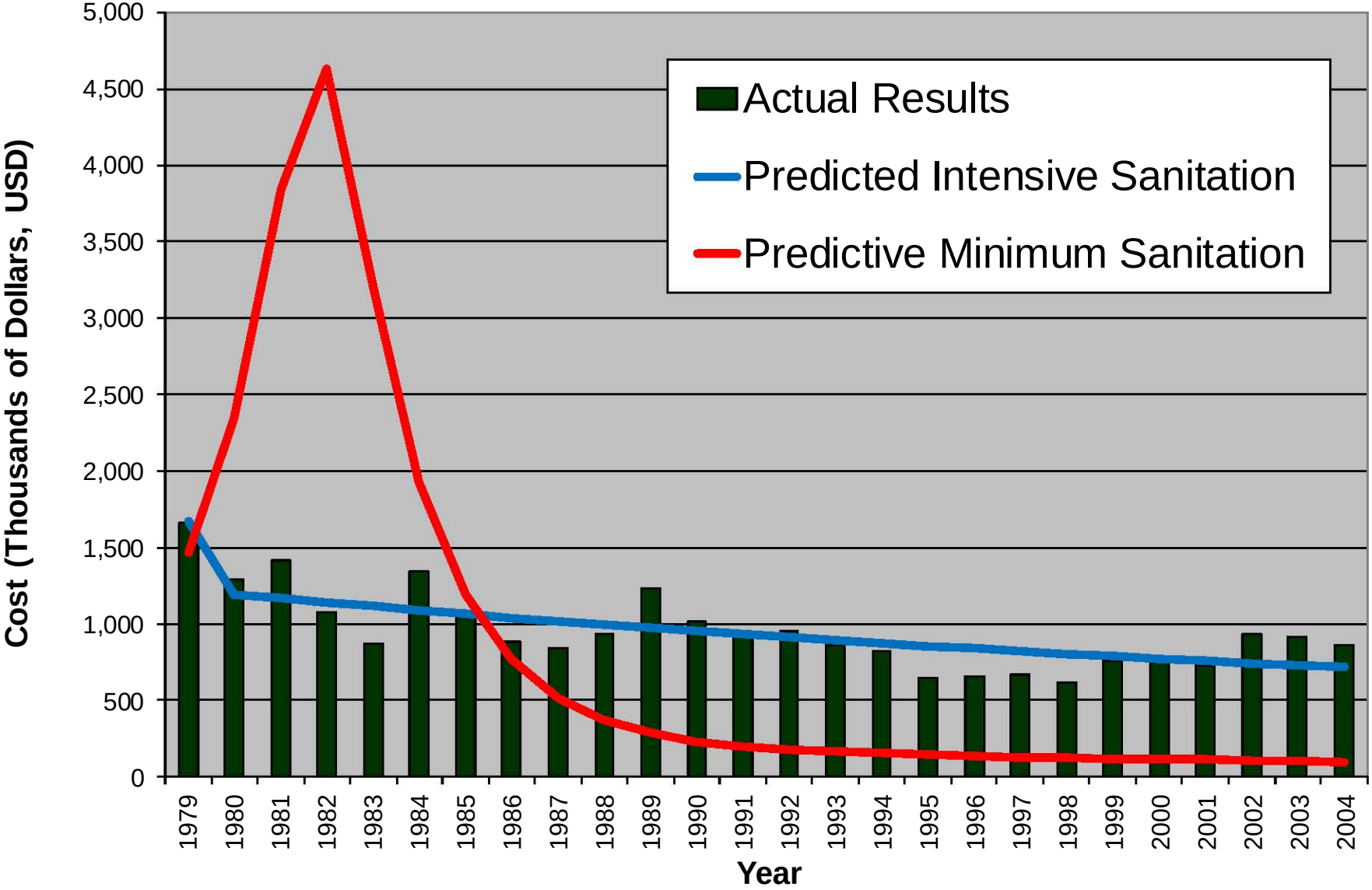
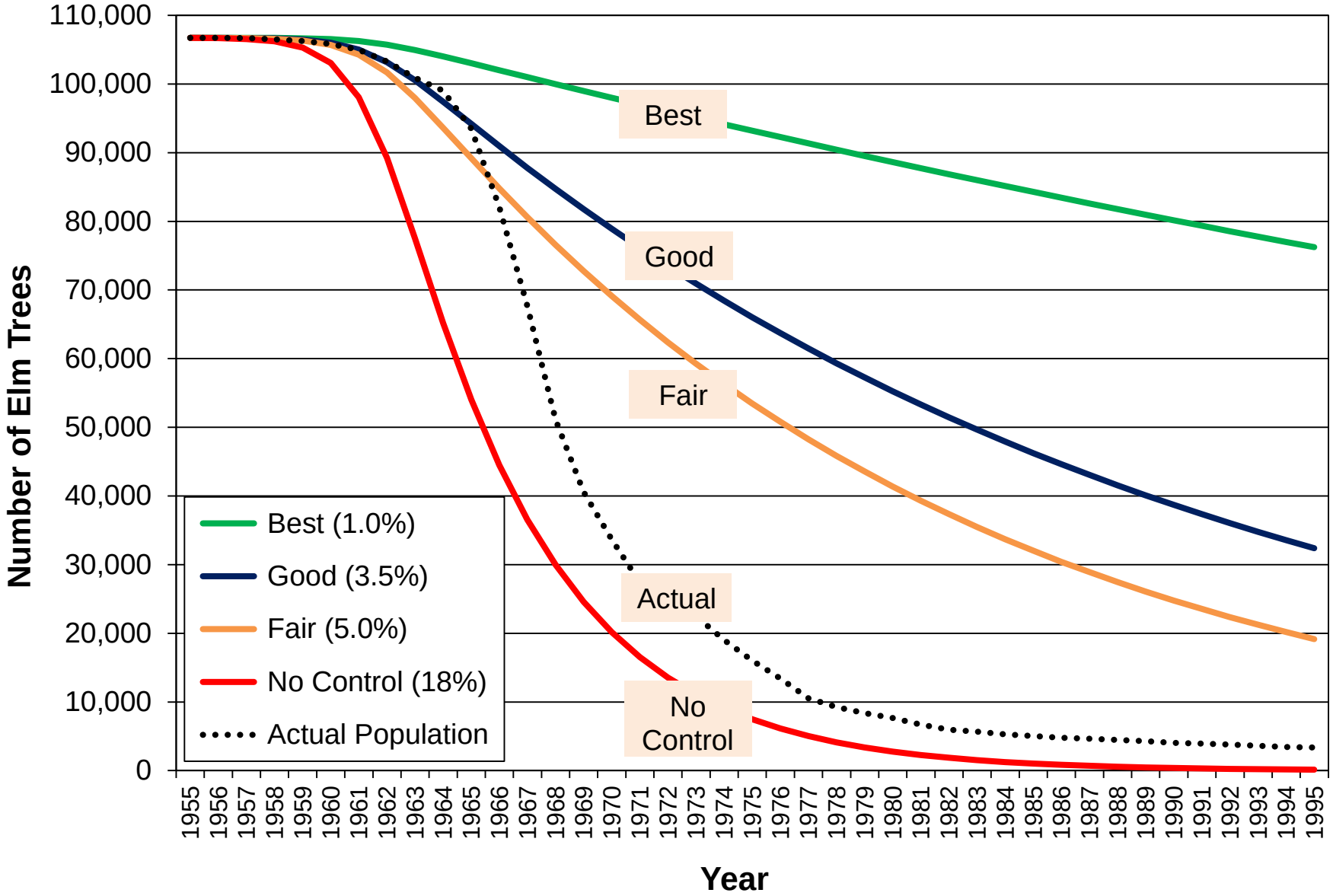
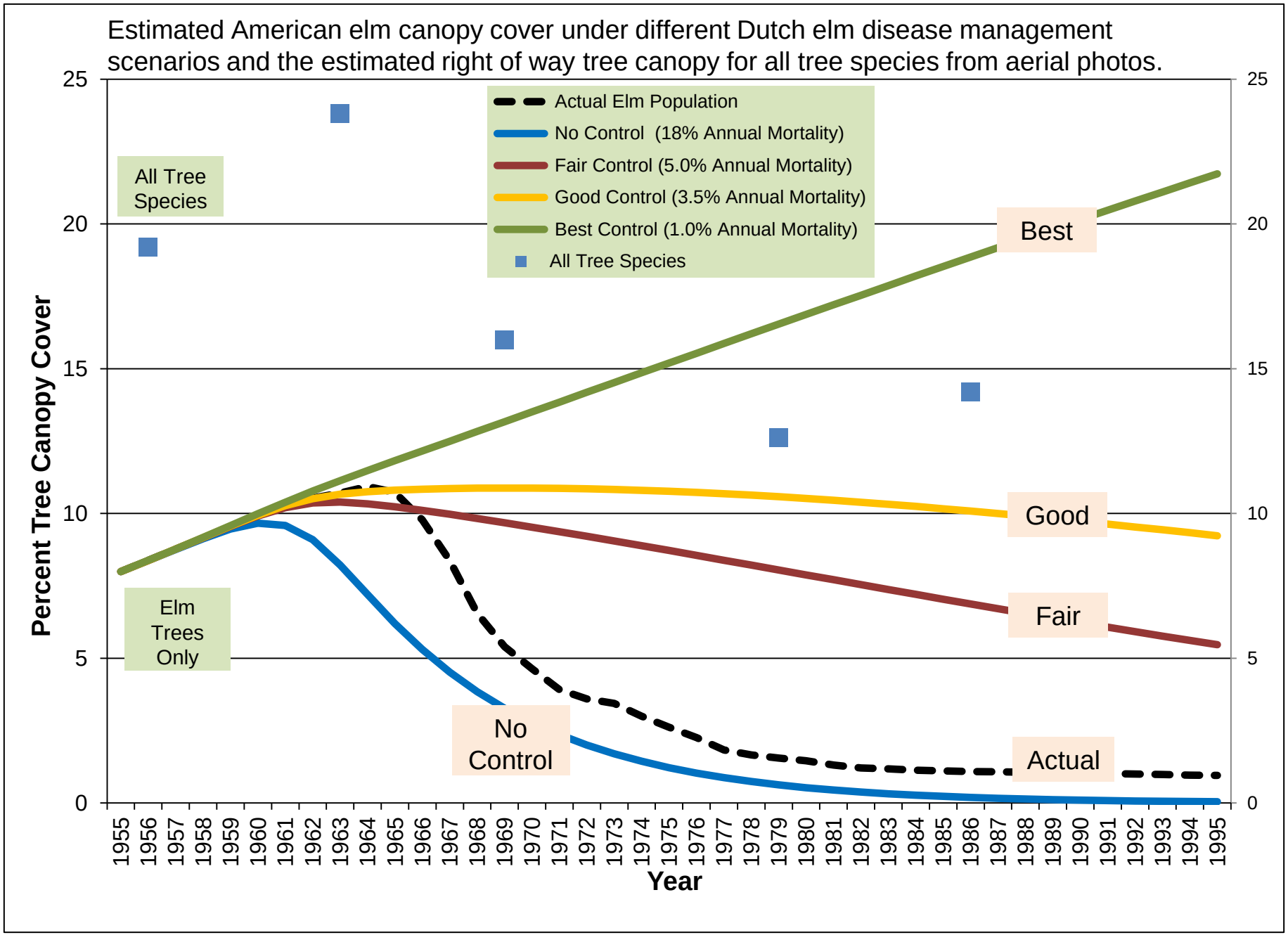


Figure 1. Elm population in Milwaukee over a 40 year period comparing the actual outcome and four management approaches and anticipated percentage annual loss. (Simulated losses adapted from Cannon and Worley (1976) with a starting population106,738)




Estimated American elm canopy cover under different Dutch elm disease management scenarios and the estimated right of way tree canopy for all tree species from aerial photos.
Actual Elm Population
No Control (18% Annual Mortality)
Fair Control (5.0% Annual Mortality)
Good Control (3.5% Annual Mortality)
Best Control (1.0% Annual Mortality)
All Tree Species
All Tree Species
Elm Trees Only
Best
Good
Fair
No Control
Actual
Percent Tree Canopy Cover
Year
0
5
10
15
20
25
1955
1956
1957
1958
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Study Objectives

- Complete Inventory: UW- Stevens Point
- Economic analysis of four EAB management scenarios…
  1. Do nothing (control) & remove after dead
  2. Approved insecticide treatment
  3. Removal of all ash in five years
  4. Removal with non-ash replacement

  * No EAB

Determining Benefits

- CTLA: **Compensatory** value (replacement value included)

- i-Tree: **Functional** value (only the benefits provided, not replacement value)

Calculating Net Present Value

Retained Value

$$VR_i = \langle \sum_{t=1}^{n} \left[\frac{V_c}{(1+d)^t} - \frac{C_m}{(1+d)^t} - \frac{C_t}{(1+d)^t} - \frac{C_r}{(1+d)^t} - \frac{C_p}{(1+d)^t} \right] \rangle$$

Lost Value

$$VL_i = \langle \sum_{t=1}^{n} \left[\frac{V_c}{(1+d)^t} + \frac{C_m}{(1+d)^t} + \frac{C_t}{(1+d)^t} + \frac{C_r}{(1+d)^t} + \frac{C_p}{(1+d)^t} \right] \rangle$$

Where:

VR_i = net average annual value retained for alternative *i*

VL_i = net average annual value lost for alternative *i*

C_m = maintenance costs

C_t = treatment costs

C_r = removal costs

C_p = planting costs

d = discount rate

EAB-PLANS

Emerald Ash Borer PLANning Simulator (EAB-PLANS©) Version MKE

EAB-PLANS© was developed to assist decision makers with managing ash trees in urban & community forests challenged by emerald ash borer (EAB). You enter data that reflects urban tree management costs, tree structure, and goals. This program projects annual tree growth and mortality. Then management costs and tree values are calculated for each management scenario (no control, preemptively remove, preemptively remove & replace, and preventative treatment). Separate analyses for trees remaining and those lost naturally and from EAB are calculated. Charts and graphs show results in an easy-to-read format. This program is best viewed in Excel 2007 or higher.

To start, proceed to **Step 1** and enter data (see worksheet tabs at the bottom of screen).

To view output, proceed to **Step 2** and **Step 3**.

View terminology comments at select cells and see the **Appendix** for more information.

Annual projections over a 20-year simulation timeframe are presented in the worksheet tabs to the right of the Appendix tab. See the following reference for more information: VanNatta, A.R., R.H Hauer, and N.M. Schuettpelz. 2012. *Economic Analysis of Emerald Ash Borer (Coleoptera: Buprestidae) Management Options*. Journal of Economic Entomology. 105(1):196 - 206.

The research supporting EAB-PLANS© was made possible through funding by the University of Wisconsin – Stevens Point, USDA McIntire-Stennis, TREEFund, and the Wisconsin Arborist Association. The Simulator is the collective work of Dr. Richard Hauer and Mr. Andrew VanNatta. Please send any comments pertaining to this program to Rich Hauer at rhauer@uwsp.edu or 715-346-3642.

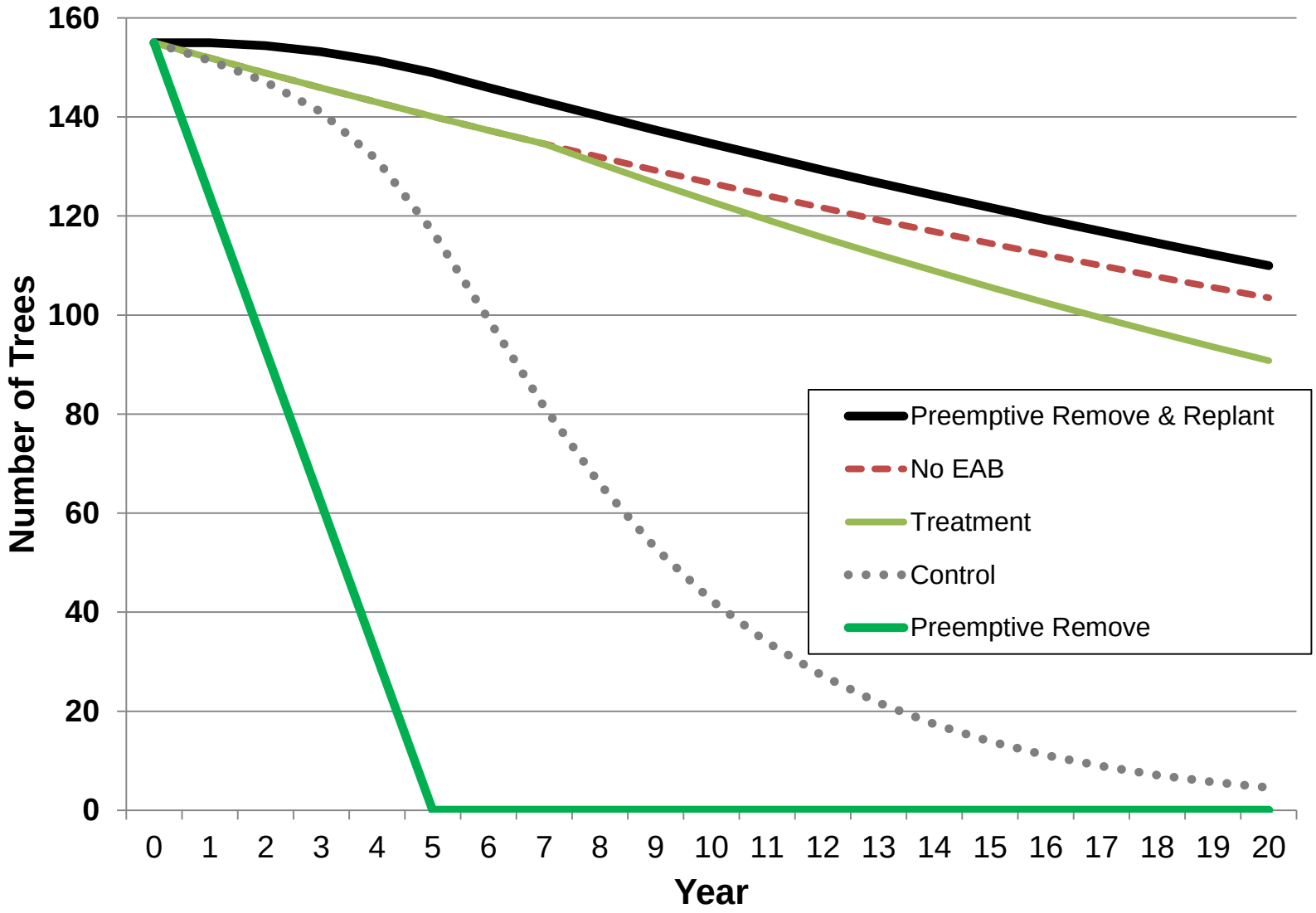
College of Natural Resources
University of Wisconsin-Stevens Point

Copyright ©2015 by Richard Hauer and Andrew VanNatta. All rights are reserved for components within this program (EAB-PLANS©). This program may be used freely for educational and non-commercial purposes. The end-user accepts all responsibility for the use of this program with ash tree management. Released January 18, 2015

http://www.uwsp.edu/cnr/Pages/outreachExtension.aspx

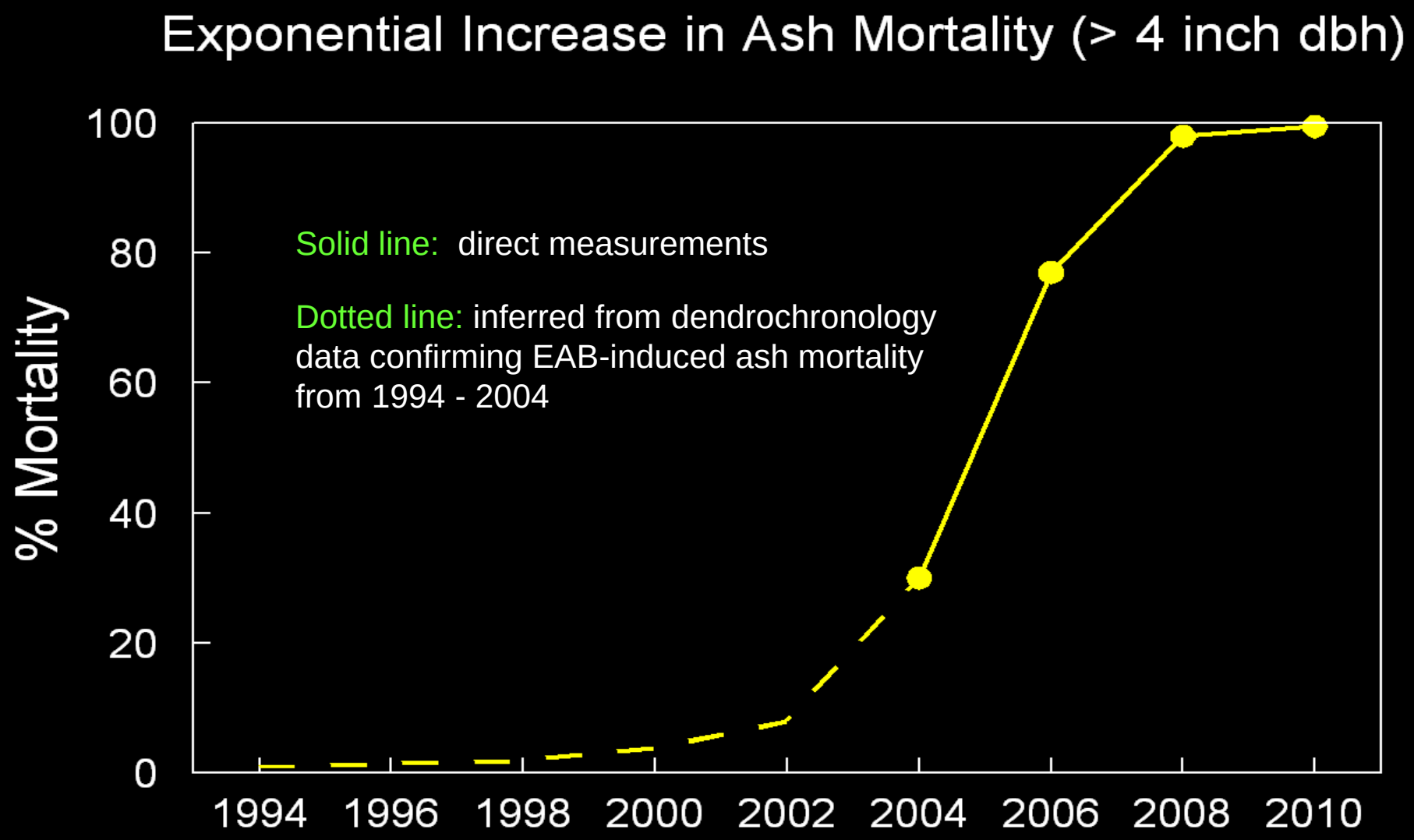
A way to compare management options

Modeled Ash Tree Loss Over 20 Years



Different Options and Tree Retention

EAB-Induced Ash Mortality SE Michigan



The outcome of doing nothing (Image by Dan Herms)

VARIABLES	UNIT	VALUE	NOTES ON HOW TO ENTER DATA Scroll cursor over for tips
Starting Diameter	Mean Size (Inches)	17.90	Average (mean) diameter (DBH, 4.5 feet) of the ash tree population at the start of the simulation
Starting Population	Number of Trees	31,421	Number of ash trees in your management area at the start of the simulation
Preemptive Removal	Number of Years	5	Number of years for preemptive removal of ash annually (enter a value of 1 to 10 years)
Tree Growth Rate	Inches/Year	0.50	The average (mean) annual increase in tree diameter (DBH, 4.5 feet)
Maintenance Cost	$/Diameter Inch	2.03	Total annual cost per tree diameter inch (DBH, 4.5 feet) to maintain trees in the management area
Removal Cost	$/Diameter Inch	25.68	Cost to remove a tree and stump per diameter inch (DBH, 4.5 feet)
Treatment Cost	$/Diameter Inch	3.75	Cost for each application treatment per diameter inch (DBH, 4.5 feet) to prevent EAB mortality
Treatment (Tx) Interval	Years Between Tx	2	Interval between ash tree treatments (Tx) in years
Expected Tx Success	Percent	99.0%	Percent of treated ash trees that will survive peak EAB pressure under chosen protocol
Planting Survival	Percent	90.0%	Percent survival of trees following planting until established
Natural Survival	Percent	99.2%	Percent annual survival normally expected for ash trees without regard to EAB
No Control Survival (EAB)	Percent	80.0%	Annual survival of nontreated ash trees starting at the 7 year tipping point (user does not modify)
Replacement Size	Inches	3.50	Average (mean) diameter (DBH, 4.5 feet) of a replacement tree
Replacement Cost	Dollars	225	Cost to purchase a replacement tree
Installation Cost	Dollars	200	Cost to install a replacement tree
Unit Tree Cost	$/sq. in.	23.39	CTLA calculated unit tree cost of replacement tree (user does not modify, based on replacement size)
Species	Percent	70.0%	CTLA species percentage of the ash tree population
Condition	Percent	69.5%	CTLA average (mean) condition of the ash tree population
Location	Percent	70.0%	CTLA average (mean) percent for ash trees in the management area
Interest Rate + 1	Percent	1.06	Discount interest rate (Enter value as 1 + the interest rate, i.e. 6% interest rate enter as 1.06)
Replant *Lost* Trees?	Yes=1, No=0	1	Replant trees killed by EAB in the Control and Treatment management options

EAB-PLANS … Entering Customized Data

VARIABLES	UNIT	VALUE
Starting Diameter	Mean Size (Inches)	17.90 ▪ ☑
Starting Population	Number of Trees	31,421 ▪ ☑
Preemptive Removal	Number of Years	5 ▪ ☑
Tree Growth Rate	Inches/Year	0.50

Enter your ash population statistics

EAB-PLANS … Entering Customized Data

Maintenance Cost	$/Diameter Inch	3.50
Removal Cost	$/Diameter Inch	31.90
Treatment Cost	$/Diameter Inch	3.75 ☑
Treatment (Tx) Interval	Years Between Tx	2 ☑
Expected Tx Success	Percent	99.0% ☑
Planting Survival	Percent	90.0%
Natural Survival	Percent	99.2%
No Control Survival (EAB)	Percent	80.0%

Enter your management costs and treatment outcomes

Default values from McPherson et al. 2005 … Midwest Guide (Adjusted for Inflation to 2012)

Maintenance Cost	$/Diameter Inch	3.50
Removal Cost Includes Stumps	$/Diameter Inch	31.90
Treatment Cost	$/Diameter Inch	3.75

Actual values from City of Milwaukee Production Records (Mean 2013 and 2014)

Maintenance Cost	$/Diameter Inch	2.03
Removal Cost Includes Stumps	$/Diameter Inch	25.68
Treatment Cost	$/Diameter Inch	3.75

EAB-PLANS … Entering Customized Data

Replacement Size	Inches	2.00
Replacement Cost	Dollars	145
Installation Cost	Dollars	200
Unit Tree Cost	$/sq. in.	46.15
Species	Percent	70.0%
Condition	Percent	69.5%
Location	Percent	70.0%
Interest Rate + 1	Percent	1.03

Enter your economic parameters

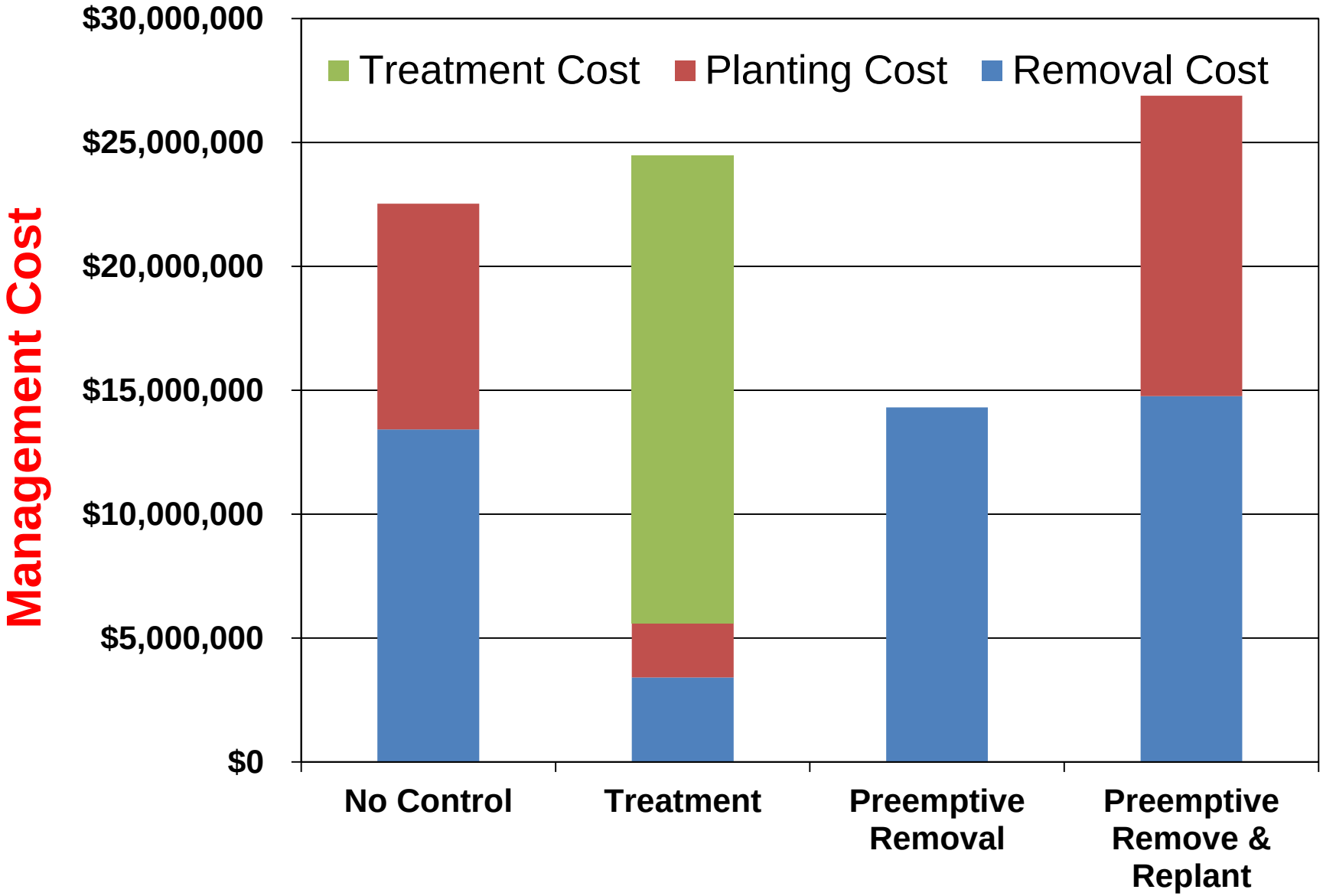
Management Alternatives	Retained Tree Analysis		Lost Tree Analysis		Benefit/Cost	
	Forest Net Value	Per Tree Net Value	Forest Net Value	Per Tree Net Value	Compare to No Control	Within Alternative
No Control	$58,152,332	4,343	$7,997,094	5,517		1.78
Preemptive Removal	$17,747,430	1,143	[illegible]	[illegible]43	0.62	0.99
Remove & Replant	$23,269,996	785	[illegible]	[illegible]20	0.32	0.69
Treatment	$130,745,328	4,690	[illegible]	[illegible]92	5.57	2.96
No EAB	$137,689,737	4,743	$1,238,953	5,580		5.67

Legend

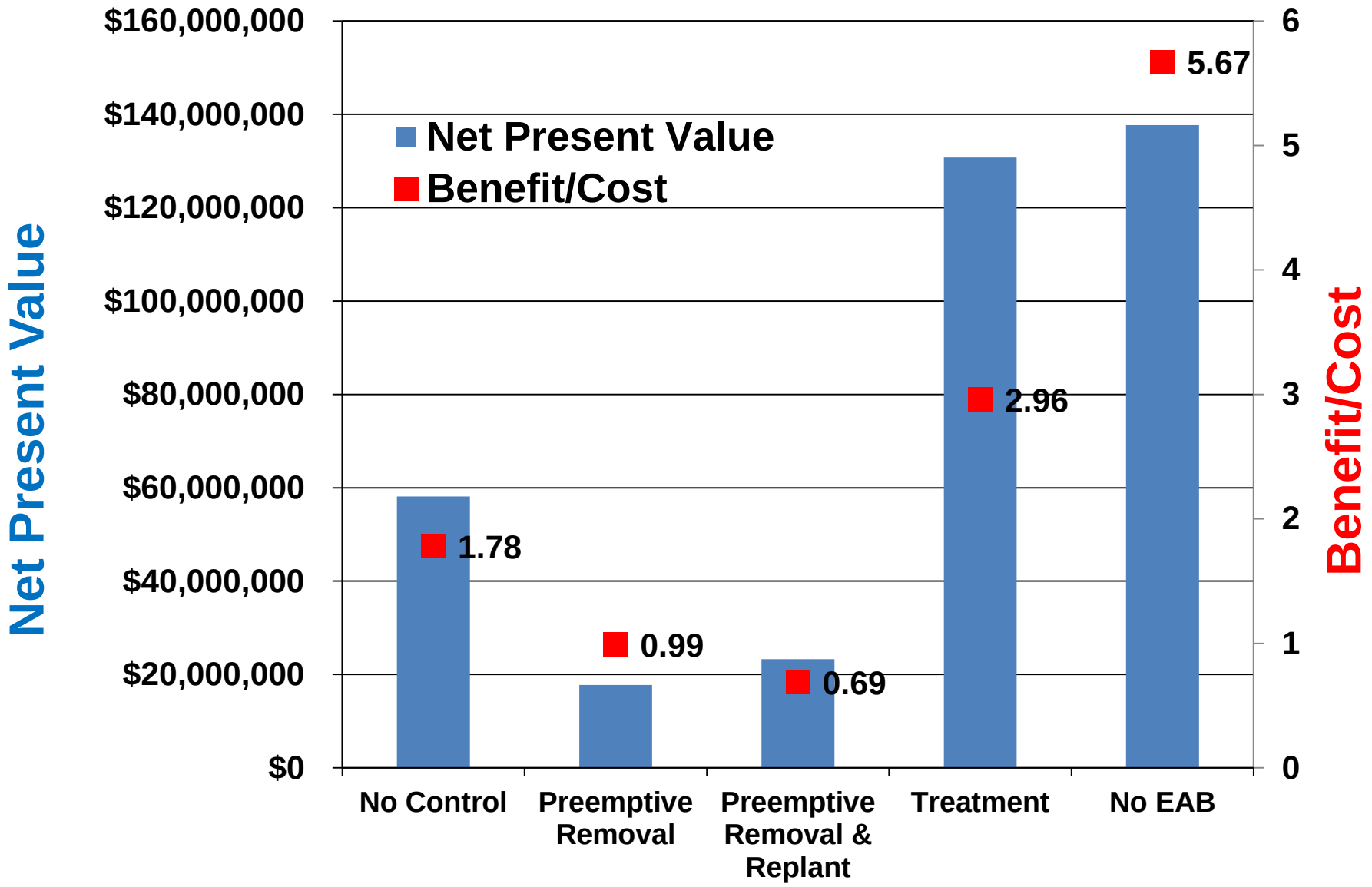
- Most Desirable Outcome
-
-
- Least Desirable Outcome

Goals & Objectives	Management Alternatives			
	No Control	Treatment	Removal	Remove & Replant
Mean Net Per Tree Value	$4,343	$4,690	$949	$785
Net Per Tree Value at Year 20	$5,167	$5,286	$0	$775
Net Total Tree Value at Year 20	$5,053,329	$124,111,463	$0	$21,253,489
Mean Net Per Tree Value Lost	$5,517	$5,692	$1,143	$4,620
Total Trees Lost After 20 Years	30,443	7,940	31,421	35,430
Mean Annual Tree Diameter (DBH)	20.4	22.6	4.4	8.0
Mean Number of Trees Lost Per Year	1,450	378	1,496	1,687
Trees Retained at Year 20	978	23,481	0	27,412
Mean Per Year Maintenance Cost	$526,393	$973,629	$216,443	$432,291
Total Maintenance Cost	$11,054,258	$20,446,211	$4,545,304	$9,078,106
Mean Per Year Removal Cost	$639,001	$162,382	$681,716	$702,997
Total Removal Cost	$13,419,019	$3,410,017	$14,316,026	$14,762,930
Mean Per Year Planting Cost	$434,254	$104,053	$0	$577,618
Total Planting Cost	$9,119,333	$2,185,120	$0	$12,129,979
Mean Per Year Treatment Cost	$0	$899,288	$0	$0
Total Treatment Cost	$0	$18,885,048	$0	$0
Total Management Cost	$33,592,610	$44,926,396	$18,861,331	$35,971,015
Mean Per Year Total Management Cost	$1,599,648	$2,139,352	$898,159	$1,712,905
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Milwaukee Example ($3.75, 2 year)



Milwaukee Example ($3.75, 2 year)



Tree Triage: Take Care of the Worst First

Remove your worst condition, high risk trees first