Module 4: Image Capture Task List

Task ID	Task Description	Explanations and Comments	Resource(s)
T1	Capture information from folders of specimens*.	Do this task if workflow includes capturing cabinet- and folder-level data as part of pre-digitization curation (see Pre-Digitization Curation Module). The information captured here is folder- or cabinet-level data to be associated with specimen-level records (see T5, this module). Information may be machine readable information (from 1D barcodes, DataMatrix codes, or QR codes), or keystroke information (see T2 in Pre-digitization curation module). *For purposes of this module, we assume the ICBN definition of specimen: “A gathering, or part of a gathering, of a single species or infraspecific taxon made at one time, disregarding admixtures, mounted either as a single preparation or as more than one preparation with the parts clearly labelled as being part of the same specimen”.	QR code, Data Matrix code, or barcode scanner. Machine readable folder labels or slips. See: iDigBio’s specimen barcode survey for list of scanners: https://www.idigbio.org/wiki/index.php/Specimen_Barcode_and_Labeling_Survey_Results#What_make_and_model_of_barcode_reader_do_you_use.3F. ICBN Glossary definition of “specimen”: http://www.iapt-taxon.org/nomen/main.php?page=glo. “Utility of QR codes in biological collections”: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3819127/.
T2	Check for specimens in need of repair or filed incorrectly.	Establish and follow protocol for repairing and rerouting specimens in the digitization process.	
T3	Remove specimen from folder.	Specimens have been previously moved to the imaging station as part of Pre-digitization curation.	

		As specimens are removed, ensure maintenance of original folder order and specimen order within folders via reverse stacking or some other institutionally specified method. Handle folders and specimens carefully. Do not turn folders or sheets upside-down. That is, follow standard best practices for handling specimens.	
T4	Stamp to indicate the specimen has been imaged.	Desirable for indication of divergence of original image/record from subsequent alteration of physical specimen (e.g., future annotations, insect damage). Implementation of this task varies among institutions. If included, there are several strategies by which it can be accomplished. Strategy if re-imaging is planned (such as after future annotations): ● Ink-stamping the actual sheet with "IMAGED." ● Writing in pencil the imaged date "YYYY-MM-DD" immediately below this stamp (the date can be erased and changed before re-imaging). ● Alternately, some institutions write the date in permanent ink each time an image is recorded to ensure a record of imaging episodes for each specimen. Strategy if re-imaging is not planned: ● Ink-stamping the actual sheet with "IMAGED YYYY-MM-DD" using a date-roller-type stamp. Strategy if permanent indication of imaged date on actual sheet is not desired:	Stamp.

		● Pre-printing a small slip of paper to fit onto the border of the imaging field for the scanner or camera (near color standard or scale bar) with "This image generated YYYY-MM-DD". Some institutions also include notation of imaging technique and resolution, e.g. "This specimen imaged YYYY-MM-DD by a scanner at 600 PPI." Some institutions choose to stamp individual specimens while others stamp the folder, meaning its entire content, as imaged. Some institutions wait to stamp until after the actual specimen image has been captured.	
T5	Apply a specimen* barcode to each sheet, if not already applied.	For some institutions, this task may have been completed previously, either as a step in pre-digitization curation (Pre-digitization curation module, T11), or as a separate barcode application workflow. Possible locations for barcode placement: ● Placed near the label, if images will be cropped to label and barcode ● Along bottom edge of sheet to easily locate a specimen in a folder without removing folder from cabinet. ● Adjacent to accession number for institutional association. ● In upper right corner of sheet to facilitate scanning with barcode reader. ● For sheets with more than one specimen, each with its own label, each specimen may have a	Barcodes.

		different barcode, which should be attached next to its label. ● To facilitate future OCR or other data extraction technologies, orientienting the barcode sticker vertically or horizontally relative to the sheet works best. In cases where a botanical specimen is spread across multiple separate preparations/items (e.g., specimens spanning multiple sheets, bulky items separate from sheet, etc.), there are different approaches. The approach that your institution chooses will depend partly on what barcodes represent in at your institution. For the case of one barcode per botanical specimen: ● Use one barcode for the specimen and affix to primary sheet/preparation (e.g., affix to “Sheet 1 of n”, where n is the total number of sheets). ● To physically keep track of other items that belong to a particular specimen: ○ Write the barcode number on the remaining item labels, OR ○ Keep multiple items together (e.g., in a folder or box, clipped together, etc.) ● In some databases (e.g., Specify 6.0), multiple preparations of a specimen can databased and associated with the specimen record. The above assumes that it is possible to recognize multiple preparations of a specimen (e.g., sheets marked as “Sheet 1 of n”,	

		"Sheet 2 of n",...) and does not refer to botanical duplicates of the same specimen. For the case of one barcode per preparation/item: ● Each sheet or object might be given a different barcode.	
T6	Scan barcode into database.	Perform this task if collection database and specimen record already exists but barcode number not yet captured. The barcode is often scanned into the database field that maps to dwc:catalogNumber. See Task T16**.** Creating or amending a record (after imaging) provides an alternate approach to capturing the barcode value into a database.	Barcode scanner.
T7	Create skeletal record if specimen record does not yet exist, via one of several entry techniques, e.g. keystroke entry, picklists, voice recognition.	Skeletal record must contain: ● Barcode value (at most institutions represented in database as dwc:catalogNumber). Skeletal record might also contain: ● The "filed as" name or most recent taxonomic identification. ● Location of specimen in herbarium (cabinet). ● Other folder level information (high-level geography). ● As alternative to T6, capture accession number for later association with existing database records. ● Critical data items transcribed from sheet (e.g., collector name, collector number, date collected, high-level geographic description such as state or country) entered via keyboard or voice	Barcode scanner. Microphone for voice recognition. Computer, keyboard. Database. Speech recognition software. The software used to create the skeletal record is various. Some possibilities are the authoritative institutional database, a spreadsheet, or a light-weight custom purpose application (e.g., a web-based or Java application).

		recognition software. Use controlled vocabularies and pick-lists when applicable. ● For exsiccati, capture exsiccati title and exsiccati number. Some institutions do not enter data at this juncture. However, some suggest that capturing some data (e.g., family and genus), followed immediately by creating a batch of records in sequential barcode order for subsequent data entry might improve efficiency. Furthermore, providing some skeletal data can increase the usability of the collection early in the project.	
T8	Turn on imaging lights.	Ensure that all lights are on and functioning and shadows are minimized. If using an imaging station that is not enclosed, then consider ambient light from the room and windows. Your imaging environment may require that you turn off other lights in the area (e.g., the overhead lights in the room) or close the imaging room door. Maintain consistent lighting for the duration of the project and perform routine checks of lighting source.	Lighting system.
T9	Stage specimen.	Place and align specimen in imaging frame, light box, light tent, copy stand, or scanner. Having a guide for specimen positioning ensures that specimens are photographed in a consistent orientation and are in alignment with field of view. Examples of specimen guides include alignment pins (thumbtacks pushed up through the bottom of a velveteen covered matt board), a herbarium sheet attached to the imaging platform on which the sheet	Lighting and copy stand or scanner. Imaging frame.

		to be imaged is placed, and attached metal guides in the shape of an “L”. See Imaging Station Set-up modules for additional details on specimen alignment techniques. Check for plant parts or other materials obscuring collection label or barcode, or remove plant parts that are obscuring the specimen and place them in a fragment packet, if this is in accordance with institutional policy. See T12 for information about fragment packets.	
T10	Place or ensure placement of scale bar and color standard and make certain they are clean and visible.	Images should include visible scale bar and color standard. Some institutions place them on the sheet. It is recommended to affix the scale and color standard to framing outside of the margin of the specimen but clearly visible in the imaging field of view to reduce manual manipulation steps and increase efficiency. See Imaging Station Set-up modules for additional details on types and placement of scales and color standards.	Scale. Color standard.
T11	Adjust camera settings if necessary.	Ideally camera settings (ISO, aperture, shutter speed, white balance) settings should be set once during station assembly and checked at the start of each session. Focus may be manual or auto, depending upon camera selected and institutional preference. If manual is selected, it is recommend to use gaffer tape to prevent lens creep. Autofocus ensures automatic adjustments to varying depths of field between bulky and flat specimens.	Camera. Institutional protocols regarding camera set-up and configuration.

		However, sheets lacking areas of contrast within the autofocus points may result in autofocus failure. One way around this is to place a ruler or other suitable object (e.g., institutional logo) in the center of the sheet for focus.	
T11a	Release shutter to capture image.	It is important during this task not to physically touch and potentially shake the camera. Camera control software will allow image capture using the spacebar or mouse. Otherwise, a wireless or tethered remote shutter release can be used.	Wireless, tethered, or mouse-activated shutter release.
T11b	Scan complete specimen sheet.	This alternate imaging method is for those institutions using scanner technology, often in association with Global Plants Initiative (GPI). The GPI protocol can be found in the JSTOR Plants Handbook. The steps in the scanning process are performed in place of T10–T15 and include: ● preview, ● check image, adjust if necessary, ● use selection tool to drag an area around the herbarium sheet, ● when the image is satisfactory, click AUTOFOCUS, ● scan, ● perform quality control: check for pixilation, blurriness, lines in the scan, green color in corners, and color separation along edges (See JSTOR Handbook for examples; check in-depth the first scan and selected scans at regular intervals thereafter,	See: JSTOR Plants Handbook, http://www.snsb.info/SNSBInfoOpenWiki/attach/Attachments/JSTOR-Plants-Handbook.pdf.

		• set image format (TIFF), image compression (NONE), byte order (IBM PC) • save image, • resume at T16	
T12	Image fragment packet.	Implementation of this task varies among institutions. If included, there are several methods by which it can be accomplished. One strategy includes: • open the packet and spreading the enclosure, • ensure that the expanded packet flaps do not obscure important plant material (weights can be used to hold the packet flaps down), • capture image. Another strategy includes: • open the packet, • remove the packet contents to a paper tray that is the same dimensions as the packet, • close the packet, • place the paper tray on top of the packet (with weights, if necessary), • capture the image. And another: • If there are only plant bits in a fragment pack and the majority of the specimen is on the main sheet, leave fragment pack closed and image entire sheet. • If fragment packet contains entire specimen & label is standard in bottom right corner, then open packet, place weights on flap corners and take image.	

		• If packet contains information on outside (label, additional specimen data), then take two images (one barcode as you are only dealing with one specimen) - one with the fragment pack closed so the label data/additional data is showing and then one image with the fragment pack open so the actual specimen can be seen. This approach will require that a protocol is developed for multiple image names that refer to the same specimen. Bryophyte and lichen packets may be free, or fastened in lots to herbarium sheets. Packets may be: • opened during image capture to reveal the contents or labels on the inside of the packet tab, • kept closed with only an image of the label recorded, • or some combination of both. If images are recorded of open bryophyte/lichen packets, contamination of succeeding specimens should be avoided by cleaning the substrate between images, especially when the contents have been removed from the packet.	
T13	Image the specimen label for later OCR processing.	These optional label images might result in greater OCR accuracy than images of entire sheets as well as increase rate of recognition. If barcode has been placed near the label at the bottom of the specimen sheet, it will also be included within this image.	

		Images intended for later OCR processing should have an x-height (height in pixels of the lower case “x”) not less than about 15 pixels. If imaging labels only, consider black and white or monochrome setting on your camera, as this can reduce file size. Multiple images of a specimen will entail greater image management effort and care will need to be taken to ensure that images are associated with appropriate record/specimen.	
T14	Check image quality, including focus, exposure, and presence/visibility of barcode.	This task is one of several quality control checks. Some suggest checking exposure at the start of an imaging session and every 15-20 specimens. Likewise for focus, if using manual focus.	Application that detects barcode in the image (see Resources in next task).
T15	Rename file.	Rename the image file as the specimen barcode. Some institutions utilize camera control functions that name files to barcode sequence specifications as the image is recorded, hence eliminating the need to rename files. Other institutions utilize a file renaming application (BCR, BardecodeFiler, reBar) to rename the image file to match the barcode value. This can sometimes be an iterative step through execution of a batch operation to process numerous files. Alternatives to file renaming include storing the camera-generated filename in a database record and associating that record with the specimen’s barcode. This assumes	Applications for renaming files based on barcode: NYBG approach (utilizes BardecodeFiler): https://github.com/NYBG-Herbarium NEVP approach (reBar, utilizes ZBar): https://github.com/psweeney-YU/reBar. PNW Herbaria approach: http://www.pnwherbaria.org/documentation/imaging-computer-configuration.zip

		that camera-produced names remain unique, even if new or multiple cameras are put into service.	
T16	Scan barcode into database record.	Some institutions create a database record here by scanning the barcode into the database, a step than can also precede image capture as outlined above. If task T6 has been completed, then task T16 should be skipped.	
T17	Check for damage to specimen that might have occurred during imaging.	If damage occurred, follow protocol for repairing and rerouting specimens in the digitization process. Upon rerouting, continue with T18.	
T18	Return specimen to the collection/folder and then herbarium.	Ensure maintenance of original folder order and specimen order inside folder via reverse stacking or other strategy as noted in task T3. Drop-tags are helpful for keeping track of where imaging left off. Follow standard best practices for handling herbarium specimens. Some institutions keep specimens unfiled until images and data have been subjected to final quality control procedures effected during the image processing module. This strategy is dependent upon space available, protocol, pace of operation, and quantity of images processed.	