

Creating a Digital Map *of the* Arboretum

BY TRACY MEHLIN

A homeowner is thinking about planting a particular tree in the garden but wants to see what a mature specimen looks like. The Arboretum might have one, but where?

A horticulture student has a project on ericaceous plants and needs to examine as many species as possible. The Arboretum is the place to start, but how can she find the plants?

A staff horticulturist needs to inspect the elms in the Arboretum for Dutch elm disease. He needs to pinpoint all the elm locations. The trees are mapped on paper, but paper isn't searchable. What to do?

*A plantsman, Daniel Mount, writing an article for the "Bulletin" (see page 10) wants to know the location and provenance of each *Picea smithiana* in the Arboretum. University staff can access this information, but the author doesn't want to bother them every time he wants to look up a tree's history. Where to turn?*

With the launch this summer of the University of Washington Botanic Gardens' new online, digital map of the Arboretum, the solution to all the above scenarios—and many more—will be just a mouse click away. Anyone with access to the Internet will be able to visit www.uwbotanicgardens.org/gardens/map.shtml, search the Arboretum's collections, pinpoint individual plant specimens, learn about where they came from and when they were planted, and—once the map is fully complete—see photos!

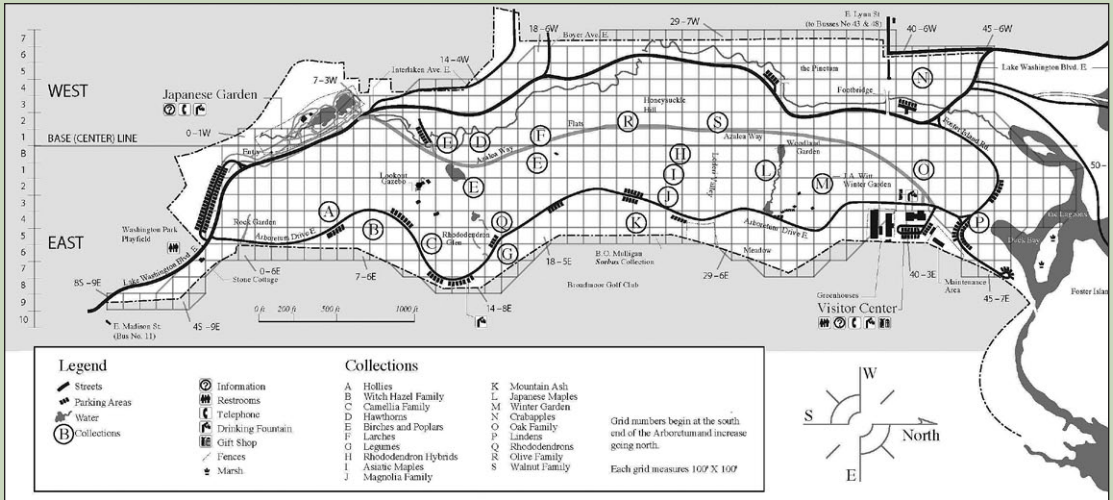
Mapping the Arboretum: A Short History

Mapping of the Arboretum's plants has been going on for more than half a century. In 1956, an anonymous gift funded the first collection-mapping effort, which involved laying out a simple grid system of 300-by-300-foot squares. Over the next few years, University of Washington students from the College of Forestry located and documented collection plants on the grid map. This effort started and stopped as funds were made available from private gifts.

RIGHT: Ryan Garrison surveying in the Arboretum using a Leica total station.

OPPOSITE TOP: The paper grid map of the Arboretum created in 1988





In 1988, Arboretum staff used surveying equipment to install a more detailed grid system of 100-by-100-foot squares within the original grid. Mapping the plants on this new map continued for a few years. Each grid (there are 598 altogether) was assigned a number from 0 to 50, with zero representing the southernmost end of the Arboretum and 50 representing the northernmost tip (not including Foster Island). The map also was divided along an east-west axis (roughly following Azalea Way), and the grids were designated accordingly. For example, grid point 40-2E is 4000 feet north of the start of the grid and 200 feet east of the baseline. Each grid square has four corner points, but only the southwest point is used to designate the grid name.

Mappers, led by former staff members Jan Pirzio-Biroli, Tim Hohn and Tracy Omar (and including part-time helper Daniel Mount), used tape measures to triangulate where accessioned

plants (plants that are officially recorded in the collection) were in relation to the grid boundaries. They documented this location data on paper maps, using one map sheet per grid. Over the next 24 years, some individual grid maps were updated many times; others have not been “ground-truthed,” or re-inventoried, since the creation of the original maps.

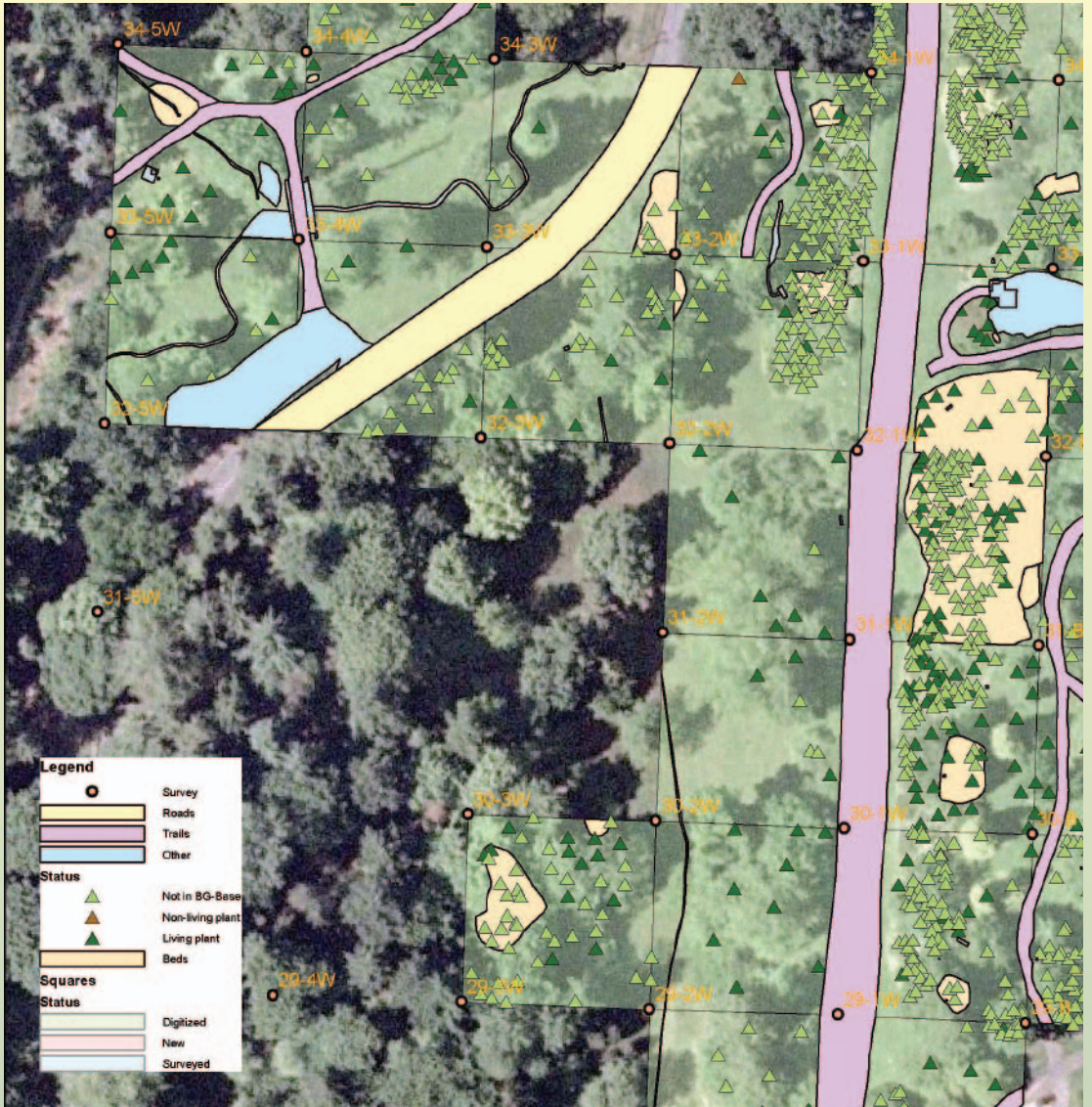
An effort was made to link the plant collection data stored in UW Botanic Gardens’ database—a program called BG-Base that’s used by many public gardens to manage their collections—to a map generated by its companion software, BG-Map, but technical difficulties proved overwhelming. Location data has been confined to paper grid maps.

Creating an Integrated System

Horticulture and curation staff at the Arboretum has always had access to the detailed, individual grid sheets, but the public had to make do with a

Linking to Historic Records

Thanks to funds provided by the Arboretum Foundation, the historic plant records from the Arboretum are being scanned and will eventually be linked to the interactive map of the Arboretum. University of Washington students have been working on the project under the supervision of the UW Libraries. Map users will be able to view the accession cards that recorded such details about each plant as its source, date planted out, and its condition as noted during field checks. As well as giving the public wider access to this valuable information, the project also will help to preserve the records by reducing handling of paper originals.



tiny version of the complete grid map printed in the “Woody Plant Collection in the Washington Park Arboretum,” a small catalog last published in 1994. The catalog lists every accessioned plant in the collection in alphabetical order, along with a grid number location for each plant. If you’ve ever tried to find a specific plant using the catalog, then you know it can be a challenge. If the grid that you’re directed to is densely planted, your search can easily end up being of the “needle-in-a-haystack” variety. Even finding a

specific grid can be difficult because few landmarks are noted on the map, and no grid-point identification system exists in the field, except for the occasional brass nail “monument” (or surveyor’s mark) pounded into the ground.

Another shortfall of print grid maps is the inability to “search” them (in the modern, digital sense). The way to see all the *Picea smithiana* specimens, for instance, was to first search BG-Base for grid-location codes, then pull the paper maps for each of the grids, and then scour

ABOVE: A sample view of the georeferenced digital map of the Arboretum, with collection plants and other features marked onto the map grids.

each map for the plant name. Performing all these tasks is only something that can be done under the supervision of certain trained members of the UW Botanic Gardens staff.

Current UW Botanic Gardens Director, Professor Sarah Reichard, imagined an integrated system in which one could search for a plant and see not only records data about the accession but also its location on a digital map and any associated scanned historic records. Conversely, she wanted to be able to scroll over a digital map of the Arboretum and click on any plant point to see records data. She wanted this system to be available to everyone from anywhere on the Web. In August 2012, UW Botanic Gardens was awarded a grant by the Institute of Museum and Library Services to build such a system.

In the Arboretum with a Total Station

The first task was to re-survey the grid to ensure the accuracy of the original surveying work, and then to link it to digital-mapping software. The grant funded the purchase of a Leica total station, which is a set of sophisticated pieces of equipment that measures and collects very accurate spatial information. The University contracted with the City of Seattle Surveying Unit to install control points (location markers of reliable authority) in the Arboretum that would give staff known references for determining the map coordinates of the monuments from the 1988 grid. (Monuments were placed in the ground on every corner of the 1988 grid.)

Jim Lutz, a former research scientist in the School of Environmental and Forest Sciences, taught our staff, student and volunteer crews how to survey and consulted on the surveying effort. Staff horticulturist Ryan Garrison and registrar Keith Ferguson were heavily involved with both surveying and managing the resulting data. Some grid points were relatively easy to survey, while others proved more elusive. Some monuments were buried and hard to find; in other instances, foliage blocked the required clear line of sight from a monument grid point to a control point. In the case of the New Zealand Forest at Pacific

Connections, the original monuments were lost during garden construction, and new ones had to be installed. Ground-nesting bees and wasps also made the work challenging.

Digitizing the Print Maps

To make the interactive digital map of the Arboretum, University staff used a geographic information system (GIS) program called ArcGIS, for which the UW has a site licence. Once four corners of an individual grid were surveyed, and that information was uploaded into the ArcGIS map of the Arboretum, a scan of the corresponding paper grid map could be imported into the program. The corners on the grid map scan were then linked to the surveyed points for that grid, and the program “georeferenced” the data (linked the digital map to the physical location) by fitting the scanned map to the four surveyed points.

School of Environmental and Forest Sciences application developer David Campbell built the geodatabase and corresponding map, while Masters student Andrew Fraser (now a graduate) performed about 95 percent of the digitizing. After the corners of each grid map were georeferenced, each tree, shrub, path and bench—or anything else documented on the print map—was transferred to the geodatabase. This was a manual process, with each item either entered as a point (e.g. a tree) or a polygon (e.g. a path).

After a majority of grids had been digitized, David published the map and associated data online and started to develop features—such as panning, zooming and searching—that would allow users to interact with the map. The plan is to start out with basic functionality and then add features as we learn how people are using the interactive map. The map has been in a beta-testing phase since April 2014 and should be ready for public use by the time this article appears in late June. ☺

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