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FINAL REPORT

2003 Storm Damage Protocol Implementation (OH-03-346)

Outline

I. Introduction

A. Background

The 2003 Storm Damage Assessment Protocol is based on work first conceived and carried out in 1997 by Dave Bloniarz and Dennis Ryan at the Forest Service's Northeast Center for Urban & Community Forestry and the University of Massachusetts, respectively. Chris J. Luley and Jerry Bond with the Davey Resource Group then expanded that work under a grant from the Northeast Center that led to the publication of a method and tools to make a scientifically valid estimate of tree damage and associated costs. These products are now available on the web at http://www.umass.edu/urbantree/icestorm/pages/assess1.html.

Interest in this protocol has been high whenever presented. Particularly intriguing was the reaction of members of the Society of Municipal Arborists at their annual conference in 2002, where some municipal arborists (for example, Ithaca NY and Yonkers NY) contacted the Davey presenter afterwards and proceeded with his help to set up damage assessment methodology in their own communities.

In 2003, the improvement and implementation of the Storm Damage Assessment Protocol that had been recommended at the close of Davey's original work became possible through another grant from the Forest Service (OH-03-346). This Final Report reviews the accomplishments of that grant work.

B. Deliverables

The following deliverables were outlined in the grant proposal:

1. Refinement of assessment protocol
    a. Revision of debris numbers
    b. Investigation of the potential of including species factor in debris estimation
    c. Development of GIS-based sampling method
    d. Investigation of critical sample size requirement for debris assessment
2. Launch of online Resource Center
3. Development of informational materials
    a. "HOW TO" brochure (5-8 pages), delivered as electronic file for Forest Service posting and distribution
    b. Creation of a PowerPoint® presentation to be posted on the Resource Center website by Forest Service
4. Authorship of a journal article for target audience
    a. *City Streets*
    b. *Journal of Arboriculture*
5. Investigate means to expand partnerships for implementation
    a. FEMA (DC office), as well as Regions 1 and 2
    b. USDA Forest Service Regional Centers
    c. State UCF Coordinators
6. Development of PDA data collection freeware

a. New application for Pocket PC® OS
b. Revised application for Palm® OS
c. Revision of Excel-based Damage Estimate Template
d. Revision of paper forms.

7. Design of a strategic marketing, implementation and distribution plan
    a. 15-25 pp long
    b. 5 hard copies plus electronic copy provided to Forest Service

In a subsequent discussion with Dave Bloniarz, then Project Director of the Northeast Center for Urban & Community Forestry and project overseer, the seventh deliverable was altered:

> "As we noted on the call [conference call including John Parry, Dave Bloniarz, and Jerry Bond, 10/13/2004], it seems most logical to focus the remaining framework of the grant on FEMA cooperation and to develop an 'executive summary' style marketing plan, that eventually could form the foundation of a more extensive plan for national distribution. As we discussed, I am comfortable if a shorter 3-4 page marketing plan is substituted for a more complex plan that would probably be slightly premature at this early date in the distribution process. I feel that the cost/benefit of a 20 page marketing plan can be offset by increased communication with FEMA and the states. Therefore, as we revise the deliverables for the project, please feel free to scale back the Marketing Plan to a level that provides direction and vision, but does not need to examine the minute details that will most likely change as further discussion with FEMA and the states takes place." (Email communication, 10/13/2004)

Furthermore, a 90-day extension was requested and granted by email in order to complete the regional meetings with potential partners and users. This extension adjusted the grant deadline to March 31, 2005.

The accomplishment of these deliverables is discussed in the following sections, following their presentation in the original grant proposal.

II. Data Research

A. Revision of Debris Numbers

Methods. Efforts to obtain reliable storm data from FEMA directly had failed in the past, so a different approach was devised that focused on the state level. A spreadsheet was constructed (Refinement\DeclaredStorms.xls)[*] consisting of the 14 federally declared disaster ice storms (Appendix A) since 2000 (http://www.fema.gov/library/drcys.shtm). State-level emergency personnel were contacted through phone calls and emails, being asked for a random 2% sample of the Project Worksheets (PWs) submitted for federal reimbursement by applicants during the recovery process. In some cases, it was necessary to invoke FOIA in order to obtain information. Data from the PWs were then entered into the spreadsheet, and analyzed.

Results. After months of multiple phone calls, emails, delays, and even repeated FOIA requests, data were finally assembled for 10 of the 14 storms. Data from 173 PWs were extracted, entered and organized. Means and other descriptive parameters were measured where possible using SAS's statistical package Statview®, and inferences drawn as warranted. The data were difficult to compare, but the following observations could be drawn:

1. Of the 8 applicants (4.6%) whose debris estimate was recorded on the PWs obtained, the error rate averaged 15% low, with a standard deviation of 47%.
2. Of the 22 applicants (12.7%) whose debris removal costs per cubic yard were recorded on the PWs obtained (excluding those for which recovery personnel assigned the standard FEMA rate of $6/CY), the average amount was $6.18/CY, with a standard deviation of $2.86.

Discussion. Despite all the work required to collect the PWs, useful results were limited by problems in the data they contained. These problems lay in various areas:

- The sampling procedure did not distinguish communities for other types of applicants, so that many very small jurisdictions and even private claimants were included unintentionally in the sample.
- Data integrity was somewhat low, since the categories of expenditures varied greatly, especially in the PWs before 2003. Transferring data from the PWs into correct and consistent categories was time-consuming and difficult.
- Almost no useful data about pruning or removal costs were reported.

To get a more complete and useful sample from the state PWs would take a large investment of time, since any researcher would probably have to go to each state emergency office and do the pulling of the sheets in order to achieve a uniform methodological application.

The high standard deviation for the debris error rate has significant policy implications, as it means that current field estimates by untrained personnel are highly unreliable at the

[*] All files named in this document can be found on the CD supplied with this document, as well as on the website of the Northeast Center for Urban & Community Forestry (http://www.umass.edu/urbantree/).

level of the specific community. Interestingly, even the small number of data points in this sample (n=8) implies that local and highly inaccurate estimates may average out to produce a reasonably accurate estimate at higher levels of abstraction. This in turn suggests that perhaps the primary benefits of the Storm Damage Assessment Protocol will come on the local level to the individual community.

B. Species Factor Investigation

Background. In an effort to improve the estimating engine of the Storm Assessment Protocol, a literature search was conducted to review the effect of species composition on storm damage and debris, with a particular eye to ice storms.

Methods. Standard scientific database search engines such as *Biosis* and *Agricola* were queried for literature concerning storm damage and debris in relation to species. In addition, a recent review of damage in forest stands (van Dyke 1999)[*] was examined. The results were then reviewed for relevance and utility to the Storm Damage Protocol. Selected articles were then obtained and read.

Results. There is ample evidence of variable resistance to ice storms, and general agreement about factors that affect severity and location of damage, but "minimal agreement" (Hauer et al 1993, Proulx and Greene 2001) on the details. Furthermore, very few studies have examined the long-term effects (van Dyke 1999), although some studies were initiated after the great January 1998 ice storm in the northeast that should produce useful results (such as Smith and Shortle 2003) in the future.

General species-related conclusions found in the literature include:

- Angiosperms are more susceptible than gymnosperms (Hauer et al 1993)
- Opposite-budded trees tend to receive more damage (Bruederle and Stearns 1985)
- Wood strength is much less significant than crown architecture (Hauer et al 1993, van Dyke 1999)
- Crown damage amount and type depend on species and size (Boerner et al 1988)
- Epicormic branching depends on species (summary by van Dyke 1999)
- Mortality and damage correlation depends upon species-specific ability to resprout (summary by van Dyke 1999)

Specific species-related conclusions vary, though some species such as honeylocust rate high damage (but not necessarily high mortality) on urban tree lists (Hauer et al 1993, Sesinni et al 1995). Rural forest studies have produced differing results as the following table shows (van Dyke 1999).

[*] All citations in this section can be found in Refinement\SpeciesLit.doc.

Location	***Reference***	***low susceptibility***	***Intermediate***	***Highly susceptible***
North Carolina	Abell, 1934	hemlock, white pine	black oak, white oak	black locust red maple scarlet oak
New York Pennsylvania	Downs, 1938	hemlock white pine white cedar ash, hickory, Norway pine, spruce, sugar maple, sycamore, white oak	American elm, American beech, birch spp black locust, red maple, yellow poplar, black gum, cucumber, magnolia	aspen, basswood, black cherry, willow
England	Sanzen-Baker and Nimmo, 1941	American elm, cedar, fir spp, Norway spruce,	oak spp	alder, American beech, ash, birch, Douglas fir, European larch, poplar, Japanese larch, Scot pine, Sitka spruce, sycamore
Connecticut	Kienholtz, 1941	red pine, Scots pine, white pine		jack pine
West Virginia	Carvell *et al* , 1957	American beech, hemlock, hickory spp, red pine, red spruce, Scotch pine, white pine	black oak, red maple, sassafras, scarlet oak, white oak	black cherry, chestnut oak, red oak, yellow poplar
New York	Lemon, 1961	red spruce, shagbark hickory, white ash, yellow birch	American beech, gray birch, hemlock, red oak, sugar maple, tuliptree, white pine	American elm, basswood, black cherry, butternut, eastern cottonwood, silver maple
Manitoba	Cayford and Haig, 1961b	balsam fir, balsam poplar, green ash, larch, trembling aspen, white birch, white spruce,	black spruce, cedar	jack pine
Iowa	Goebel and Deitschman, 1967	eastern red cedar, Norway spruce, other spruce spp.	Austrian pine, American elm, basswood, cedar, oak	Scots pine, white pine
Wisconsin	Bruederle and Stearns, 1985	basswood, bitternut hickory, shagbark hickory	American beech, red maple, red oak, sugar maple	American elm, black ash, black cherry, hackberry, largetooth aspen, slippery elm, tamarack, trembling aspen, white ash, white birch, yellow birch
Virginia	Whitney and Johnson, 1984	hickory	chestnut oak, red maple, scarlet oak , white oak	black oak, pitch pine, Virginia pine, yellow poplar
Ontario	Borzon *et al* , 1978	larch	white pine	jack pine, red pine, Scots pine
Ohio	Boemer *et al* , 1988	elm spp, tuliptree, yellow birch	American beech, black cherry, white ash, chestnut oak, red maple, white oak	hemlock, pitch pine red oak, red pine sycamore

Location	Reference	low susceptibility	Intermediate	Highly susceptible
New York	Seischab *et al* , 1993	American elm, green ash, hemlock, hickory, white ash, white oak	American beech, basswood, largetooth aspen, red maple, sugar maple	black cherry ,red oak, sassafras, willow
Missouri	Rebertus *et al* , 1997	black walnut , ironwood, shagbark hickory	black oak, red elm, serviceberry, white ash	American elm, basswood, bitternut hickory, red oak, sugar maple,
Quebec	Gouv du Quebec, 1998	balsam fir, black spruce, hemlock, ironwood, red pine, red spruce, shagbark hickory, tamarack, white pine, white spruce,	white cedar	American beech ,American elm, basswood, , black cherry, butternut, gray birch, hard maple, Manitoba maple, pitch pine poplars, red maple, red oak, silver maple, slippery elm, white oak, willows

Discussion. The results of research on ice storms and the tree damage and mortality they cause carry important consequences for the management of storm-damaged trees. There are significant differences between rural forest trees and urban trees with respect to ice storms because of different growing conditions, crown status, species composition, disease and insect rates, etc. But the extensive rural literature still offers much of value to urban foresters.

As an example of this value, the ability of some species like white ash or basswood (and presumably other ashes and lindens) to resprout a full crown without health consequences (reviewed in van Dyke 1999) means that these species—and others like them—probably should be exempted from the removal recommendation (>50%) suggested by 1998 FS guidelines (Shortle and Smith 1998). This publication needs to be updated, modified and expanded so that urban tree managers will be able to have an accurate and useful document to guide their decisions under emergency conditions.

Nevertheless, the species-specific conclusions of this research only affect the Storm Damage Protocol in its demonstration ("Pre-Storm") mode. This mode is specifically designated to be of rhetorical use only, as a tool to persuade officials of the possible magnitude of such an event. To make such persuasion, the Protocol assumes a 40% damage level in order to make a demonstration of the costs that would be involved with a serious storm. In the Post-Storm mode, actual estimates are made from real observations that ignore species, and no specific management recommendations are made.

C. GIS-based Method Development

Under the guidance of Jeff Walton, (Research Forester, USDA FS, Northeastern Research Station, Syracuse), a GIS-based method of random blockside selection was developed. It is described in an illustrated guide (Refinement\GISstreet_sampling.pdf). This accompanies a tool developed as an ArcView extension earlier by Jeff Walton for automatically locating random 0.1 acre plots in a domain for UFORE field work (Refinement\RandomPlots.zip).

III. Online Access

A. Launch of Resource Center

The Storm Damage Resource Center was brought online in March 2003:

http://www.umass.edu/urbantree/icestorm/

The site has an attractive GUI and a simple navigational structure, and should prove very useful as an interim source for the target audience until the i-Tree website is up and running in mid-2006.

Future developments and improvements could include:

- All documents and tools required or useful for carrying out the Storm Damage Assessment Protocol should be posted on the site
- A single "Download" button that brings up a menu should be placed on the front page, probably on the right side, so the end user does not have to guess which category or page to go through.
- The "Prepare" submenu should not have the FEMA forms on it
- This Final Report and all products of this grant should be made available under "Assess"
- The "Respond" menu should carry a link to Lisa Burban's work, especially the recent and useful "Tree Emergency Plan Worksheet"

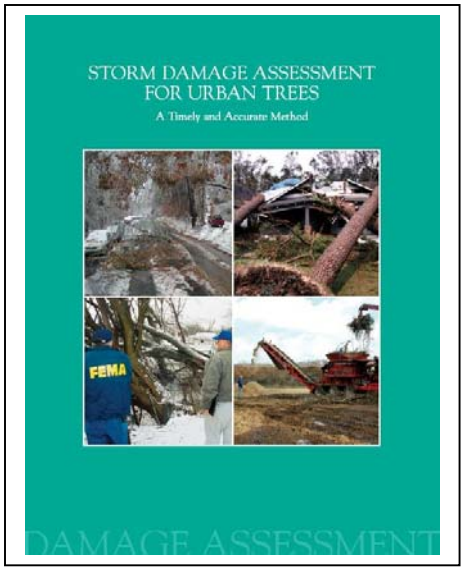
http://www.na.fs.fed.us/spfo/urbanforestry/ucfdisasters/tree_emerg_plan/TreeEmerPlanWkSheet.htm

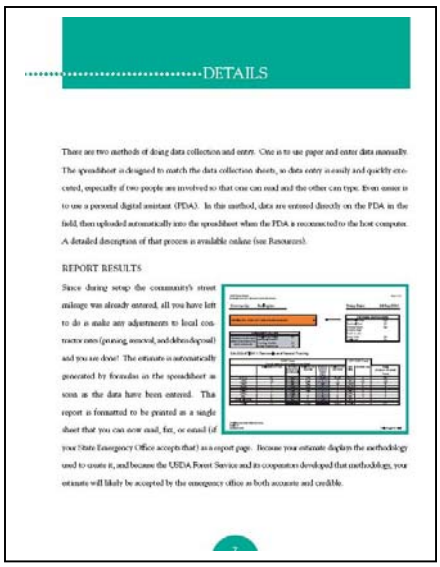
- The "Regreen" menu should be dropped, and links included on the right side to other sites and materials that already cover this topic.
- The right categories ("Utilities" and "Municipal and Commercial") should be populated or discarded.
- The right category "Other Links" should be changed to "Resources," and both paper, electronic, and human resources should be included.

IV. Promotion

A. How-To Brochure

An 8-page brochure was developed for use in promoting, explaining, and expediting the use of the Storm Damage Assessment Protocol to end-users. Copy written in a colloquial style was developed, and then submitted for review by seven readers, 3 inside Davey and 4 in the Forest Service. Design was subcontracted out to a professional company (Jerry Moody Advertising and Design Services) in Ohio, and three rounds of revisions were required before the product was finally accepted. The result is handsome and compelling. The brochure is supplied both as a web-ready document (Promotion\Brochure\PDF with Web Links\StormBrochure.pdf), and as a print-ready document. Text and graphics are also supplied as separate files, and the brochure file is also supplied in the proprietary format (Quark) in which it was developed on a Mac.





B. PowerPoint Presentation

A PowerPoint presentation (Promotion\Presentations\StormAssessment_2004.ppt) was developed for use by state and federal personnel, preferably in conjunction with the brochure). In its full form it has 55 slides, and is divided into the following areas:

- Development
- Sampling Method
- Estimating Engine
- Report Means
- Personal Digital Assistants
- Resources

This presentation is designed to explain in some depth the main elements of the Protocol (Sampling Method, Estimating Engine, Report Means), as well as provide a context for it. A shortened form is also provided (StormAssessment_2004_Short.ppt).

V. Professional Publications

A. City Trees

An article was published in the November 2003 issue of *City Trees*, the journal associated with the Society of Municipal Arborists:

> Bond, Jerry. 2003. Storm Damage Estimates in a New York Minute. *City Trees*. Nov/Dec (39:6): 16-17.

The intent of this article was to announce to the prime target audience the Protocol and its implementation, using an easy-to-read format. Scanned images of the published article are included on the products CD (Publications\CityTreesArticle_1.jpg and CityTreesArticle_2.jpg) along with the original text.

B. Journal of Arboriculture

I have been working with a team of researchers on developing an article about the sampling method being used by the Storm Damage Assessment Protocol 2.0. From the USDA Forest Service Research Unit in Syracuse NY Jeff Walton and Dave Nowak are involved, as well as others. The topic is the use of TIGER/Line files and the sampling percentage required for reliable projection. This article is in draft, and is intended for 2005/2006 publication in the *Journal of Arboriculture*.

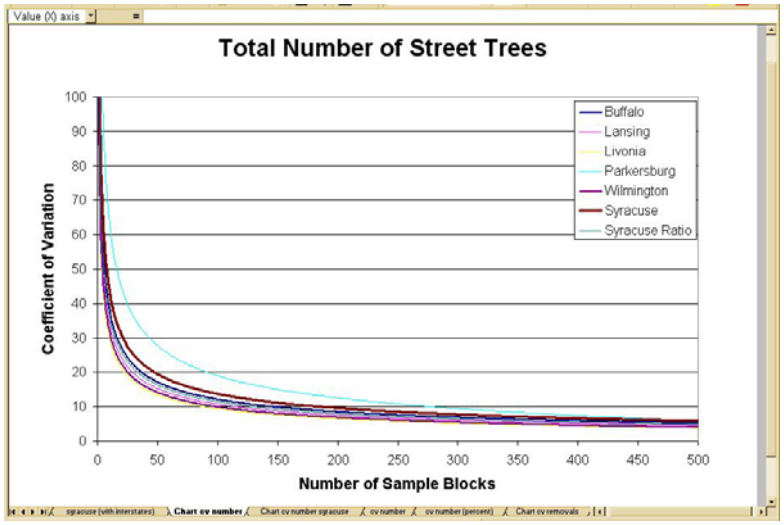


Figure 1 Graphic from the article in progress on sampling percentage.

Source: Jeff Walton, USDA Forest Service Research Unit, Syracuse NY

VI. Partnership development

The new Storm Damage Assessment Protocol was presented to and discussed with potential partners on the following occasions:

Date	Location	Attendees	Comments
24 Feb 05	Wilmington, DE	22	Arranged by Mid-Atlantic Center
3 Mar 05	Concord, NH	18	Arranged by Northeast Center
10 Mar 05	Eugene, OR	125	Storm conference
18 Mar 05	Raleigh, NC	110	Arbor Day conference
21 Mar 05	Minneapolis, MN	10	Conference call arranged by Midwest Center

These occasions were immensely useful to the work of implementation. In the first place, simply having members of the Forest Service, state and federal emergency personnel, and urban forest managers together around a common topic produced a fruitful dynamic. Secondly, participants raised important questions from their differing work contexts, and could address each other's questions as well. Thirdly, we were able to assemble a list of "FAQ" from the sessions that will provide the basis of a very practical document for future deployment under i-Tree.

Partner reactions by group

FEMA personnel:

- Would welcome an accurate tool
- Important to stress FEMA reimbursement limitations
- State emergency offices are probably most important players
- Would make their work easier, speeding their validation work
- Topic belongs in Planning, not Recovery

State emergency personnel:

- Would welcome an accurate tool
- Could help managers control contractors' estimates
- Wanted to take back to main office for discussion
- No apparent concern about report form being faxed or emailed
- Question whether communities will cooperate if GIS not readily available

Urban forest managers:

- Positive reaction to new tool to make their work easier
- Concerned about finding qualified personnel for post-storm plot survey
- Wanted a "cookbook recipe" for setup
- Suggested possibility of partnership with local utility
- Wonder about future support
- Willing to go ahead without waiting for state emergency approval

FS personnel:

- Positive reaction overall
- Interested in adding future features such as an improved prediction engine or a total tree loss calculator
- Concern about safety of volunteers under disaster conditions
- Unsure about how to proceed with state emergency personnel
- Some might be able to lend PDAs to communities for setup work

State Coordinators:

- Positive reaction overall
- Wanted to take it back to state office for discussion
- Suggested that DOT and county/town level officials might really profit
- Some proposed that states could do GIS sampling for communities, offer it to them as an incentive to set up Protocol
- Protocol will be presented to them as a group in May

FAQ

- Will the use of this estimate lock the community into the dollar amount?
- Does this replace FEMA's own documentation?
- Can you use existing inventory data?
- What about parks, golf courses, or cemeteries?
- How will communities react that do not have a dedicated tree manager?
- How long will this take to set up, and how much will it cost?
- What about streets that have stands of trees just off the ROW?
- What about park areas with differences of public access?
- Is it necessary to carry out the pre-storm survey?
- Can this protocol be used for utilities?
- How would this handle riparian trees and flooding questions?
- What about trees that need immediate hazard pruning, then hazard removal?
- In what sort of community will this protocol not work?
- Will smaller communities have any use for this protocol?
- Is any funding available to set this up?

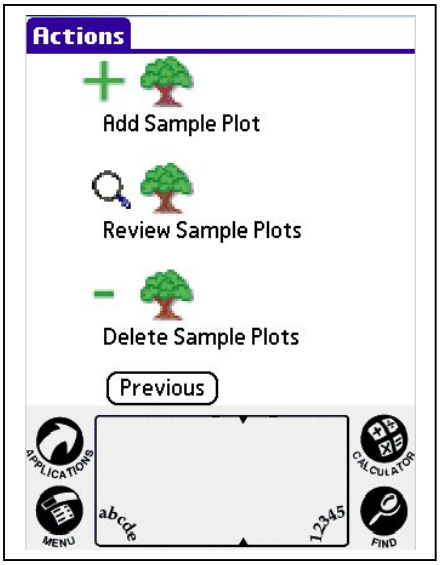
VII. Tool Improvement

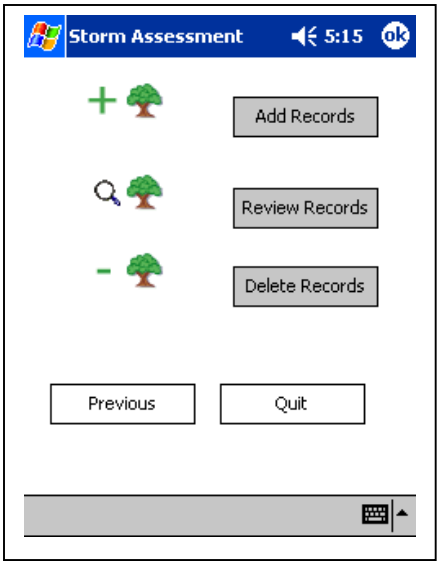
A. Development of Handheld Data Collection Application for Windows Mobile (AKA Pocket PC) Platform and Revision of Handheld Data Collection Application for Palm OS Platform

Brand new PDA applications were developed (Tools\PDA) as part of the technological improvement of the Storm Damage Assessment Protocol. (In the following screenshots, the Palm application is on the left, the Windows one on the right.)

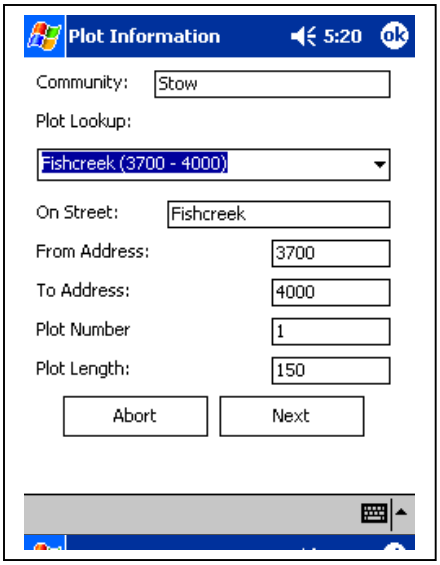
The applications begin with an attractive welcome screen:

This is followed by the actions menu:

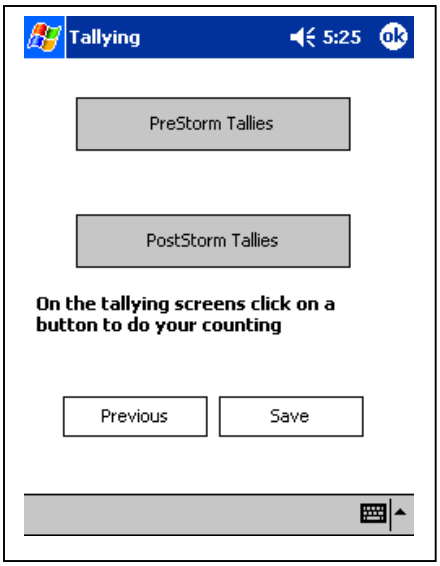




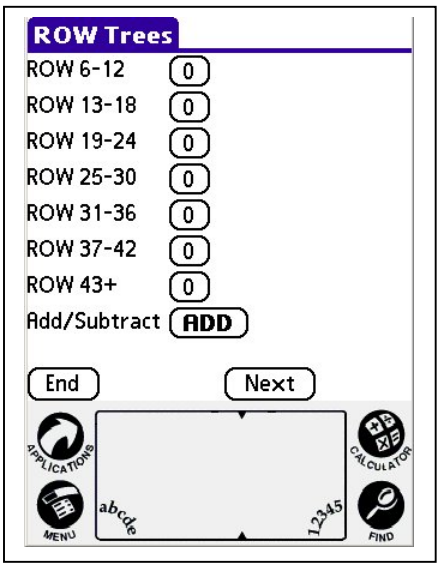
When the user chooses to add a plot, the plot information screen comes up—if random plots have been set up, this information is automatically entered by the program when the user clicks on the plot in the Lookup list:

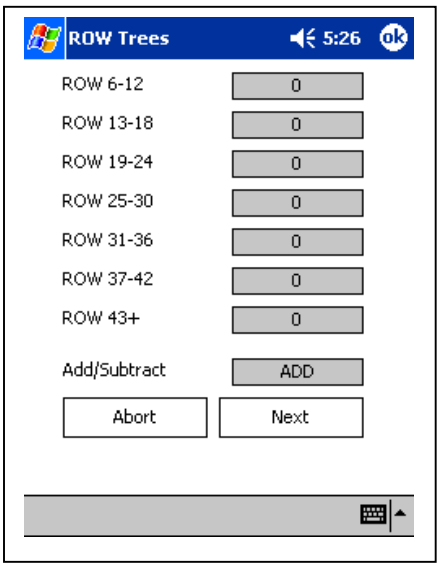


Other plot information screens follow that allow entry of descriptions of plot beginning and end (when necessary), ROW width, and data collectors. Once the data collector has begun to walk the plot, s/he will use the tallying screen. This complex piece of code writing has allowed the replacement of paper forms by tallying directly on the PDA. The process begins by selecting PreStorm or PostStorm:

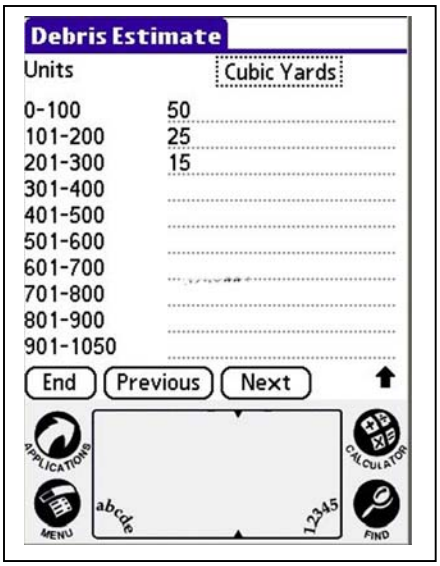


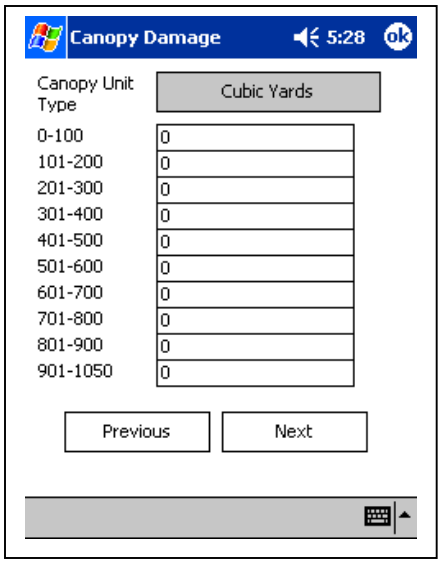
The actual tallying is very simple on the screens (here the screen for ROW trees, with a similar one that follows for Off ROW trees):





Debris measurement during post-storm data collection is made through the choice of crown loss or cubic yards as the unit to measured on that plot (here the one for cubic yards):





When the PDAs are synchronized with the desktop, the data will be placed automatically in the correct place in the estimator spreadsheet. For end-users comfortable with PDAs, these data collection applications offer great ease of use and quality of data, in addition to a substantial reduction in time required for field data collection and entry.

B. Development of graphic user interface for both platforms

In order to render the use of the PDA as straightforward as possible, a graphic user interface was developed. This interface sits on the desktop and functions with PDAS running either Palm or Windows Mobile/PocketPC operating systems. Furthermore, it combines a number of administrative tasks within a single easy-to-understand framework.

Here is the main screen:

Note that a number of different tasks are grouped together:

- Management of users and their PDAs
- Collection of random plot data
- Exporting collected data to a spreadsheet for report or analysis
- Resetting the database—useful, for instance, after a large error of some kind such as using the wrong TIGER data.

This useful little application—written in VB—makes the end-user's task easier, rendering in this manner the whole process a bit less daunting.

The use of this interface and the PDA software is explained without technical jargon in an illustrated *Storm Damage Assessment: Getting Started Guide* (Tools\Documents\Getting Started Guide.pdf).

C. Revision of Excel Template

Based on the new debris information derived from the Project Worksheets sampled from the federally declared ice storm disasters and the new PDA programs, the original Excel template was modified (Tools\Template\StormDamageTemplate.xls). The goals of this modification were

1. User-friendliness
2. Accuracy
3. Flexibility

The opening screens of the old (left, below) and new (right, below) templates provide a vivid example of the user-friendly changes:

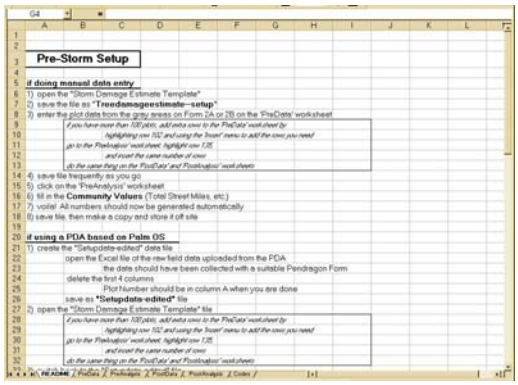


Figure 2 Opening screen of old template

Figure 3 Opening screen of new template

In the old version, the user had no sense of how the template was organized, and was immediately presented with detailed instructions. On the right, an attractive interface renders navigation easy and intuitive, and clicking on the hyperlinked buttons enables the user to jump to the section indicated.

Increased accuracy is achieved through two principal means:

1. Revised debris information derived from the collected PWs has been incorporated
2. The new PDAs programs automatically load the data into the correct location in the spreadsheet

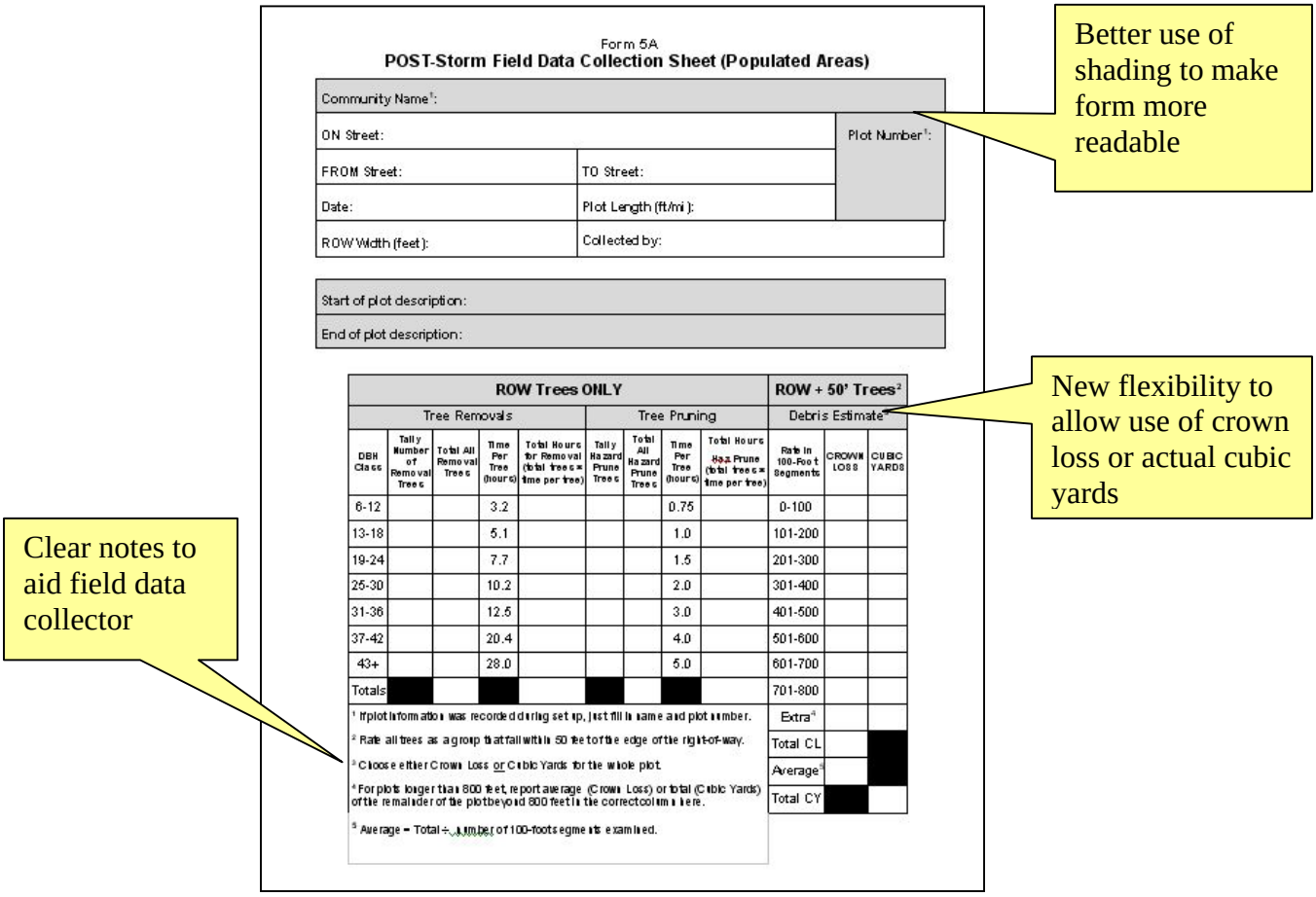
This second improvement has greatly increased the attractiveness of using PDAs, since the end user will not have to lift a finger to get the data into the spreadsheet. As more users turn to PDAs, the error rate from data entry will drop.

Finally, the new template is more flexible. Instead of being forced to make use of the crown loss percentages that drove the original template, the user is presented with the option of simply estimating cubic yards, and can even change techniques from plot to plot if s/he wishes. This increased flexibility will lead to a wider adoption of the template and its easy calculating and reporting capabilities, easing the burden on the tree manager who is laboring under emergency conditions.

D. Revision of Paper Forms

The paper data collection forms (Tools\Documents\Forms_rev2004.doc) have been revised for clarity and accuracy, as well as to incorporate new application features that have been developed. **It is important that these paper forms be reviewed periodically** so that feedback from actual field use can be incorporated into future revisions. Many end-users, especially in smaller communities, may stick to paper in the foreseeable for a variety of reasons that range from budgetary to technological.

The main post-storm data collection form provides an example of the changes in the new forms:



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 (ft/mi):
ROW Width (feet):	Collected by:

Start of plot description:
End of plot description:

ROW Trees ONLY									ROW + 50' Trees[2]		
Tree Removals					Tree Pruning				Debris Estimate[3]		
DBH Class	Tally Number of Removal Trees	Total All Removal Trees	Time Per Tree (hours)	Total Hours for Removal (total trees x time per tree)	Tally Hazard Prune Trees	Total All Hazard Prune Trees	Time Per Tree (hours)	Total Hours Haz. Prune (total trees x time per tree)	Rate in 100-Foot Segments	CROWN LOSS	CUBIC YARDS
6-12			3.2				0.75		0-100		
13-18			5.1				1.0		101-200		
19-24			7.7				1.5		201-300		
25-30			10.2				2.0		301-400		
31-36			12.5				3.0		401-500		
37-42			20.4				4.0		501-600		
43+			28.0				5.0		601-700		
Totals									701-800		
									Extra[4]		
									Total CL		
									Average[5]		
									Total CY		

[1] If plot information was recorded during set up, just fill in name and plot number.

[2] Rate all trees as a group that fall within 50 feet of the edge of the right-of-way.

[3] Choose either Crown Loss or Cubic Yards for the whole plot.

[4] For plots longer than 800 feet, report average (Crown Loss) or total (Cubic Yards) of the remainder of the plot beyond 800 feet in the correct column here.

[5] Average = Total ÷ number of 100-foot segments examined.

Better use of shading to make form more readable

New flexibility to allow use of crown loss or actual cubic yards

Clear notes to aid field data collector

VIII. Implementation of Storm Damage Assessment Protocol

An implementation strategy (Marketing\ImplementationStrategy.doc) was developed through discussions with key Forest Service personnel, federal and state emergency offices, and developers of the "iTree" suite. This 4-pp outline lays out a **2005 action plan** for the Forest Service in its bid for implementation of this storm damage assessment protocol. Key conclusions of the plan are:

- Well-developed user-friendly product that satisfies a real need in field
- Endorsement is the key to implementation, and Forest Service personnel need to lead the way by reviewing the protocol and requesting FEMA review as well
- States do the initial promotion by sending the brochure and contact information to existing lists of tree managers, and perhaps offering to do the GIS sampling
- Further implementation and development of the protocol will take place through iTree, under whose umbrella the protocol will be included by June 2005.

IX. Remaining Implementation Work

During the interim before the Storm Damage Assessment Protocol is published with the i-Tree tool suite, the following steps are strongly recommended for Forest Service action

- Revise the storm website as suggested above (Section III) to make it easier for users to understand and navigate.
- Review the materials developed with this grant.
- Populate the storm website with the new materials as soon as possible.
- Revise the 2001 *Storm Damage Assessment Protocol* to reflect the changes implemented during this implementation phase.
- Develop a "cookbook recipe" for implementation that leads the end-user through the necessary steps, indicating along the way supporting documents that are available.

Appendix A

Declared Disaster Ice Storms since 2000

State	StormYear	DisasterNo	Data?
Arkansas	2000	DR-1354	Y
	2003	DR-1450	Y
Kansas	2002	DR-1402	N
Louisana	2001	DR-1357	N
Missouri	2002	DR-1403	Y
New York	2003	DR-1467	Y
North Carolina	2002	DR-1448	N
	2003	DR-1457	N
Oklahoma	2001	DR-1355	Y
	2002	DR-1401	Y
	2003	DR-1452	Y
South Carolina	2003	DR-1451	Y
	2004	DR-1509	Y
Texas	2001	DR-1356	Y