Enabling the TCNs and Collaborators
Breakout Group #3: Specimen Imaging & Post-Processing

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Time Allotted: 150 minutes

Group Participant List: Barbara Thiers, Christopher Dietrich, Melissa Tulig, Christine Johnson, Greg Riccardi, Gil Nelson, Kevin Love, Betty Dunckel

Objectives:
Discuss and produce a report to summarize specimen imaging within the ADBC community. Focus on opportunities to leverage existing tools/systems, standards, practices and techniques. Nominate a reporter to deliver a 15-minute summary report to the plenary session at the conclusion of your session.

Deliverables:

1. Define and order at least five critical challenges faced by the TCNs related to specimen imaging and post-processing (#1 is the most critical challenge).

Rank Order	Challenges Related to Specimen Imaging and Post-Processing
1	Quality Ccontrol Issues: equipment calibration, hardware, color bars, scales, consistency; training of staff
2	Standards & Best practices: standardization (type of camera, quality of image), recommendations, would be nice to establish a **clearing house** to pool and share experiences and recommendations (esp problematic for challenging specimens - e.g., microscopic)
3	File transfer (esp. large files); institutions where important collections are housed have differing capacities (small institutions may have real problems here)
4	Basic decisions about what to image, how to prep and stage the materials for imaging
5	file management: naming, organization, Need for standards
Other	dealing with composite/aggregate images and how to separate out distinct images from larger whole (including labels)
Other	archiving / backing up / safe-guarding original image files
Other	maximize image quality and utility while keeping costs low

Other	follow guidelines established at project outset/protocols (recommendations on pixels/lenses/cameras)
Other	image presentation for on-line serving / tools to use, etc.
Other	**very small specimens - microscopic preparations (what quality, what purpose?)** **many analog images that need to be converted (metadata capture)** TIME necessary for scanning and other approaches

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2. Identify and order up to five existing practices and techniques that can be leveraged for specimen imaging and post-processing (#1 is the most preferred practice/technique). If more than five, focus on the five that are currently the most viable, commonplace, and applicable to the needs of the TCNs and collaborators, while keeping a list of all references to existing practices.

PREAMBLE: The materials that we seek to capture images of are exceedingly heterogeneous and solutions will be nature-of-specimen dependent and extremely variable

Rank Order	Specimen Imaging and Post-Processing Practices and Techniques
Others (non-prioritized list)	****Collaboration to share info/experiences regarding best practices via innovative methods: blogging, webinars, video library of methods** ****Training workshops (including take advantage of assembly venues like SPNHC)** ****Take full advantage of local experts (photographers, mathematicians, IT, computer science expertise) to MUTUAL benefit (interactions and collaborations)**

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3. Identify and order up to five existing standards that can be leveraged for specimen imaging and post-processing. If more than five, focus on the five that are currently the most viable, commonplace, and applicable to the needs of the TCNs and collaborators. Explain the choices.

PREAMBLE:

1. What are the standards? Standards will vary depending on subject being imaged and purpose of image (display vs. archive) but there should be a minimum standard (e.g. dpi) to yield images that are research-usable, also vital to store / manage original metadata

2. Balance among: Objectives to be achieved in imaging (use), cost, and quality achievable (limits to technology) **highest resolution achievable for affordable price: :**
3. Clearing house would help:
VISION: HUB COULD / SHOULD be this clearng house

Rank Order	Specimen Imaging/Processing Standards	Explanation of Selections
1	Morphbank Audobon Core is a developing standard	Take advantage of their accumulated experience / wisdom
2	Image format standards: xmp exif jpg 2000 dng MUST archive raw images	Adobe converters produce standardized raw format without losing any data/archive raw data
3	NEED to implement standards for: File naming and management	simple standards for file naming; the important part is the metadata but a clear/specific name helps.
4	www.archives.gov	archives.gov has standards already set up

4. Identify and order up to five existing tools/systems that can be leveraged for specimen imaging and post-processing (#1 is the most preferred tool/system). If more than five are proposed, focus on the five that are currently the most viable and beneficial to the greatest number of stakeholders. Explain the choices. Link tools/systems to the practices/techniques (identified in Deliverable #2) and standards (identified in Deliverable #3) that each enables or supports.

PREAMBLE: Disclipine/specimen dependent - must yield research quality images

Rank Order	Specimen Imaging and Post-Processing Tools	Explanation of Selections	Linked Practices/ Techniques (Line Numbers)	Linked Standards (Line Numbers)
Other (non-prioritized)	open zoom	Tiled image processing and display standard with many implementations		
Other (non-prioritized)	GIMP	open source “Photoshop”		
Other (non-prioritized)	computed tomography (CT for 3-D)			
Other (non-prioritized)	lightfield image	uses light / retains more information		
For specimens w/depth of field issues	LEAF system - camera, super hi rez	Global Plants Initiative project		
1 For herbarium specimens:	**e-box**	**light box system (MK direct); allows for standard imaging, standard positioning of all elements, can change out cameras Best for flat Herbarium specimens**		
1 For Invert specimens	**SAT-scan, to be replaced by more affordable option**	**used in Australia and in London (insect collections); camera mounted to a robotic arm, tilts, BEST FOR INSECTS (Invert net more affordable)**		

Other (non-prioritized)	Gigapan	robotic arm that allows panorama shots / stitch images together to yield higher quality image overall		
For herb specimens (non-prioritized)	Herbscan	lifts specimen up to scanner		
1. For specimens w/depth of field issues	**Automontage**	**stacking software (other options similar available for free).** **Best for LARGE specimens and depth of field, also very small specimens and long distance microscope lenses** **Free/open source options = Combine-Z or Image J**		

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5. Define specific gaps that exist within each of the identified tools/systems (e.g., functionality problems, scalability limitations, availability, licensing issues, cost, lack of standard usage, missing features).

Rank Order	**Specimen Imaging and Post-Processing Tools (list 1-5 from table above)**	**Gaps, Issues and Opportunities for Improvement**
1	Herbarium/plant specimens	depth = camera or other approaches/software; jarred/pickled specimens can be problematic
2	Microscopic specimens	specimens on microscope slides (very small specimens); no system for efficient capture
3		data capture from labels/need automated process
4	Training	understanding necessary tools and feasibility of workflow
5	Speed & Automation	

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6. Identify the critical implementation date for HUB appliances that would enable/enhance specimen imaging and post-processing based upon TCN project plans. Explain why this date is critical.

Critical Implementation Date (Appliance)	Explanation
7/1/2012	

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7. Produce documentation related to the development/implementation of a specimen imaging and post-processing appliance to serve the needs of the ADBC community.

Our vision = TCNs devise (a) discipline specific requirements to achieve research quality images , (b) software & hardware implementations, © protocols to be followed by other participants (this should two-way street with advice from HUB serving as clearing house / source of expert advice)

HUB "appliance-ize' all steps that follow image capture (including working to solve problems with file transfer from variously capacitated institutions)
(again, two-way street / interaction with TCN participants)

HUB automates / ensure output to relevant data banks / archivers / servers: Morphbank, GBIF, EOL, etc. (two-way street)

HUB ensures data / image archiving / back-up, etc. (two-way street)

Functional Requirements:	
Estimated computational resource requirements (computation, storage, network capacity):	
Specific items the HUB needs to deliver to enable/enhance specimen imaging and post-processing:	
Specific items the TCNs needs to deliver to enable/enhance specimen imaging and post-processing:	Discipline appropriate standards to be achieved (minimal bar for research use) Protocols Images

Provide a risk assessment related to this specimen imaging and post-processing appliance.
Likelihood of Occurrence: 1 = Highly Likely, 2 = Somewhat Likely, 3 = Not Likely
Impact of Occurrence: 1 = Significant Impact, 2 = Moderate Impact, 3 = Little/No Impact

!!!PREAMBLE: HUB must be perceived as facilitating rather than controlling!!!

Risk Name	Brief Description	Likelihood of Occurrence	Impact of Occurrence	Potential Mitigation Strategies
compliance	ppl might not understand protocols/protocols			ongoing support for contributors; make it a dynamic system Help desk Outreach
won't be adopted	people won't want to participate			steps to ensure adoption. Must be perceived as facilitating rather than controlling

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8. Other notes, comments and details not captured elsewhere.

Nature of specimens and appropriate standards
Protocols
Taxon-specific requirements
Images