NMNH Botany
Mass Digitization Production Project
Physical Workflow Design Document

Introduction

This document covers the processes that occur for specimen movement and handling before and after imaging. Please refer to the Imaging Workflow Design Document for the specific steps involved with digitization. For data processes before and after imaging, please refer to the Virtual Workflow Design Document or the CIS Interoperable Workflow.

The document specifically describes the physical workflow for movement and handling for the digitization of the National Museum of Natural History’s botanical specimen sheets. The design process is divided into five parts:

1. Item Inventory and Sub-collections
2. Storage and Digitization floorplans (power & network drops)
3. Sub-collection Item Handling Guidelines, Movement Plans and Object Placement Guidelines
4. Equipment & Supplies
5. Project Related Staff (Handling Staff and Admin)

1. Item Inventory and Sub-collections

The materials that shall be digitized are relatively homogeneous in nature. The following list enumerates a number of representative sub-collections.

Approximately 875,000 flat, reflected light specimens from NMNH’s Botany collection to include but not limited to:

- Onagraceae - 28,000 specimens
- Pteridophytes (Ferns) - 254,000 specimens
- Asteraceae - 350,000 - 400,000 specimens approximately
- Fabaceae - 270,000 – 310,000 specimens approximately

2. Storage and Digitization Floorplans (including power & network drops)

Storage

The National Museum of Natural History’s US Herbarium is stored in cabinets in the West Wing’s 4th and 5th Floors.

- Specimen sheets are compiled in taxonomic groups to which they belong and placed into a large lightweight folder that is labelled and barcoded on the bottom edge.
- Groups of species folders are then placed together into larger, heavier folders by genus.
- The genus folders are then sorted by taxonomic family according to the standard system selected for use by the herbarium and placed into pigeonholes in herbarium cabinets.

Figure 1: Collection Location Maps w/proposed movement routes
Digitization Floorplan

The space allocated for digitization courtesy the Department of Botany is in room NHB W531 (measuring 29' x 35'). The space is available for use in digitization production from 8:00AM until 5:00PM, Monday through Friday. The space will also be accessible outside the hours of 8:00AM and 5:00PM for non-production work such as setup, maintenance, calibration, etc. This space is designated as room W531 and the West Wing 5th Floor Herbarium.

Figure 2: NHB W531 Floorplan showing conveyor
Power & Network

120V, 50Hz electrical Power is supplied and outlets are located in the pillar near the north-east corner of the room. Telephone & network/internet access also located behind door on the south wall.

Network connectivity will be provided by Smithsonian OCIO to include high speed network access via 50 micron MM Fiber as well as support to configure contractor storage servers as network accessible drives. Every effort will be made to provide additional network connectivity where possible within the IT security regulations of the Smithsonian and Federal government. For more detailed information on the data paths see: The Virtual Workflow Design Document.
3. Sub-collection Item Handling Guidelines, Movement Plans and Object Placement Guidelines

All item handling labor shall be performed by museum approved and trained museum staff and contractor personnel which shall include retrieving items from the storage area and delivering them to the staging area, removing items from containers one at a time, performing the digitization and associated record keeping, replacing the items in the storage container after digitization has been completed and returning objects in their storage containers to their original storage area.

Handling Guidelines

General rules
1. No food or drink (including water, chewing gum and candy) may be brought into areas with collection specimens.
2. No cell phone use permitted except on breaks.
3. Secure or remove any loose items which may come into contact with the specimens (i.e. Work ID badges, jewelry, clothing/neckties/scarves). Remove rings and any dangling jewelry (i.e. bracelets, long necklaces) before handling.
4. Hands must be washed prior to handling specimens. Gloves may need to be used in certain situations. Hands may need to be washed again and gloves may need to be changed as they become soiled. Hands should always be washed after the work has been completed.
5. Work surface should be flat, clear and clean.

Handling Botanical Specimens
1. Always handle botanical specimens with both hands and hold horizontally (not vertically), plant specimen facing up. Do not touch the plant material unless absolutely necessary.
2. When travelling with single botanical specimens for any distance beyond 5 feet, always use a rigid cardboard underneath the specimen for support.
3. Botanical specimens should not be left out in the open and exposed except for purposes of digitization.
4. Botanical specimens should always be placed on countertops with no overhang; they should never be placed on the floor or unstable/uneven surfaces.
5. Botanical specimens must be returned to their original folders immediately after digitization.
6. If possible, note any specimens in need of repair or showing insect damage and bring them to the attention of herbarium staff after digitization.

Containers (folders)
1. Always handle folders with 2 hands. Do not squeeze or bend.
2. Always keep the folder horizontal. Do not tilt.
3. Folders must be kept closed and within case pigeon holds unless in process for digitization.
4. Herbarium specimens within folders should not be shuffled or leafed through like the pages of a book.
5. Loose herbarium specimens should not be returned to the folder without first removing the folder from the herbarium cabinet. (I.e., do not force a herbarium specimen into the folder while the folder is still in the cabinet.)
6. All species folders should have a taxonomic barcode located on the bottom right side. If they are missing, folders should be removed before entering the conveyor to a specified location for labelling.
Movement Plans

For the duration of the project, by 8:00AM each morning NMNH staff will remove contents of 5 botanical specimen cases and place in 6 Viking transport carts.

- Each Viking cart will hold 900-1300 botanical specimens in folders
- Each cubby within the cart must match the contents of reciprocal cubby in case.
- For each cubby worth of material that will not be digitized (oversized, fragile, etc), the corresponding cubby in the Viking cart will be filled with a placeholder (ie; a shoe box that is labeled “placeholder”) so that cubby-for-cubby matching between the cart and the permanent storage case will be maintained
- Carts will be given numbers on dry erase magnets to help with organization

The steps below describe the movement of specimens from collections storage to room NHB W531 and back again after digitization is complete. For detailed information on the steps involved with the specimen’s digitization see: The Imaging Workflow Design Document.

<table>
<thead>
<tr>
<th>Step</th>
<th>Role</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>NMNH Cnvyr Assistant</td>
<td>Using the custom Viking rolling carts, brings the folders for the day’s production from permanent storage to pre-digitization staging area in NHB W531. Storage cabinet numbers will be written onto dry erase magnets on the carts to facilitate the correct rehousing of specimens after digitization is completed. <em>See figure 1 for room schematic and proposed layout.</em></td>
</tr>
<tr>
<td>2.</td>
<td>NMNH Cnvyr Assistant</td>
<td>All filled carts will be placed along the western wall with first cart northernmost of NHB W531 in the order to be digitized with the first cart to be digitized placed on the westernmost of the line of carts.</td>
</tr>
<tr>
<td>3.</td>
<td>Cnvyr Op 1</td>
<td>Moves an empty cart to the end of the conveyor and a full one to the start to begin removing the genus folders from.</td>
</tr>
<tr>
<td>4.</td>
<td>Cnvyr Op 1</td>
<td>Lays the genus folders out in reverse order on the west counter (in order to preserve the folder order by the conveyor foreman at the end).</td>
</tr>
<tr>
<td>5.</td>
<td>Cnvyr Op 1</td>
<td>Removes folders from west counter and places them on the conveyor belt table.</td>
</tr>
<tr>
<td>6.</td>
<td>Cnvyr Op 1</td>
<td>Double checks bottom right front of folders to ensure taxonomic/IRN barcode exists.</td>
</tr>
<tr>
<td>7.</td>
<td>Cnvyr Op 1</td>
<td>Puts the taxonomic/IRN barcoded folder on the conveyor belt so barcode can be read.</td>
</tr>
<tr>
<td>8.</td>
<td>Cnvyr Op 1</td>
<td>After specimen’s folder is placed on conveyor, one specimen after another is placed on the conveyor. <em>See exceptions below for specimens that require special attention</em></td>
</tr>
<tr>
<td>9.</td>
<td>Cnvyr Op 1</td>
<td>Supporting material such as literature, photographs, illustrations and reference material (anything that is not a specimen), will be placed on the conveyor but to the left of the imaging area of the conveyor belt.</td>
</tr>
<tr>
<td>10.</td>
<td>Cnvyr Op 2</td>
<td>Checks barcodes of specimens and applies a barcode if one isn’t present. Barcode placement in the low middle of specimen sheet is ideal or to the right or left depending on space available.</td>
</tr>
<tr>
<td>11.</td>
<td>Automatic</td>
<td>Specimen advances down the conveyor belt and is photographed.</td>
</tr>
</tbody>
</table>
12. **Cnvyr Foreman**
   Collects genus folder(s), specimens, and ephemera at the end of the conveyor and reconstitutes them into the original order from when they were first taken out of the cubby.

13. **Cnvyr Team**
   During imaging, staff will know to reintegrate specimen folders into the correct cubbies on a matching empty cart by way of colored tokens. A yellow token placed on the conveyor belt indicates the end of that cubby and the Conveyor Foreman should then proceed to fill the next cubby with all the upcoming folders.

14. **Cnvyr Op 1**
   Specimens will continue to be imaged until all specimens from the folder are imaged. When the next folder arrives, it is placed on the conveyor as per step 5 and process continues from there.

15. **Cnvyr Team**
   Once the cart is filled with folders, staff will use dry-erase magnets on the carts to indicate to the NMNH conveyor assistants that a cart has been “checked off” and finished with digitization.

16. **NMNH Cnvyr Assistant**
   Once the custom Viking rolling carts are filled up at the end of the day or at regular intervals, it is moved to permanent storage where the folders are unloaded into their shelves in correct order.

17. **NMNH Cnvyr Assistant**
   Magnetic labels will be placed on herbarium cabinets that have been digitized as complete.

*Exceptions: Conveyor operating vendor staff will flag problematic specimens for NMNH contractors to review after the imaging process.

The flags used and their definitions are as follows:

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pink</td>
<td>Damaged Specimen/ Floating Labels/ Anything Else</td>
</tr>
<tr>
<td>Yellow</td>
<td>Missing Barcode on Genus Folder</td>
</tr>
<tr>
<td>Orange</td>
<td>Barcode Issue</td>
</tr>
</tbody>
</table>

**Object Placement Guidelines**

After specimen’s folder is placed on opposite edge of conveyor, one specimen after another is placed on the conveyor on 1 black background rectangle, positioned as straight as possible and oriented on the guidelines of the conveyor-belt.
4. Equipment & Supplies

1. (6) Custom Herbarium Viking Carts
   Viking Metal Cabinet Co – 24047 W. Lockport St., Plainfield, IL 60544

2. Boxes of Nitrile Gloves – Medium & Large to be provided by contractor
3. Custom Printed Magnets for “Rapid Capture Prepped” & “Digitization Complete” on herbarium cabinets
4. Blank dry erase magnets for Viking cabinets

5. Barcodes: For Specimen sheets provided by vendor.
   Supplier: Autajon
5. Project Related Staff (Handling Staff and Admin)

The persons named below are considered Key Personnel and the positions (“Key Personnel Positions”) are considered essential to the successful completion of this project.

<table>
<thead>
<tr>
<th>Role:</th>
<th>Name &amp; Organization Affiliation:</th>
<th>Contact Info:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conveyor Assistant 1</td>
<td>NMNH Contractor</td>
<td></td>
</tr>
<tr>
<td>Conveyor Assistant 2</td>
<td>NMNH Contractor</td>
<td></td>
</tr>
<tr>
<td>Conveyor Foreman</td>
<td>Vendor contractor</td>
<td></td>
</tr>
<tr>
<td>Conveyor Operator 1</td>
<td>Vendor contractor</td>
<td></td>
</tr>
<tr>
<td>Conveyor Operator 2</td>
<td>Vendor contractor</td>
<td></td>
</tr>
<tr>
<td>Backup Conveyor Operator</td>
<td>Vendor contractor</td>
<td></td>
</tr>
<tr>
<td>Project Director - Vendor</td>
<td>Vendor contractor</td>
<td></td>
</tr>
<tr>
<td>Project Manager</td>
<td>OCIO - DPO</td>
<td></td>
</tr>
<tr>
<td>TPC - Botany IT and Digitization Manager</td>
<td>Dept. of Botany, NMNH</td>
<td></td>
</tr>
<tr>
<td>COTR – Senior Project Manager</td>
<td>OCIO - DPO</td>
<td></td>
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</tbody>
</table>