The Journal of Extension

Volume 48 | Number 4 Article 20

8-1-2010

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Steven C. Prochaska
Ohio State University Extension, prochaska.1@osu.edu

Melinda Hoffman
Ohio State University, hoffman.396@osu.edu

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Recommended Citation

Prochaska, S. C., & Hoffman, M. (2010). Street Tree Resource Evaluation and Education Trust (STREET). *The Journal of Extension, 48*(4), Article 20. https://tigerprints.clemson.edu/joe/vol48/iss4/20

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Journal of Extension
www.joe.org

August 2010
Volume 48 Number 4
Article Number 4RIB5

Return to Current Issue

Street Tree Resource Evaluation and Education Trust (STREET)

Steven C. Prochaska
Associate Professor
Ohio State University Extension
Bucyrus, Ohio
prochaska.1@osu.edu

Melinda Hoffman
Student
Ohio State University
Columbus, Ohio
hoffman.396@osu.edu

Abstract: An educational and applied research project, Street Tree Resource Evaluation and Education Trust (STREET), was conducted to train Master Gardener volunteers to identify and inventory Bucyrus street trees, to educate city government and citizens on street tree benefits, to secure funding and city approval for new street tree planting, and to compare citizen and landscape contractor tree planting by tree planting depth. Outcomes of STREET included: identification and inventory of 1,797 street trees, grant funding of $5000, 194 new trees planted, and citizen tree planting depth higher than tree professionals.

Introduction

Benefits of street trees include energy savings, mitigation of storm water runoff, reduction of carbon dioxide, and increased property values (Maco & McPherson, 2002). Trees are estimated to have a significant economic value. For example, the value of a small tree (21 feet in height) is estimated from $160 to $600, depending upon tree location, and a large tree (47 feet in height) may have benefits of over $2,320 when planted in a street lawn (McPherson et al., 2006).

Street trees also may provide social benefits, including increased feelings of community involvement and environmental awareness (Thompson, Nowak, Crane, & Hunkins, 2004). Trees planted along roadways can provide enough shade to extend the life of road pavement. For example, areas in California were able to prolong repaving shaded areas an additional 10 to 25 years (McPherson & Jules, 2005). However, it is imperative to plant trees that are appropriate for the location to reduce conflicts between the tree growth patterns and obstacles such as power lines and traffic signs (McPherson, 2003).

Education of volunteers and tree professionals can have a significant impact on the improvement of community tree resources and their management (Skelton & Josiah, 2003).

Due to budget constraints, the city of Bucyrus, Ohio does not have a municipal tree maintenance or replacement program. Thus, citizens of Bucyrus essentially select, plant, and care for trees in the city tree lawns. This arrangement can be viewed in the framework of "legal trust" in that city tree lawns should be managed for the benefit of all. However, this "trust" has been violated by poor tree selection, poor selection of the planting area, and improper tree maintenance (Amato, Sydnor, & Struve, 2001).

This article describes the outcomes of the Street Tree Resource Evaluation and Education Trust (STREET) program and economic impact on the community of Bucyrus, Ohio.

Purpose and Objectives

The purpose of the Street Tree Resource Evaluation and Education Trust (STREET) program was to identify and inventory Bucyrus street trees, educate city administrators and citizens on the economic and environmental benefits of trees, and compare citizen tree planting to professional landscape contractor tree planting by planting depth in 2007. The latter objective is important because tree death due to excessive soil over the root system is serious problem inherent in recent tree plantings in the United States (Watson, 2006). Thus, a valid concern was the ability of citizens to select, site, and plant trees correctly.

Street Tree Resource Evaluation and Education Trust (STREET) objectives were:

1. To train Master Gardener volunteers to identify the various species of Bucyrus street trees.

2. To inventory and describe Bucyrus street trees (trees growing in the city tree lawn) by location, species, and size.

3. To write a grant to obtain funding for purchase of street trees for citizen planting.

4. To educate city administrators and citizens on street tree planting by site, species and culture.

5. To describe new tree plantings over survival, and twig growth (length) by citizen and professional landscape contractor.

6. To compare tree planting depth between citizens and a landscape contractor.

7. To analyze the economic and environmental benefits of existing street trees (as identified in the street inventory), utilizing the USDA STRATUM software.

Methods

Presentations were made to the Bucyrus City Council on the benefits of improved selection, placement and planting of street trees and to obtain permission to survey city trees. Master Gardeners were trained to identify common trees and record appropriate data. The Master Gardeners surveyed sites at 2,102 street addresses recording tree species, size, and location. A grant was written to a local foundation (that was

funded at $5,000) to purchase trees for planting by city residents and commercial firms at approved sites. In August of 2006 and 2007, new tree planting sites were surveyed for data as described below.

Data collected at new tree sites included the following.

1. Depth of tree planting was measured where the root flare was located in inches below or above grade.

2. Tree growth was measured by averaging the new growth on three branches. This measure was used (as opposed to a trunk measurement) because trees in the data set had been transplanted within 2 years of data collection and little if any change in trunk measurement would be expected. Further, the presence of new growth on branches is a visible sign of life and concomitantly vigor.

3. Tree condition (survival) was measured using the following scale: A tree's condition was rated on a scale from 0 to 4. A score of 4 indicated the tree was in excellent condition (6" or more new growth), a 3 indicated good condition (new growth less than 6"), a 2 indicated fair condition (no new growth), a 1 indicated poor condition (no new growth, less than 50% of the tree's leaves present), and 0 score indicated that the tree was dead.

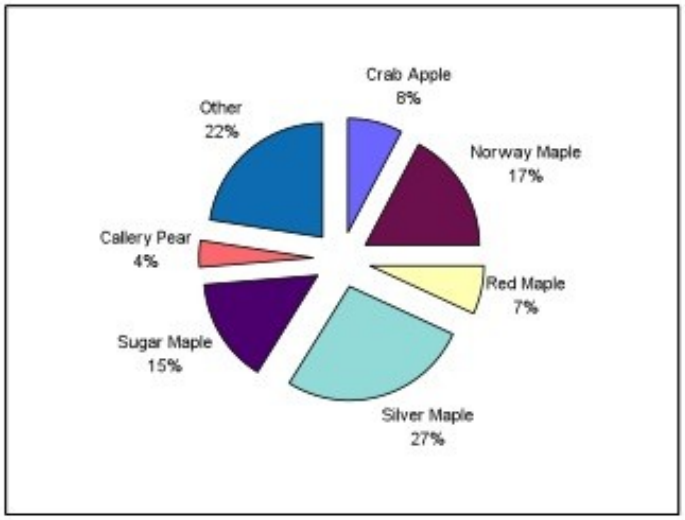
The inventory of street trees in Bucyrus was further analyzed using (STRATUM) to quantify economic and environmental street tree benefits (Sydnor, Subburayalu, & Prochaska, 2008).

Results

After educational presentations were made to city administrators, permission was granted by Bucyrus city officials to survey street trees, and additional funding of $4,000 for the purchase of new street trees for citizen planting was provided. Tree surveys were conducted by the Master Gardeners on 2,102 Bucyrus street addresses in 2005, with 1,797 trees inventoried.

There were 54 species of woody plants identified in street tree lawns. The most common trees planted (Figure 1) in Bucyrus tree lawns were silver maples (27%). However, silver maple is not a recommended tree due to negative attributes of poor branch structure and aggressive roots (Dirr, 1998). Thus, citizens have violated the city trust component of STREET by selecting and planting silver maple to excess in Bucyrus. From the viewpoint of biodiversity, maples account for 66% of all street trees. This percent is over double the recommendation of 30% of trees from one plant family as street trees (Sydnor et al, 2008). This finding strongly supports the need for greater diversity in new tree plantings.

Figure 1.
Distribution of Bucyrus Street Trees



In 2006 and 2007, 98 and 96 new street trees, respectively, were planted by citizens and a landscape contractor. Trees planted were selected based on Bucyrus tree lawn site characteristics. Small trees such as crabapple and serviceberry were used for sites with overhead utility lines. Sites without any obstructions or easements and an adequate tree lawn were planted to larger trees such as oak and hybrid elm cultivars. In both 2006 and 2007, tree losses were low. The overall survival rate of all STREET trees planted in 2006 and 2007 was 97.9% (Table 1).

Table 1.
Tree survival rate (%) for 2006 and 2007 plantings

Tree Data for 2006 & 2007	**Citizen Planted**	**Landscape Contractor**
Total Number of Trees Planted	129	65
Number Lost	2	2
Percent Survival	98.4	96.9
Average Percent Survival	**97.9**	

For both citizen and professional landscape contractor who planted trees, the depth of planting was acceptable in that 89% of homeowner and 61% of the landscape contractor trees were planted at or above grade. Only six of the 194 trees were planted 2 inches below grade (Table 2 and 3). This is an important finding in that, as planting depth increases, tree survival decreases (Watson, 2006).

Table 2.
Planting Depth Frequencies for Trees Planted by Citizens in 2007

Planting Depth	**Frequency**	**Percent %**
Greater than 2" above grade	24	35.30
1" above grade	20	29.41

At grade	13	19.12
1" below grade	7	10.29
Greater than 2" below grade	4	5.88
Total Trees Planted	**68**	**100.00**

Table 3.
Planting Depth Frequencies for Trees Planted by Professional Landscape Contractor in 2007

Planting Depth	**Frequency**	**Percent %**
Greater than 2" above grade	5	21.74
1" above grade	6	26.09
At grade	3	13.04
1" below grade	7	30.43
Greater than 2" below grade	2	8.70
Total Trees Planted	**23**	**100.00**

There was a significant statistical difference between planting depths (planting depth was represented with a continuous real number of either a positive, negative or zero value) when comparing citizen verses professionally planted trees (Table 4). However, mean planting depth was acceptable for both citizens and the landscape contractor.

Table 4.
Comparison of Tree Planting Depths for Citizen and Professionally Planted Trees in 2007

Planted by	**Number of Trees Planted**	**Mean of Planting Depth (inches)**	**Standard Deviation (Inches)**	**t-Test**
Citizens	68	0.78	1.44	**0.04576***
Professional Tree Planting Service	23	0.20	1.34	
*Significant at alpha <.05				

Average new growth varied by species and perhaps by the summer weather (Table 5). During 2007, a summer drought occurred that may have influenced the observed difference in tree growth.

Table 5.
Average of New Tree Growth in 2006 and 2007

Year	Number of trees planted	Growth (in.)
2006	98 trees planted	4.34 inches
2007	96 trees planted	3.02 inches
Average growth for all trees over 2 years 3.68 inches		

With the inventory of Bucyrus street trees completed, United States Department of Agriculture software, Street Tree Management Tool for Urban Forest Managers (STRATUM), was used to quantify the dollar value of tree environmental and esthetic benefits.

The STRATUM analysis of the economic benefits of the existing 1,797 Bucyrus street trees found an annual economic contribution of $354,579 dollars, or $197 per tree. These monetary benefits can be separated out and ordered by dollar value (Table 6).

Table 6.
Average Annual Value of Bucyrus Street Trees

Economic Benefit	Value (in U.S. Dollars)
Storm Water Abatement	131,020
Aesthetic/Other	106,593
Energy Savings	87,954
Carbon Sequestration	13,618
Air Quality Improvement	15,394
Total	**354,579**

Conclusions and Implications

Educational outcomes of STREET included the following: city government support for the identification and inventory of 1,797 Bucyrus street trees by Master Gardener volunteers; grant written and funded by a local foundation at $5,000 for purchase of street trees; Bucyrus city funding support for STREET by way of the transfer of $4,000 dollars to new tree acquisition; and education of citizens on appropriate street tree placement and planting. Nearly 200 new street trees have been planted along the Bucyrus city streets. These trees will contribute significantly to energy savings, air quality improvement, storm water abatement, and carbon sequestration as they grow larger. This is evidenced by the STRATUM analysis of economic benefits in excess of $350,000 annually from existing Bucyrus street trees.

Tree depth of planting for both citizens and the landscape contractor was acceptable even though street trees planted by citizens averaged 0.58 inches higher above soil grade than the landscape contractor planted trees. Further, tree survival has been excellent for both groups. Therefore, the study presented here suggests that

citizens are able, after education, to plant trees with survival rates equivalent to those planted by landscape contractors. In conclusion, strong city government support can be obtained for environmental enhancement programs such as STREET that empowers citizens to correctly plant new trees that will provide significant economic and environmental benefits for the community into the future.

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