Plant Inventory Operations Manual

Second Edition – April 2011

The ARNOLD ARBORETUM
of HARVARD UNIVERSITY

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Cover image: The white pine (Pinus strobus) grove on Peters Hill.

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1. INTRODUCTION

1.1. Overview

Inventory[1]:

> Definition 1: (*n*) an itemized list of current assets

> Definition 2: (*v*) the act or process of taking an inventory

Museums conserve objects, be they vases, bones, herbarium specimens or plants. Here at the Arnold Arboretum, preservation or conservation of our objects (in this case plants) includes expert horticultural care as well as strict curatorial oversight. Among curatorial activities in a museum, one of the most fundamental is the creation of an inventory of the accessioned objects housed within the collection. In basic form, an *inventory* lists what is being held within the collection and where the object is located. In combination, these two elements help to ensure collection accessibility to museum staff as well as other users. As a process, an *inventorying system* is also central to the conservation of the collection, as it introduces an evaluation or assessment step. In static collections, once an inventory is complete it only needs updating as new objects are registered or accessioned; current accessions are transferred to another location within the museum (e.g., a new storage area, an exhibit) or loaned to another institution; or accessions no longer needed are deaccessioned completely.

However, botanic garden collections are dynamic, comprising living plants that are subject to innumerable vagaries. Plants constantly change: their conditions may vary rapidly over a short period; they may shift from their original locations; and sometimes they disappear completely due to poor performance or even vandalism. And, unlike the uniform cabinets and cases that store traditional specimens, outdoor landscapes are highly variable. Like the plants they accommodate, landscapes change over time, and are subject to an array of abiotic and biotic influences. Lastly, some of the tools we use to track accessioned plants in the field, such as records labels, are themselves subject to these same influences. For these reasons, a system for inventorying living plant collections is quite different from that used in a static collection and must address some of these unique curatorial challenges.

Conducted "in the field," these activities are known as field checks and are perhaps the single-most important process whereby curatorial staff and others interface with the living collection. As a means of organization, field checks can be segregated into two primary categories. Those that are part of a routine and systematic review are classified as **inventory field checks**. These formal procedures are conducted by curatorial staff and are most often associated with a discrete geographic location such as a map grid or nursery, although in cases such as the Center for Plant

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[1]Definition: Inventory. (2011). In *Merriam-Webster Online Dictionary*. Retrieved February 20, 2011, from http://www.merriam-webster.com/dictionary/inventory

Conservation (CPC) collections might be distributed across the landscape. The other class, **ad hoc field checks** (see pg. 22, Appendix A, *Guidelines and Recommendations for Conducting ad hoc Field Checks*), includes all other activities that result in observations or notations made on accessioned plants at a documented point in time. Examples include the collection of voucher specimens, horticultural maintenance activities, plant-health inspections (see pg. 24, Appendix B, *Operationally Defined Plant Conditions*), and even casual observations made by staff or visiting scholars. While they may not be systematic in nature, collectively these represent a rich body of secondary documentation. One need only to peruse the card file or back issues of *Arnoldia, The Magazine of The Arnold Arboretum,* to find amazing commentary on our accessioned plants. A goal of this manual is to ensure the integration of these notes and observations into the documentation process.

The value of **inventory field checks** cannot be overstated. Because curatorial and horticultural staff rely heavily upon inventories and maps of the living collections in their daily work, failure to maintain these at their fullest can result in an incomplete and inaccurate inventory. This may in turn jeopardize the future preservation of the accession in question. Thus, at its most basic level, a field check system requires:

➢ all accessioned plants to be routinely verified as being present or absent;

➢ the specific map locations of accessioned plants to be verified for accuracy and precision;

➢ the identities of accessioned plants to be coarsely verified for accuracy; and

➢ the primary means of collections control in the field (records labels) to be assessed for accessibility, accuracy, and presentation.

To meet these objectives, the Arboretum fields expert curatorial staff able to conduct inventories as well as troubleshoot an array of taxonomic, cartographic, and horticultural puzzles.

This *Manual* serves several purposes. The initial and basic intention is documentation: to put into print the Arboretum's meticulous procedures related to inventorying living plants. Thus, it becomes a resource for staff to use as they carry out their day-to-day work. Also, because it is a document unique in the public garden community, it so can be used as a resource by peer institutions. The initial creation and subsequent updating of the document proved meaningful. During the process of writing and editing, curatorial and other staff members had the opportunity to scrupulously assess our current practices in light of a bolder and more expansive curatorial paradigm. As a result, current practices were evaluated to see if they met curatorial needs and requirements; any necessary changes were then crafted. The end product, this *Manual*, is a composite of tried-and-true methods and many new approaches.

The following table details improved inventory methods and new approaches.

Table 1. Improved Inventory Methods at the Arnold Arboretum.		
TOPIC	**PREVIOUS METHOD**	**NEW METHOD**
Communication of inventory value, goals, and procedures	In field and office trainings with scant documentation	In field and office trainings supplemented by *Plant Inventory Operations Manual*, 2010
Communication with horticulturists and Horticulture Department managers	As needed; if at all	Formalized (*Inventory Field Check Summary Report Form* and printed inventories) and required*
Data collection	Field observations written on paper then catalogued in data management systems	Field observations catalogued in real time using a laptop computer with 3G card, April 2009
Plants field checked in grid	A majority of accessioned plants	All accessioned and existing plants; excludes woodland areas*
Coarse identification of plant material (verification)	Inconsistently reviewed	Required and expected*
Measurement diameter at breast height (DBH)	Largest stem	All stems; unless otherwise noted*
Plant condition definitions	January 2003 standard definitions used	Revised definitions, March 2009
Plants listed as "unable to locate"	Inconsistently reviewed	Required review and notation standardized*

*Employed in 2010 unless otherwise noted.

2. INVENTORY FIELD CHECK PROCESS

2.1. Timeline

Planned inventory field checks are conducted across the Arboretum landscape on a five-year cycle between the months of May and October (see pg. 26, Appendix C, *Inventory Field Check Timeline and Regions of Curatorial Focus*).

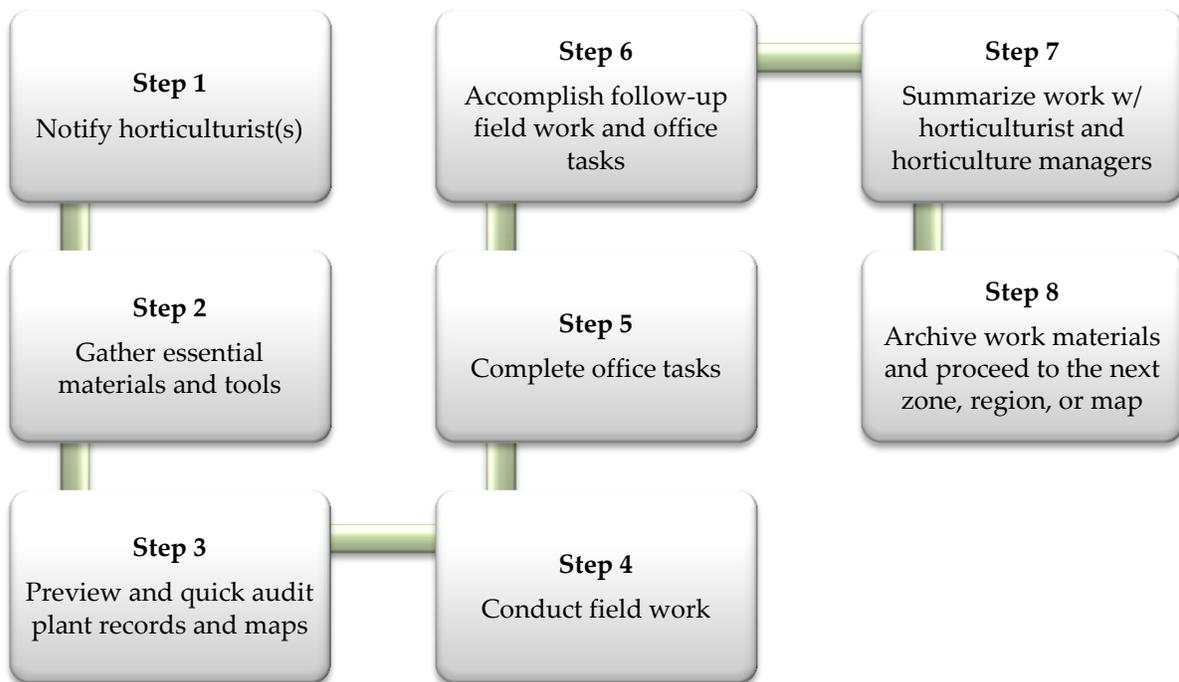Inventory field check operations are suspended at various times throughout the growing season to allow for seasonal mapping of new plantings, label need sweeps in advance of special events, research use, visitor use, (e.g., self-guided tours, interpretive installations), records review (data clean-up), and/or natural disaster response (see pg. 27, Appendix D, *Natural Disaster Response and Assessment*).

2.2. Workflow

The process below emphasizes the broad categories of action constituting the Arboretum's inventory field check program. Each action is further outlined in subsequent pages.

Circumstance and/or individual preference may, at times, require field check activities to deviate from this recommended workflow. However, history and staff experience bear witness to the workflow's effectiveness in fostering required outcomes. Outcomes include: authenticated, accessible, well-documented collections that foster research, education, and general use; and knowledgeable, well-trained staff who perform in a meritorious manner in their day-to-day work.

ARNOLD ARBORETUM INVENTORY FIELD CHECK WORKFLOW

Step 1 Notify horticulturist(s)	**Step 6** Accomplish follow-up field work and office tasks	**Step 7** Summarize work w/ horticulturist and horticulture managers
Step 2 Gather essential materials and tools	**Step 5** Complete office tasks	**Step 8** Archive work materials and proceed to the next zone, region, or map
Step 3 Preview and quick audit plant records and maps	**Step 4** Conduct field work	

> **The Manager of Plant Records, in consultation with the Curator of Living Collections, manages inventory activities in the permanent collections. Other curatorial staff are critical contributors in the inventory process and are necessary members of the field check team.**

2.2.1. Step 1 - Notify Horticulturist

The week before inventory field work commences, schedule a meeting with the horticulturist, gardener, or apprentice managing the zone (map area). This allows staff to bring certain questions or concerns to the attention of curatorial staff and enriches the field check process by encouraging discussion about the living collections. After the meeting, fill out section 1 (Complete Prior to FC) of the *Inventory Field Check Summary Report* (Appendix E, pg. 28).

Refer to Appendix F, pg. 31, for a list of staff managing landscape zones (landscape zones can be found in Appendix G, pg. 32).

> **Communication before, during, and after field work ensures completeness of field checks and enhances communication and awareness.**
>
> **See pg. 33, Appendix H, *Staff Nextel Telephone and Direct Connect Numbers.***

2.2.2. Step 2 - Gather Essential Materials and Tools

The following materials and tools are used at various stages in the inventory field check process and can be retrieved from curatorial offices located in the Hunnewell building, fourth floor studio:

- ➢ **Laptop computer** – Remote desktop and broadband access technologies allow BG-BASE users an opportunity to review and edit records in the field.
- ➢ Grid and quadrant maps – Single sheet (11 x 17") maps depicting living plants.
  - ▪ R:\ArbMaps\AA STAFF\Grids 1-65
  - ▪ R:\ArbMaps\AA STAFF\Quadrants NW, NE, SW, SE
- ➢ **"Dead" plant map** – Single sheet (11x17") map(s) depicting the location of dead, unlocated, and removed plants.
  - ▪ Plot (print) using AutoCAD Map 3D 2011 or DWG TrueView 2011
- ➢ ***Living Collections Map Book*** – An annual publication detailing georeferenced features such as plants, hardscape, and wayfinding aids.
- ➢ **Form and card**
  - ▪ *Plant Care Request Form*, green pad or booklet
  - ▪ *Pest Monitoring Card*, yellow pad or booklet
- ➢ **Measurement devices**
  - ▪ Diameter tape – measures diameter at breast height in centimeters.
  - ▪ LaserAce Hypsometer (as needed) – Provides accurate height measurements. Typical accuracy 5cm/ 2".
  - ▪ Haglöf Electronic Clinometer (as needed) – Provides accurate height and angle measurements. Accuracy ± 1' (0.3 m); ± 1 degree (depending on the accuracy of the distance entered).
- ➢ **Nextel mobile phone** – Direct Connect (walkie talkie) feature facilitates communication with collections managers, horticulturists, and Visitor Services staff.
- ➢ **Plastic labels, yellow** – Temporary labels used to identify plants in need of records labels.

- **Pruners**
- **Reference books** – General or specific references that can be used in the field. For example:
  - Rehder, A. *Bibliography of Cultivated Trees and Shrubs Hardy in the Cooler Temperate Regions of the Northern Hemisphere*. Jamaica Plain, MA: Arnold Arboretum, 1949. 825 pp.
  - Dirr, M. *Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses*. Champaign, Ill.: Stipes Pub., 2009.

  The Dana Greenhouse facility maintains a small library that can be accessed during office hours.
- **Tool belt(s) and/or backpack(s)**
- **Trimble ProXRT GPS (Global Positioning System) receiver** – Records coordinates of features (e.g., plants, benches, signage, millstone, etc.) with decimeter accuracy. Aids in navigating to previously georeferenced features.

> **The Trimble ProXRT receiver with Trimble Nomad handheld should be used to GPS <u>all</u> plant material.**

- **Trunk and/or records label adjustment devices**
  - Cordless drill; standard, Phillips, and square bits
  - Hammer, pry bar, needle nose pliers, stainless steel screws
- **Writing and highlighting instruments**
  - Pen for marking maps
  - Permanent marker (Sharpie preferred) for writing on temporary plastic labels
- **First Aid Kit(s)**
  - Portable first aid kits
    - field packs
    - departmental vehicle (Ford Freestyle)

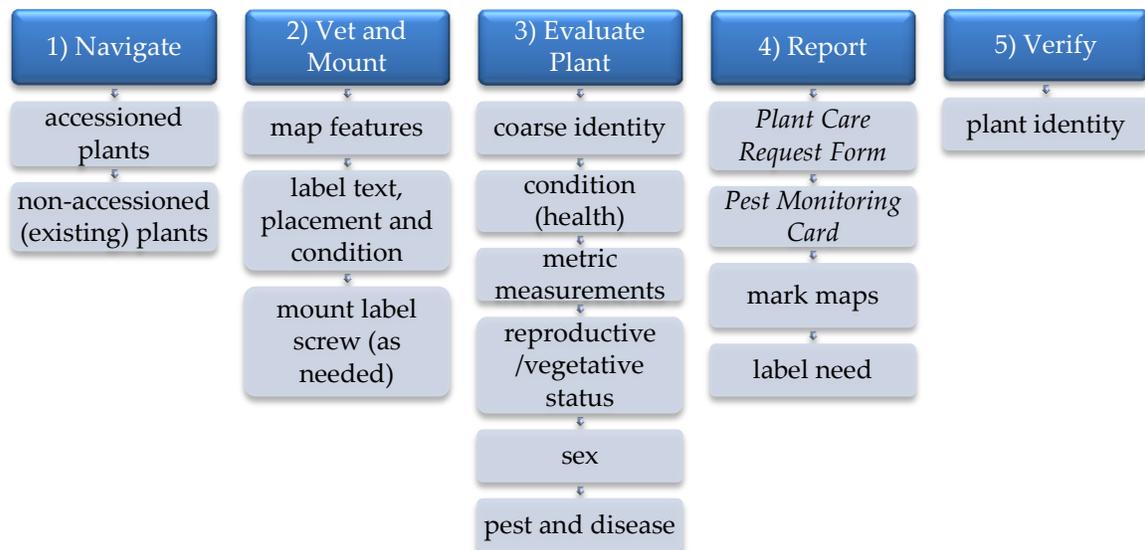## 2.2.3. Step 3 – Preview and Quick Audit Plant Records and Maps

Efficiencies are gained by reviewing all grid/zonal materials before beginning the inventory field check process.

- ➢ Compare plant inventories (dead and alive) to maps
- ➢ Highlight plants that are not georeferenced
- ➢ Review identifying characteristics of taxa to be field checked prior to going outside

2.2.4. Step 4 – Conduct Field Work

Field work should be conducted by a two-person team. The division of labor will depend on the team assembled; however, team members should assist each other in evaluating plant condition and verifying plant identity. During data collection, one person typically enters observations and label need into BG-BASE while the second person verifies map features, fills out forms/cards, scrutinizes labels, and mounts a records label screw. After all observations and clerical efforts are complete, proceed to the next plant.

ARNOLD ARBORETUM INVENTORY FIELD CHECK WORKFLOW: CONDUCT FIELD WORK

1) Navigate	2) Vet and Mount	3) Evaluate Plant	4) Report	5) Verify
accessioned plants	map features	coarse identity	*Plant Care Request Form*	plant identity
non-accessioned (existing) plants	label text, placement and condition	condition (health)	*Pest Monitoring Card*	
	mount label screw (as needed)	metric measurements	mark maps	
		reproductive /vegetative status	label need	
		sex		
		pest and disease		

1) **Navigate –** All plants within a map location must be field checked. This includes accessioned and non-accessioned (excludes woodlands) plant material. This step requires less reliance on maps and more emphasis on observing actual plant material.

> **Symbols on a map may reflect the relative position of plant material. Labels can be hung in error. Observe plants first then consult inventory field check materials.**

2) **Vet and Mount** –

a) **Map features** – Double-check for correct spatial relationships of map features (e.g., plants, signage, rocks, etc.).
- Note features that are not georeferenced **(**see pg. 10, Table 2, *Standardized Map and Inventory Notations used in Field Check Operations at the Arnold Arboretum*).
- Draw in features that are not reflected on the map.

b) **Label text, placement and condition** – Review existing labels.
- Read records and trunk label text thoroughly (see below, Figure 1, *How to read a plant label*).
- Note placement of records label(s) and the way in which label wire is twisted (see picture on pg. 34, Appendix I, *Label Standards and Source Guide*, indicating the preferred wire twisting method (the 'curatorial twist')).
- Remove redundant labels. (see pg. 34, Appendix I, *Label Standards and Source Guide*)
- Make note of label need (see pg. 10, Table 2, *Standardized Map and Inventory Notations used in Field Check Operations at the Arnold Arboretum*; see also pg. 34, Appendix I, *Label Standards and Source Guide*).
- Hang a yellow temporary label if both records labels are missing. Using a Sharpie marker, write the accession number, qualifier, and name (abbreviated) on the label.

c) **Mount –** Mount records label screw (as needed) and affix one records label following the curatorial standard (see pg. 34, Appendix I, *Label Standards and Source Guide*); see picture on pg. 35.

How to read a plant label

accession number
plant family

1422-77-F   BETULACEAE

scientific name — BETULA SCHIMIDTII

accession date

SD - LINEAGE 1422 - 77 - 1977
W - JAPAN - SPONGBERG, S.A.
AND WEAVER, R.E. 320
1977 EXP. TO KOREA & JAPAN

SCHMIDT BIRCH
31 - NW

location
source / collection data

common name

propagation material
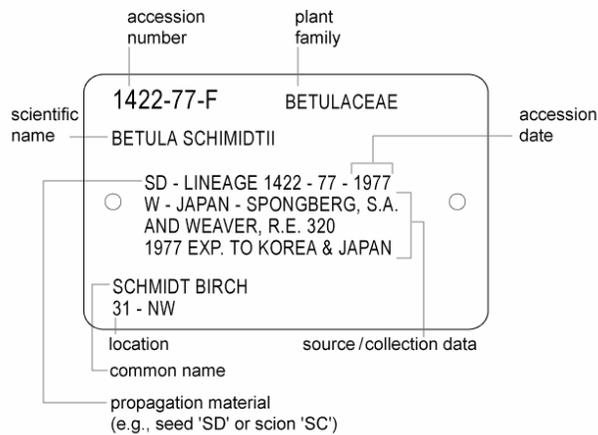(e.g., seed 'SD' or scion 'SC')

Figure 1

Table 2. Standardized Map and Inventory Notations used in Field Check Operations at the Arnold Arboretum.

NOTATION	OBJECT	ACTION
GPS	feature(s) (e.g., plants, bench)	georeference
Accession	plant	accession
Verify	plant	verify (e.g., labels hung incorrectly, plant misidentified by original source)
Labels		
L	records label	emboss (1)
2L	"	emboss (2)
TM	trunk label	mount or order
TMA	"	adjust
TMR	"	remove
OK	feature(s)	edit(s) complete; action taken
Surgery	label, nail, screw, and/or wire engulfed by cambium	adjust, remove, repair
UNLOC	plant or hardscape feature	double-check
/ or \	feature(s)	verified (no action required)
?	feature(s)	research, report, document

3) **Evaluate Plant** – Using a laptop computer, input evaluative data in the appropriate BG-BASE PLANTS table fields or write on a hardcopy *inventory* (see pg. 6, Section 2.2.2. *Step 2 - Gather Essential Materials and Tools*) if broadband connection is down or weather hinders use of electronic devices. Quickly examine previous notations made in the PLANTS table, as they often are illustrative and aid in evaluation. For instance, the plant may have recently been coppiced and the DBH entry may contradict in-field observations. Also, be a skeptic and on the lookout for plants that appear atypical – perhaps unlike other qualifiers of the same accession or some other deviation from the type. Such oddities could indicate unusual seedling variation, mismapped features, or perhaps misidentified or wrongly-hung labels.

> **Challenge assumptions! Do not complete a field check if the plant material is in any way questionable. Likewise, read prior field check thoroughly; they may indicate error(s). Plants may also be labeled and/or mapped incorrectly. Additional sleuthing may be necessary (see pg. 14, Section 2.2.5. *Step 5 – Complete Office Tasks, Consult*).**

a) **Coarse identity** – Does the plant and label information match? If the label and plant do not match, additional verification may be necessary (see pg. 13, *Verify - Plant Identity*).

b) **Condition** – Assign a subjective health rating. The Arnold Arboretum has operationally defined BG-BASE plant conditions as follows:

> *Making observations on plants in the collection is an integral part of the documentation process. In order to facilitate objectivity and to ensure common usage among evaluators, the following standardized condition definitions are to be used as a guide for staff and others during their plant*

health assessments. Special projects and/or other collection management activities such as the Plant Health Program may dictate additional plant condition use.

LIVING PLANT CONDITIONS:

Alive (A) - Plant present.
- ✓ Primarily used in the dormant season or if *none* of the observations relate to plant health: e.g., presence/absence notations, phenology, aesthetic/ornamental value, height/DBH measures, etc.
- ✓ Historic evaluations; e.g., date or year noted on accession cards, maps, correspondence, etc.
- ✓ Check_note field use encouraged

Excellent (E) - An outstanding and/or exemplary plant, not just in good health but thriving (vigorous).
- ✓ No recent structural damage or defects; no pest(s) or disease(s)
- ✓ Past damage has fully compartmentalized
- ✓ Check_note field use <u>required</u>

Good (G) - A plant in good health, actively growing, no evidence of decline.
- ✓ Minor structural damage or disease that is not significantly harming the plant (e.g., powdery mildew can still grow on a "good" *Syringa*).
- ✓ Compartmentalization proceeding well
- ✓ Check_note field use encouraged

Fair (F) - A plant in minor decline (minimal vigor), but not life-threatening.
- ✓ Notable pathological, structural, or physical damage
    - o Some form of stress or pressure is evident (or at least the symptoms are); may have some active growth or is in stasis.
- ✓ Compartmentalization not proceeding well
- ✓ May prompt the completion of a *Plant Care Request Form* (green) or *Pest Monitoring Card* (yellow); see pg. 39, Appendix J.
    - o Further monitoring may be necessary
- ✓ Check_note field use <u>required</u>

Poor (P) - A plant in major decline, the problem is life-threatening, and the expectation is that the plant will be dead within 1 to 2 years unless remedial action is taken.
- ✓ Major pathological, structural, or physical damage
- ✓ No evidence of active growth
- ✓ No compartmentalization
- ✓ Warrants the completion of either a *Plant Care Request Form* (green) or *Pest Monitoring Card* (yellow); see pg. 39, Appendix J.
- ✓ Check_note field use <u>required</u>

DEAD PLANT CONDITIONS:

Dead (D) - A dead plant still in place.

- ✓ No living tissue.
- ✓ Check_note field use <u>required</u>

Deaccessioned and/or Removed (R) - A plant removed from the collection because of death, curatorial review, or other permanent action.
- ✓ Check_note field use <u>required</u>

Unable to locate (U) - An unfound plant. USE SPARINGLY (see pg. 16, Section 2.2.6 *Step 6 - Accomplish Follow-up Field and Office Tasks, Update*).
- ✓ Requires follow-up to confirm "unlocated" status.
- ✓ Confirmed unlocated plants must have "confirmed unable to locate" noted in the check_note field.
- ✓ Check_note field use <u>required</u>

d) **Measurements (in meters)** –
  - ▪ Diameter at breast height (DBH) of all trees – The Arboretum *generally* follows the USDA Forestry Standard (see Recommended Reading section, *USDA Forest Inventory and Analysis National Core Field Guide*, v 4.0. 2007).
    - • Rules of thumb
      - o Measure <u>all stems</u> at 4.5 feet above soil line and enter the information in BG-BASE, PLANTS table, field DBH. Field DBH_MISC can be used to articulate height at which DBH is taken if the aforementioned standard is not followed.
      - o Stand on the upslope side of the stem(s) being measured.
  - ▪ Height and Spread – As needed and at the discretion of curatorial staff. Include notations of spread for shrub masses if they are particularly useful for future interpretation, mapping, etc.
e) **Reproductive Status** – Primarily captured as flowering is encountered, but can be applied during fruiting or before flowering. Also can be useful when something is atypically NOT in flower. Use free-text descriptions if and when appropriate (see pg. 40, Appendix K, *BG-BASE PLANTS, Field Checks and Observations Section: Field Options*).
f) **Vegetative Status –** Observations catalogued when unusual leaf drop or leaf emergence is encountered as well as leaf color in autumn (see, pg. 40, Appendix K, *BG-BASE PLANTS, Field Checks and Observations Section: Field Options*).
g) **Sex** - Enter when sex of dioecious plants has not been determined (see pg. 40, Appendix K, *BG-BASE PLANTS, Field Checks and Observations Section: Field Options*).
h) **Pest and Disease** – BE ON THE LOOKOUT FOR ANYTHING ABNORMAL. A *Pest Monitoring Card* should be filled out for pest and disease issues (see pg. 39, Appendix J, *Plant Care Request Form, Pest Monitoring Card, and Workflow*).

4) **Report –**
  a) **Fill out *Plant Care Request Forms* and *Pest Monitoring Cards* as needed.** All forms and cards should be submitted to the Curator of Living Collections.

b) **Mark maps (**see pg. 10, Table 2, *Standardized Map and Inventory Notations used in Field Check Operations at the Arnold Arboretum*).

c) **Request labels** by entering a record in the LABEL_REQUESTS table (see pg. 42, Appendix L, *How to Enter and Process Label Requests Saved in BG-BASE v6.8*).

> **Single instance poison ivy and/or invasive woody plants should be reported using a *Plant Care Request Form*! Save forms by reporting large populations directly to the Manager of Horticulture.**
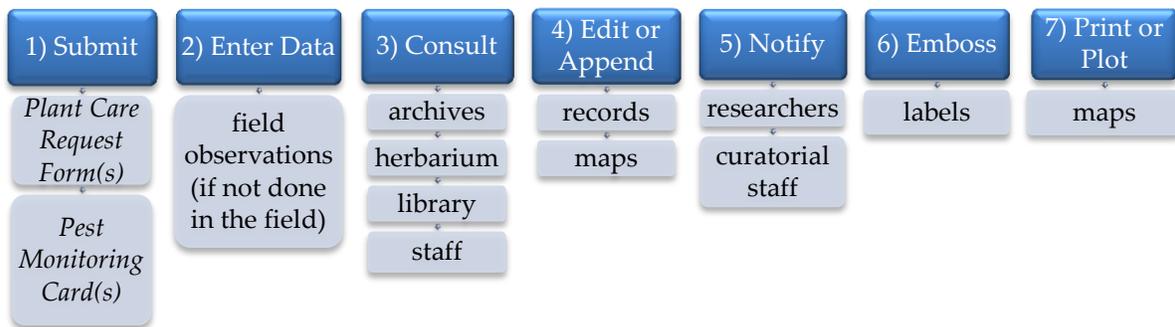
5) **Verify**
   a) **Plant Identity**– A coarse identity verification should be made for each plant in the field, and for those particularly suspect a more detailed investigation can be conducted. This may require the collection of reproductive and vegetative samples.
      - Double-check maps and labels.
      - Initiate in-field ID using reference materials (e.g., books, key, web, photo guides, etc.).
      - Collect plant samples for further investigation; use references, the herbarium, archival maps, etc. Coordinate efforts with the Curator of Living Collections or fill out a *Plant Care Request Form* as needed.

2.2.5. Step 5 – Complete Office Tasks

After field work has been completed, divide office tasks following the schedule recommended below.

ARNOLD ARBORETUM INVENTORY FIELD CHECK WORKFLOW:
COMPLETE OFFICE TASKS

1) Submit	2) Enter Data	3) Consult	4) Edit or Append	5) Notify	6) Emboss	7) Print or Plot
Plant Care Request Form(s)	field observations (if not done in the field)	archives	records	researchers	labels	maps
Pest Monitoring Card(s)		herbarium	maps	curatorial staff		
		library				
		staff				

1) **Submit** – *Plant Care Request Forms* should be submitted to the Curator of Living Collections as soon as possible. Likewise, timely *Pest Monitoring Card* submission, to the Curator, will ensure appropriate actions are taken.
2) **Enter Data** – If not done in the field
    a) Enter field observations in PLANTS table, BG-BASE
    b) Enter label needs in the LABEL_REQUESTS table, BG-BASE
3) **Consult** – A broad suite of resources can fill in gaps in understanding or expedite problem solving. Resources include:
    a) **Archival documentation** (accession card file, verification records, map case, map books, AutoCAD drawings, previously entered BG-BASE records, etc.)
    b) **Cultivated Herbarium -** The Cultivated Herbarium contains approximately 130,800 specimens of cultivated origin. Of these, over 48,800 specimens document accessions grown at the Arnold Arboretum throughout its history. http://arboretum.harvard.edu/plants/herbaria/
    c) **Horticultural Library -** To support the research, curatorial, and educational programs of the Arboretum, the library collects works on botany, dendrology, horticulture, floras of the world, forestry, and taxonomy. http://arboretum.harvard.edu/library/
    d) **Staff**
4) **Edit or Append** – Edit or append database (BG-BASE) records and map features based on archival records review.
    a) The CHECK_NOTE field (free text) in PLANTS should be used to record any anomalies, questions, and findings (e.g., labels were hung incorrectly, mapped wrong, etc.). Notes in the CHECK_NOTE field are essential in problem solving in the future and limit the propagation of errors.
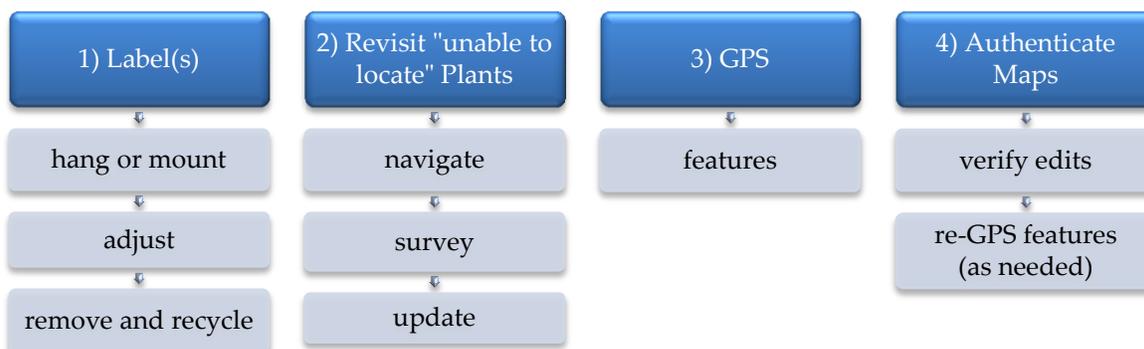
5) **Notify –** If errors are found, active researchers and/or curatorial staff managing associated collections and/or programs (e.g., herbarium, repropagations, distributions) must be notified.

6) **Emboss** – Emboss records labels as needed (see pg. 42, Appendix L, *How to Enter and Process Label Requests Saved in BG-BASE v6.8*).

7) **Print or Plot** – Edited maps will be used to accomplish follow-up field work (see pg. 16, Section 2.2.6. *Step 6 - Accomplish Follow-up Field and Office Tasks*).

2.2.6. Step 6 – Accomplish Follow-up Field and Office Tasks

Follow-up field work and office tasks may be necessary. See additional steps below.

ARNOLD ARBORETUM INVENTORY FIELD CHECK WORKFLOW: ACCOMPLISH FOLLOW-UP FIELD AND OFFICE TASKS

1) Label(s)	2) Revisit "unable to locate" Plants	3) GPS	4) Authenticate Maps
hang or mount	navigate	features	verify edits
adjust	survey		re-GPS features (as needed)
remove and recycle	update		

1) **Label(s)** –
   a) **Hang or mount** - Hang records labels and/or mount trunk labels (see pg. 34, Appendix I, *Label Standards and Source Guide*).
   b) **Adjust** - Adjust stake labels, label screw(s), swap-out nails, perform surgical tasks
   c) **Remove and recycle** - Remove temporary label and/or labels with outdated, incorrect information. Recycle labels in the appropriate receptacles inside the horticulture support building ("garage").
      ▪ Tip: Wire cutters can be used to quickly remove antiquated labels
2) **Revisit "Unable to locate" Plants** –
   a) Navigate - Using the "Dead" plant map, revisit the location of previously documented "unable to locate" plants. Current calendar year "unlocatables" should be noted on quadrant maps; revisit the location.
   b) Survey – Survey the area to confirm or refute "unable to locate" status. Keep in mind, Horticulturists may have valuable information regarding unfound plants.
   c) Update the BG-BASE PLANTS table records (as needed) with current observation(s).
      ▪ If a plant is found alive, follow prescribed field check methods (see pg. 8, section 2.2.4. *Step 4 – Conduct Field Work - Evaluate Plant*).
      ▪ If a plant is confirmed "unable to locate", enter a new line in the Field Checks/observations section (pg. 1 of entry windows) as follows:

Code	Condition	Q	Check_dt	Check_note	Check_by
U	Unable to locate	D	DD MM YYYY	confirmed unable to locate	Last name, First initial

3) **GPS –** Hardscape features and plants must be georeferenced using the Trimble receiver with Trimble Nomad handheld. Schedule a training session with the Plant Records Manager

before proceeding. Additional references are available at R:\Living Collections\Curation\Tutorials Guides and Manuals.

4) **Authenticate Maps** –
   a) **Verify edits** made to current maps to ensure consistency and accuracy.
      ▪ Additional georeferencing may be necessary!
   b) **Re-GPS features (as needed).** See step 3, *GPS* above.

2.2.7. Step 7 - Summarize Work with Horticulturists and Horticulture Managers

Close the field check loop by summarizing field work with horticulturists and Horticulture Managers. Communication is facilitated by completion of an *Inventory Field Check Summary Report Form* (see pg. 28, Appendix E) and accompanying inventory (see pg. 46, Appendix M, *How to Print an Inventory List using BG-BASE v6.8*) which are reviewed by the Curator of Living collections before distribution to the Manager of Horticulture. Additional forms (*Plant Care Request Form, Pest Monitoring Card* (see pg. 39, Appendix J) and maps may also be submitted as support documentation. In addition to the above actions, the map posted in horticulturist work area should also be updated to show progress.

2.2.8. Step 8 – Archive Work and Proceed to the Next Zone, Region, or Map

Before field checking plants in a new area, ensure that all previous work has been archived in the appropriate data management systems: ArcGIS, BG-BASE. Hardcopy maps, printed inventories, and *Inventory Field Check Summary Report Forms* (see pg. 28, Appendix E) are retained. See Plant Records Manager for more information.

Final Questions
1. Have all living, existing (including spontaneous), and unlocated plants been accounted for?
2. Have you archived your work in the appropriate ways (i.e., departmental file cabinet and /or data management system)?
3. Have you communicated with the appropriate Horticulture Department staff?

3. CONSIDERATIONS

3.1. Safety and Assistance

➢ In the event of an emergency, see pg. 47, Appendix N, *Arnold Arboretum Medical Emergency Procedure.*

➢ Use a Nextel mobile phone with Direct Connect (walkie-talkie) to contact curatorial and/or horticultural staff with questions or to solicit advice (see pg. 33, Appendix H, *Staff Nextel Telephone and Direct Connect Numbers*).

➢ Visitors engaged in activities which deter others from studying plants or disrupt the passive appreciation of nature should be approached and reminded of Arboretum rules. As an alternative, rule violations can be reported to Visitor Services at: 617-384-5610.

- ▪ Rules:
  - Removing or destroying plant material is strictly prohibited.

  - Climbing trees is forbidden.

  - Dogs must be leashed at all times. Owners are responsible for removal and disposal of their dogs' waste.

  - Motor vehicles are not allowed without a special permit.

  - Picnicking, fires, and barbecues are prohibited.

  - Organized group sports and commercial film crews are prohibited.

4. RESOURCES

4.1. Recommended Reading

➢ *Arnold Arboretum Collections Policy.* Arnold Arboretum. September 10, 2007
  - http://arboretum.harvard.edu/plants/collections-management/living-collections-policy/
➢ *Arnold Arboretum Inventory of Living Collections.* Arnold Arboretum. March, 2010
  - http://arboretum.harvard.edu/plants/collections-management/living-collections-policy/
➢ *Curatorial Practices for Botanical Gardens.* Timothy C. Hohn. AltaMira Press, 2008.
➢ *Emergency Plan.* Arnold Arboretum.
  - See Human Resources staff for access to the Arboretum's intranet site.
➢ *General Procedures for Managing the Flow of Plants through the Department of Horticulture.* Arnold Arboretum. 2008
  - R:\Living_Collections\Policy\ManagingFlowOfPlants2008.doc
➢ *Interpretive Master Plan for Arboretum Visitors.* Arnold Arboretum. Summer 2008
  - Summary - http://arboretum.harvard.edu/about/planning/interpretive-master-plan/
➢ *Landscape Management Plan.* Arnold Arboretum. 2011
  - Summary - http://arboretum.harvard.edu/about/planning/landscape-management-plan/

4.2. Tutorials, Guides, and Manuals
➢ Database

  - *BG-BASE Quick Start Guide.* BG-BASE Inc.
    - R:\Living_Collections\Curation\Tutorials Guides Manuals\BGBASE_QUICK_START_GUIDE6.0
➢ Mapping
  - *The Guide to Geographic Information Systems (GIS).* ESRI (Environmental Systems Research Institute Inc.). 2011
    - www.gis.com
  - *GPS Tutorial.* Trimble. 2011
    - www.trimble.com/gps/index.shtml
  - See R:\Living_Collections\Curation\Tutorials Guides Manuals\ for the following map-related documentation:
    - *ArcPAD: Mobile GIS Software for Field Mapping Applications.* ESRI. 2006
      - Capture (GPS), edit, analyze, and display geographic data
    - *What's New in ArcPAD 10?* ESRI. 2010

- *ArcPAD 10 Quick Reference.* ESRI. 2010
- *ArcGIS 10 Using ArcReader.* ESRI. 2010
  - View, query, print, and explore maps published using ArcGIS software
- *DWG TrueView Quick Start Guide 2008.* Arnold Arboretum. 2008
  - View and plot (print) AutoCAD drawings (maps)
- *Guide to Best Practices for Georeferencing.* BioGeomancer Consortium. August, 2006
- Measurement Standards
  - *USDA Forest Inventory and Analysis National Core Field Guide.* v4.0. 2007. USDA
    - R:\Living_Collections\Curation\Tutorials Guides Manuals\

5. APPENDICES

A. Guidelines and Recommendations for Conducting *ad hoc* Field Checks

B. Operationally Defined Plant Conditions

C. Inventory Field Check Timeline and Regions of Curatorial Focus

D. Natural Disaster Response and Assessment

E. Inventory Field Check Summary Report Form

F. Staff Managing Landscape Zones

G. Landscape Management Zones

H. Staff Nextel Telephone and Direct Connect Numbers

I. Label Standards and Source Guide

J. Plant Care Request Form, Pest Monitoring Card, and Workflow

K. BG-BASE PLANTS Table, Field Checks and Observations Section: Field Options

L. How to Enter and Process Label Requests Saved in BG-BASE v6.8

M. How to Print an Inventory List using BG-BASE v6.8

N. Arnold Arboretum Medical Emergency Procedure

Appendix A – Guidelines and Recommendations for Conducting *ad hoc* Field Checks

As described in the Introduction to this *Manual*, field checks are fundamental to sound curatorial practice and are classified into two categories. **Inventory field checks** pertain to the regularly scheduled and routine reviews of the living collection conducted by curatorial staff and comprise the bulk of this *Manual*. Because of their additional value to the distributed curatorial process, **ad hoc field checks** also deserve consideration and are elaborated upon in this appendix. Part of their value is the fact that they are indeed variable and *ad hoc*. Thus, this appendix is simply a means to provide guidance to Arboretum staff and others, and to improve the capture of quality information.

Who can make an *ad hoc* field check, and how is the information recorded?
Ad hoc field checks can be made by any person, including members of the Arboretum's Curatorial Team, other Arboretum staff, as well as external visiting scientists and scholars. In some instances, curatorial department members may vet, filter or edit some observations.

For those individuals with BG-BASE access, they are encouraged to input their notations directly into the PLANTS table. In situations where individuals lack editorial access to BG-BASE, their notations and observations may simply be made in another format (including handwritten notes or annotations to a printed ACCESSIONS or PLANTS summary) and submitted to the Curatorial Department for review. They will then entered into BG-BASE by a member of the Curatorial staff. For example, it is not unusual for visiting scholars to take a printed ACCESSIONS summary into the field and make a series of notations. These are then input at a later time, with the observer (not the person tasked with data entry) listed in the CHECK_BY field, PLANTS table.

What types of information are gathered?
An *ad hoc* field check is any form of observation or notation made on an accessioned plant at a known date that is outside the scope of a formal inventory field check. These should include:

- ➢ Accession number and qualifier
- ➢ Date
- ➢ Plant health observations
- ➢ Phenological observations
- ➢ Observer(s)

Other types of observations may include:

- ➢ Measurements such as height or DBH (diameter at breast height; 4.5' above soil line)
- ➢ IPM-related inspection or chemical treatment
- ➢ Anecdotal or casual observations related to a plant's performance or aesthetics
- ➢ Identity verifications

Additional notes on observations:

Plant Health Observations. When considering health, please use the Arnold Arboretum's Operationally Defined Plant Conditions (see pg. 24, Appendix B). These definitions help minimize observer bias. Note that the following living plant conditions are reserved for health-related assessments: Excellent, Good, Fair, and Poor. Check notes that do not take in to consideration health are encouraged, but should apply different conditions (e.g., Alive). When appropriate complete a Plant Care Request Form (green card) or Pest Monitoring Card (yellow card); see pg. 39, Appendix J, *Plant Care Request Form*, *Pest Monitoring Card*, and Workflow.

Phenological observations. Recording reproductive and vegetative status on accessioned plants is highly valuable. Observers should consult pg. 40, Appendix K, *BG-BASE PLANTS Table, Field Checks and Observations Section: Field Options*, for definitions. Observations should be representative of the entire plant, unless it is simply a notation of first flower, etc... The use of free text descriptions (i.e., 75% bloom, flower color or size, etc…) is encouraged, as is the use comparisons among a group of similar accessions (e.g., 'Flower buds of this accession still closed unlike those of accession 17587-1*B *Symplocos paniculata*, which are completely open').

Verifications. Observations that either confirm or refute a plant's identity are appreciated, even if multiple verifications for the same plant may be in conflict over time. All verifications are reviewed by the Curator of Living Collections, with follow-up actions (e.g., name changes, label [annotation, records] generation) taken as appropriate. For the purposes of *ad hoc* field checks, we recommend that verification notes generally fall into the following three categories:

➢ Identity suspected as being incorrect, but no new determination made.
➢ Identity suspected as being incorrect, and a new determination made (with new determination).
➢ Identity confirmed.

Additional reasons that substantiate the diagnosis are welcome (e.g., 'terminal buds imbricate and not valvate'), as are references or resources used (e.g., citations, specimens, comparisons with other living collection material).

Ornamental and aesthetic observations. Lest they be neglected, these subjective comments and notes are oftentimes the most colorful and reflective of observer bias – and for that reason, they, too are welcome. They not only become part of the historic record, but are instrumental when making decisions related to plant promotion and introduction. While these notes can be used in combination with observations on plant health, it is important that conditions of Excellent, Good, Fair, and Poor are reserved for plant health diagnoses only (i.e., a plant in full and fantastic bloom cannot be assigned a condition of 'Excellent' unless it also meets the Plant Health Conditions for Excellent).

Appendix B – Operationally Defined Plant Conditions

Making observations on plants in the collection is an integral part of the documentation process. In order to facilitate objectivity and to ensure common usage among evaluators, the following standardized condition definitions are to be used as a guide for staff and others during their plant health assessments. Special projects and/or other collection management activities such as the Plant Health Program may dictate additional plant condition use. Expounding on observations is decidedly encouraged.

LIVING PLANT CONDITIONS:

Alive (A) - Plant present.
  ➢ Primarily used in the dormant season or if *none* of the observations relate to plant health: e.g., presence/absence notations, phenology, aesthetic/ornamental value, height/DBH measures, etc.
  ➢ Historic evaluations; e.g., date or year noted on accession cards, maps, correspondence, etc.

Excellent (E) - An outstanding and/or exemplary plant, not just in good health but thriving (vigorous).
  ➢ No recent structural damage or defects; no pest(s) or disease(s)
  ➢ Past damage has fully compartmentalized

Good (G) - A plant in good health, actively growing, no evidence of decline.
  ➢ Minor structural damage or disease that is not significantly harming the plant (e.g., powdery mildew can still grow on a "good" *Syringa*).
  ➢ Compartmentalization proceeding well

Fair (F) - A plant in minor decline (minimal vigor), but not life-threatening.
  ➢ Notable pathological, structural, or physical damage
      ▪ Some form of stress or pressure is evident (or at least the symptoms are); may have some active growth or is in stasis.
  ➢ Compartmentalization not proceeding well
  ➢ May prompt the completion of a *Plant Care Request Form* (green) or *Pest Monitoring Card* (yellow)
      ▪ Further monitoring may be necessary

Poor (P) - A plant in major decline, the problem is life-threatening, and the expectation is that the plant will be dead within 1 to 2 years unless remedial action is taken.
  ➢ Major pathological, structural, or physical damage
  ➢ No evidence of active growth
  ➢ No compartmentalization
  ➢ Warrants the completion of either a *Plant Care Request Form* (green) or *Pest Monitoring Card* (yellow).

DEAD PLANT CONDITIONS:

Dead (D) - A dead plant still in place.
  - ➢ No living tissue.

Deaccessioned and/or Removed (R) - A plant removed from the collection because of death, curatorial review, or other permanent action.

Unable to locate (U) - An unfound plant. USE SPARINGLY.
  - ➢ Requires follow-up to confirm "unlocated" status.
  - ➢ Confirmed unlocated plants must have "confirmed unable to locate" noted in the check_note field.

Appendix C – Inventory Field Check Timeline and Regions of Curatorial Focus
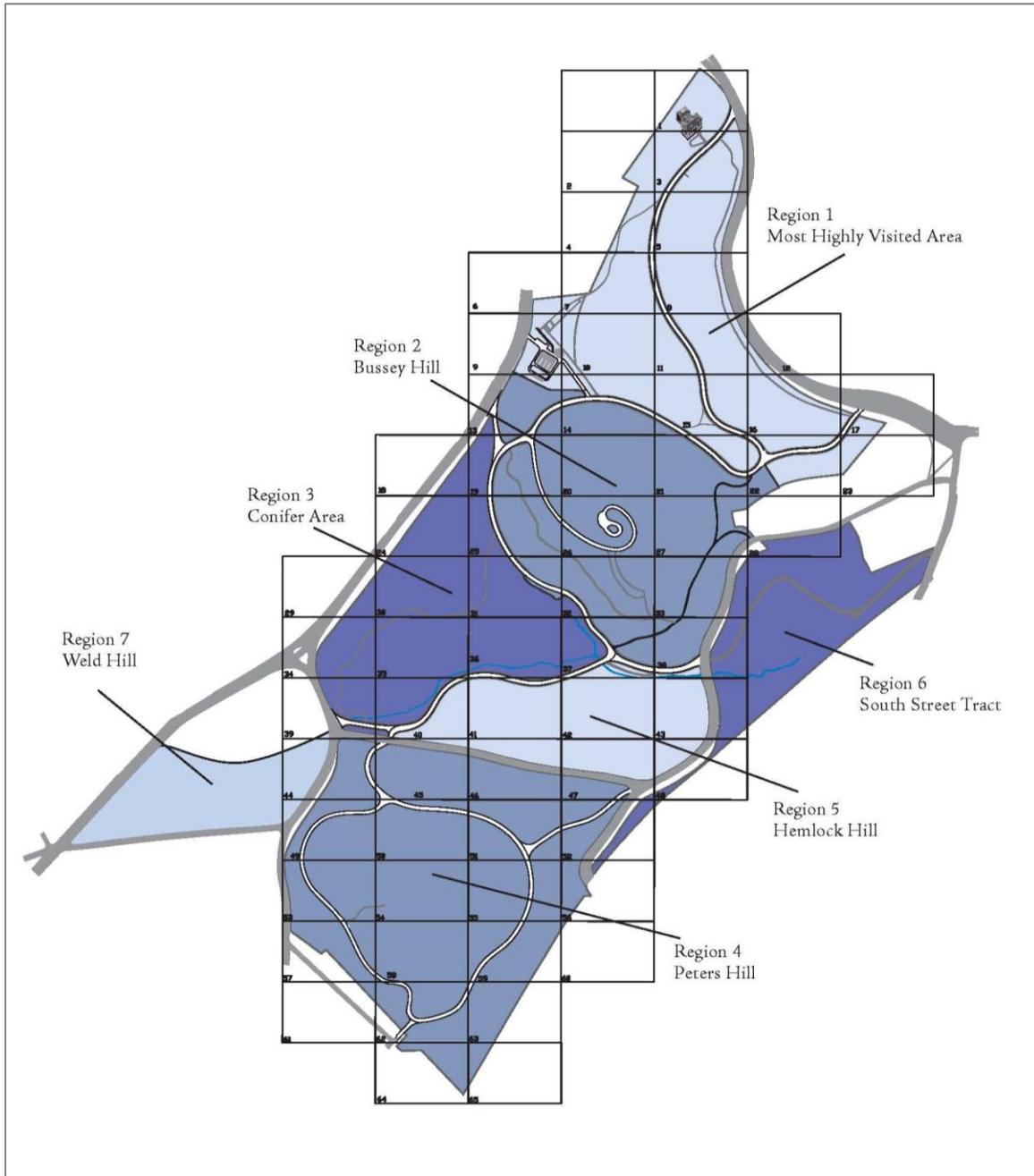
Appendix D – Natural Disaster Response and Assessment

In the event of a natural disaster, biological threat (Asian Longhorned Beetle (ALB)) or severe weather (e.g., blizzard, heavy wet snow, ice, flood, hurricane, or tornado) normal field check workflows and procedures are modified. Curatorial staff members, in coordination with the horticulture and greenhouse departments, are mobilized[2] and conduct collections appraisals (field checks) that primarily quantify damage and propose action (e.g., pruning, removal, deaccessioning, repropagation).

Damage assessments must meet agreed upon standard(s) and are typically customized to the weather event. Likewise, standardized database entries and best practice ensure that reporting is timely and resource allocation is appropriately considered.

A typical storm damage database entry contains six key elements:

1. Date
2. Name of storm or storm category (e.g., hurricane, ice, tornado, etc.)
3. Condition of plant (health assessment)
4. Damage category
5. Recommended action
6. Assessor(s) names (last name, first initial)

Examples of field check notes made by curatorial staff after the "April Fools' Day Blizzard" of 1997 include:

➢ 1 APRIL 1997 BLIZZARD - RECOMMEND REMOVAL
  ▪ trees with more than 50% crown damage or large fissures in the trunk
➢ 1 APRIL 1997 BLIZZARD - MAJOR DAMAGE
  ▪ trees with more than 25% to 50% crown damage
➢ 1 APRIL 1997 BLIZZARD - MINOR DAMAGE
  ▪ trees with less than 25% crown damage

Examples of field notes catalogued by arborists and horticulturists after curatorial reports quantifying damage were distributed include:

➢ REMOVED - 1 APRIL 1997 BLIZZARD
➢ Not of accession quality after removing all storm breaks and deadwood.

---

[2] In 1997, after an April blizzard, curatorial staff field checked all accessioned plants in a three-week period; Kelley, S., 1997. *Storms in the Landscape: 1938 – 1997*. Arnoldia. Spring, 1997: 23-32.

Appendix E - Inventory Field Check Summary Report

INVENTORY FIELDCHECK (FC) SUMMARY REPORT
rev. August 2010 (KDP, MSD)

The ARNOLD
ARBORETUM
of HARVARD UNIVERSITY

Grid or Grid Quadrant: **Dates of FC:**   **FC Team:**

COMPLETE PRIOR TO FC   LY of formal FC: # acc. plts. with LIVING Condition (A, E, G, F, P, Q, I):

acc. plts. UNABLE TO LOCATE (U):

Concerns/questions expressed by HT(s):

Other concerns or anticipated problem areas known in advance:

COMPLETE AFTER FC   *LIVING COLLECTIONS*

acc. plts. with LIVING Condition (A, E, G, F, P, Q, I) :

resurrected plts. prev.: UNABLE TO LOCATE (U):   DEAD (D):

REMOVED (R):

DEAD COLLETIONS

#acc. plts. confirmed UNABLE TO LOCATE (U):

#acc. plts. found DEAD (D):

EXISTING AND/OR SPONTANEOUS PLTS.

existing, yet unaccessioned, plts. accessioned: or to be accessioned:

LABEL(S)   # plts. requiring new records label(s):

plts. incorrectly labeled: # plts. requiring new trunk label(s):

plts. requiring label adjustment:

MAPPING   #plts. requiring GPS coordinates (new and/or adjusted):

Total # plts. mapped incorrectly:

VERIFICATION(S)   #plts. formally verified as part of FC:

plts. requiring ID verification:

General notes for HT(s) and/or arborists not covered with a green card (e.g., weed control or deadwood issues that might pertain to landscape areas):

Remaining curatorial tasks (e.g., remapping, bulk accessioning of existing trees, curatorial review, etc…) to occur after FC complete:

How to Compile Inventory Statistics using BG-Base v6.8 S/List Commands (Sentences)

INVENTORY FIELDCHECK (FC) SUMMARY REPORT
rev. August 2010 (KDP, MSD)

The **ARNOLD**
ARBORETUM
of HARVARD UNIVERSITY

Grid or Grid Quadrant: Dates of FC: FC Team:

| COMPLETE PRIOR TO FC | LY of formal FC: |

acc. plts. with LIVING Condition (A, E, G, F, P, Q, I):
1) select plants with alive = 'a' and with current_location '*grid or location code*'

acc. plts. UNABLE TO LOCATE (U):
1) select plants with current_condition 'U' and with current_location '*grid or location code*'

Concerns/questions expressed by HT(s):
Other concerns or anticipated problem areas known in advance:

| COMPLETE AFTER FC | *LIVING COLLECTIONS*

acc. plts. with LIVING Condition (A, E, G, F, P, Q, I) :
1) select plants with alive = 'a' and with current_location '*grid or location code*'
2) sl '*grid or location code*'
   This list will be used in reporting label need; see LABEL(S) header below.

resurrected plts. prev.: UNABLE TO LOCATE (U):
1) select plants with condition 'U' and with current_location '*grid or location code*'
2) sl REVIEW
3) exit S/List
4) open the PLANTS table
   a. click on the 'get a saved list' icon in the program toolbar
   b. type in the name of your saved list (step 2 above)
   c. press the 'OK' button
   d. review the 'browse list'; tallying only those records that have 'U' directly under the current
      condition.
DEAD (D):
Follow the steps directly above, replacing condition 'U' with 'D' (step 1).
REMOVED (R):
Follow the steps above, replacing 'D' with 'R' (step 1).

DEAD COLLETIONS
 #acc. plts. confirmed UNABLE TO LOCATE (U):
1) select plants with current condition 'U' and with check_note containing 'confirmed unable to locate'
 #acc. plts. found DEAD (D):
1) select plants with current_condition 'D' and with current_check_dt containing '*four digit year*'

EXISTING AND/OR SPONTANEOUS PLTS.
 # existing, yet unaccessioned, plts. accessioned:
1)select plants with acc_num containing '-2011' and with current_location '*grid or location code*'
or to be accessioned:

LABEL(S)
plts. requiring new records label(s):
1) select LABEL_REQUESTS with label_type 'AL'
2) sl 'Label_Requests'
3) close S/List
4) open the 'convert list' tool by selecting Tools > Convert List from the program menu
5) type the name of the saved list (step 2) in the 'Name of first list'
6) change or accept the default name appearing in 'Name of second list'
7) click on the downward facing arrow under 'Conversion process' and select
   LABEL_REQUESTS (convert list from table) – PLANTS (to a list from table) from the pop-up window
8) click 'OK'
8) click the 'Convert' button
9) click 'OK' after the process (conversion) completes
10) open S/List
11) type in the name of the second list used in step 6.
12) select plants with current_location '*grid or location code*'

plts. requiring new trunk label(s):
Follow the steps directly above, replacing label_type 'AL' with 'TM' (step 1).
 # plts. incorrectly labeled:
 # plts. requiring label adjustment:

MAPPING
#plts. requiring GPS coordinates (new and/or adjusted):
Total # plts. mapped incorrectly:

VERIFICATION(S)
#plts. formally verified as part of FC:
1)select verifications with veri_dt containing '2011' and with veri_by containing '*last name of verifier*'
plts. requiring ID verification:

General notes for HT(s) and/or arborists not covered with a green card (e.g., weed control or deadwood issues that might pertain to landscape areas):

Remaining curatorial tasks (e.g., remapping, bulk accessioning of existing trees, curatorial review, etc…) to occur after FC complete:

Key to S/List Commands:
sl – save list
gl – get list

Appendix F – Staff Managing Landscape Zones

As of March 25, 2011, the following individuals in the Horticulture Department were managing landscape zones (see pg. 32, Appendix G):

REGION 1

1.1, 1.2, Matt Connelly

1.3, Wes Kalloch

1.4, Sue Pfeiffer

1.5 – 1.9, Kit Ganshaw

1.10, Kevin Block

1.11, Wes Kalloch

1.12, Matt Connelly

1.13, 1.14, Sue Pfeiffer

1.15, Matt Connelly

1.16, Sue Pfeiffer

1.17, Apprentice

1.18, Dana Greenhouse Staff

1.19, Sue Pfeiffer & Matt Connelly

REGION 2

2.1, 2.2, Kevin Block

2.3, 2.4, Scott Grimshaw

2.5, 2.6, Kevin Block

2.7 – 2.9, Wes Kalloch

2.10, Sue Pfeiffer

2.11, Matt Connelly

2.12, 2.13, Scott Grimshaw

2.14, Sue Pfeiffer

REGION 3

3.1 – 3.2, Jen Kettell

3.3, Apprentice

3.4, Jen Kettell

3.5, Wes Kalloch

3.6 – 3.8, Jen Kettell

3.9, Brendan McCarthy

3.10, Jen Kettell

3.11, Sue Pfeiffer

REGION 4

4.1, Matt Connelly

4.2, Apprentice

4.3, 4.4, Mark Walkama

4.5, Kevin Block

4.6, Mark Walkama

4.7, Kevin Block

4.8, 4.9, Mark Walkama

4.10, Apprentice

4.11, Matt Connelly

4.12, 4.13, Mark Walkama

4.14, Matt Connelly

REGION 5

5.1, Brendan McCarthy

5.2 - 5.4, Apprentice
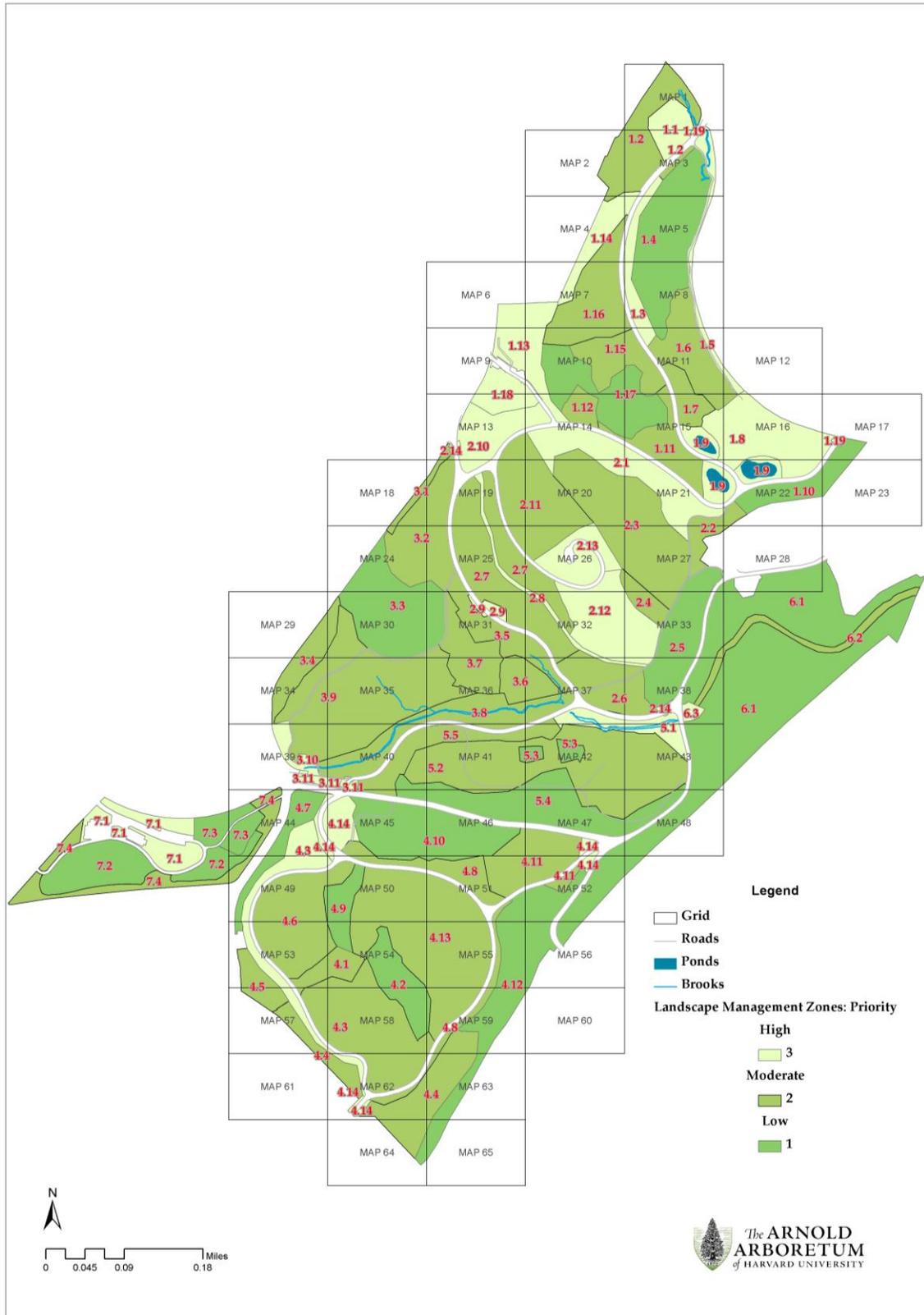
5.5, Brendan McCarthy

REGION 6

6.1, 6.2 Dennis Harris

6.3, Sue Pfeiffer

REGION 7

7.1 – 7.4, Brendan McCarthy

Appendix G – Landscape Management Zones

Appendix H – Staff Nextel Telephone and Direct Connect Numbers

Staff telephone numbers have been removed from the web and/or public version of this manual.

Appendix I – Label Standards and Source Guide

As a general rule, plants in the collection are labeled with two brown anodized aluminum records labels. Gold records labels replace brown labels on specimens highlighted in self-guided tours. In some cases, one records label is attached to a screw mounted opposite sightlines derived from primary paths, roadways, viewsheds.

Trunk labels are mounted on trees with DBH greater than 15 cm using 3" stainless steel screws. Plants with ornamental bark are typically not labeled in this manner to avoid scarring. Grove plantings and accessions with multiple qualifiers are labeled at the discretion of the Curation department.

Trees

Records labels are placed opposite one another on trees with low hanging branches. Accessibility is critical and every effort is made to hang the labels in conspicuous locations on stems that bear secondary branching.

Trees (> 15 cm DBH) without low-hanging branches are labeled by inserting a 3" stainless steel screw (square head) at an appropriate height (approximately 12") above soil line.

A records label is attached to a loop stake and placed next to trees < 15 cm DBH.

In rare cases, records labels may hang from trunk label mounts (screws [preferred] or nails), however every precaution should be taken to avoid owl-eyeing (discoloration of bark due to label spinning due to

loosely wrapped wire). Aluminum loop stakes can also be used to present records labels on young trees that do not have secondary branches.

A typical records label hung by the preferred wire twisting method (the 'curatorial twist').

Shrubs

Two records labels are hung on each shrub. One records label is attached to the base of the plant or affixed to a loop stake while the other is hung in a conspicuous location, roughly at waist height. In the Bradley Rosaceous Collection, one label is always hung at or near cardinal point north (N).

Vines

Vines growing on trellis structures in the Leventritt Garden are labeled in a specific manner. Narrow pillars are labeled with two anodized aluminum labels at horizontal bar 5 and 25. Wide

panels are labeled with two anodized aluminum labels hung on horizontal bar 1 and 12. In both cases, labels hang on the same side of the trellis, however, vine growth may dictate placement. Vines without supplemental support are labeled by twisting wire around a main stem. Ideally, an aluminum loop stake holding one anodized aluminum label should be placed at the base of the plant.

Herbaceous Plants

One anodized aluminum records label is twisted onto an aluminum loop stake and inserted near the base of herbaceous plants.
Stakes are sunk deeply (> 10") into the soil to reduce frost heaving and ensure relative permanence.

Special Considerations

Center for Plant Conservation collections are labeled following the standards noted above. However, red plastic tags with the accession number and letter qualifier written in pencil or pen are also maintained.

Dedication labels are maintained on plants and vary in material type. Historic dedication labels are maintained until such time their condition requires replacement. All "memorialized" plants are labeled with two records labels embossed with accession information (see pg. 9, Figure 1, *How to read a plant label*) and an additional label containing dedication text.

Historic labels (e.g., zinc, aluminum, wood) are left in the landscape at the discretion of curatorial staff.

Yellow temporary labels are hung for various research reasons and are also used in the inventory field check process (see pg. 8, Section 2.2.4. *Step 4 – Conduct Field Work, Vet - Label text, placement, and condition*).

A records label attached to a 3" stainless steel screw.

Record labels are embossed in-house using a Datacard 295 machine (www.datacard.com) purchased from Higgins (www.higgins3.com).

Records labels are purchased from:

- ➢ Higgins

  777 Broadway
  South Portland, ME 04106
  phone: (800) 486-1312
  www.higgins3.com

- ➢ Arnold Arboretum standard
  - ▪ Damon Tags-Brown Aluminum Anodize, #TAG31A50BR6215, 3¼" x 2"
  - ▪ $375.00 per box (1000 labels/box); $0.37 each label or $0.74/plant

Records labels are fitted with rubber grommets in high wind areas to reduce wire wear and label fatigue.

Grommets are supplied by:

- ➢ Western Rubber & Supply, Inc.

  7888 Marathon Drive, Suite F
  Livermore, CA 94550
  phone: (925) 960-8700
  email: sales@westernrubber.com
  www.westernrubber.com

- ➢ Arnold Arboretum standard
  - ▪ 0 .080" ID GROMMETT 60 SBR, $0.15 ea.

Records labels are attached to plants using wire supplied by:

- ➢ Forest Hills Electric Supply Inc.

  3607 Washington Street
  Boston, MA 02130
  phone: (617) 983-9920
  primary contact: Edward (Ed) Katz, Proprietor, edcalling@aol.com

- ➢ Arnold Arboretum standard
  - ▪ 22 gauge (0.64 mm or .025" thickness) copper wire with plastic coating

Aluminum loop stakes are purchased from:

➢ Paragon Spring Company

 4435-45 W. Rice Street
 Chicago Illinois 60651
 phone: (773) 489-6300
 fax: (733) 489-6356
 primary contact: Amy Whittle, President, awhittle@paragonspring.com
 www.paragonspring.com

➢ Arnold Arboretum standard
  ▪ 0.187 or 3/16" diameter aluminum stake; 16" in length with looped and flattened
    end, $1.80 ea.
     • OD (outside diameter) of loop 1.410"
     • ID (inside diameter) of hole at the end of the loop, 0.065", which
       accommodates 22 gauge (0.64 mm or .025" thickness) copper wire with
       plastic coating

Trunk & stake label production is outsourced to:

➢ Nameplate & Panel Technology

 387 Gundersen Drive
 Carol Stream, IL 60188
 phone: (630) 690-9360 or (800) 833-8397
 fax: (630) 690-9365
 primary contact: Renee Melbourn, reneem@nptec.com
 www.myplantlabel.com/products.asp

➢ Arnold Arboretum standard (prices vary based on quantity ordered)
  ▪ Trunk Labels
     • 4" x 6", two hole centered (style I); mounted with Grip Rite 3" stainless steel
       screws, sq. head
  ▪ Stake Labels
     • Explorers Garden: 3" x 6", hidden mount (style III); 24" metal stake
     • Leventritt Garden and Bradley Rosaceous Collection: 2" x 4", hidden mount
       (style III); 24" metal stake

Trunk & stake label text are edited before vendor production by the Label Text Editing Committee:

Michael Dosmann, Curator of Living
  Collections
Kathryn Richardson, Curatorial Assistant
Nancy Rose, *Arnoldia* Editor

Kyle Port, Plant Records Manager
Julie Warsowe, Manager of Visitor
  Education

A Typical Trunk Label

A Typical Stake Label

Appendix J - Plant Care Request Form, Pest Monitoring Card, and Workflow

PLANT CARE REQUEST FORM   *PEST MONITORING CARD*

Arnold Arboretum Plant Care Request Form

Requested by:_____ Date: _____

Botanical name: _____

Accession #: _____ Map location: _____

Problem and maintenance proposed: _____

_____

Standing dead: Yes No   **Region_____   Zone_____**

Action(s) proposed: Remap Label Verify Remove Reprop.

Relocate from _____ to _____

Maintenance completed by: _____ Date: _____

Stump Treatment (circle one): Pulled Ground To be ground
Treated w/ herbicide (describe):_____

Curatorial Review:

Field check by: _____ Date: _____

Herbarium checked by: _____ Date: _____

Action(s) to be taken: Remap Label Collect voucher Remove

Reprop.   Relocate from _____ to _____

Signature for removal:_____

Mapping/labeling by: _____ Date: _____
Voucher collected by: _____ Date: _____
Propagation completed by: _____ Date: _____
BG-BASE entry completed by: _____ Date: _____

Pest Monitoring Card

Reported by: _____ Date:_____

Botanical Name: _____

Accession #(s): _____ _____

_____ _____ _____

Map location: _____

Pest or Disease (if known): _____ ____

Circle damage: chewed discolored distorted dieback or

Other evidence (describe): _____

Comments: _____

_____

Plant Health Review:

Field check by:_____ Date:_____

Field Check: Excellent Good Fair Poor Comments:_____

_____

Plant Diagnostic sample taken: Yes No
Date sent: _____ Date received: _____

Results of sample: _____

Recommendations for control: _____

_____ Date:_____

Control completed by:_____ Date:_____

BG-BASE entry completed by:_____ Date:_____ _____

Card and Form Workflow

Report and/or Propose	**Revise and/or Approve**	**Action**	**Data Entry**	**Review, Archive and/or Resubmit**
•Staff •Volunteers	•Curator •Mgr. Hort. •Mgr. Plant Records	•Hort. Mgrs. •Staff	•Staff •Curation •Greenhouse •Horticulture	•Curatoial Asst. •Review and/or enter •File • Return to Hort. Mgrs. as needed

Appendix K - BG-BASE PLANTS Table, Field Checks and Observations Section: Field Options

Definitions copied from BG-BASE v6.8, general help.

A. **Reproductive Status** – When flowering and/or fruiting are observed, this field is required; document observations.

Please note a "blank" or "no value" in this field does not indicate bisexual flowers. Enter the current reproductive status as follows:

- ➢ Flowering
  - ▪ I - immature or emerging inflorescences, cones, or sporangia; buds
  - ▪ F - "flowering" (flowers or cones opening for release or reception of pollen, or sporangia dehiscing)
  - ▪ O - old flowers or cones persistent
- ➢ Fruiting
  - ▪ D - fruits or seeds developing but immature ("unripe")
  - ▪ R - fruits or cones bearing mature seeds ("ripe")
- ➢ Juvenile / vegetative / sterile
  - ▪ J - juvenile (has not yet reached reproductive maturity)
  - ▪ V - vegetative or sterile

> **Reproductive Status codes can be combined. See help screens in BG-BASE.**

B. **Vegetative Status** – This field is required in the spring and fall months or when abnormal leaf drop is observed.

Enter the current vegetative status as follows:

- ➢ Leaf emergence:
  - ▪ LB leaves beginning to emerge
  - ▪ L25 ca 25% (1/4) of the leaves have emerged
  - ▪ L33 ca 33% (1/3) of the leaves have emerged
  - ▪ L50 ca 50% (1/2) of the leaves have emerged
  - ▪ L66 ca 66% (2/3) of the leaves have emerged
  - ▪ L75 ca 75% (3/4) of the leaves have emerged
  - ▪ LA   all leaves have fully emerged
- ➢ Autumn color (the RHS mini color chart should be consulted, see curatorial staff)
- ➢ Leaf drop
  - ▪ CB   beginning of autumn color
  - ▪ C25   ca 25% (1/4) of the leaves have autumn color
  - ▪ C33   ca 33% (1/3) of the leaves have autumn color

- C50   ca 50% (1/2) of the leaves have autumn color
- C66   ca 66% (2/3) of the leaves have autumn color.
- C75   ca 75% (3/4) of the leaves have autumn color
- CA   all leaves have autumn color
- DB   leaves are beginning to drop
- D25   ca 25% (1/4) of the leaves have dropped
- D33   ca 33% (1/3) of the leaves have dropped
- D50   ca 50% (1/2) of the leaves have dropped
- D66   ca 66% (2/3) of the leaves have dropped
- D75   ca 75% (3/4) of the leaves have dropped
- DA   all leaves have dropped

C. Sex – This field is required when sex is known yet unrecorded or observations are made to confirm sexual identity.

Note a "blank" or "no value" in this field does not indicate bisexual flowers. Enter Sex as follows:

- Dioecious taxa:
  - F - female individual(s)
  - M - male individual(s)
  - B - both female and male individuals
- Monoecious taxa:
  - O - monoecious taxa (both male and female flowers on an individual)
- Taxa with hermaphroditic flowers:
  - H - hermaphroditic (bisexual) flowers
- Unknown:
  - Q - sex unknown

Appendix L - How to Enter and Process Label Requests Saved in BG-BASE v6.8

Enter Label Requests using the following LABEL_REQUESTS entry window as a guide; press F9 or click on the 'save record' icon in the toolbar to save the request record.

Process Label Requests by retrieving label requests saved in the LABEL_REQUESTS table.

Please check the duplicate label drawers before proceeding! If duplicate labels are found, retrieve the appropriate LABEL_REQUESTS record(s) and change the request_status from 'P' (pending) to 'C' (complete) using the 'Change (batch process)' tool outlined in step K below.

A. Open BG-BASE and click on the S/List shortcut (lower right hand corner of program window)
B. Type the following commands in the S/List sentence box (command line) provided
    1) Select label_requests with label_type 'AL' and with request_status 'P'
        i. Press <enter>
    2) Select label_requests with num_needed '1'   *selects records with num_needed (qty.) = 1*
        i. Press <enter>
    3) sl label_requests_1_21AUG2009   *saves records selected in step 2 as a list*
        i. Press <enter>   *follow the naming convention provided*

OR

    1) Select label_requests with label_type 'AL' and with request_status 'P'
        i. Press <enter>
    2) Select label_requests with num_needed '2'   *selects records with num_needed (qty.) = 2*

i. Press <enter>
3)   sl label_requests_2_21AUG2009   *saves records selected in step 2 as a list*
            i. Press<enter>   *follow the naming convention provided*

        NOTE: THE NUM_NEEDED FIELD MAY CONTAIN VALUES > '2'. TYPE
        THE FOLLOWING IN S/LIST TO CONFIRM:

1)   Select label_requests with num_needed > '2'
            i.   Press <enter>
2)   List label_requests by num_needed num_needed
            i.   Press <enter>
            ii.   Follow protocol step B… change the num_needed value accordingly.

Convert LABEL_REQUESTS to PLANTS
    C. Choose Tools → Administrator → Convert list
   D. Modify fields using the screen shot below as a guide:

    E. Click Convert

Open or get converted list(s) and create a text file

    F.   Click on the S/List shortcut (lower right hand corner of program window)

    G.   Type the following commands in the S/List sentence box (command line) provided

        1) gl PLANTS_LABELS_1_21AUG2009   *retrieves list*

            i. Press \<enter>

        2) List plants label_datacard_aah id-supp hdr-supp tab H:\EXAMPLE.txt (replace EXAMPLE.txt with yourname.txt or listnameofyourchoice.txt   *sends a text file to a specified directory*

            i. Press \<enter>

    H.   Close S/List and exit BG-BASE

Edit text file and emboss anodized aluminum labels
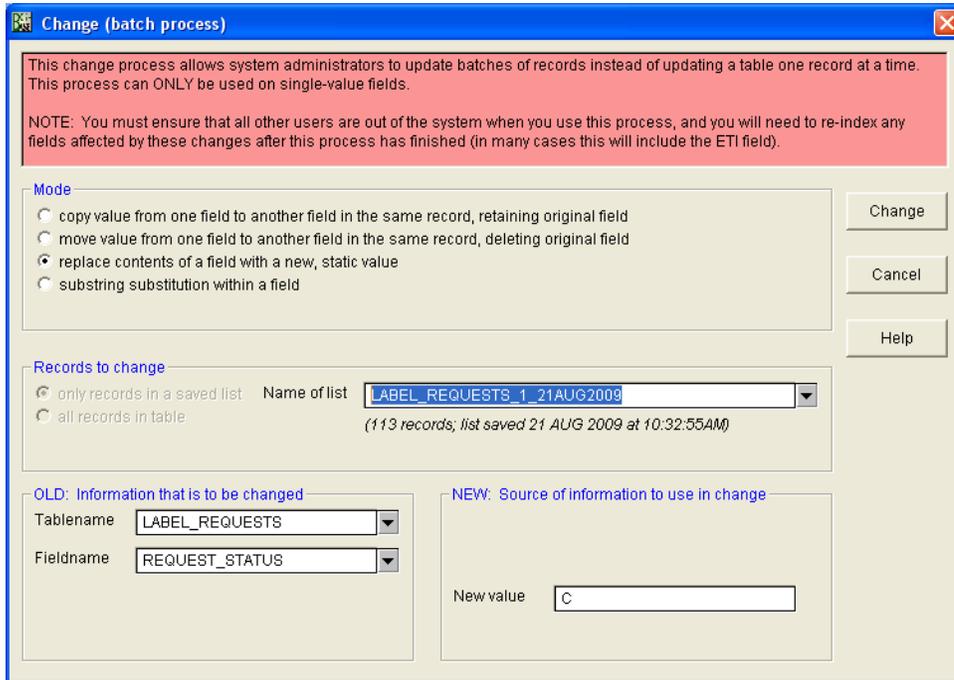
    I.   Open and edit text file saved in step G above using Microsoft Office Word 2007

        1) Convert file if prompted to do so

        2) Set margins to zero (click Margins under Page Layout tab)

        3) Edit text to the following standards (see Microsoft Word screen shot below)

            o No more than 11 lines between the beginning (\<) and end (>) of the text

            o Text lines must be less than 2.8" except for the 5th and 6th lines which must be less than 2.6"

            o Propagule type, provenance, and source data must be indented three spaces
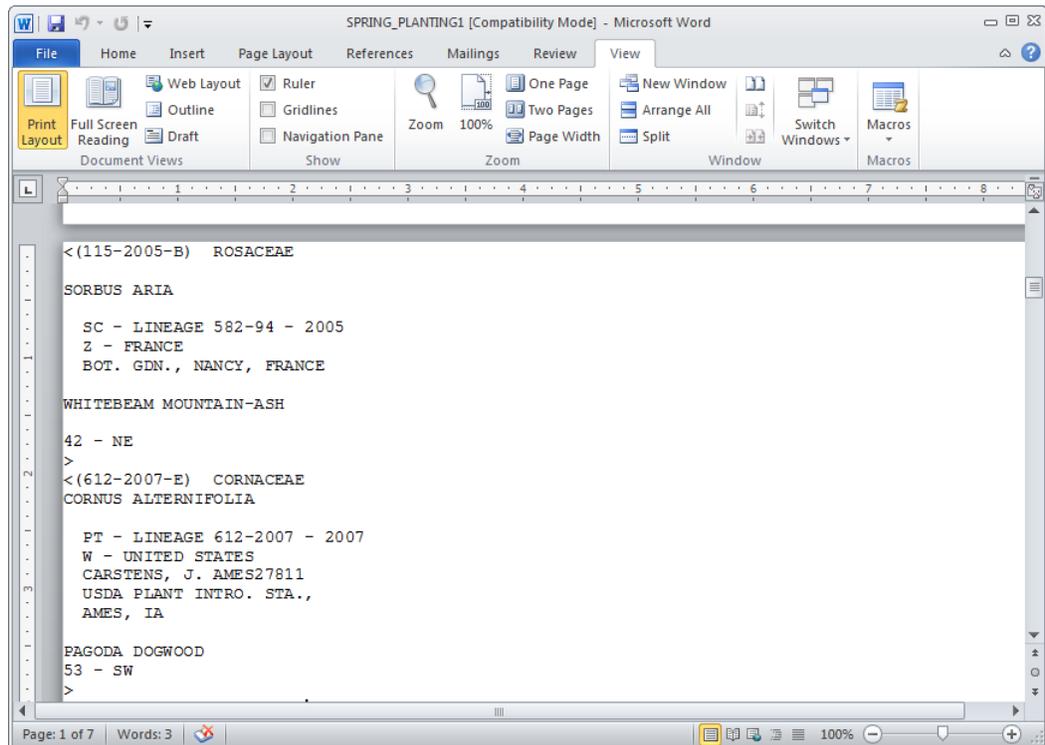
J. Emboss (print) anodized aluminum labels using DataCard® 295 hardware
   1) Click file > print
       o Select Datacard 295 printer (default)

Change LABEL_REQUESTS with request_staus 'P' (pending) to request_status 'C' (completed)
K. Choose Tools → Administrator → Change (batch process)
L. Modify radio button options and fields using the screen shot on the next page as a guide.

Change (batch process)

This change process allows system administrators to update batches of records instead of updating a table one record at a time. This process can ONLY be used on single-value fields.

NOTE: You must ensure that all other users are out of the system when you use this process, and you will need to re-index any fields affected by these changes after this process has finished (in many cases this will include the ETI field).

Mode
- ○ copy value from one field to another field in the same record, retaining original field
- ○ move value from one field to another field in the same record, deleting original field
- ● replace contents of a field with a new, static value
- ○ substring substitution within a field

Change   Cancel   Help

Records to change
- ● only records in a saved list   Name of list   LABEL_REQUESTS_1_21AUG2009
- ○ all records in table
   (113 records; list saved 21 AUG 2009 at 10:32:55AM)

OLD: Information that is to be changed
Tablename   LABEL_REQUESTS
Fieldname   REQUEST_STATUS

NEW: Source of information to use in change
New value   C

M. Click the Change button
   Note: This will change records saved the requests_status from 'P' (pending) to 'C' (completed). Run this batch process for ALL lists saved in step B.

Key to S/List Commands:

gl = get list
sl = save list
label_datacard_aah = Arnold Arboretum label format
id-supp = suppress key field
hdr-supp = suppress header
tab = creates a tab delimited file

Appendix M – How to Print an Inventory List using BG-BASE v6.8

1) Login to BG-BASE
2) Click Query > Inventory from the program menu
3) Use the form (below) to generate a location-based plant list (an inventory).
    a. Type the grid(s) and/or garden location(s) in the 'Location code(s)' field.
        i. Use a space between disparate locations.
    b. Click the 'Add' button; location(s) will be 'added' to the 'location(s) code(s) to be searched' box.
    c. If multiple locations are added, an option to 'Separate Lists' or 'Combine Lists' will appear; select a radio button.
    d. Select a 'Sorting order' radio button.
        i. 'by grid then alphabetically' is preferred
    e. 'Restrict' the list and 'Output' using the radio buttons provided; typically the default selections are adequate.
    f. Further define the records selection using the 'Search criteria' radio buttons and check boxes.
    g. Click the 'Continue' button.
4) Preview and print the resulting list (inventory).

Appendix N – Arnold Arboretum Medical Emergency Procedure, rev. 4/2011

A. CALL 911
- ➢ **Ask to be connected to the Boston Police Department, Area E.**
- ➢ **Describe the situation to the dispatcher**.
- ➢ **Provide dispatcher with a call back number, if asked.**
  - ✓ During normal business hours, 9:00 – 4:00, use front desk: (617) 384-5209
  - ✓ During off business hours give your own cell phone # or explain that you cannot provide a call-back number if on a 2-way radio.
- ➢ **Direct emergency vehicles to enter at the gate closest to the incident:**
  - ✓ Arboretum proper- main gate at 125 Arborway
  - ✓ Peters Hill- gate on Bussey Street
  - ✓ Greenhouse- sign on fence reads "Dana Greenhouse / 1050 Centre Street"
  - ✓ South Street Tract or Bussey Brook Meadow - on South Street across from South Street gate.
  - ✓ Weld Walter Research and Administration Building or Weld Hill tract – gate at 1300 Centre Street.

B. INTERNAL NOTIFICATION:
- ➢ **Call the Visitor Center front desk**, so that they are prepared to receive a call back.
- ➢ **Call for back-up support** (use 2-way radio or ask the front desk to contact fellow staff).
  - ✓ Mgr. of Horticulture, the Working Foreman, or Mgr. of the Greenhouse
  - ✓ If no response, start talking and use "Code Red" to signify an emergency.
  - ✓ Try the next person on the list.
  - ✓ Use ALERT button if needed.
- ➢ **Meet the emergency vehicle** at the designated gate and escort them to the scene.
- ➢ **Complete incident report** form and submit it to the front desk.

> **Injured employees or injured members of the public should only be transported by qualified emergency personnel (i.e., EMT, ambulance, police). Employees are not required to administer CPR.**

- ❖ **RECOGNIZE WHEN TO CALL 911 - Emergencies are rare.**
  - ➢ **Anaphylactic shock**
    - ✓ Signs: difficulty breathing, overall itching, dizziness, faintness, swelling. Person may have an Epipen but might need assistance administering it.
      - • Ask: Are you having an allergic reaction? Are you allergic to bee stings?
  - ➢ **Asthma attack**
    - ✓ Signs: straining to breathe, difficulty walking or talking, use of inhaler does not relieve symptoms
      - • Ask: Do you have an inhaler?
  - ➢ **Falls, sprains, punctures, dog bites, ingestion of plant material** (make sure a sample is brought with the patient to the emergency room)

- ➢ **Heart attack, stroke, cardiac arrest**
  - ✓ Signs: chest discomfort, shortness of breath, nausea/vomiting, numbness, confusion, dizziness, severe headache, loss of consciousness. Note: An AED (Automated External Defibrillator) is available in the Hunnewell Visitor Center.
- ➢ **Insulin shock**
  - ✓ Signs: fast breathing, dizziness, change in level of consciousness, sweating, headache
    - Ask: Are you diabetic? Have you eaten today? Have you taken your medication today?