Workflows and Personnel

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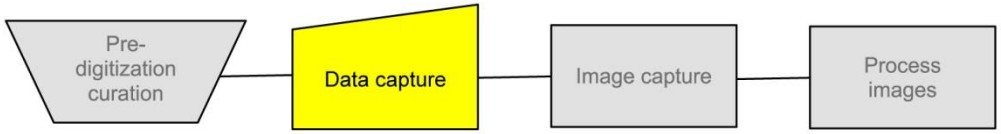


Guiding Principles

Follow a modular approach

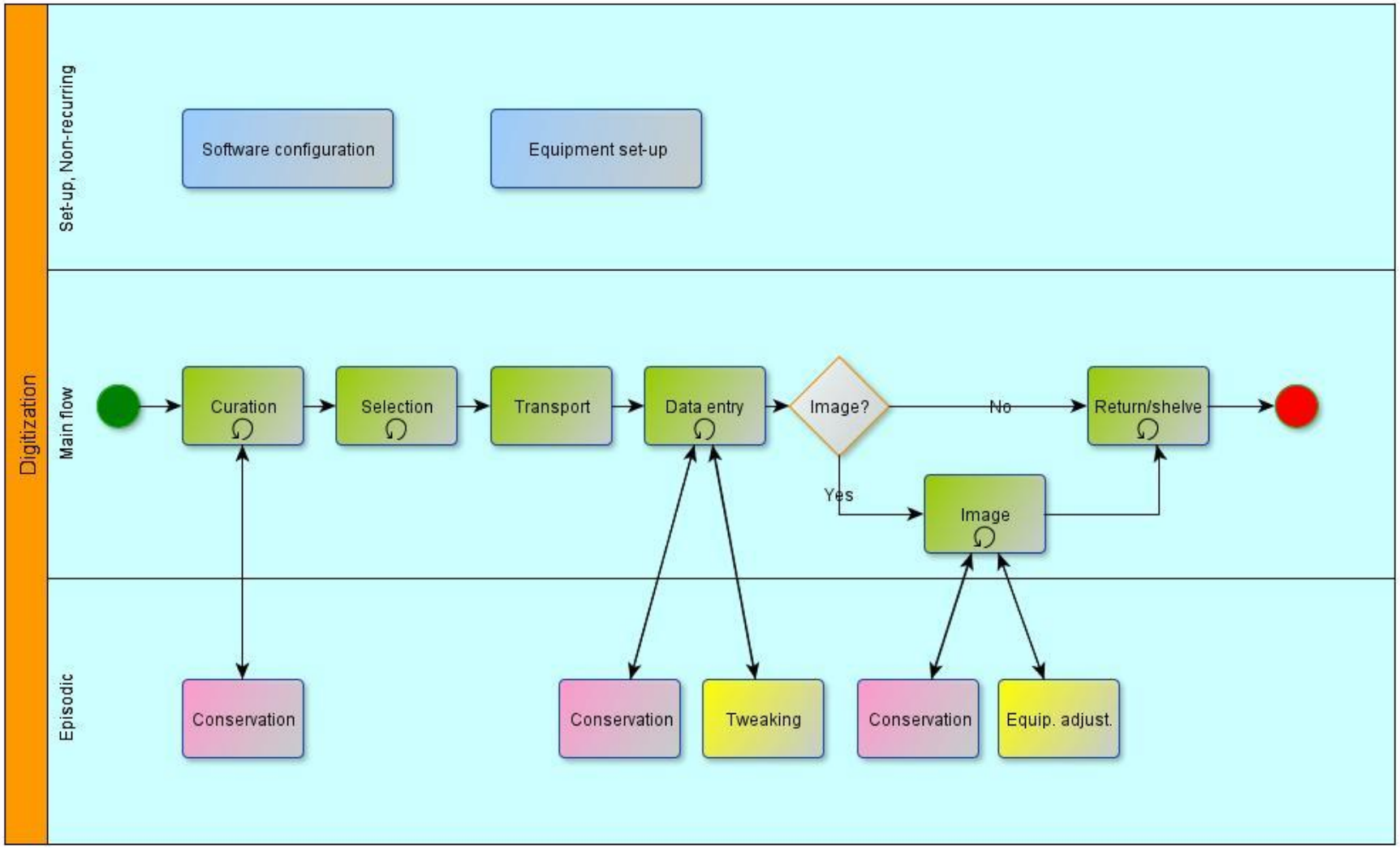
- "Plug and play" modules are preferred.
- Simple modules involving a limited number of tasks are easier to troubleshoot and maintain.
- Divide large modules into sub-modules.
- Modules are generally self-contained but tangential.
- There is no consensus workflow, virtually all workflows are customized.

Assign roles deliberately

- Adjust to strengths of each technician--using students and volunteers requires flexibility in role assigned to personnel rather personnel assigned to role.

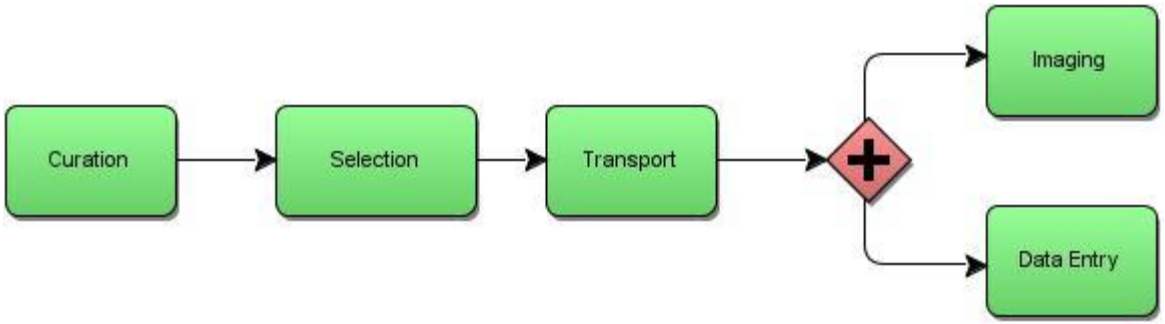
Create task lists

- Complete.
- Clear.
- Succinct.
- Ordered.
- Reusable.


Digitization
Set-up, Non-recurring
Software configuration
Equipment set-up
Main flow
Curation
Selection
Transport
Data entry
Image?
No
Return/shelve
Yes
Image
Episodic
Conservation
Conservation
Tweaking
Conservation
Equip. adjust.

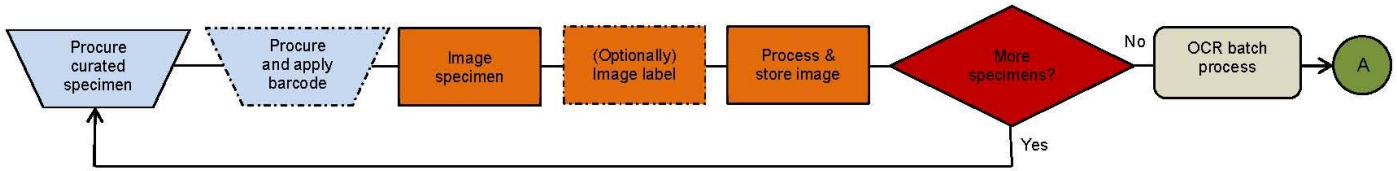
Example Processes (Modules), their Cycles and Dependencies

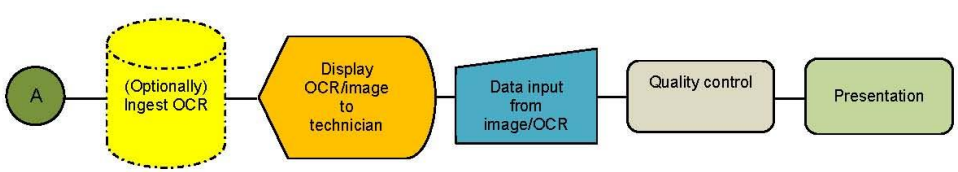
Process	Cycle	Dependency
Software configuration	Once/non-recurring	
Equipment set-up	Once/non-recurring	
Specimen curation	Recurring	
Specimen selection	Recurring	Pre-digitization curation
Specimen transport	Recurring	Specimen selection, imaging, data entry
Conservation	Episodic	Curatorial processes, imaging, data entry
Data entry	Recurring/tasks iterative	Specimen transport
Imaging	Recurring/tasks iterative	Specimen transport
Equipment adjustment	Episodic	Data entry/imaging
Software update/tweaking	Episodic	QC
Specimen return/shelving	Recurring	Imaging or data entry



O2I2D(1)—Existing Specimen Workflow Using Optical Character Recognition: Object to Image to Data

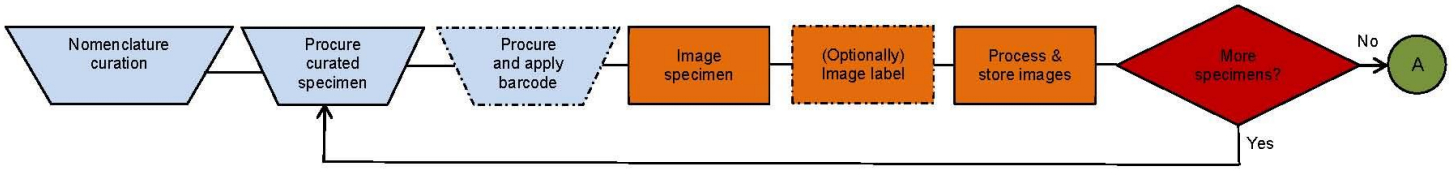
This workflow is designed to capture images of existing specimens, pass the images through optical character recognition (OCR) software, and use the combination of image and OCR output to capture data. There are variations on this workflow. For example, depending on preparation type, barcodes are sometimes applied inline as the step immediately previous to imaging (shown optionally below) and other times en masse within an independent step during which several dozen or several hundred barcodes are applied in preparation for imaging. OCR may also occur in various ways: 1) in batch (as shown below), with numerous images being processed following the close of one or more imaging sessions, 2) "on the fly" as a record and its associated image are loaded for data entry, or 3) one image at a time as a step immediately following the imaging of each specimen. OCR output may be ingested into a field in the database (shown optionally below), stored as individual text files within the computer's file system, or virtually processed at the time the image is presented to the data entry technician. The presentation of images and OCR to data entry technicians occurs in a single interface in which database fields, OCR output, and specimen image are simultaneously visible. Pre-digitization curation and annotation is particularly important in this workflow to ensure that the current nomenclature to be used in data entry is obvious and clearly visible in the image and/or OCR output.

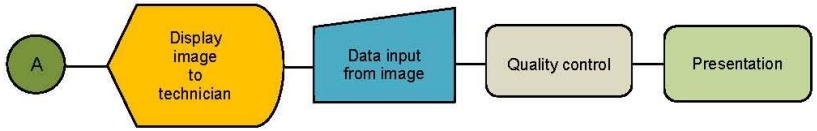




O2I2D(2)—Existing Specimen Workflow: Object to Image to Data

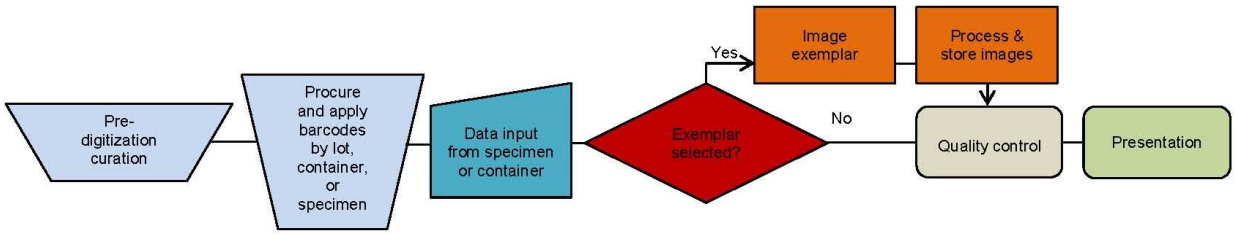
This workflow is designed for capturing images of existing specimens and using these images as the basis for data capture. Depending upon preparation type, barcodes are sometimes applied inline as the step immediately previous to imaging (shown optionally below) and other times en masse within an independent step during which several dozen or several hundred barcodes are applied in preparation for imaging. Pre-digitization curation and annotation is particularly important in this workflow to ensure that the current nomenclature to be used in data entry is obvious and clearly visible in the image.





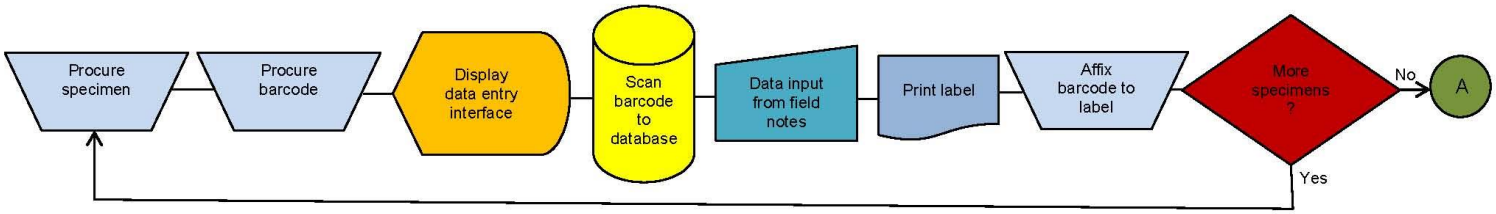
O2D2EI—Existing Specimen Workflow: Object to Data to Exemplar Images

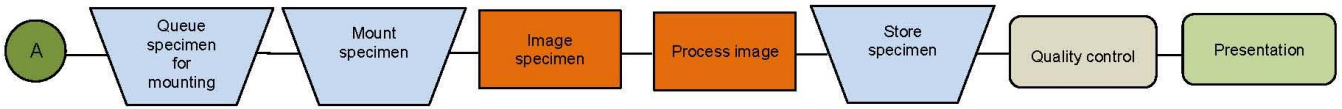
This workflow is in use for collections that capture data in specimen lots, collecting events, taxon container, or other aggregates, but capture images only for exemplar specimens. Data capture is effected from specimen labels. Depending upon preparation type, barcodes are usually applied inline—often to the containing tray or container—as the step immediately preceding data entry. Hence, barcodes may designate a single specimen or an aggregate of specimens, such as a unit tray within an insect drawer or ethanol-filled container in a wet collection. Barcode application is executed prior data entry and image capture usually follows data entry. Pre-digitization curation, including nomenclatural annotations and specimen organization, is usually important in this workflow.

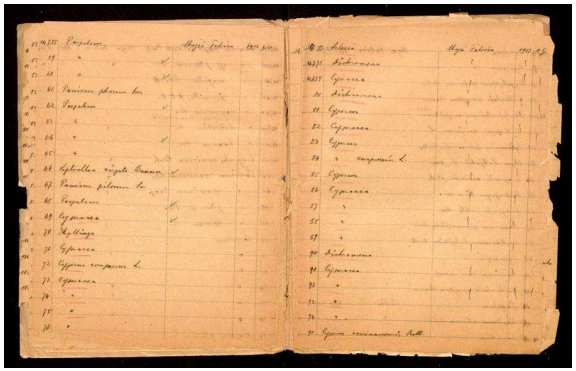


FN2D2I—New Specimen Workflow: Field notes to data to image

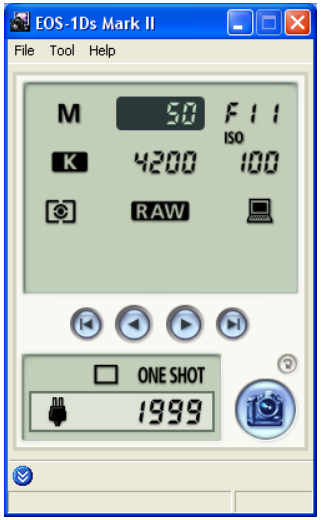
This workflow is designed for actively growing collections in which new specimens are regularly added. Collectors, especially in herbaria, typically keystroke label data from field notes, store the label with the specimen, and queue the specimen for mounting. Following mounting, the specimen is treated as an existing specimen with the data entered into the database by a technician, who re-keys the data previously keyed by the collector. The workflow proposed here eliminates the second keying of label data by capturing label data into the database as the label is prepared, allowing the label to be printed from the database immediately following data entry. The workflow assumes a database management system with functionality for printing labels, as well as a strategy that includes the application of bar codes to the newly printed label rather than to the specimen sheet.



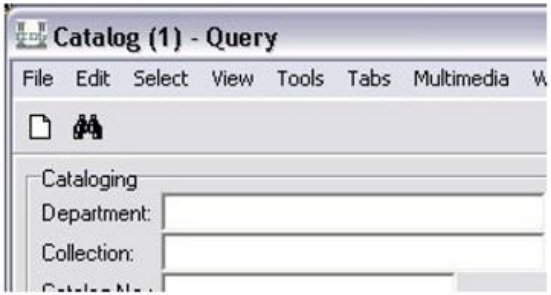




Documentation and Instructions



- **Written Protocols**
  - Essential!
  - Include screen shots and pictures.
  - Attention to detail (leave nothing to the imagination).
  - Express limits on technician authority.



- **Feedback Loops**
  - Technicians: best source of efficiency adaptations, either by show or tell.
  - Easy methods for receiving feedback.
  - Personal copies of the protocol.
  - Master copy available via Google docs or other shared storage for updates and suggestions.

Idigbio.org->Digitization->Documentation->Workflow and Protocols->Workflow Modules and Task Lists

https://www.idigbio.org/content/workflow-modules-and-task-lists

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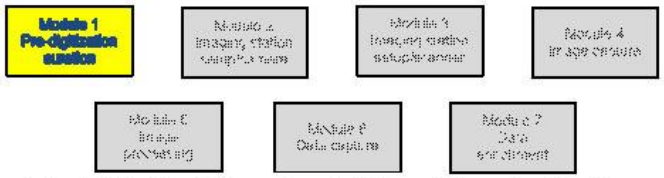


One outgrowth of the DROID (Developing Robust Object-to-Image-to-Data) workflow workshop held in May 2012 was the establishment of a series of working groups, each focused on workflow modules and tasks for various preparation types. The first of these groups, informally called the Flat Sheets and Packets Working Group, was charged with fleshing out task lists for digitizing vascular and non-vascular plant collections. A reconstitution of this working group, convened in January 2015, added 8 modules to this set of workflows and updated the existing ones.The second working group, Pinned Specimens in Trays and Drawers, invested its time developing modules to support effective entomological digitization workflows. Things in Spirits in Jars devoted time to workflows for fluid-preserved collections. The 3D Objects in Trays and boxes completed its work in spring 2015 and focused mostly on paleontological specimens.

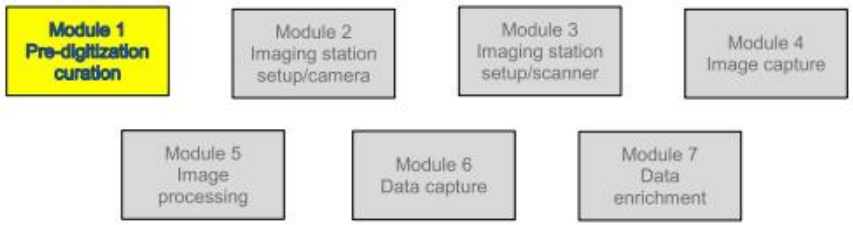
We have chosen a modular approach for presenting our results in order to accommodate the broad range of workflow implementations within the collections community. We recognize that there is no consensus workflow that fits all situations, even within a single preservation type. In light of this, we have attempted to assemble orderly, comprehensive task lists to serve as foundations from which institutionally specific workflows can be created. Not all institutions will use every task, but we hope that the lists we have developed encompass all relevant digitization tasks. We also hope that those in the collections digitization community will provide feedback on these lists, either through forum posts or e-mails to Gil Nelson, alerting us to deficiencies and oversights.

Links to published modules as they are completed are provided below:

Flat Sheets and Packets Working Group - Vascular and Non-vascular Plants

- Module 1 Pre-digitization Curation Tasks
- Module 2 Selecting Components for an Imaging Station
- Module 3 Imaging Station Setup Camera/Copy Stand
- Module 4 Imaging Station Setup Light box
- Module 5 Image Station Setup Scanner
- Module 6 Imaging

Workflow Detail: Pre-digitization Curation (for flat sheets and packets)



Module 1: Pre-digitization Curation Task List

Task ID	Task Description	Explanations and Comments	Resources
T1	Apply storage locator barcodes to storage locations (rooms, cabinets, shelves, folders, drawers, etc).	Most useful when systematically digitizing an entire collection. Otherwise potentially helpful with herbarium inventory. May be less helpful for collections that are digitizing in random order or only portions of the collection related to specific projects, or with significant separation between the pre-digitization curation, databasing, and image capture modules.	Barcodes, QRcode, DataMatrix.
T2	Select specimens to digitize.	For herbaria, this often includes all specimens. Where this is not the case, selection should follow the institution's pre-determined digitization policies or project management plan.	Digitization policy manual or project management plan.
T3	Associate/insert machine readable barcodes/documents with/into folders.	Some institutions create machine readable documents to gather data at the cabinet and/or folder level. Documents might contain such information as family, higher geography, and current identification ("filed-as name"). These data will be read and associated with individual collection records in Module 4, T1 or Module 7. Tasks T2 or T3 might also include determining whether specimens are out on loan or	QRcodes, DataMatrix, 1D barcode, or OCR-readable documents for insertion into specimen folders.

http://www.bioone.org/toc/apps/3/9

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Digitization Workflows for Flat Sheets and Packets of Plants, Algae, and Fungi
Gil Nelson, Patrick Sweeney, Lisa E. Wallace, Richard K. Rabeler, Dorothy Allard, Herrick Brown, J. Richard Carter, Michael W. Denslow, Elizabeth R. Ellwood, Charlotte C. Germain-Aubrey, Ed Gilbert, Emily Gillespie, Leslie R. Goertzen, Ben Legler, D. Blaine Marchant, Travis D. Marsico, Ashley B. Morris, Zack Murrell, Mare Nazaire, Chris Neefus, Shanna Oberreiter, Deborah Paul, Brad R. Ruhfel, Thomas Sasek, Joey Shaw, Pamela S. Soltis, Kimberly Watson, Andrea Weeks and Austin R. Mast
1500065
Abstract
Abstract & References : Full Text : PDF (778 KB) : Supplementary Materials

APPLICATION ARTICLE

Bioinformatic Identification and Expression Analysis of *Nelumbo nucifera* MicroRNA and Their Targets
Lei Pan, Xiaolei Wang, Jing Jin, Xiaolu Yu and Jihong Hu
1500046
Abstract
Abstract & References : Full Text : PDF (1342 KB) : Supplementary Materials

PRIMER NOTES

Development of 23 Novel Polymorphic EST-SSR Markers for the Endangered Relict Conifer *Metasequoia glyptostroboides*
Yuqing Jin, Quanxin Bi, Wenbin Guan and Jian-Feng Mao
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Abstract
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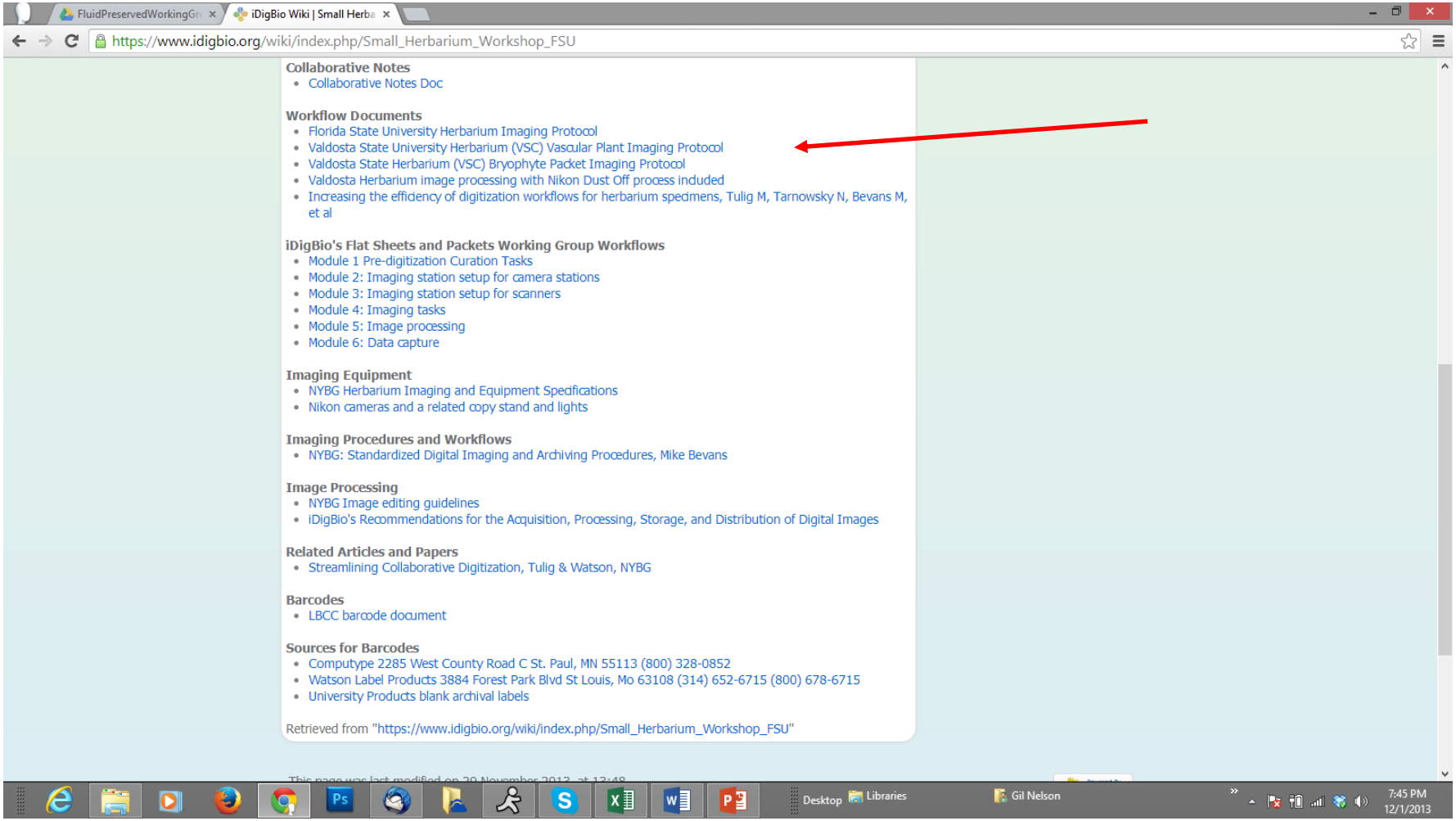
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Collaborative Notes
Collaborative Notes Doc
Workflow Documents
Florida State University Herbarium Imaging Protocol
Valdosta State University Herbarium (VSC) Vascular Plant Imaging Protocol
Valdosta State Herbarium (VSC) Bryophyte Packet Imaging Protocol
Valdosta Herbarium image processing with Nikon Dust Off process induded
Increasing the effidency of digitization workflows for herbarium specimens, Tulig M, Tarnowsky N, Bevans M, et al
iDigBio's Flat Sheets and Packets Working Group Workflows
Module 1 Pre-digitization Curation Tasks
Module 2: Imaging station setup for camera stations
Module 3: Imaging station setup for scanners
Module 4: Imaging tasks
Module 5: Image processing
Module 6: Data capture
Imaging Equipment
NYBG Herbarium Imaging and Equipment Specfications
Nikon cameras and a related copy stand and lights
Imaging Procedures and Workflows
NYBG: Standardized Digital Imaging and Archiving Procedures, Mike Bevans
Image Processing
NYBG Image editing guidelines
iDigBio's Recommendations for the Acquisition, Processing, Storage, and Distribution of Digital Images
Related Articles and Papers
Streamlining Collaborative Digitization, Tulig & Watson, NYBG
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Continuous Workflow Improvement

Develop written workflows that reflect actual practice

Continuous evaluation of written and actual workflows by:

- Technicians
- Workflow managers
- Collections managers

With particular attention to:

- Bottlenecks
- Redundancy
- Handling time
- Varying rates of productivity

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