# STORM DAMAGE ASSESSMENT FOR URBAN TREES

## A Timely and Accurate Method


DAMAGE ASSESSMENT

# OVERVIEW

The range and frequency of disasters that impact urban forests is astounding, with a typical community seeing at least 3 major events per century. This includes ice storms, wind events, and destructive pest attacks. If it has never happened to you, you should count yourself lucky: it's going to happen, and it's a lot of work! In this brochure we present a new scientific method for estimating tree damage and associated costs that you can carry out easily and cheaply.

## THE PROBLEM

After a disaster hits a community's forest, state emergency officials need a quick and accurate estimate of damage and costs. This is often a difficult task for local personnel: they are very busy right then, and making such estimates is tricky. For those reasons, many of the estimates are either way high or way low. Such errors cause problems and delays up and down the emergency response system, from obtaining the necessary dollars from Congress to reimbursing the local community.

## A BETTER WAY

What is needed is a method for looking quickly at a community's urban forest and then making an accurate projection of the level of damage it has sustained. The USDA Forest Service and its cooperators have now developed the tools to do this: a scientific sampling method, a reliable estimate of tree damage and debris, and an easy way to calculate and report the associated costs. Using these tools, you can now plan for urban forest disasters in a much better way.

# OVERVIEW

## METHODS

This storm damage method is based on a true random sample of the street segments (blocksides) of any community that can be made in less than half an hour using free data from the US Census Bureau. Community personnel then visit each sample street segment, recording the number and size of trees inside the right-of-way as well as 50 feet outside. That information is stored in a spreadsheet for the future, and can also be used to provide an approximation of potential costs. When a disaster strikes, trained observers revisit the sample streets, and record how much of the tree crown has been lost and how much hazard work such as pruning or removal is necessary. These observations are loaded back into the spreadsheet, and a detailed estimate is automatically generated that can be submitted to emergency officials.

## TIME AND MONEY

Because so much of the assessment process can be automated, the amount of time and money required for damage and cost estimates has been reduced to a minimum. The setup phase is usually done during down time before any disaster, and takes less than 3 days in total:

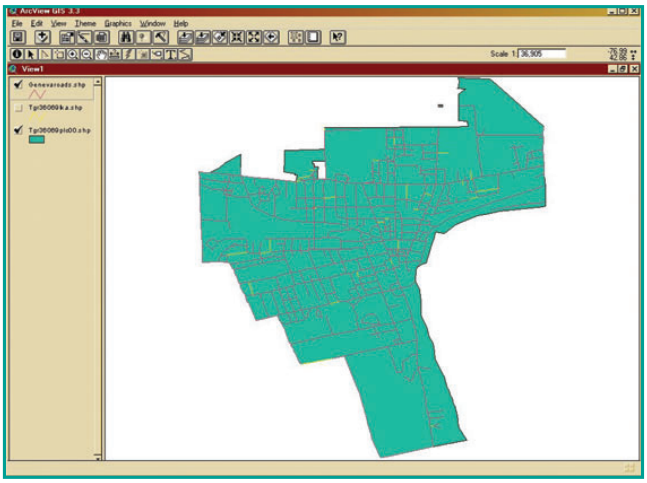
- 3-4 hours for office work
- 1-2 days for field work
- 1-2 hours to train one or two observers

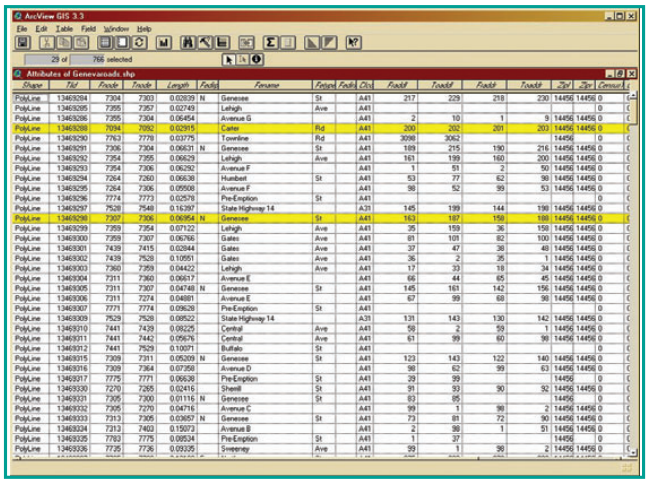
Damage assessment after a disaster can be limited to about 5 hours when the number of trained observers is matched to the number of samples at the rate of about 25 per observer. Another hour of office time is required to get the data into the spreadsheet and send it in, completing the process.

# SET UP – BEFORE THE DISASTER

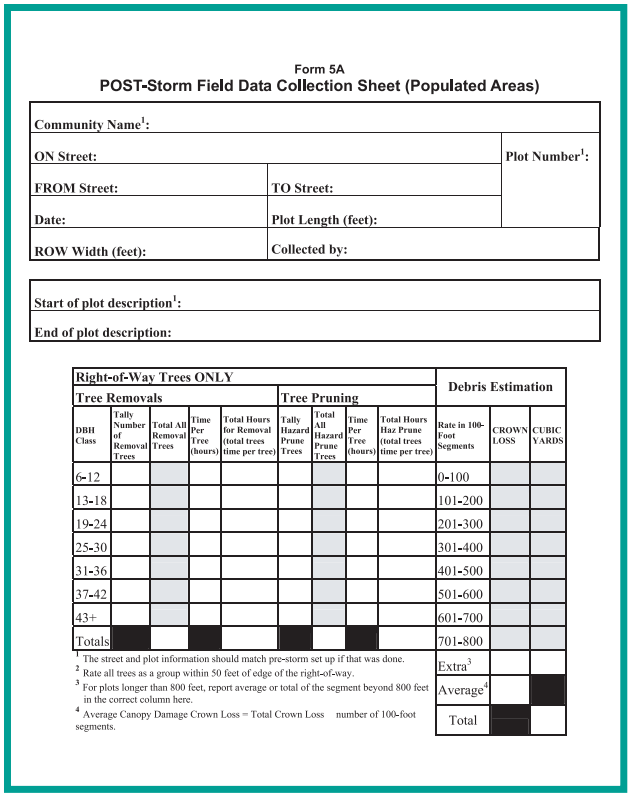
## CREATE SAMPLE

The work of creating a random sample has become vastly easier over the last few years. The US Census Bureau has established definitive national datasets of features such as boundaries and road segments known as TIGER/Line files that are available to the public free of charge. These datasets can be obtained in a format (called a "shapefile") that can be brought inside ESRI's ArcView® by anyone with training in using a Geographic Information System (GIS). (If a given community does not have GIS personnel, county or state governments can be approached for help.) Within a GIS the data can be manipulated to create a map of all the road segments in any single community along with a detailed table of segment attributes such as start address, end address, etc. By working with the table and map, a random sample of any size can be made, and documents created for field use. The number of segments required for an accurate sample starts at 10 and rises as necessary to make up 3% of the segment total. Detailed directions for making a random sample in a GIS are available online (see Resources).





## COLLECT DATA



Form 5A
**POST-Storm Field Data Collection Sheet (Populated Areas)**

| | | |
|---|---|---|
| **Community Name[1]:** | | |
| **ON Street:** | | **Plot Number[1]:** |
| **FROM Street:** | **TO Street:** | |
| **Date:** | **Plot Length (feet):** | |
| **ROW Width (feet):** | **Collected by:** | |

| |
|---|
| **Start of plot description[1]:** |
| **End of plot description:** |

| **Right-of-Way Trees ONLY** | | | | | | | | | **Debris Estimation** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tree Removals** | | | | | **Tree Pruning** | | | | | | |
| **DBH Class** | **Tally Number of Removal Trees** | **Total All Removal Trees** | **Time Per Tree (hours)** | **Total Hours for Removal (total trees time per tree)** | **Tally Hazard Prune Trees** | **Total All Hazard Prune Trees** | **Time Per Tree (hours)** | **Total Hours Haz Prune (total trees time per tree)** | **Rate in 100-Foot Segments** | **CROWN LOSS** | **CUBIC YARDS** |
| 6-12 | | | | | | | | | 0-100 | | |
| 13-18 | | | | | | | | | 101-200 | | |
| 19-24 | | | | | | | | | 201-300 | | |
| 25-30 | | | | | | | | | 301-400 | | |
| 31-36 | | | | | | | | | 401-500 | | |
| 37-42 | | | | | | | | | 501-600 | | |
| 43+ | | | | | | | | | 601-700 | | |
| Totals | | | | | | | | | 701-800 | | |
| | | | | | | | | | Extra[3] | | |
| | | | | | | | | | Average[4] | | |
| | | | | | | | | | Total | | |

[1] The street and plot information should match pre-storm set up if that was done.
[2] Rate all trees as a group within 50 feet of edge of the right-of-way.
[3] For plots longer than 800 feet, report average or total of the segment beyond 800 feet in the correct column here.
[4] Average Canopy Damage Crown Loss = Total Crown Loss number of 100-foot segments.

Setup data is best collected before a disaster in order to make possible a rapid response under emergency conditions. On each of the segments, all living trees greater than 6" in diameter at breast height (DBH) within the right-of-way (ROW) need to be tallied in 6" size categories. All trees greater than 6" DBH and within 50' of the ROW must also be included, because residents bring storm debris to the curb, and not taking that debris into account would make the estimate low. Special procedures are available for estimates in areas with a mixture of urban and rural areas (see Resources).

The field data, collected on paper or with personal digital assistants (PDAs) as described below, are entered into the spreadsheet developed for this project (see Resources) back in the office. The user also needs to enter the street mileage for the community and adjust, if necessary, the estimated local costs for debris, pruning, and tree removals. At this time the appropriate contact information for emergency personnel and agencies should be assembled and archived along with the spreadsheet.

### TRAIN OBSERVERS

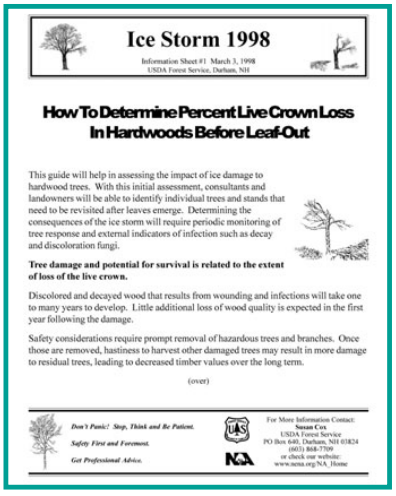
The final step in the set-up phase is to identify and train the observers who will do the field work in the period just after a disastrous storm. At least two observers should be selected, so that the response time will be relatively short. Another good idea is to select people who would not ordinarily be involved with emergency response, in order not to add to the burden of official personnel. As a guide, you will need one observer for each 30 segments in your sample, if all the fieldwork is to be done within 5 hours or so with the goal of producing an estimate within a single workday.

## EMERGENCY ASSESSMENT – IMMEDIATELY AFTER THE DISASTER

### RE-COLLECT DATA

As a community's emergency staff begins to mobilize after a disaster, a call is made to tell the trained observers to go to work. They retrieve their stored materials—which must be available under power outage situations—and head out into the field. Once there, they collect three pieces of information for each sample segment:

- the average percent of crown loss for every 100' of street, including within 50' of the ROW in populated areas
- the number and size of trees on the ROW that will require removal, including trees with greater than 50% crown loss
- the number and size of trees on the ROW that have hazardous branches greater than 2" in diameter requiring pruning



Ice Storm 1998

Information Sheet #1 March 3, 1998
USDA Forest Service, Durham, NH

**How To Determine Percent Live Crown Loss In Hardwoods Before Leaf-Out**

This guide will help in assessing the impact of ice damage to hardwood trees. With this initial assessment, consultants and landowners will be able to identify individual trees and stands that need to be revisited after leaves emerge. Determining the consequences of the ice storm will require periodic monitoring of tree response and external indicators of infection such as decay and discoloration fungi.

**Tree damage and potential for survival is related to the extent of loss of the live crown.**

Discolored and decayed wood that results from wounding and infections will take one to many years to develop. Little additional loss of wood quality is expected in the first year following the damage.

Safety considerations require prompt removal of hazardous trees and branches. Once those are removed, hastiness to harvest other damaged trees may result in more damage to residual trees, leading to decreased timber values over the long term.

(over)

*Don't Panic! Stop, Think and Be Patient.*
*Safety First and Foremost.*
*Get Professional Advice.*

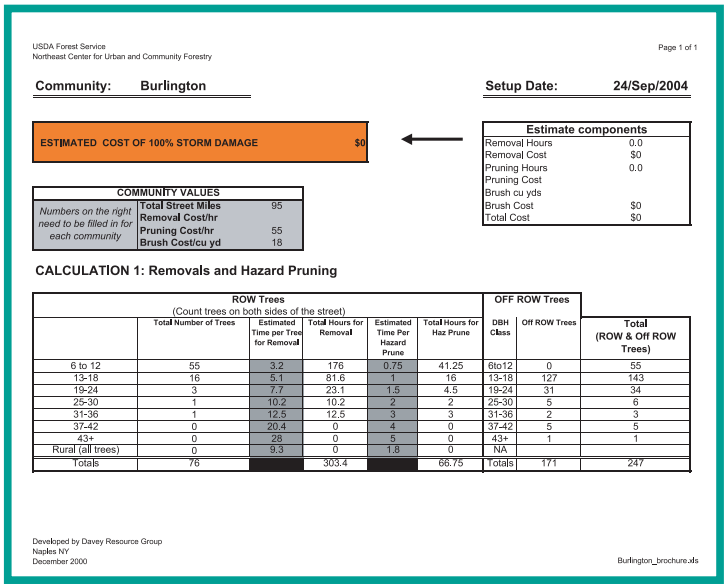
For More Information Contact:
Susan Cox
USDA Forest Service
PO Box 640, Durham, NH 03824
(603) 868-7709
or check our website:
www.nena.org/NA_Home

# DETAILS

There are two methods of doing data collection and entry. One is to use paper and enter data manually. The spreadsheet is designed to match the data collection sheets, so data entry is easily and quickly executed, especially if two people are involved so that one can read and the other can type. Even easier is to use a personal digital assistant (PDA). In this method, data are entered directly on the PDA in the field, then uploaded automatically into the spreadsheet when the PDA is reconnected to the host computer. A detailed description of that process is available online (see Resources).

## REPORT RESULTS

Since during setup the community's street mileage was already entered, all you have left to do is make any adjustments to local contractor rates (pruning, removal, and debris disposal) and you are done! The estimate is automatically generated by formulas in the spreadsheet as soon as the data have been entered. This report is formatted to be printed as a single sheet that you can now mail, fax, or email (if your State Emergency Office accepts that) as a report page. Because your estimate displays the methodology used to create it, and because the USDA Forest Service and its cooperators developed that methodology, your estimate will likely be accepted by the emergency office as both accurate and credible.



USDA Forest Service
Northeast Center for Urban and Community Forestry

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**Community:** Burlington

**Setup Date:** 24/Sep/2004

| ESTIMATED COST OF 100% STORM DAMAGE | $0 |
|---|---|

| Estimate components | |
|---|---|
| Removal Hours | 0.0 |
| Removal Cost | $0 |
| Pruning Hours | 0.0 |
| Pruning Cost | |
| Brush cu yds | |
| Brush Cost | $0 |
| Total Cost | $0 |

| COMMUNITY VALUES | |
|---|---|
| Total Street Miles | 95 |
| Removal Cost/hr | |
| Pruning Cost/hr | 55 |
| Brush Cost/cu yd | 18 |

*Numbers on the right need to be filled in for each community*

**CALCULATION 1: Removals and Hazard Pruning**

| | ROW Trees (Count trees on both sides of the street) | | | | | OFF ROW Trees | | |
|---|---|---|---|---|---|---|---|---|
| | Total Number of Trees | Estimated Time per Tree for Removal | Total Hours for Removal | Estimated Time Per Hazard Prune | Total Hours for Haz Prune | DBH Class | Off ROW Trees | Total (ROW & Off ROW Trees) |
| 6 to 12 | 55 | 3.2 | 176 | 0.75 | 41.25 | 6to12 | 0 | 55 |
| 13-18 | 16 | 5.1 | 81.6 | 1 | 16 | 13-18 | 127 | 143 |
| 19-24 | 3 | 7.7 | 23.1 | 1.5 | 4.5 | 19-24 | 31 | 34 |
| 25-30 | 1 | 10.2 | 10.2 | 2 | 2 | 25-30 | 5 | 6 |
| 31-36 | 1 | 12.5 | 12.5 | 3 | 3 | 31-36 | 2 | 3 |
| 37-42 | 0 | 20.4 | 0 | 4 | 0 | 37-42 | 5 | 5 |
| 43+ | 0 | 28 | 0 | 5 | 0 | 43+ | 1 | 1 |
| Rural (all trees) | 0 | 9.3 | 0 | 1.8 | 0 | NA | | |
| Totals | 76 | | 303.4 | | 66.75 | Totals | 171 | 247 |

Developed by Davey Resource Group
Naples NY
December 2000

Burlington_brochure.xls

# RESOURCES

**Bloniarz, David. 2004. Storm Damage Resource Center.**
On the web at http://www.umass.edu/urbantree/icestorm/

**Bond, Jerry. 2000. Tree Emergency Manual**
http://www.umass.edu/urbantree/TEM.pdf

**Burban, Lisa L., and John W. Andresen. 1994. Storms Over The Urban Forest. 2nd ed.**
http://www.na.fs.fed.us/spfo/pubs/uf/sotuf/sotuf.htm

**Burban, Lisa L., et al. 2003. Tree Emergency Plan Worksheet.**
http://www.na.fs.fed.us/spfo/urbanforestry/ucfdisasters/ucfdisasters.htm

**Luley, Christopher J., and Jerry Bond. 2001. An Initial Storm Damage Assessment Protocol for Urban and Community Forests.**
http://www.umass.edu/urbantree/icestorm/pages/StormAssessProtocol.doc

DAVEY RESOURCE GROUP
A Division of The Davey Tree Expert Company

Support provided by

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