TREE CITY USA®
BULLETIN
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How to Measure Progress

Planting trees is popular with the public. It can be fun and is almost always an uplifting and memorable experience. Follow-up, including care and replacement, is more the neglected child of urban forestry. Today's monitoring and evaluation methods are changing this and are an important step toward sustainable community trees and ensuring the confidence of supporting organizations.

There is a saying sometimes attributed to Winston Churchill that might well be applied to urban forestry: "How do we expect to know where we are going unless we know where we've been?"

By using some of the tools presented in the pages of this bulletin, it is possible to more clearly see where we are and to plan for what is needed in the future. In short, they can strengthen community forestry in a number of ways. They allow tree boards and forestry staff to quantify progress — or lack of it. Proven progress can be communicated to those who support — or should support — the idea of community trees. Everyone likes success, and it is human nature to rally around a successful cause. On the other hand, by understanding lack of progress, those responsible for urban forestry can plan interventions to correct a situation and turn it into success.

Planting trees is important, but monitoring and evaluation is essential to ensuring long-term success.

In its advice to organizations seeking funding, World Bank authorities say that "monitoring and evaluation are important management tools to track your progress and facilitate decision making … By closely examining your work, your organization can design programs and activities that are effective, efficient, and yield powerful results for the community."

There are many ways to evaluate urban forestry and measure progress. The limited space in this bulletin allows for only a few of the more proven and promising. Whatever method is used, *something* should be used in communities of all sizes to validate and publicize efforts to create greener and cleaner living conditions for residents — and make changes when necessary.

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The Tree Report Card

If there is one thing that is almost universally understood, it is a report card. There is something authoritative about this term, and it presents the reader with a fairly clear picture for comparison with others or from one period of time to the next.

THE CASEY TREES METHOD

The nonprofit organization Casey Trees serves as a champion for trees in Washington, D.C. Its volunteers — along with city partners, including the Departments of Transportation and Energy and Environment — have planted more than 80,000 trees in our nation's capitol since the organization's inception in 2002. Five years later it pioneered a Tree Report Card. "It is one of the most powerful things we've done," said Executive Director Mark Buscaino. "It is viewed by all the decision makers and in 2016 helped us get an important revision to the city's tree protection ordinance — one of the strongest in the nation." The methods used to create the report card include use of the city's satellite imagery for an assessment from above and applying iTree tools on the ground. The result is an extremely comprehensive evaluation. Importantly, the report card is published consistently, year after year, and is written for understanding by a lay audience.

Each year, four evaluation categories, called metrics, are given numerical scores and grades. These are averaged for the final grade.

Casey Trees volunteers in Washington, D.C., serve to monitor the city's trees as part of preparation for the city's annual Tree Report Card.

TREE COVERAGE

Using aerial imagery, canopy coverage in 2016 was determined to be 38 percent, indicating that the maturing of planted trees and the retention of older trees (thanks in large part to the city's ordinance) are bringing the canopy close to the goal of 40 percent coverage — ahead of the city's 2032 goal. This warranted a grade of A.

TREE HEALTH

This measurement is taken every five years through iTree Eco by examining tree condition, species, size, and forest or land use type in 201 sample plots throughout the city. Currently, 83 percent of the city's 2.4 million trees are judged to be in good to excellent condition, earning a grade of B-.

TREE PLANTING

Casey Tree's report card draws upon information from government agencies and other tree-related organizations. For example, in 2016, 14,137 trees were collectively planted on private and public property, the most in any year to date, earning a well-deserved A+.

PROTECTION

To arrive at a grade in this category, answers were given to several questions that reflect the mission and interests of this particular nonprofit. Other communities might create different submetrics aligned with their own mission or needs.

- Is the Urban Forestry Protection Act discouraging the removal of healthy special trees?
- Are replacement trees effectively replacing canopy removed?
- Is the Tree Fund being administered properly, i.e., are moneys collected from fines and fees being used to plant trees, as specified in the Urban Forestry Protection Act? In 2016, the answers resulted in a grade of B.

A PROBLEM OF PERCEPTION

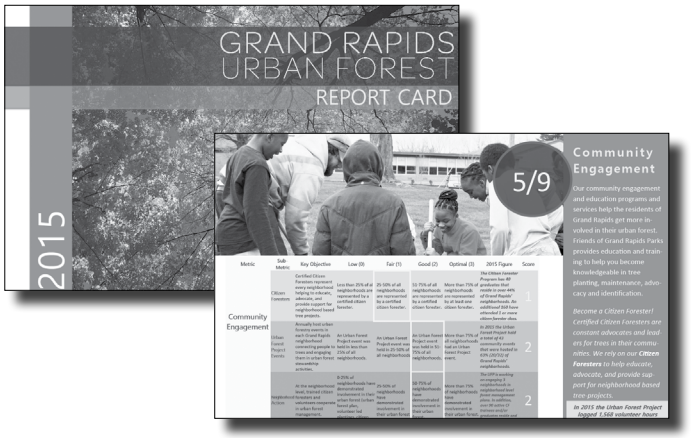
In some communities, there is reluctance to create a Tree Report Card because municipal governments, in particular tree management divisions in their many forms, are concerned it may reflect poorly on them. Casey Trees overcame this problem by emphasizing that the evaluation in its Tree Report Card is that of the collective efforts of all agencies, organizations, and citizens in the community, including Casey Trees, not solely the municipalities and its agencies or any one specific entity.

GRAND RAPIDS' METRIC CHART

The Friends of Grand Rapids (Michigan) Parks is a nonprofit organization with a mission to protect, enhance, and expand parks and public spaces in its city. It also seeks to engage the entire community in growing a larger, healthier urban forest. In 2015, this Friends group spearheaded an Urban Forest Report Card as part of its Urban Forest Project. After consulting with professionals in various other organizations, these residents created a series of measurables that they believe will help them gauge progress toward their goals over time. In the Grand Rapids study, four metrics were used and will be re-analyzed every two years:

- Canopy Cover – An assessment of cover types and the current canopy as a percentage of the city's goal of 40 percent cover.
- Forest Health – Condition of public trees, species suitability, and species diversity.
- Tree Planting – Not only how many trees were planted by the city and Urban Forest Project, but also an evaluation of related education and communication.
- Community Engagement – A measure of the social aspect of urban forestry.

For each of the above metrics, a scale in spreadsheet format was developed to guide the measurements used in the report card. With permission of Friends of Grand Rapids Parks, the scale for the Community Engagement metric is reproduced here as an example. The scale for the other metrics can be seen in the report available online (Visit arborday.org/bulletins for a direct link).



Metric	Sub-Metric	Key Objective	Low (0)	Fair (1)	Good (2)	Optimal (3)	2015 Figure	Score
Community Engagement	Citizen Foresters	Certified Citizen Foresters represent every neighborhood helping to educate, advocate, and provide support for neighborhood based tree projects.	Less than 25% of all neighborhoods are represented by a certified citizen forester.	25-50% of all neighborhoods are represented by a certified citizen forester.	51-75% of all neighborhoods are represented by a certified citizen forester.	More than 75% of neighborhoods are represented by at least one citizen forester.	The Citizen Forester Program has 40 graduates that reside in over 44% of Grand Rapids' neighborhoods. An additional 160 have attended 1 or more citizen forester classes.	1
	Urban Forest Project Events	Annually host urban forestry events in each Grand Rapids neighborhood, connecting people to trees and engaging them in urban forest stewardship activities.	An Urban Forest Project event was held in less than 25% of all neighborhoods.	An Urban Forest Project event was held in 25-50% of all neighborhoods.	An Urban Forest Project event was held in 51-75% of all neighborhoods.	More than 75% of all neighborhoods had an Urban Forest Project event.	In 2015 the Urban Forest Project held a total of 43 community events that were hosted in 63% (20/32) of Grand Rapids' neighborhoods.	2
	Neighborhood Action	At the neighborhood level, trained citizen foresters and volunteers cooperate in urban forest management.	0-25% of neighborhoods have demonstrated involvement in their urban forest (urban forest plan, volunteer led plantings, citizen foresters, etc.).	25-50% of neighborhoods have demonstrated involvement in their urban forest.	50-75% of neighborhoods have demonstrated involvement in their urban forest.	More than 75% of neighborhoods have demonstrated involvement in their urban forest.	The UFP is working on engaging 3 neighborhoods in neighborhood level forest management plans. In addition, over 90 active CF trainees and/or graduates reside and volunteer in 23/32 GR neighborhoods.	2

An important goal of Friends of Grand Rapids Parks is to engage the entire community in planting and care of community trees. The report card therefore takes this into account to measure progress toward that goal.

The Tree Report Card

LEXINGTON'S TREE CANOPY REPORT CARD

In this case, Kentucky's Lexington-Fayette Urban County Government retained the services of Davey Resource Group to create report card grades that reflect the current status of the city's tree canopy and can be readily understood by residents. Earlier, an Urban Tree Canopy analysis had been conducted to quantify the area's existing tree canopy and identify where trees might help address stormwater management issues. Among other things, the analysis revealed that trees cover about 25 percent of all land in the area and provide residents with more than $50 million in benefits.

Based on the information from the analysis, future goals were determined and grades were assigned to show the current situation in relation to those goals.

Reaching the Goal (Existing Canopy/Canopy Goal)

This grading scale compares the existing tree cover to the city's overall canopy goal of 30 percent. Grading Scale:

97-100: A+	80-82: B-	63-66: D
93-96: A	77-79: C+	60-62: D-
90-92: A-	73-76: C	Below 60 is an F.
87-89: B+	70-72: C-	
83-86: B	67-69: D+	

Achieving Maximum Possible Canopy
(Existing Canopy/Maximum Canopy Possible)

Canopy can also be evaluated by how much has been achieved compared to the amount of canopy possible in each area. Maximum potential canopy was calculated in an urban tree canopy assessment for the city overall, as well as by council districts, homeowner associations, and more. Each grade represents the level of potential canopy that has been achieved. Grading Scale:

Over 85: A+	60-64: B-	35-39: D
80-85: A	55-59: C+	30-34: D-
75-79: A-	50-54: C	Below 30 is an F.
70-74: B+	45-49: C-	
65-69: B	40-44: D+	

Ability to Prevent Flooding & Water Pollution
(Acres of Pervious Land/Acres of Impervious Land)

The amount of stormwater that enters sewer systems is greatly impacted by the amount of tree canopy in that area. Interception of stormwater means less rainwater running into combined storm/sewage pipes that overflow during rainfalls. Less rainwater in the sewer means less pollution in local waterways. The ability to prevent water pollution is quantified as a ratio of pervious surfaces (land covers such as bare soil, streams, turf, shrubs, and trees that can absorb rainwater) to non-pervious land covers (concrete, buildings, and other paved surfaces). Grading Scale:

Above a 5: A+	4.0-4.24: B	2.25-2.49: D+
4.75-4.99: A	3.75-3.99: B-	2.00-2.24: D
4.50-4.74: A-	3.50-3.74: C+	1.50-1.99: D-
4.25-4.49: B+	3.0-3.5: C	Less than 1.50 is an F.
	2.50-3.00: C-	

Avoiding Heat Stress
(Acres of Impervious Land/Acres of Tree Canopy)

Heat extremes in urban areas — termed urban heat island (UHI) effects — is a leading cause of respiratory and cardiac illnesses. Heat stress leads to higher energy usage and costs and lower quality of life. Grades are assessed as a ratio of impervious surface (concrete) to tree canopy, which is a strong predictor of heat-stressed areas. The higher the ratio value, the more UHI issues. Grading Scale:

0.10: A+	0.60: B-	1.10: D
0.20: A	0.70: C+	1.20: D-
0.30: A-	0.80: C	1.30 or higher is an F.
0.40: B+	0.90: C-	
0.50: B	1.00: D+	

Overall Canopy Benefits
(Total Value of Benefits from Trees/Total Acres)

Tree canopy is valuable for the benefits it provides, such as air and water quality, carbon storage, reduced energy needs, and property value increases. Total value of benefits is divided by the total acres in each district; that way, benefits across districts can be more accurately compared. Grading Scale:

$1250: A+	$912: B-	$587: D+
$1187: A	$837: C+	$500: D
$1125: A-	$750: C	$370: D-
$1062: B+	$662: C-	$250 is an F.
$1000: B		

Other Evaluation Methods

Other evaluation methods are — or should be — used to help communities monitor progress. Here are just a few to consider.

ANNUAL REVIEW OF PLANS

Plans do little good if they are created only to sit in a drawer. Whether it is a city's urban forest plan or a tree board's annual plan, a regular review and discussion will reveal the amount of progress being made or what adjustments are necessary to move forward. Even a debriefing after an event like an Arbor Day celebration is a good way to ensure improvement in the future.

MUNICIPAL FORESTRY ACCREDITATION

The Society of Municipal Arborists has a peer-reviewed program that recognizes communities that meet a set of standards that reflect excellent management practices. Guidance and assistance is available if the standards are not met, and an annual review is required to maintain the recognition once it is achieved.

THE TREE CITY USA PROGRAM

Similar to the above, Tree City USA and related programs (Tree Campus USA, Tree Line USA, Tree City USA Growth Award) are means of annually taking stock in a very public way.

COMMUNITY ACCOMPLISHMENT REPORTING SYSTEM (CARS)

CARS is a long-standing process that requires state urban and community forestry coordinators to annually report to the U.S. Forest Service the status of community forestry in their areas. The report is based on the number of municipalities that have: (1) management plans, (2) a tree ordinance, (3) professional staff, and (4) an advocacy/advisory organization, such as a tree board or nonprofit tree organization. In this case, the report actually helps determine the amount of federal funding received the following year — a good incentive for progress.

WHAT ABOUT TREE BOARDS?

Taking stock of how well your tree board is functioning is important for ensuring the kind of effectiveness that leads to community support. Good models have been provided by school boards across the country. These assessments consider the participation and interest of members as well as external relations, planning, and other factors, many of which can be easily adapted to tree boards. A link to an example is provided in the Supplemental Resources Library mentioned on page 8.

Measuring Tree Survival and Growth

Planting trees is essential to the improvement of any community's urban forestry efforts. Considerable time and money is spent each year on this activity, and it is usually the one that enjoys the most media coverage and public support. This makes accountability and progress toward improved practices an important part of the process — and this begins with monitoring survival, growth, and tree health.

THE MOST BASIC LEVEL

At the very least, any planting project deserves a follow-up inspection of the trees after one or more growing seasons. Mortality should be noted — and the reason(s) if possible. Quick replacement is also important not only for maximizing future environmental benefits, but also protecting the public image of those responsible for the project. If planting is done using a contractor, it only makes sense to make replacement a part of the contract. If done by volunteers, replacement is still an important component of the project.

A BETTER WAY – THE URBAN TREE GROWTH & LONGEVITY PROJECT

To address the problem of urban tree mortality, we need data to understand it. The need for a standardized way to gather such data and monitor urban trees has been recognized for a long time. To address this issue, an Urban Tree Growth & Longevity Working Group has been formed to create standard monitoring protocols. It is a group open for additional members and operates under the auspices of the Arboriculture Research & Education Academy of the International Society of Arboriculture. Among the working group's projects is a publication titled *Urban Tree Monitoring: Field Guide.* The guide explains: (1) what data, at minimum, should be collected and the best methods that will detect change over time and across cities, (2) techniques for pinpointing the exact location of trees for later re-measurement, and (3) establishing a science-based foundation for long-term studies of tree health, growth, longevity, and mortality. According to the lead author of this useful publication, U.S. Forest Service Research Ecologist Lara Roman, "This is an attempt to step up our game in urban forestry. It is intended to provide guidance for getting the best, most useful data."

Why This is Important

Lara Roman points out that while several dozen urban forestry programs are already doing tree monitoring, methods vary widely. Also, there have not been coordinated efforts to collect data across many cities. This makes it challenging for managers and researchers to make comparisons. Comparisons between cities, programs, or other variables would enable investigation of the factors associated with tree performance, such as survival and growth. This, in turn, would ultimately help identify key points of intervention by which performance could be improved.

Importantly, the first step in any monitoring project is to determine the objective for the study. That is, what information will be useful for future guidance and improvement? For this reason, local modification is necessary in order to gather the appropriate data. The protocols determined by the working group provide a framework for the bare minimum of data necessary for monitoring and guidance for optional additional variables that could be selected to address specific study goals.

THERE ARE TWO BASIC FORMS OF MONITORING:

Cohort Monitoring — This kind of monitoring is usually done within the first few years of planting, but it can be done over longer time spans. These are field checks on a specific group of trees planted around the same time — a cohort. For example, it may entail measuring all trees planted in a specific year and/or perhaps by a particular volunteer organization or in a particular neighborhood. At the very least, it will note failures and sites needing to be replanted.

Example: Pete Smith of the Arbor Day Foundation worked with colleagues in Houston, Texas, to monitor shade tree survival as part of the Foundation's Energy-Saving Trees program. Following the working group's guidelines, a minimum data set approach was used — the core set of variables that are essential for any long-term tree monitoring — supplemented with information from a questionnaire sent to individuals who received the program's free trees.

Repeated Census or Systematic Re-inventory —
This involves the creation of a study area that will be re-measured at intervals that are long enough to reflect substantial change. The area may be a neighborhood, campus, or an entire community. Scientists see the importance of this work as a way to improve the accuracy of computer models used for projecting the ecoservices of trees, i.e., the data used in iTree tools. Another use of long-term studies might be to monitor the effects of cyclical pruning on certain streets or to measure the effects of planting done in an effort to increase a community's tree canopy. Similar study plots have long been used in rural forests to study changes in forest health and other ecological phenomena.

Example: The U.S. Forest Service and The Nature Conservancy have established permanent street tree plots for long-term monitoring in New York City and Philadelphia. Tree location, size, and health were recorded extremely carefully to allow for re-measurement of tree growth and re-evaluation of tree vigor in five years. This will shed light on cycles of tree planting, growth, removal and replacement, and trends in tree health not only in New York and Philadelphia, but across other cities as well.

Unlike in a one-time street tree inventory, measurements of diameter, height, and other tree characteristics must be taken with precision in order to monitor change over time.

Urban Tree Monitoring: Field Guide is written in a way that volunteers can consistently and accurately gather information for a minimum data set. Guidelines for more advanced tree health monitoring are also provided but are intended primarily for professionals.

AN INVITATION TO PARTICIPATE

The Urban Tree Growth & Longevity Working Group is a partnership of researchers and practitioners with the common goal of improving urban forestry outcomes that serve our nation's communities. Membership involves no cost and is open to all individuals engaged in urban and community forestry. Members receive:

- Information updates via newsletters
- Invitations to field trips
- Opportunities to network
- A chance to showcase local efforts

Join online at **urbantreegrowth.org/join**.

Tree City USA Growth Award

Establishing a new monitoring system in your community may qualify for points toward a Tree City USA Growth Award.

Growth Award
TREE CITY USA®

Encouraging Citizen Action

Measuring progress is important for improving management practices and understanding the science behind tree growth and ecoservices. However, it is a missed opportunity if it does not lead to enhanced public awareness and citizen action. Examples of how measurements were used as part of public information campaigns are found in both the Grand Rapids and Lexington report card projects. These were appeals to readers that included suggestions such as:

- Volunteer to help plant or prune trees
- Serve as a citizen naturalist
- Develop an idea for NeighborWoods Month
- Help write grant applications
- Nominate a tree for the Mayor's Tree of the Year
- Start a neighborhood project
- Report tree maintenance needs
- Attend a tree board meeting
- Donate money or other charitable gifts
- Join a local tree-related nonprofit group
- Participate in Arbor Day

FOR MORE INFORMATION **Please visit arborday.org/bulletins to find additional information about the topics in this issue. Click on "Available Bulletins & Resources" for quick links to the organizations and materials mentioned in this issue.**

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