UFORE:
Urban Forest Effects
Washington, DC
2009

Management Guide for the
Washington, DC
UFORE Inventory

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I. Introduction

The UFORE (Urban Forest Effects) inventory is designed to be completed every five years in Washington, DC. This is in compliance with the UFORE standards to maintain the most accurate comparison and time series of DC's Urban Forest. We have now completed two cycles of the UFORE inventory (2004 and 2009). The data collection/inventory takes a considerable amount of preparation and management. After two cycles we have created this guide to enhance consistency and maintain data integrity throughout the years. We encourage the managers of the future inventories to read through this manual and the corresponding documents months in advance to be sufficiently prepared.

It is crucial to coordinate and create the partnership with the National Park Service in advance. Timing of the inventory will depend heavily on number of field interns but allow at least 12 weeks of the summer (leaf on) for the inventory including: two weeks of training, two months of data collection, two weeks to finalize, clean data, prepare documents and send in for analysis.   Raw results turnaround from the Forest Service in 4 – 6 weeks and media ready in winter.

The following provides detailed guidelines for planning and executing the inventory.

II. Inventory Goal and Objectives

Overall Goal

Complete required data collection on all 201 plots within the 5th summer of the previous survey. Use the inventory results to inform Casey Trees, residents and partner agencies of existing conditions and changes in the canopy over time.

Main Objectives

 1. **Quality:** *Collect high quality data – Refer to UFORE Quality Control Manual for standards*

2. **Productivity:** *Finish data collection during the 5th summer since previous study (2009, 2014, 2019…)*

3. **Participant Satisfaction:** *Positive feedback from volunteers and interns; Repeat participation and referrals from Interns, Citizen Foresters, HS Students*

4. **Outreach:** *permission from each plot, NPS collaboration and cooperation, media release of the results and to inform our success measures such as the Tree Report Card*

5. **Safety:** *good health & safety record for all participants/any incidents documented*

III. Timeline

- Six months in advance:
  - Read through this *UFORE Management Guide* **(Casey Trees) and the** *UFORE Data Collection manual* **(USFS)**to grasp the scope of what you are getting into
  - Contact National Park Service and establish lead contact
    - They may need a reminder even earlier to budget for data collection
- Four to two months before start date:
  - Call UFORE/iTree headquarters (currently Directed by Dave Nowak in Syracuse) inform them of upcoming inventory and request any updates and request support
  - Read through this UFORE document and the Data collection manual again
  - Advertise and Hire Team Leaders
  - Meet with NPS to solidify partnership/create timeline and set up subsequent meetings
  - Citizen Forester teaser in newsletter or email to participate in summer inventory
  - Hardware inventory and test
- Two months to two weeks before
  - Set up training schedule for interns and volunteers
  - Advertise for CF Training for Inventory
  - Inventory/checklist all necessary equipment including field equipment and plot folders
  - Work with NPS to coordinate schedules, assignments and equipment
- Two - one week before start date
  - Citizen Forester training for UFORE
    - Set up online sign up for inventory teams
  - Divvy up partnership responsibilities
  - Send out notification postcard
  - Call 'double asterisk' plots
  - Do practice plots to familiarize and work out kinks
- Week prior
  - Solidify who is completing each plot
  - Continue training with Team Leaders and NPS
    - Practice plots (minimum three days)
    - QA/QC final days and compare results for consistency among teams

IV. Staffing

Casey Trees employ two staff 20 – 30 hours per week for the month leading up to inventory, the GIS Specialist and the Director of Geographic Resources. During the two months of inventory the Director goes to 5 - 10 hours per week and the GIS Specialist remains at about 15 – 20 hours per week.

In 2009 we hired two college intern Team Leaders for a 10 week period. This was based on the assessment that each team would average two plots per day and data collection would span 40 days (8 weeks). We sought applicants via our website, through craigslist, and local college recruiting sites. The announcement we posted can be found here: P:\Administration\Job Descriptions + Hiring\Job Announcements\2009 Announcements\Geographic Resources\UFORE Team Leader 20090123.doc. (*Appendix A – Summer Internship: Urban Forest Internship*)

If you have it in the budget to have at least one or both of the interns come at least a week before if not two weeks before and one week after the inventory it is very helpful for preparation. There are many

phone calls and paper pushing to be done and it will also help the interns become more familiar with the project. This time could also be spent with other staff to familiarize with tree ID skills and become good ambassadors for Casey Trees by attending any outreach efforts or classes during this time.

Some details:
- Hiring was complete by 3/18/2009.
- Approximately 15 people applied for the position.
- Advertising:
  - Online through all local universities: 7 or 8 resumes
  - Craigslist: 2-3 resumes
  - Print ad with UMD: unclear how many resumes
  - Casey Trees website
- 3-4 applicants with Tree ID skills.
- Neither hire arrived with Tree ID skills

V. Resources

Refer to the Casey Trees Public drive (currently the P: drive on SVR-1) for all of these documents and appendices. Here is a snapshot of the folder organization.

In 2004 file folder was assigned to each plot. This folder contained the following:
- Aerial image (2002 imagery) of plot with surrounding roads and perhaps another close-by plot (for reference purposes)
- Aerial image (2002 imagery) of plot zoomed-in
- Small diagram filled in with pen/pencil of ground cover on plot
- Permission-granted post-card (when required)

In 2009 completed plots were filed with the following contents:
- 2002 imagery (at least the zoomed-in imagery)
- 2008 zoomed-in imagery (**Note**: the plot centers in the 2002 and 2008 imagery are oftentimes a bit off – possibly due to the angle and height of the plane and different contractors for the different years)
- Plot Information Sheet: This is a sheet that our team leaders filled out for each plot prior to visiting. Key contents included: tree species and counts from 2004, reference objects and distances from 2004, 2009 permissions, transportation notes, plot notes (e.g. additional barriers to measurement, tips and tricks, report-out on difficulty). The Plot Information Form is here: P:\Geographic Resources\Inventory\UFORE 2009\Plot_Info_Forms_for_print\Plot Information Form.xlsx (*Appendix J*)
- 2004 and 2009 permissions post cards when applicable
- 2009 Plot photos
- Any additional reference material including any incident reports, contact information that is not already on Plot Information Sheet

VI. Coordinating with the National Park Service

Casey Trees and the National Park Service (NPS) divided the plots based on jurisdiction in 2004. NPS has committed to being responsible for 39 plots that fall on their property and Casey Trees has taken responsibility for the remaining 162 plots throughout the city. It is easiest to use the GIS database which provides the plot ownership in the data fields. (*Appendix B – UFORE plot table*)

The coordination in 2009 was complicated by the fact that no single NPS manager was able to act as point of contact for all NPS parks in the District (as was the case in 2004). Instead we communicated individually with the managers of each of the District's four NPS divisions (*Appendix C: Key Contacts*):

- Monumental Core – Contact Mary Willeford-Baer
- National Capital East – Contact Mikaila Milton
- National Capital West – Monumental Core – Mary Willeford-Baer covered these plots for West
- Rock Creek Park – Contact Ken Ferabee
- The Director of Urban and Community Forestry – Contact Jim Sherald (retired 2009)

Brad Conway, Information Systems at NPS Monumental Core, continued to act as the point person for technology for all of the regions. NPS provided their own equipment (PDA, laser range finders…)

Casey Trees managed the training for NPS to ensure the methodologies were consistent. NPS sector leaders, interns and biotechs that made up the NPS inventory teams attended classroom and field trainings at Casey Trees. NPS also did additional field training focusing on wooded plots because many of the park plots are heavily treed and often difficult to access or find plot center. NPS has documented plot center with photos and can mark out the plot center in advance with GPS. In 2009 this was done by an NPS employee a few days in advance of each plot so the day wasn't spent just looking for plot center.

It is important to stay in contact with the NPS leaders and give them their deadlines for data collection. The main goal is to complete the plots in a certain time period (e.g. August 15th). If Casey Trees has extra time at the end we can transfer some plots and help out (as was the case in 2009). The inventory may not be high on their priority list so to ensure they complete their plots, keep in touch and provide deadlines.

VII. Permissions

A list detailing each plots permission situation is in the corresponding UFORE permissions folder on the Casey Trees public drive. This will be your key reference and very helpful in deciphering how to deal with access to each plot and which plots need extra care/time. If you are using this as a reference from other cities we suggest tracking how you access each plot to reference in future years.

Receiving permission to visit the properties on which each plot falls is probably the trickiest part of the data collection process. The ownership is constantly changing in an urban area like DC especially five . We have tried several means of contact. Each plot is treated differently primarily depending on the land owner. This ranges immensely – though the variety is entertaining it is also challenging. Some examples

of plot locations include residential backyard, flamingo cage at the zoo, Italian ambassador's home, Bolling air force base, Fort McNair and center of busy streets. So the access issues vary from security clearance, safety, locked gates, dogs and concerned citizens.   In 2004 and 2009 we tried the following basic steps to gain permission to properties:

1. Analyze each plot to determine ownership and the level of difficulty of accessing the plot
2. Sent self addressed postcards to primarily residential properties but some commercial… to be signed and returned granting permission
3. Personally call/email government properties or other high security areas, find a contact who can arrange access

In 2014 and beyond, **we suggest eliminating the return request postcard and instead sending an informational postcard** explaining the project and saying 'we are back again'. We have received permission for all of these plots twice now, many of which can be solved/requested on the day of data collection.

Conversely there are several that require advance notice and personal contact usually with a direct phone call. There are many highly sensitive sites. We created two important permission sheets to detail the contact process (*Appendix D-Tricky Plots*).

VIII. UFORE Shell Application and Data Collection Device Set Up

Data Collection Options

For the 2009 study the UFORE data collection program was limited to using a specific type of PDA. To have the data in correct format for USDA to run the UFORE model the data must be uploaded using this type of device. So instead of using a spatial program (i.e. our tablets with ESRI (or any spatial) software) we opted to conform to the standards of the UFORE PDA data collection program. In 2014, we suspect there may be other options.

PDA
On the recommendation of Bob Hoehn, at the Northeastern Research Station, we chose the UFORE PDA data collection program. Our PDAs from the 2002 inventory were outdated so we purchased two refurbished HP iPaq 111 model units with an up-to-date version of Windows Mobile. These devices cost about $100 each. Additionally, we purchased rubberized protection for the devices and screen overlays to minimize scratching. These devices were very susceptible to water damage.   They frizzed out when wet but would recover when they dried out, but this would be hours later.   Maybe waterproof devices in later years.

UFORE Shell
We installed the UFORE shell application from the i-Tree CD on one computer only in order to avoid any confusion about what data had been collected and downloaded. National Park Service team members stopped by the Casey Trees office periodically to download their data.

Our UFORE project was setup according to defaults for the most part; decisions are documented below:

- Plot generation: We created the two text files and the projection file from the 2004 plot shapefile in order to generate the same plots we analyzed before. These files are locted here: P:\Geographic Resources\Inventory\UFORE 2009\
- Species list: We created a species list of a bit over 200 trees based on the 108 species found in 2004 and the species on i-Tree's Piedmont region list
- Project Options: We enabled all project options except for the Shrub Option. We thought the difficulty and added time spent in data collection of shrub ID outweighed the benefits of more accurate VOC benefits.

IX. Data fields and methods

We finalized the data fields and methods based on the project options selected above. Once project options are selected and sent to the PDA, it is very easy to tell what data one must collect in the field. The methods for the collection of each data field were established based primarily on the UFORE Manual (P:\Geographic Resources\Inventory\UFORE 2009\Reference_material) with additional input from Bob Hoehn and Dave Nowak at Forest Service and Casey Trees staff.

The detailed data fields and methods document is available here: P:\Geographic Resources\Inventory\UFORE 2009\UFORE 2009 Data Field Definitions and Methods.doc
(Appendix E)

X. Training

We put on two levels of training for different groups of people based on the level of expertise required. All participants including Team Leaders, NPS team members, and Citizen Foresters/Other Volunteers participated in a 1.5 – 2 hour classroom session in which we presented on three topics (*Appendix F,G,H*):
1. **UFORE Overview**: P:\Geographic Resources\Inventory\UFORE 2009\Training\UFORE_2009_overview_and_intro.pptx
2. **Safety and Scheduling**: P:\Geographic Resources\Inventory\UFORE 2009\Training\UFORE_2009_Safety andScheduling.pptx
3. **UFORE Data Fields and Methods**: P:\Geographic Resources\Inventory\UFORE 2009\Training\UFORE_2009_data_fields_and_methods.pptx

This classroom session was held 4 times. The first time was for Team Leaders and NPS team members. The 2nd and 3rd times were evening sessions for Citizen Foresters and the 4th time was for the Casey Trees High School Interns that were rotated into the teams as needed.

In addition to the classroom training the NPS team and the CT Team Leaders participated in a half day of field training at an actual plot. CT Team leaders gained additional experience through visiting plots with GIS Specialist and Dir. GR before embarking on their own. We followed up with two days of QA/QC to ensure we were all following proper methodology (see QA/QC section).

Key elements of training:
From our 2009 experience there are certain data fields that required reinforcement such that consistent field measurements/estimates were taken:
- Estimates of plot ground cover and ground cover under canopy

- Estimates of crown missing and dieback
- Measurements of crown N/S and E/W

XI. UFORE Team Leader responsibilities

Primary Responsibilities:
- Schedule visits to assigned plots
- Contact volunteers in advance to tell them where to meet and what to bring
- Put together plot folders for field including:
  - Plot Aerial Images (2002 and 2008)
  - Plot Information Sheet
  - Permission information
  - Reference map
- Check plot folders well in advance to ensure plot is accessible, that permissions are in place
- Be responsible for data collection equipment including PDA charging and report any problems that may interfere with data collection to the GIS Specialist
- Lead volunteer in high quality data collection – in the end the Team Leader is responsible for all data entry.   The team support, CFs or high school student do not use the PDA.
- Take notes on Plot Information Sheet discussion intricacies of data collection for future data collectors including (see Plot Folder Set up above)
- Mark plots as completed in the PDA and on the check-off sheet above the data-download computer
- Close-out folders for completed plots:
  - Complete notes on Plot Information Sheet
  - Mark drawings on aerial or other paper as needed
  - Leave any records in from previous years

XII. Team Support: Citizen Forester Volunteers and High School Students

Data collection teams are a minimum of two people per team. No team leader should go out alone primarily for safety, but our Citizen foresters provide additional tree species expertise as well as various other helpful duties.

Team support, preferably is a trained Citizen Forester, however later in the summer as the team leaders are more familiar with trees and city navigation, high school student or untrained volunteers may be added to the mix. We estimated a need for 80 team support slots throughout the summer. This is based on 40 days of data collection at an average pace of 2 plots/team/day and a minimum of one additional person with each team leader. Aggressively, we sought 2 additional people per team per day so that one cancellation would not derail a team for the day. Also it is easier on the plots with a greater number of trees to have more than just one team support.

In 2009 there were 9 High School students that began at Casey Trees about a month after the inventory had begun and worked three inventory days each.

All Citizen Foresters and HS Interns were trained on all of the data collection methods using the Powerpoint referenced in the Training section. They were not trained on use of the PDA as actual data entry was the job of the Team Leader.

Team Support were solicited via normal Citizen Forester e-mails and announcements at events preceding the beginning of the inventory. Volunteers signed up for work days either via Wild Apricot or on a master calendar on the day of the each of the training sessions. Bringing the paper calendar to the training sessions was a good way to fill immediate volunteer needs.

XIII. Visiting plots: scheduling and logistics

The two team leaders were each assigned roughly half of the 162 plots by assigning them all the plots in each of the District's eight Wards. Conveniently the number of plots in Wards 1, 2, 5, 8 and the plots in Wards 3, 4, 6, 7 had roughly equal number of data collection days. Team Leads were given latitude in deciding which Wards to start in and which plots within their assignment to visit in a given week.

To decide on where to go on a given day, plots can be grouped in advance relatively easily based on past data and aerial photos. The plot summary sheet has the estimation of how long the plot takes to complete based on 2009 and one can also infer based on the number of trees on the plot. This will also help in deciding how many volunteers each team may need to inventory that plot.
Though you may want to knock out a day doing 5 plots that have no trees, keep in mind that in 2009 we had Citizen Forester volunteers that were disappointed if they went to too many plots in a row with no trees as in Ward 1 and 2.

Getting to the plots: Team Leads and volunteers traveled to plots using public transit, bikes, walking, their car, or a volunteer's car. If they used public transit they noted the bus route/metro line that was most convenient on the Plot Information Sheet.

Once arrived if it was determined that the plot was still inaccessible for some reason (e.g. locked fences, dogs), the Team Lead should be prepared with additional plot folders so work can continue on that day.

XIV. Plot establishment

Plot boundaries and distance and direction measurements to trees should ideally be done while standing at plot center. In order to find the center of the plot we started by using the 2002 aerial imagery. Once it appeared that we were close we used the 2004 Reference Objects recorded on the Plot information sheet to hone in to within a foot or two. There were additional comments and photos taken in 2009 to add the ease of finding plot center.

Important Issue to Note:
Plot centers were located originally in 2004 using DC aerial images from 2002. In 2009 we had access to the 2002, 2005 and 2008 imagery. While the 2005 and 2008 imagery line-up spatially with each other,

the 2002 imagery does not. This is due to a change in the vendor contracted by the District government to collect the data. ***In order to establish plot boundaries that were the same as those in 2004, in 2009, we had to use the 2002 imagery.*** There will continue to be upgrades in aerial imagery and even today GPS coordinates are becoming more mainstream. In 2014, it may be possible to use the aerial imagery as a reference point but use new GPS systems to pinpoint the exact center.

What to do if plot center is inaccessible
There are two ways to handle the situation where plot center falls in a busy road, on a building, behind a locked gate, etc.
1. Bring up the plot layer and imagery in GIS and measure the distance from plot center to a point you will be able to access on the ground then follow the ***USFS UFORE Data Collection manual*** protocol. Note the possible distance discrepancies caused by the "weird issue" above.
2. Don't worry about plot center at all. Simply use GIS to measure distances and directions to several points along the plot boundary from an accessible point in the plot. For instance, find a curb corner on the imagery and use the Measurement tool in GIS to calculate the distance from that curb to 3 points on the boundary that are not on top of the building or in the road. Using cardinal directions is simplest but not necessary. Remember the "weird issue".'

XV. **Weekly check-in and data download**

We chose each Friday to meet as a team. Team Leaders spend the afternoon (~2pm to 5pm) in the office. There are several goals for this session:
1. Team Leaders meet with the GIS Specialist and Director of GR to discuss progress and issues
2. Team Leaders complete folders for completed plots making sure that contents are as specified above in the Plot Folder Setup section
3. The GIS Specialist downloads the week's worth of data into UFORE Shell and confirms accuracy. He also checks for species entered that weren't part of the list and notes those occurrences (e.g. "cherry" or "unkn")
4. The GIS Specialist reviews folders and files them in the completed folders file
5. Team Leaders choose plots (with permission) for the following week and notify volunteers by e-mail that everything is a go and that they will contact them by phone the night before their day in the field to coordinate meet-up logistics

XVI. **Quality Assurance/Quality Control**

The National Park Service, U.S. Forest Service and Casey Trees developed methods for UFORE quality assurance in 2004. The USFS developed a manual based on the same standards which we continued to follow in 2009. The USFS created a manual ***UFORE Quality Assurance Manual*** can be found here: P:\Geographic Resources\Inventory\UFORE 2009\Reference_material\QA-QC Plot SOP.pdf.

We performed "hot checks" in the first few days of data collection on two plots. Lynn and Mike went to plot "1" then plot "2" while Holli and Grace went to plot "2" and then plot "1". Everyone met afterward to compare results and work towards data collection consistency within the tolerances of the QA/QC manual.

Holli and Mike "cold checked" 4 plots about 1.5 weeks into data collection; we checked two of each team leader's plots. Mike selected plots that had a few trees but were not forested. We found that most plot and tree measurements were within the tolerances set forth in the manual. The problem arising most consistently was overestimation of tree height. Other problems included:

- Inconsistent tree-canopy-over-plot estimation
- Inconsistent crown missing estimation

Mike then visited the 4 plots again with team leaders to take some remeasurements and solidify methods. The *corrected* measurements were entered into the UFORE database.

XVII. Bundle and Send to USGS

The data should be downloaded on a regular basis. We chose each Friday before or after the meeting to ensure there was a copy backed up into the UFORE shell at the home office. We followed the procedures from UFORE shell in uploading to the database. Once all the plots had been completed, we performed select queries and update queries on the data to check the key fields were populated. Because each city is different and often not all species can be accounted for some manual updates and data entry will have to be performed.

Once the database is complete, the data should be sent off to the Northeastern Research Station of the USFS for analysis.

XVIII. Suggested Final Products

a) Final Report (See 2004 and 2009 automatically generated by USFS)
b) Comparison Tables for Five Years
c) All documents of findings including charts, graphs and analysis should be uploaded to the web
d) Provide data for the Tree Report Card or other DC Urban Tree Canopy measurement tools
e) Media release of any significant results
f) Citizen Forester/Casey Trees evening Workshop to report out findings
g) Presentation of Findings to regional workshops (i.e. 2009 results presented at 2010 MillionTrees NYC March Symposium)

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