Instituto Tecnológico de Costa Rica
Escuela de Diseño Industrial
Proyecto de Investigación eFlora

Informe final de proyectos de investigación y extensión
ACTIVIDAD DE FORTALECIMIENTO

eFlora 1.1 – Metodología para el desarrollo de la visualización de un herbario digital – exploración de formatos.

Documento 1. Informe técnico sobre los resultados obtenidos en la actividad de fortalecimiento

Presentado ante la Vicerrectoría de Investigación y Extensión
Dirección de Proyectos

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ENERO del 2018

Tabla de contenido

1 Información general del proyecto

1.1 Código del proyecto

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1.2 Título del proyecto

eFlora 1.1 – Metodología para el desarrollo de la visualización de un herbario digital – exploración de formatos.

1.3 Fecha de ejecución

01 de enero de 2015 al 31 de diciembre 2015

1.4 Autores

D.I. Ivonne Madrigal Gaitán, MBA. coordinadora

2. Resumen

Se determinan los elementos que serán necesario documentar en un eventual herbario digital, trabajo realizado en conjunto con los encargados técnicos del proyecto de eFlora y el encargados del herbario de la escuela de ingeniería forestal de la institución. Se investigan y analizan casos de éxito para definir los sistemas de visualización utilizados, en la mayoría de los casos los herbarios presentan fotografías de alta calidad de las muestras secas que se mantienen en custodia en el herbario para cada una de las especies, permitiendo al usuario el acceso a detalles específicos a través de acercamientos (tipo zoom in) a las respectivas fotografías.

Se realizan además pruebas de visualización utilizando métodos de toma de datos en tres dimensiones de flores y frutos, pues son los más sensibles a la degradación y por lo tanto de mayor complejidad para ser exitosamente colectadas y preservadas, sin embargo los resultados no arrojaron una mejora sustancial relevante, que justifique la inversión de los recursos requeridos para la generación de dichos datos, por lo que la metodología para la documentación del herbario digital define un protocolo de trabajo para la documentación óptima de las muestras existentes y futuras, para el acceso a la información de la mejor manera a los usuarios del herbario digital.

3. Palabras clave

Herbario digital, especies arbóreas, identificación de especímenes, preservación material biodiversidad, visualización, interacción estructuras naturales, biodiversidad.

4. Introducción

Dentro del marco del proyecto de eFlora, se determina desde sus primera etapa que la identificación de especies arbóreas uno de los requisitos determinantes para la actividad profesional del sector forestal, sobre todos para aquellos ingenieros forestales dedicados a la conservación y manejo de los bosques e igualmente importante para los profesionales en el área de la biología, el turismo y la conservación. La necesidad de contar con herramientas tecnológicas para el apoyo y soporte necesario para estas actividades, fue el norte del proyecto, habiendo desarrollado en la primera etapa una aplicación móvil para la identificación de especies arbóreas en el campo. En una segunda etapa, y justamente al ser analizado el flujo de trabajo del usuario con la aplicación, se determina que al realizar el proceso de identificación el usuario no logra una respuesta inequívoca, dada la naturaleza del material colectado y las diferentes variables involucradas en la guía de identificación brindada por la herramienta digital, entonces el siguiente paso es la consulta a un herbario, para poder realizar las comparaciones respectivas con muestras secas debidamente colectadas e identificadas. Oportunidad además óptima para llevar a la luz el Herbario de la Escuela de Ingeniería Forestal, el cual ha sido alimentado y mantenido durante décadas por profesores y estudiantes de dicha escuela. Esto permitiría que un grupo más amplio de usuarios pueda tener acceso a la información documentada fisicamente, y además que se vincule con la información generada para la aplicación móvil.

Por lo tanto, la naturaleza del problema que pretende analizarse en esta actividad de fortalecimiento, cual sería entonces la mejor forma de llevar a los usuarios esta colección, de manera que pudieran interactuar con la información para lograr una mayor efectividad tanto en la clasificación taxonómica de las especies, como en el conocimiento y estudio de las mismas.

Por lo tanto, para desarrollar la metodología de documentación de un herbario digital, una vez definidos los requerimientos técnicos como primer objetivo específicos, se generaran de manera preliminar los elementos a documentar en el herbario digital, esto a través de criterio experto de los encargados técnicos. Se investigan los sistemas de visualización de informaciones similares, y se decide realizar un análisis de referenciales de manera que se pueda determinar los patrones de diseño involucrados, los elementos de interacción, así como los mínimos comunes a considerar; se realizan pruebas de visualización y se seleccionan los formatos más adecuados para generar como cuarto y último objetivo la metodología recomendada para el herbario digital de la escuela de ingeniería forestal.

6. Marco Teórico

La digitalización del material de un herbario involucra un proceso de captura de datos e imágenes de manera que estén preparados para su consumo digital. En los últimos años se han realizado grandes progresos en la creación de material documental digital para las colecciones de los herbarios a nivel global, que además ayudan al proceso de difusión de la información, no solo por la posibilidad que diferentes instituciones académicas puedan compartir información técnica, sino que también hace posible que nuevos tipos de usuarios sean capaces de conocer, estudiar y accesar las colecciones de referencia. En este proyecto se analizaron diversos casos de éxito, a nivel externo e interno, para definir los parámetros técnicos necesarios.

De acuerdo a al definición de herbario del Royal Botanical Garden KEW, un " herbario es una colección de plantas preservadas almacenadas, catalogadas y organizadas sistemáticamente para el estudio por profesionales y aficionados de diferentes ámbitos de la vida" y debe de cumplir con parámetros normados internacionalmente que definen la forma sistemática de organizar las especies, por familias, géneros y especies que facilita los procesos de estudio y comparación.

Igualmente se deben seguir protocolos estándar en cuanto a la preservación y almacenaje y cuidado de las muestras físicas, datos, observaciones e ilustraciones que pueda contener una colección, de manera que puedan ser consultadas de acuerdo a referentes técnicos conocidos. Es labor del curador del herbario procurar que estas colecciones se preserven de la mejor manera para el largo plazo, pues se consideran que los materiales de los herbarios son un tesoro de biodiversidad que contribuye al conocimiento colectivo.

7. Metodología

7.1. elementos a documentar

Como primer paso se determinan los elementos a documentar en el Herbario, Ruperto Quesada como coordinador del proyecto eFlora junto con la ingeniera Casia Soto, determinan una lista específica, que ha sido utilizada en los procesos del proyecto eFlora1.0; la cual se corrobora con los estándares internacionales en aplicables a colecciones de herbarios de plantas vasculares, en el caso específico del herbario digital de la Escuela de Ingeniería Forestal: especies arbóreas.

1. Los especímenes - puede comprender la planta completa en caso de especies pequeñas, o en partes de ésta, como en el caso del herbario forestal-TEC que documenta especies de árboles, y debido a sus dimensiones no es factible guardar muestras completas. Deberá incluir ejemplos de las hojas y tallos, en algunos casos de la corteza y semillas, e idealmente debe incluir flores y frutos, que serán los elementos más valiosos en el momento de la identificación de la especie, sin embargo no siempre se encuentran disponibles. En algunos casos se incluyen muestras de flores o frutos conservados en líquidos inertes, pues son los elementos mas susceptibles a la degradación.

2. Otros - para el herbario forestal-TEC se tiene definido un protocolo de documentación a través de fotografías del espécimen, que enriquecen la información colectada de manera física de cada espécimen; sin embargo este protocolo está siendo implementado desde 2014, pues lo que la mayoría de muestras en las colección son anteriores a éste.

7.2. criterios de selección

A nivel mundial existen al rededor de 3000 herbarios activos indexados (Index Herbariorum, 2018) y dentro de los sistemas de visualización estudiados se seleccionaron los siguientes casos:

Herbario de París: el más extenso a nivel mundial, con aproximadamente 8 millones de especies; el más antiguo, fundado en 1793; realiza una intensa labor de documentación digital de sus colecciones.

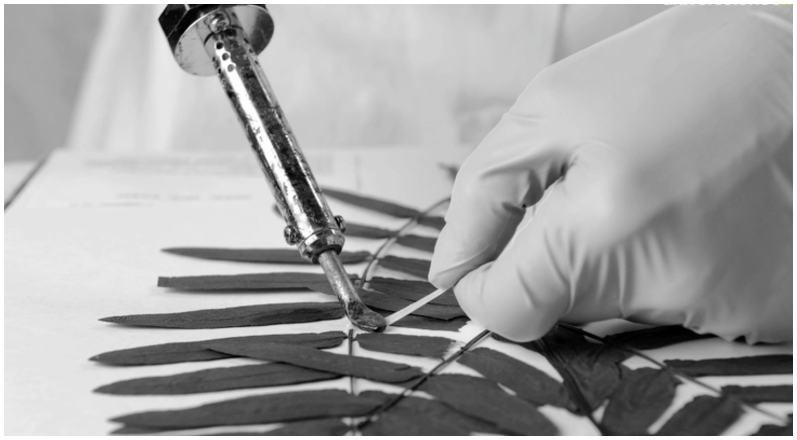
Herbario Nacional - Museo Nacional de Costa Rica: cuanta con más de 3000 registros asociados a publicación y nomenclatura de especies, además de más de 9000 registros de ejemplares históricos, con más de 100 años de haber sido colectados.

Zoosphere: repositorio internacional y web para secuencias de imágenes de alta resolución de especímenes biológicos.

Otros: videos y gráficos de la naturaleza, visualización, animación e ilustración.

7.2.1 HERBARIO DE PARIS

La colección de plantas más antigua conocida, actualmente parte del museo de historia natural - MUSÉUM NATIONAL D'HISTOIRE NATURELLE; en el año 2009 se sometió a una completa remodelación, y durante cuatro años la colección fue removida de sus estanterías tradicionales, lo que les permitió empezar un proceso de restauración meticulosa de las colecciones, una labor titánica debido a la gran cantidad de especímenes que han conservado durante siglos, aproximadamente unos 8 millones, entre sus diversas colecciones.



Cada una de las muestras fue digitalizada de manera individual, ya sea por medio de escáner plano o fotografía, para preservar la información en una base de datos que mantuviera el orden y clasificación que ya se tenía en la colección respectiva. En la fotografía se incluyó una cartilla cromática, para facilitar el ajuste e interpretación del color en los diferentes dispositivos digitales, de manera que se pueda comparar y ajustar con el fin de preservar la integridad cromática del ejemplar, que podría presentar alteraciones de tono durante los procesos de edición; además de una escala para determinar la relación de tamaño del ejemplar.


universcience.tv
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K.-L. Huynh
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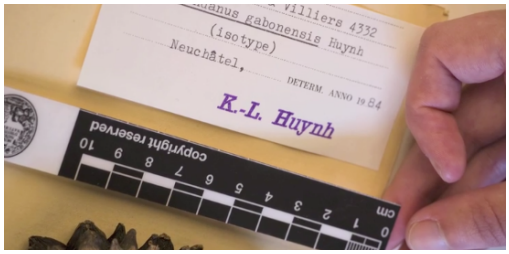
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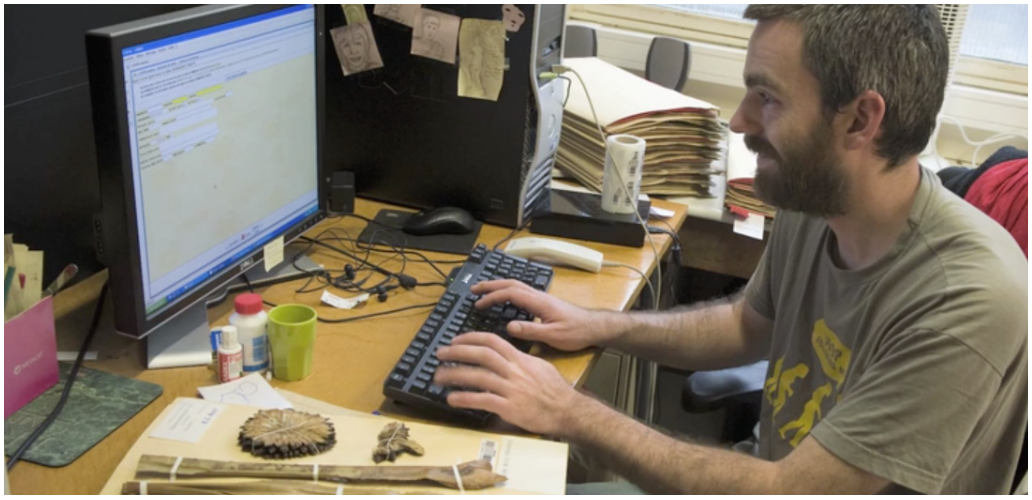


Tras un proceso de revisión, limpieza y renovación, cada una de las muestras fue documentada digitalmente. La magnitud del trabajo de documentación y digitalización requirió el diseño de un sistema estandarizado para el procesamiento de al menos 18 mil ejemplares diarios.

Este tipo de sistema, se utilizan sobre todo para colecciones especialmente extensas; incluso hoy en día aún se continua trabajando en forma diaria con la digitalización y etiquetado éstas.

7.2.2 HERBARIO NACIONAL - MUSEO NACIONAL DE COSTA RICA

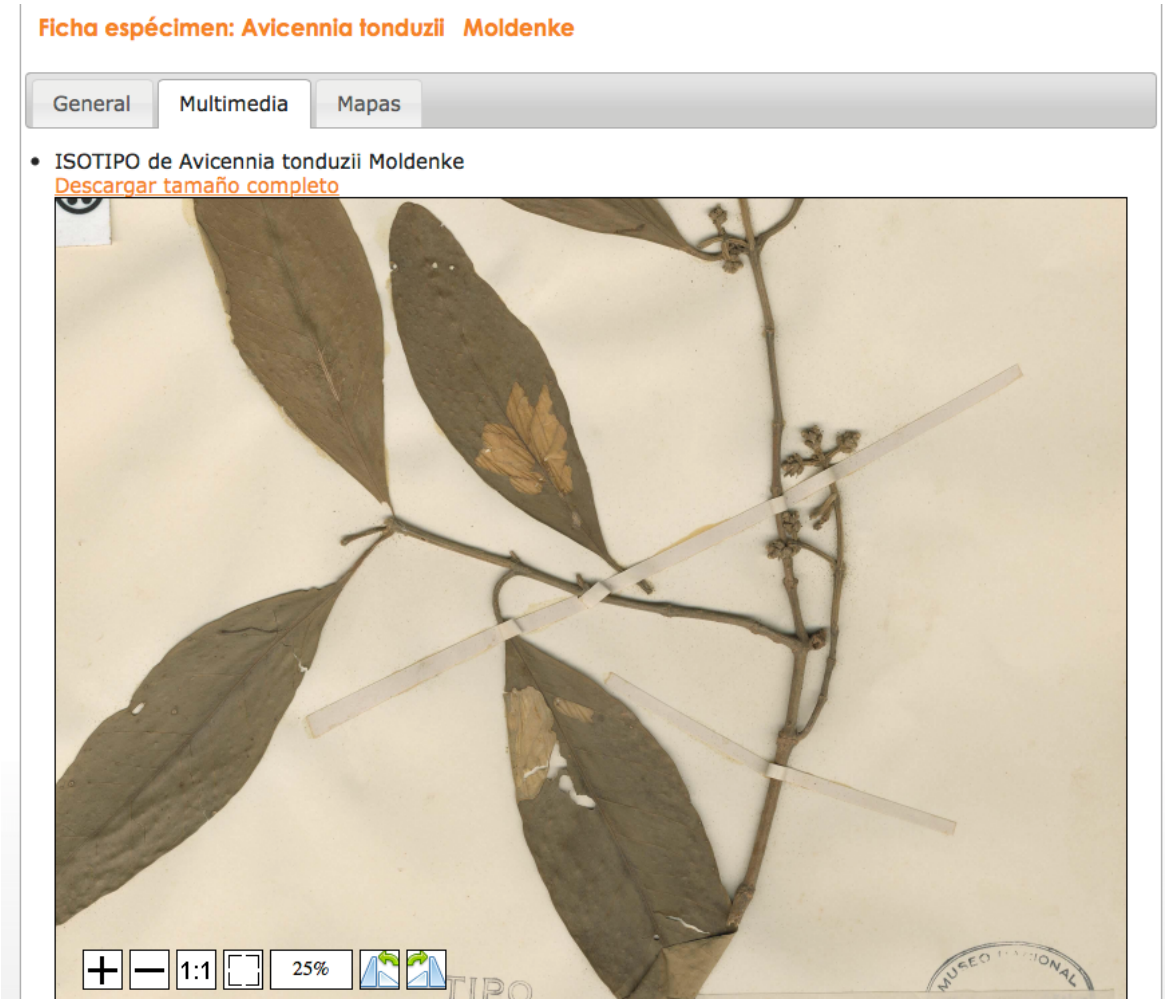
Es el herbario más reconocido y extenso del país; hace algunos años recibió como donación la colección que en su momento perteneció al InBIO, esta colección aún no ha sido incluida digitalmente en el portal ECOBIOSIS, que es el portal del Departamento de Historia Natural, del Museo Nacional de Costa Rica.

Integra de manera digital 3000 registros de ejemplares y observaciones sobre plantas, hongos, insectos, aves y mamíferos; en el caso de plantas se consignan en el sitio web 904 registros, 107 de ellos de árboles y 195 de arbolitos y arbustos.

La colección presenta un formato clásico, pudiendo realizarse búsquedas por taxonomía, geografía o colección; generando una ficha de espécimen con datos generales de su nombre, publicación, taxonomía, identificación, colección u observación, geografía.

Además de una pestaña denominada multimedia, donde se encuentra la fotografía de la muestra seca, la cual puede navegarse, acercarse y alejarse así como descargarla de manera completa.

Sin embargo por la calidad y detalle de la fotografía no es posible que más allá de un 140% de ampliación, se logre identificar los detalles requeridos para una observación más minuciosa; a pesar del software utilizado brinda la posibilidad de llegar hasta un 800% de ampliación.



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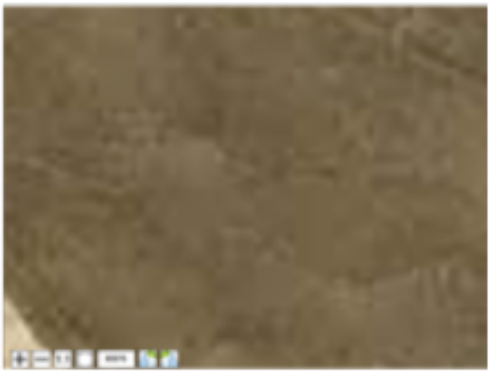


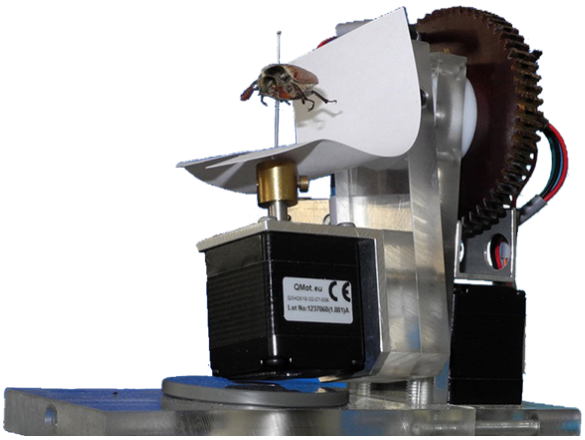
800%

descarga a tamaño completo de la muestra.

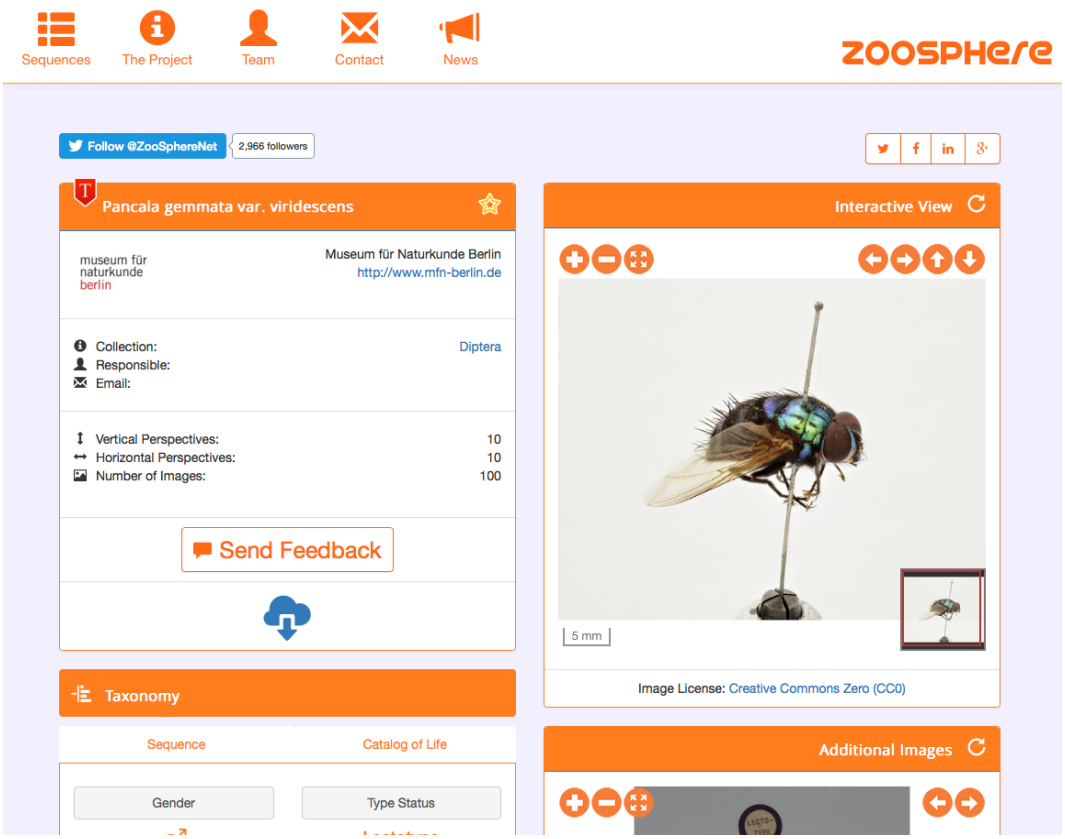
7.2.3 ZOOPHERE

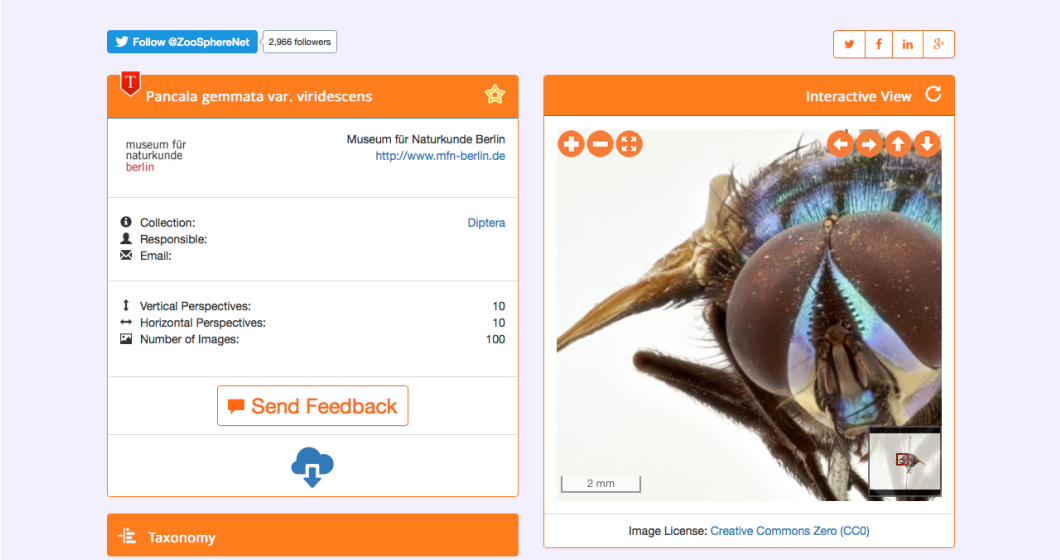
Como se indicaba anteriormente, Zoophere es un repositorio internacional y web para secuencias de imágenes de alta resolución de especímenes biológicos; una iniciativa del Museo de Historia Natural de Berlín y patrocinado por diversas organizaciones europeas.

Pretende crear una herramienta para los científicos, especialmente para los taxonomistas, para mejorar y acelerar la investigación al brindar acceso a imágenes esféricas de alta resolución de muestras biológicas, disponibles gratuitamente a través de la web; el proyecto se encuentra en una etapa temprana, sin embargo ya ofrece interesantes resultados con respecto a la captura automática de secuencias de imágenes de alta resolución de objetos de colección biológica; su objetivo es publicar el software y los componentes para el uso libre de la comunidad científica y publico en general.

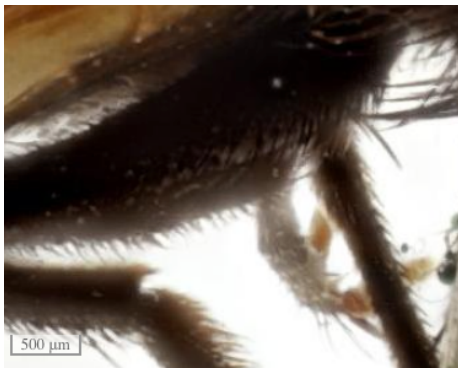


Para cada una de las muestras, se tiene una vista interactiva de alto nivel de detalle, que incluye 100 imágenes secuenciales, que generan una progresión de diez vistas verticales y horizontales, permitiendo la exploración minuciosa de la muestra.





La presencia permanente de la escala permite mantener la referencia en cuanto al tamaño, y la referencia del contexto facilidad la ubicación en el espécimen. La interacción con el conjunto de fotografías es sencilla y eficiente, y se logra un nivel de detalle óptimo hasta los 50nm.

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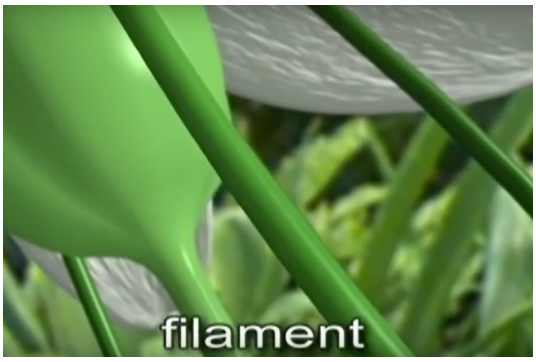
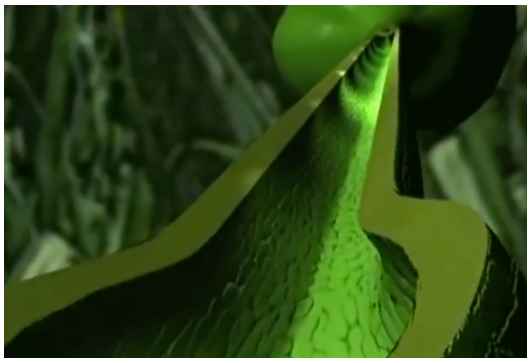
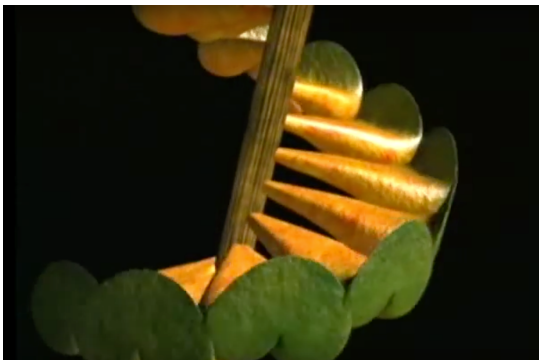
7.2.4 OTROS SISTEMAS DE VISUALIZACIÓN

Se investigaron además otros sistemas de visualización de información, entre los más interesantes fueron las propuestas de modelación y animación de partes de la planta que por su naturaleza son delicadas y difíciles de preservar, como flores y frutos. Estos a su vez dan la posibilidad de explorar partes internas y procesos fenológico propios de una especie en particular.

En el documental “The Amazing Lives of Plants” de Larry Jensen, publicado por McGraw-Hill (2008), se muestran detalles de manera puntual, para que la atención en el proceso a mostrar sea el enfoque principal.

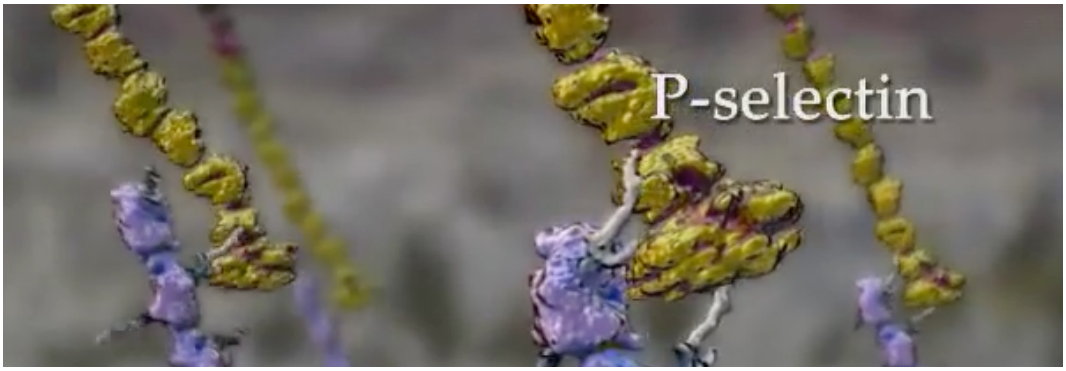






El caso del cortometraje “The Inner Life of a Cell” se muestran diferentes mecanismos biológicos que suceden en plantas y en el cuerpo humano. La animación de los gráficos en 3D fue encargada por el Departamento de Biología Molecular de la Universidad de Harvard a la empresa BioVisions, especialistas en animaciones científicas.

La animación es particularmente detallada y altamente rigurosa a nivel científico, lo que permite representar de manera virtual procesos posibles de imaginar; pero requieren mucho trabajo por parte de ilustradores científicos y animadores para un resultado óptimo.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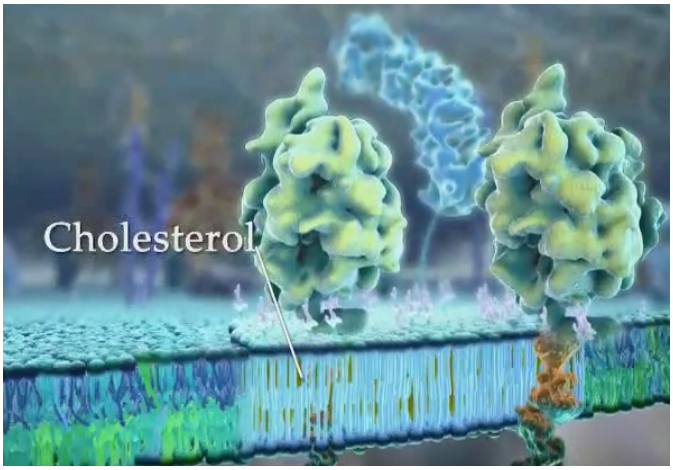
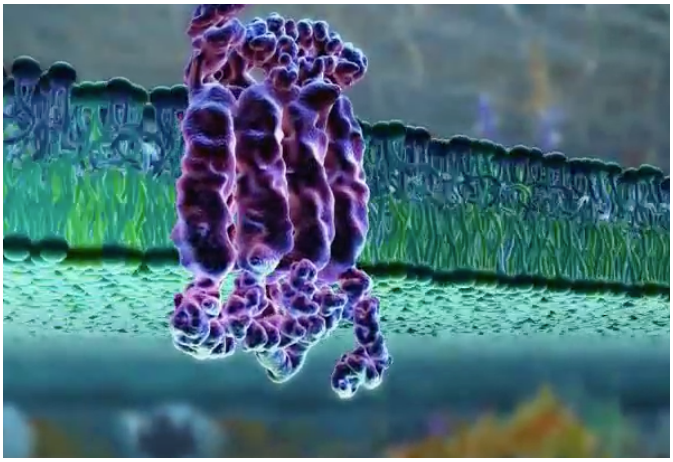

Cholesterol



7.2.5 PRUEBAS DE TOMAS EN 3D

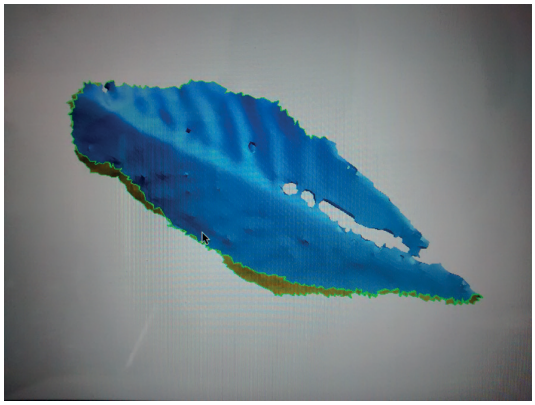
Se realizaron pruebas de tomas en 3D de muestras vegetales, de manera que se pudiera determinar el potencial de este tipo de tecnología para la documentación requerida para el herbario.

El equipo con el que cuenta la Escuela de Diseño Industrial es un escáner de mano 3Dd Sense.

Se seleccionan para la prueba una hoja de níspero ***Eriobotrya japonica,*** por su tamaño de uno 10cm a 13cm de longitud, de textura coriacea, color verde oscuro y nervaduras prominentes.

Con condiciones de luminosidad natural, luz día las pruebas arrojan resultados desalentadores. Se realizan varias pruebas con muestras de hojas similares, sin obtener resultados positivos.

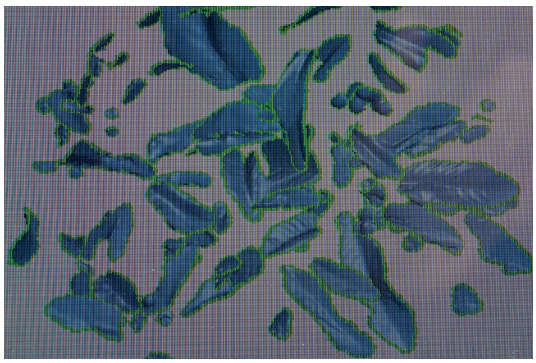
a. muestra de hoja



b. resultado del escaneo

Se realiza una prueba a un conjunto de frutos, para poder dimensionar la calidad de la toma de un sujeto con múltiples elementos.

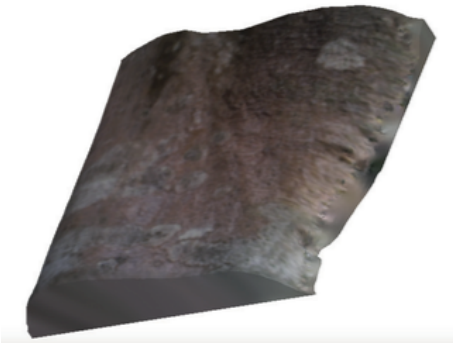
a. muestra de hoja



b. resultado del escaneo

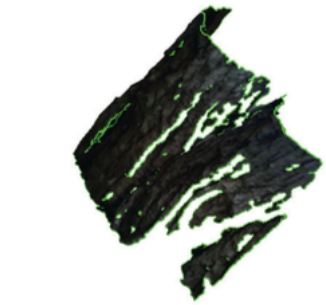
Se realizan además pruebas de cortezas externas, para determinar el desempeño del escaneo en objetos con diferentes rugosidades.

b. resultado del escaneo



a.muestra de corteza - rugosidad leve

a.muestra de corteza - rugosidad alta



b. resultado del escaneo

Las pruebas se realizaron directamente en el árbol y de manera aislada. El resultado en cada uno de los casos no fue satisfactorio con este equipo. Es casi imposible escanear objetos menores a un cubo de 30 cm de lado, por ende imposible tener una buena lectura de la mayoría de hojas, frutos y flores.

El único resultado concreto fue la muestra de corteza con rigurosidad leve, sin embargo la resolución es muy baja. El factor del viento es una variable que afecta la lectura por lo que se hicieron ajustes para minimizar su impacto durante la toma de la información.

8. Resultados

En cuanto a los resultados del análisis de referenciales, tanto en los casos detallados como casos de éxito, así como en los diferentes herbarios que fueron consultados, se genera una matriz de mínimos comunes, en donde se analizan diversas variables.

tabla1: matriz completa de mínimos comunes analizados

		nombre común	nombre científico	taxonomía	fotografía de muestras secas	otras fotografías	mapas - distribución	georeferenciación
herbarios								
1	HERBARIO DE PARIS - Museo de Historia Natural		X	X	X	X		X
2	ROYAL BOTANICAL GARDEN - KEW		X	X	X	X		X
3	C. V. Starr Virtual Herbarium NY		X	X	X	X		X
4	Herbario ASBA - Australia		X	X	X	X	X	X
5	NEW SOUTH WALES FLORA		X	X				
6	Real Jardín Botánico de Madrid		X	X	X	X		X
7	Smithsonian Tropical Research Herbarium	X	X	X	X	X		X
8	Herbario Berolinense de la Universidad Libre de Berlín		X	X	X			X
9	Herbario - Missouri Botanical Garden	X	X	X	X	X		X
10	Herbario Jaca - Aragón, España.	X	X	X			X	
11	Herbario Digital de Trinity Western University		X	X	X			
12	Herbario Virtual de Brasil		X	X	X		X	X
13	HERBARIO NACIONAL - Costa Rica	X	X	X	X		X	
14	Herbario Digital de Golfito - Costa Rica	X	X	X				
15	Herbario Virtual UDBC - Colombia	X	X	X	X			
otros								
16	CIUDAD CIENCIA	X	X			X	X	
17	iPlants		X	X		X		
18	iDigBio		X	X		X	X	
19	TÓPICOS	X	X	X		X		
20	World Flora online		X	X		X		

		nombre común	nombre científico	taxonomía
herbarios				
1	HERBARIO DE PARIS - Museo de Historia Natural		X	X
2	ROYAL BOTANICAL GARDEN - KEW		X	X
3	C. V. Starr Virtual Herbarium NY		X	X
4	Herbario ASBA - Australia		X	X
5	NEW SOUTH WALES FLORA		X	X
6	Real Jardín Botánico de Madrid		X	X
7	Smithsonian Tropical Research Herbarium	X	X	X
8	Herbario Berolinense de la		X	X

onomía	fotografía de muestras secas	otras fotografías	mapas - distribución	georeferenciación
X	X	X		X
X	X	X		X
X	X	X		X
X	X	X	X	X
X				
X	X	X		X
X	X	X		X
X	X			X

detalle de herbarios y otros investigados

		nombre común	nombre científico	taxonor
herbarios				
1	HERBARIO DE PARIS - Museo de Historia Natural		X	
2	ROYAL BOTANICAL GARDEN - KEW		X	
3	C. V. Starr Virtual Herbarium NY		X	
4	Herbario ASBA - Australia		X	
5	NEW SOUTH WALES FLORA		X	
6	Real Jardín Botánico de Madrid		X	
7	Smithsonian Tropical Research Herbarium	X	X	
8	Herbario Berolinense de la Universidad Libre de Berlín		X	
9	Herbario - Missouri Botanical Garden	X	X	
10	Herbario Jaca - Aragón, España.	X	X	
11	Herbario Digital de Trinity Western University		X	
12	Herbario Virtual de Brasil		X	
13	HERBARIO NACIONAL - Costa Rica	X	X	
14	Herbario Digital de Golfito - Costa Rica	X	X	
15	Herbario Virtual UDBC - Colombia	X	X	
otros				
16	CIUDAD CIENCIA	X	X	
17	iPlants		X	
18	iDigBio		X	
19	TÓPICOS	X	X	
20	World Flora online		X	

9.1 Datos aportados: fue importante hacer un análisis exhaustivo de diferentes herbarios a nivel local e internacional de manera que se pudiera determinar, no solo desde las especificaciones de elementos a documentar (8.1 de este documento) sino que además se realizara una búsqueda de estos referentes. Se enlistaron 20 diferentes productos digitales, en su mayoría herbarios, quince en total. Además se incluyeron cinco sitios de interés científico en el área de la documentación de especímenes botánicos para usuarios tanto científicos como publico de interesado.

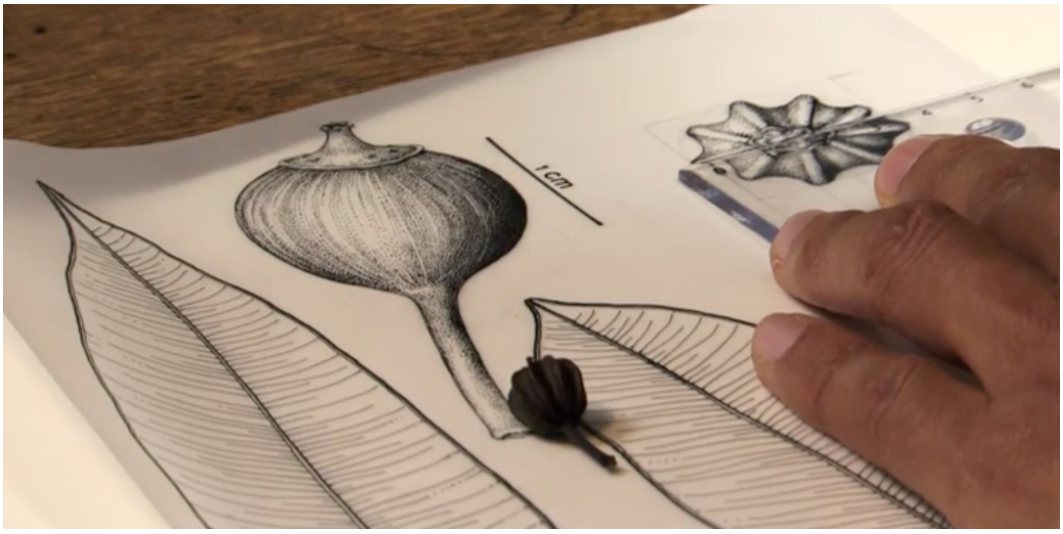
En el 100% de los casos de herbarios analizados se incluye el nombre científico; y solamente en la mitad de ellos se incluye el nombre común, esto sobre todo en los casos de portales de datos para usuarios no técnicos, y con alcance más que todo local.

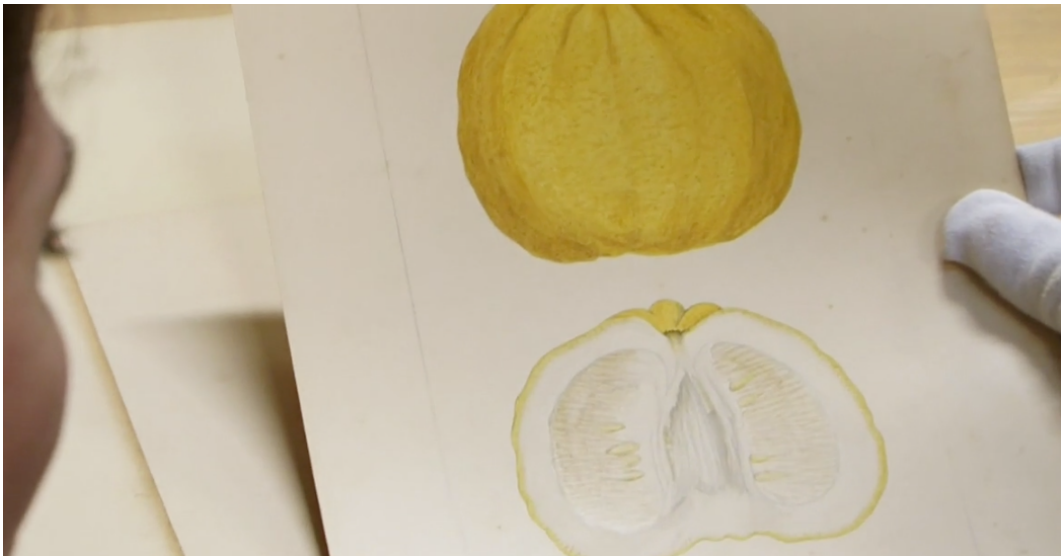
Igualmente en el 100% de los casos se incluye la taxonomía de la especie colectada; además del acceso a fotografías de las muestras secas, no en la mayoría de los casos de alta calidad en la visualización en línea, pero al menos disponible para ser consultadas.

En cuanto a otras fotografías, no es una norma en los herbarios, pero en aquellos que además cuentan con jardines botánicos o están relacionados con áreas de investigación académica, se presentan fotografías de los especímenes vivos.

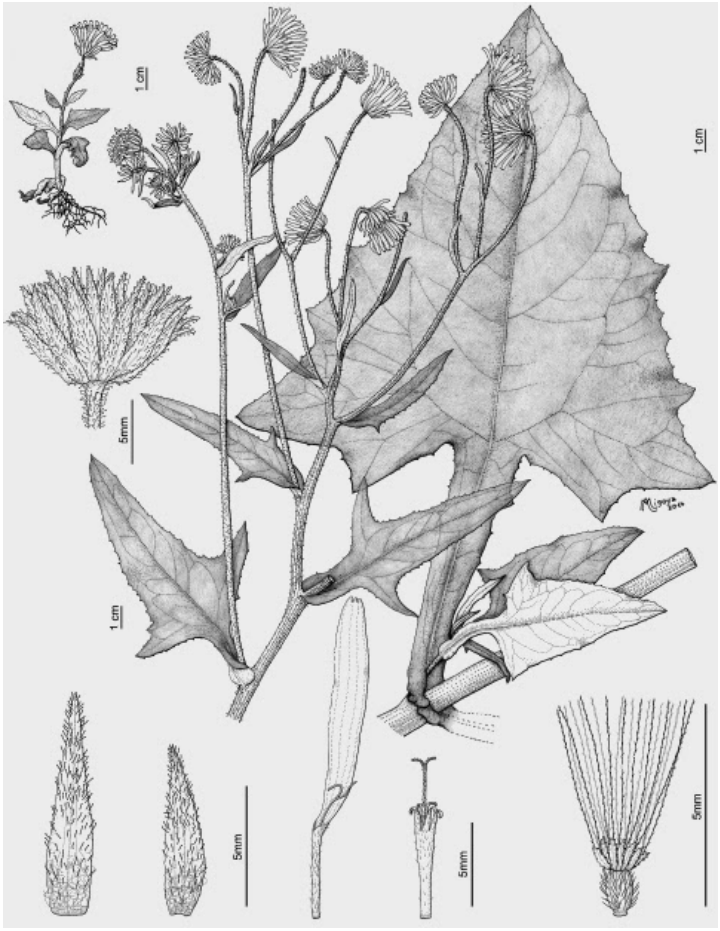
Los mapas de distribución de la especie en cuestión, no es común encontrarlo en los herbarios analizados, así como tampoco la georeferenciación de las muestras colectadas.

En ninguno de los casos estudiados se hace uso de otros recursos de documentación, como podrían ser la animación o las tomas en tres dimensiones; si se hace uno de la que la ilustración científica, como complemento a la información preservada de la especie; de manera que se puedan mostrar características insólitas de la especie a analizar.





Ocimum basilicum
Basil
Legend: a, habit; b, inflorescence; c, flower bud; d, mature flower en front view; e, mature flower in lateral view; f, leaves in top view.
Scale bars: c – d, 5 mm; e, 10 mm


1 cm
1 cm
5mm
1 cm
5mm
5mm
5mm


Salix alba

9. Discusión y conclusiones

De acuerdo a los resultados es evidente en existe una tendencia al herbario clásico, pues en ninguno de los casos estudiados se hace uso de otros recursos de documentación, que no sea la ilustración científica, como complemento a la información preservada de la especie.

Se genera por lo tanto una metodología para el procesamiento fotográfico de las muestras del herbario, siento un protocolo de trabajo para la sistematización y eficiencia del trabajo de documentación. Ya que el herbario de la escuela de ingeniería forestal no cuenta con altos volúmenes de especímenes, el trabajo puede ser realizado de manera individual, sin tener que ser sistematizado en mayor medida, siempre considerando las variables definidas para la documentación correcta de las muestras.

Si bien las pruebas de documentación en 3D con el equipo existente no fueron exitosas, no hay evidencia que exista por el momento una necesidad para este tipo de propuesta gráfica.

Si bien las colecciones en los herbarios se han limitado a los elementos físicos, el aporte de las fotografías y colecciones de imágenes no debe de ser subestimado, si se maneja y documenta de la manera adecuada; así estas imagen de alta resolución pueden facilitar el estudio de características particulares de cada organismo.

La estandarización de las imágenes de especímenes vivos, como en el caso de la base de datos de fotografías de eFlora, es un recurso invaluable para la creación de recursos educativos, que a través de redes de investigadores, científicos y otros usuarios interesados en el tema.

10.Recomendaciones

Se recomienda afinar los detalles técnicos del protocolo de fotografía del herbario, de manera que se consideren las variables que puedan mejorar el proceso.

Se recomienda ademas hacer pruebas con especímenes de flores o frutos seleccionados, para realizar colecciones de fotografías que documenten y permitan observar la muestras desde todas sus perspectivas.

En el caso de las flores, igualmente se considera valioso poder contar con microscopios para lograr hacer visibles detalles que son críticos para la identificación; apoyando el enfoque académico con que cuenta el herbario.

11. Bibliografía

Consortium of Pacific Northwest Herbaria (2011). Espécimen Imaging Documentation (version 3.0). Recuperado de http://www.pnwherbaria.org/documentation/imaging-documentation-v3.pdf

Apéndices

apéndice 01 - metodología de documentación de muestras del herbario

TEC | Tecnológico de Costa Rica

eFlora

protocolo documentación fotográfica de muestras para herbario digital

el presente documento definirá el protocolo adecuado para la documentación fotográfica de las muestras secas del herbario de ingeniería forestal - proyecto eFlora

Instrucciones generales

- Fotografiar en formato RAW y jpg
- Calidad de jpg alta (4912 x 3264 px)
- Colocar el fondo para fotografiar la muestra
- Encuadrar la fotografía siempre en formato vertical
- Colocar la escala de referencia
- Llevar el control de las partes y los especímenes en la lista de chequeo

Equipo requerido

- Cámara Sony Alpha A57
- 1 lente teleobjetivo Sony 55-200mm f/ 4.5-5.6
- 2 baterías cargadas
- 1 cargador de baterías
- 2 tarjetas SD de 32 Gb
- Cable micro USB para descarga
- Escalas de referencia
- Trípode

2. Configuración de la cámara

ajuste la camara a los siguientes valores:

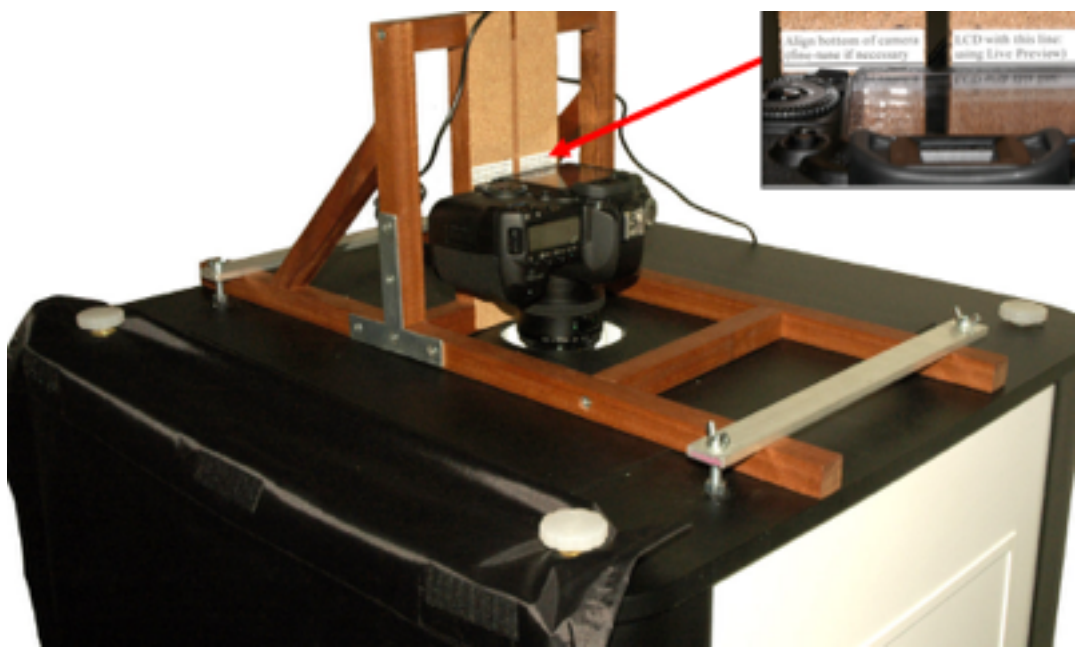
- velocidad de disparo: 1/4 de segundo
- apertura; F18
- balance de blancos: kelvin (el símbolo “K”)
- color de temperatura: 6500
- ISO: 100
- calidad de imagen: RAW
- modo de almacenaje: cámara + computadora

.

1. estación de trabajo

preparar la estación de fotografía

- ajustar la camara al soporte de la caja de luz

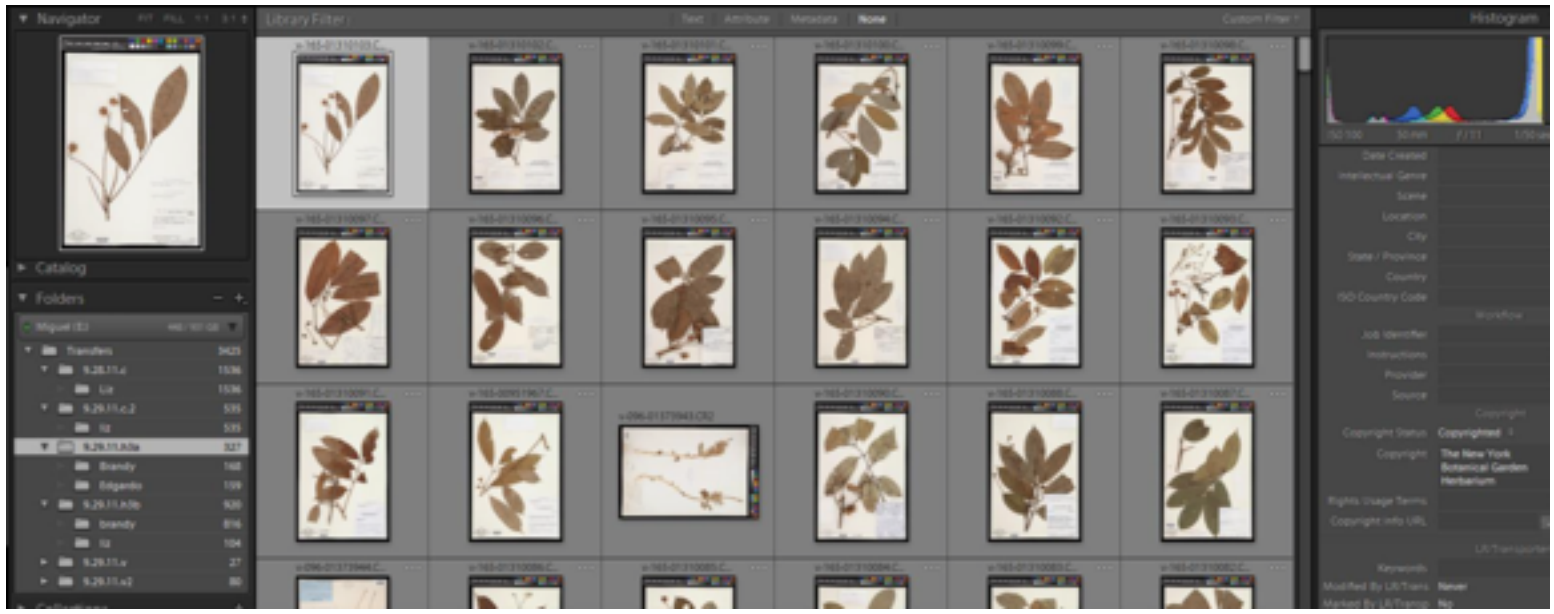


3. muestra

consideraciones:

- siempre en posición vertical
- incluir cartilla de escala y color para referencia
- de ser necesario, enmarcar la muestra de manera que mantenga el formato
- realice al menos tres fotografías de la misma muestra

3. verificación



después fotografiar la primera muestra, realice una verificación de las fotografías de manera que puede realizar los ajustes requeridos, de ser necesario.

3. verificación

revisar detalles y calidad del acercamiento a los mismos.

ademas de la legibilidad y definición de la ficha del espécimen

.

apéndice 02 - pruebas preliminares de fotografía de muestras herbario

Instituto Tecnológico de Costa Rica - eFlora

Análisis de la prueba de fotografía de las colectas del herbario

Objetivo

Seleccionar la cámara y el lente adecuado para fotografiar las muestras del herbario, además hacer la primera prueba para generar un protocolo de fotografía que permita generar un producto homogéneo de la manera más eficiente posible.

Prueba realizada por: Ivonne Madrigal - Casia Soto - Leonardo Castro

Equipo:

- Mesa
- Tela azul
- Escala con colores y logo de eFlora
- Plantilla de corte
- Trípode Manfrotto
- Cámara Sony Alpha 57 con lente teleobjetivo de 28-70
- Cámara Sony Alpha 7 con lente macro de 2,8/50

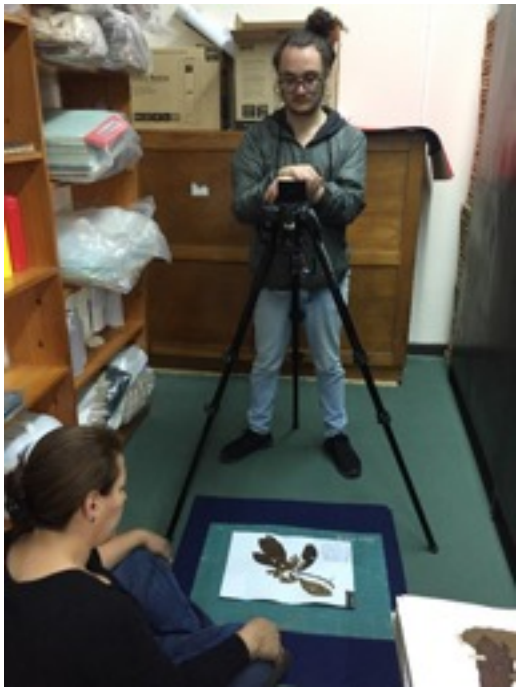


Figura 1. Fotografiado de las muestras de herbario.

Figura 2. Fotografiado de las muestras de herbario.

Figura 3. Cámara y lente utilizado.

Figura 4. Cámara y lente utilizado.

Figura 5. Fotografiado sobre una mesa.

Resultados

Muestra 1

Figura 6. Muestra 307, con un lente teleobjetivo (28-70) y un lente macro (2,8-50).

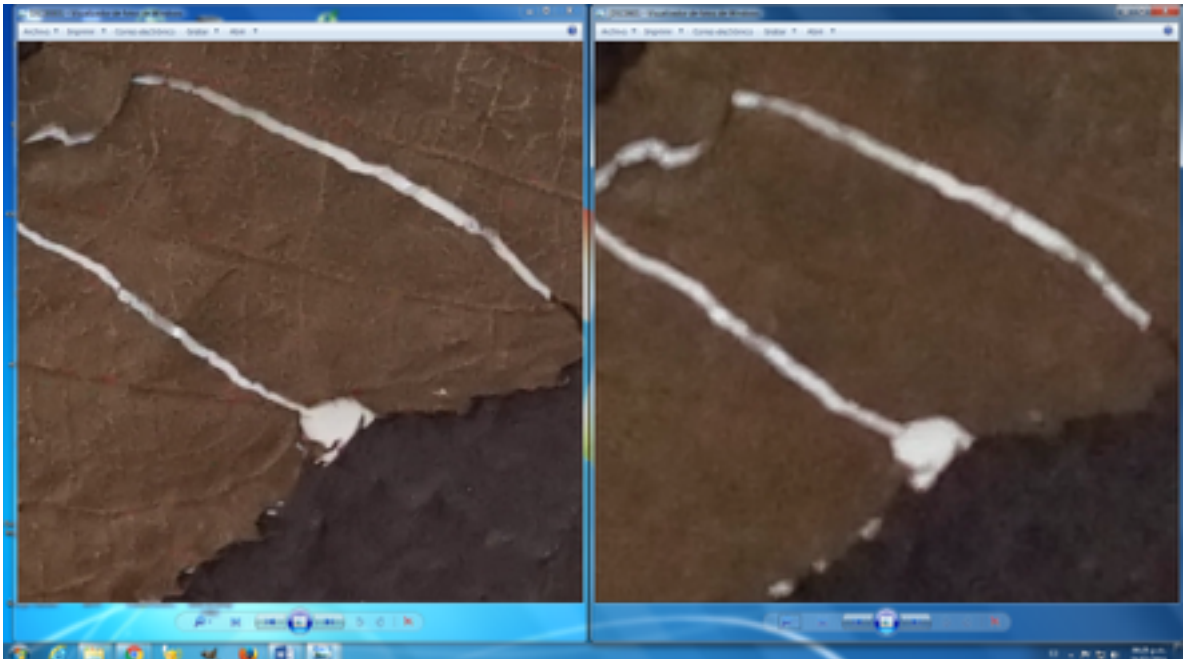


Figura 7. Muestra 307, con un lente teleobjetivo (28-70) y un lente macro (2,8-50).

Figura 8. Muestra 307, con un lente teleobjetivo (28-70) y un lente macro (2,8-50).

Muestra 2

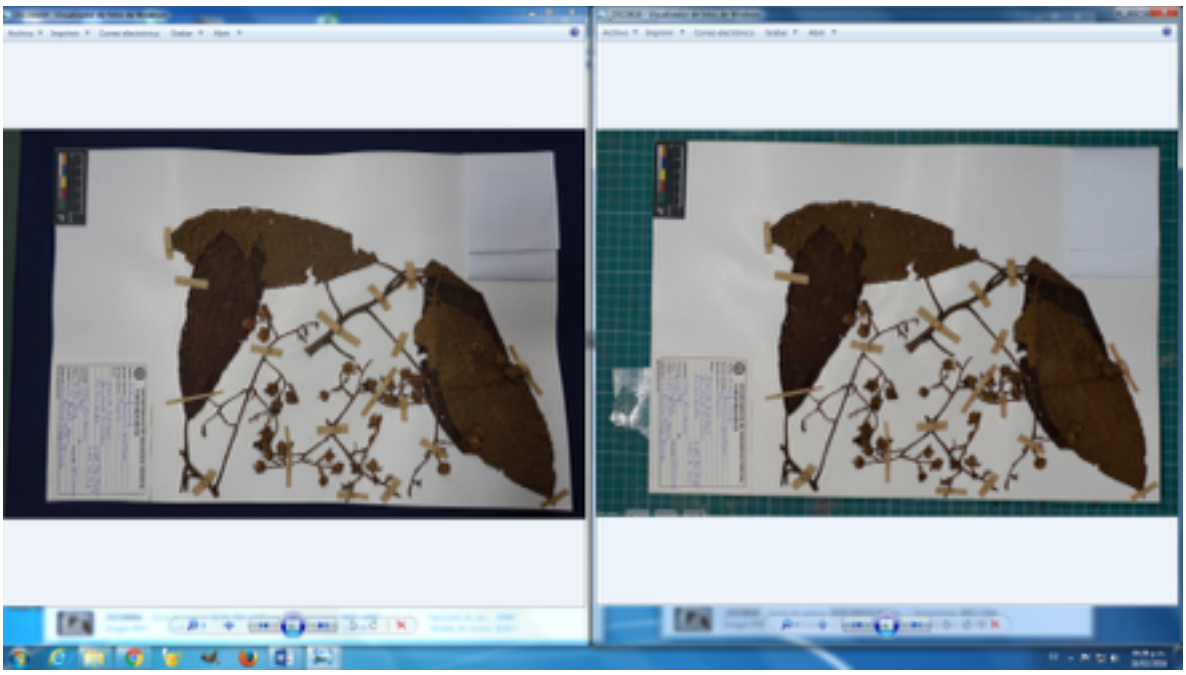


Figura 9. Muestra 2.

Figura 10. Muestra 2.

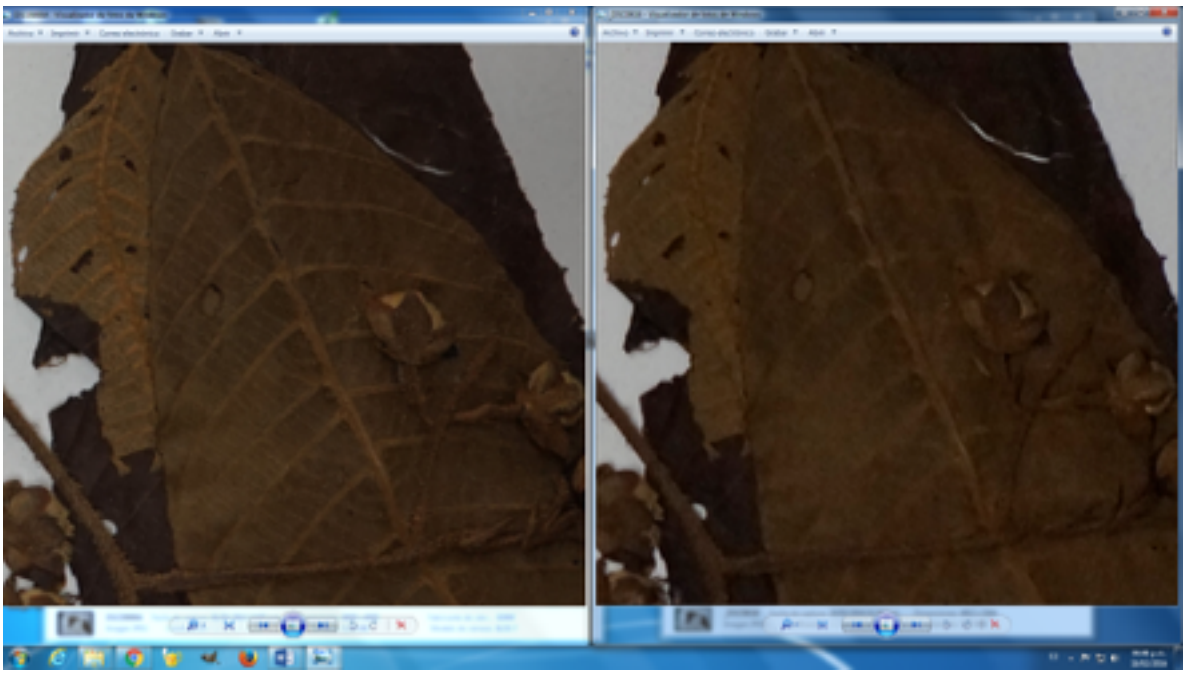


Figura 11. Muestra 2.

Muestra 3

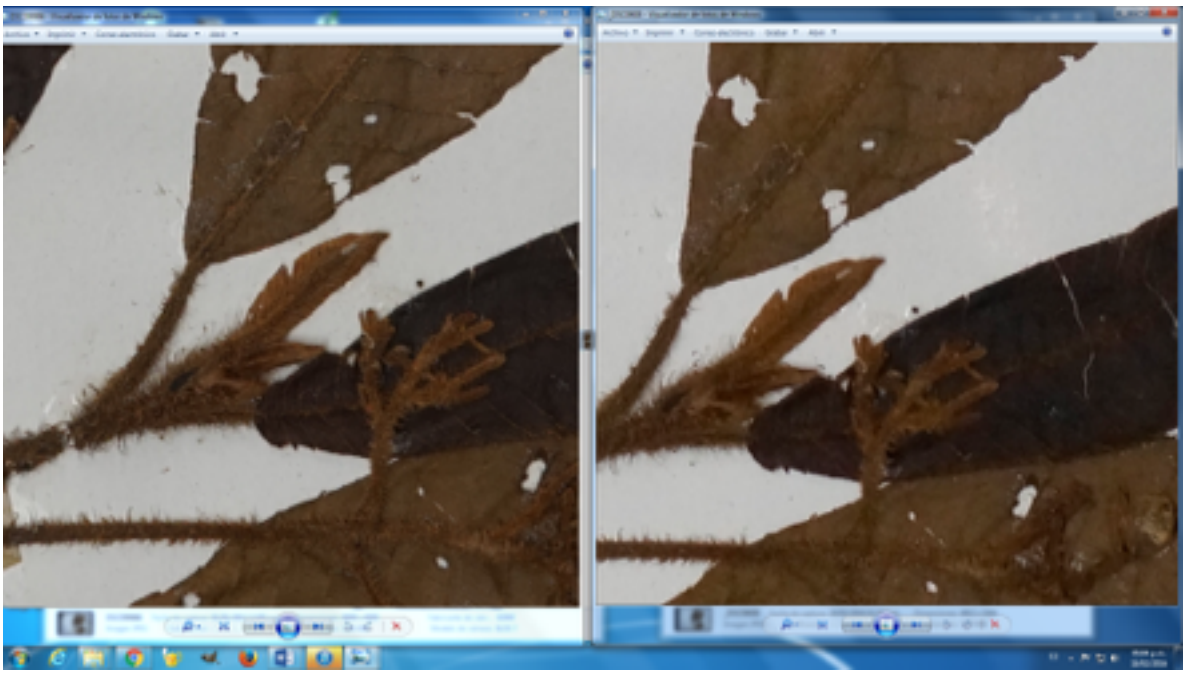


Figura 12. Muestra 3.

Figura 13. Muestra 3.

Conclusiones

Presentan mejor resolución las fotografías tomadas con la cámara Sony Alpha 57 y el lente teleobjetivo de 28-70.

Sería conveniente realizar otras pruebas prueba para descartar que fuera un problema de enfoque con el lente macro.

No se debe iniciar el trabajo antes de definir muy bien el protocolo porque las diferencia son muy significativas.

La prueba se hizo en una posición incómoda, es necesario colocar una mesa adecuada, poner las cosas cerca para que el proceso sea eficiente pues son más de 2000 fotografías.

Sería bueno adquirir un disparador, para hacer el trabajo sentado.

Anexos

anexo 01 - specimen imaging documentation, consortium on pacific northwest herbaria

ANEXO 01 / eFlora 1.1 – Metodología para el desarrollo de la visualización de un herbario digital

Specimen Imaging Documentation

Consortium of Pacific Northwest Herbaria

Version 3.0
June 14, 2011

Ben Legler
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WTU Herbarium, Burke Museum of Natural History and Culture
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Table of Contents

1. Introduction

This document provides instructions for imaging specimens under the Consortium of Pacific Northwest Herbaria's 2010-2013 collaborative NSF Grant (DBI0956414). It is intended for use by project facilitators and imaging personnel working under the grant. The instructions are specific to the equipment we have chosen to use and may need modification if used elsewhere.

In addition to this document, there are separate instructions for creating the customized equipment (camera mount, specimen holder, rulers, weights, etc.) required here, and cheatsheets to which imaging personnel can quickly refer during the imaging process.

The default workflow used here (Figure 1) assumes each collection is being imaged sequentially from start to finish by capturing the entire collection or an easily defined subset such as all Pacific Northwest specimens (Alaska, Idaho, Montana, Oregon, Washington, British Columbia, and Yukon Territory). It also assumes the specimens are not already databased and, therefore, the images do not need to be matched up to existing database records. Under this scenario, the images can be used to populate a new database with label data later captured from the images using keystroking or OCR. The databases are hosted on the Consortium's web server with data entry interfaces accessible over the internet. This eliminates the need for smaller collections to develop and manage their own in-house server. It further simplifies the transfer of data and images to the Consortium's online search portal.

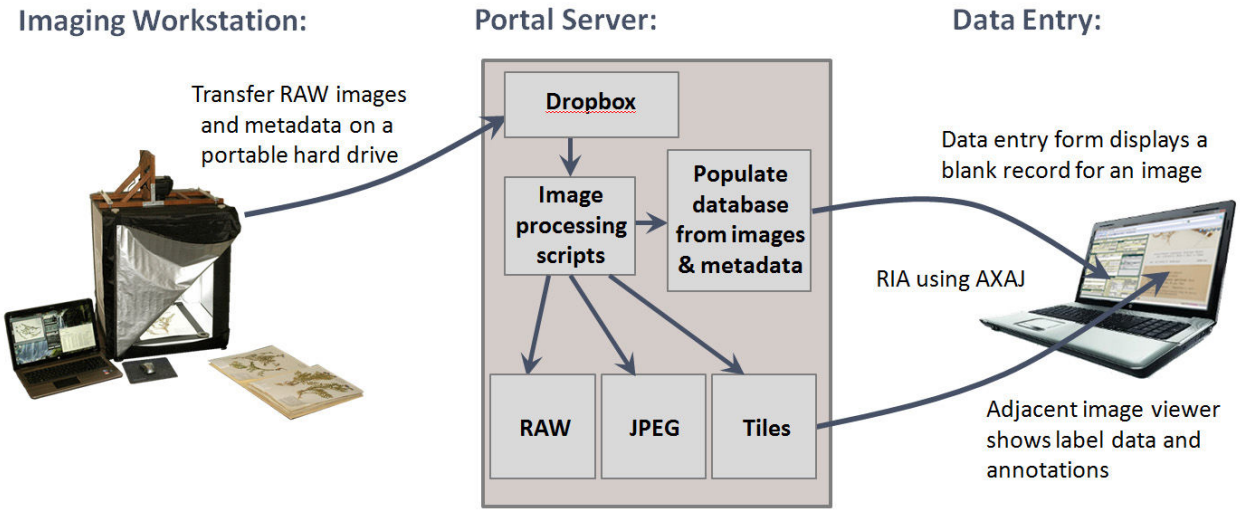

Figure 1. Simplified overview of the default imaging workflow, including image capture, transfer to server, image processing, and databasing from the images.

There is no need to barcode specimens unless desired by the collection being imaged. However, for collections that already have a database, barcoding is a suitable option. We use this option at several large herbaria. Before imaging, each specimen is given a barcode and the corresponding database record is updated to include the barcode. Then, during image capture, a custom script and barcode reader are used to rename each image to match the barcode.

Following image capture, the image processing scripts match image names to existing database records.

The imaging technology used here was chosen for ease of use and efficiency. The core components of the system are a high-resolution digital SLR, an enclosed lightbox, and a laptop computer. This system involves fewer pieces of equipment than one based on external flash units, thereby reducing the number of potential failure points. Although higher quality digital imaging solutions exist, such as medium-format sensors or flatbed scanners, they require significant tradeoffs in higher equipment costs or slower imaging rates.

One disadvantage of the system used here is the relatively low light intensity of the lightbox, which requires a slow shutter speed to maintain adequate exposure and depth of field. This can be accommodated by placing the lightbox on a stable surface and using a sturdy camera mount attached to the top of the lightbox.

We are using a Canon EOS 5D Mark II camera with a 21 MP sensor. Images are captured in RAW format (CR2) and archived in RAW format (either CR2 or DNG), with high-quality JPEGs created for general use and tiled images for the online image viewer. Together, these files require about 32.5 MB (if using DNG) or 36.5 MB (if using CR2). 100,000 images will require about 3.1 to 3.5 terabytes of storage space. The archival images could alternatively be stored as 8-bit LZW-compressed TIFF images instead. These are similar in size to the DNG images.

Initial use of the equipment suggests an image capture rate of between 100 and 180 specimens per hour, depending on the number of difficult specimens encountered and the skill of the imaging person. A four hour workday for a single person will thus generate between 400 and 720 images. A single person working for 19 hours per week will finish a collection of 20,000 specimens in about 6 to 10 weeks.

About the Consortium:

The Consortium of Pacific Northwest Herbaria is a regional partnership of herbaria from Pacific Northwestern North America, formed in 2007. Its primary objective is the formation of a network of collections data accessible through a single online search portal. The Consortium supports digitization of specimens at participating regional herbaria by providing technical assistance, equipment, and funding.

Funding for the Consortium has been provided primarily by the National Science Foundation, first with a supplement to the WTU Herbarium's 2004-2007 NSF grant (0346624), and currently with a collaborative NSF grant (0956414) between WTU, OSC, ID, and MONT. Administration and web site development occur at WTU.

2. Who to contact for help

If you have questions or encounter problems, check with the imaging coordinator from your state or the project coordinator.

Project coordinator and programmer:

Ben Legler
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University of Washington
PO Box 355325
Seattle, WA 98195
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cell phone: 1-206-940-6723

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Imaging coordinator, Oregon:

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Corvallis, OR 97331-2902
email: hardisol@science.oregonstate.edu
office phone: 1-541-737-4338
fax: 1-541-737-3573
office: 1048 Cordley Hall

Imaging coordinator, Idaho:

Emily Poor
College of Natural Resources
Stillinger Herbarium
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Moscow, ID 83844-1130
emilypoor@vandals.uidaho.edu

Imaging coordinator, Montana:

Ryan Quire
Dept of Plant Sciences & Plant Pathology
P.O. Box 173150
Bozeman, MT 59717-3150
ryan.quire@msu.montana.edu

3. List of imaging hardware and software

Not listed here are custom components as described in "Custom Imaging Components.pdf"

3.1. Hardware:

Item	Cost (in 2010)	Notes
Ortery Lightbox	$1,200	http://ortery.com/support/where_to_buy.php or call 1-949-859-5580
Canon EOS 5D Mark II	$2,399 w/rebate	Get the body only, without a kit lens
50 mm macro lens, one of: • *Canon EF 50mm f/2.5 Compact Macro* • *Sigma Macro 50mm f/2.8 EX DG with Canon mount*	$299 (either one)	The Canon lens only goes to ½ life size, while the Sigma goes to full 1x life size. Both are equal in image quality and price. The Sigma's extra magnification may be useful for close-ups of small parts of a specimen.
Canon AC Adaptor Kit (ACK-E6)	$149 to $189	Purchasing online is probably cheaper than in-store.
16 or 32 GB Compact Flash (e.g., Sandisk Ultra 15x)	$65 or $130	16 GB will hold about 550 CR2 images. 32 GB will hold about 1,100 CR2 images.
Laptop computer, min specs: • *17", 1600x900 pixel screen* • *500 GB 7200 RMP hard drive* • *3 to 4 GB RAM* • *Newer processor such as Intel T6600, i3, i5, or i7* • *Dedicated graphics card with at least 512 MB memory* • *Windows 7 (can use OS X)*	$700 to $1000	Try an HP Pavillion 17" or a Dell Vostro 17". Get a model with an anti-glare screen if possible.
2 portable hard drives, 500 GB minimum for each	$100 each	Get something compact like the Western Digital 500 GB or 1 TB Passport Drives with USB connections.

3.2. Software:

Item	Cost (in 2010)	Notes
Canon Software (including EOS Utility)	Free (comes on CD with the camera)	All we use are EOS Utility and Digital Photo Professional.
Python 2.7	Free (open source)	http://www.python.org/download/ (get version 2.6 or higher, but not 3.x)
wxPython	Free (open source)	http://www.wxpython.org/download.php
Adobe Reader	Free (proprietary)	http://get.adobe.com/reader/ (for viewing imaging documentation)

4. Initial configuration of the hardware and software

The steps given here should only need to be done once when the equipment is first purchased. They do not need to be performed when moving the workstation to each herbarium.

4.1. Assemble the Lightbox:

The Lightbox comes unassembled. An instruction sheet should be included with the Lightbox. During assembly, note the following modifications:

1) Leave the front panel completely off (Figure 2). The front panel has a door cut into it, but it is too small. It is easier to insert and remove specimens if the entire front side is open.
2) Attach the fabric door cover to the front of the Lightbox. Affix self-adhesive velcro strips to the fabric door to allow the door to be easily held out of the way (Figure 3). Refer to "Custom Imaging Components.pdf" for recommended positions for the velcro strips.
3) Remove the square metal brackets and the velcro strap on the top of the box. These are not used and will get in the way of the custom camera mount.
4) Four holes need to be drilled into the top of the box in order to attach the custom camera mount. Refer to "Custom Imaging Components.pdf" for instructions on how to build and attach this mount.
5) A custom specimen backdrop and weights need to be created to go inside the lightbox. This backdrop provides a deep black background, allows quick positioning of the specimen, and includes a ruler and logo for the collection being imaged. See "Custom Imaging Components.pdf" for instructions on building this insert and positioning it within the lightbox, and making a ruler.

Figure 2. Front side of the Lightbox with the front panel removed, a custom specimen holder inside, and a custom camera mount.

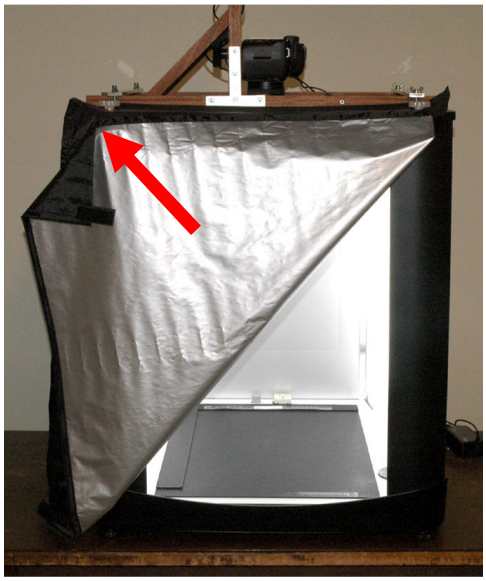


Figure 3. Fabric door on front of Lightbox, with velcro tabs added to allow a corner to be easily held out of the way.

4.2. Prepare the camera:

1) Attach the lens by removing the lens mount covers on both the camera and the lens, lining up the red dots on the lens and the camera, and twisting the lens until it locks into place.
2) Insert the Compact Flash card into the slot on the right side of the camera (behind and below the shutter release). The card should only go in one way, so don't force it.
3) Charge the battery (it arrives completely drained). We'll be using an AC adaptor instead of the battery, but it helps to have the battery available just in case.

4.3. Configure the laptop computer and install software:

Before proceeding with these steps, you may want to let your university IT upgrade Windows and install Microsoft Office and anti-virus software.

1) Install the Canon software that came on the CD with the camera. Create desktop shortcuts to the EOS Utility and Digital Photo Professional (Figure 4).
2) Install Python 2.7. If you are using a 64-bit computer be sure to get the 64-bit version of Python. Don't install Python 3; it is incompatible with the scripts used here.
3) Install wxPython 2.8. If you are on a 64-bit machine use the wxPython runtime for Windows called "Win64-Unicode".
4) Install Adobe Reader, if not already present.
5) You can install the optional software listed under section 3.2 on page 3 if you like. However, these are currently not used in the imaging workflow:
6) You should have been provided with a CD containing the folder hierarchies and custom scripts and documents needed for the imaging workflow. Copy this entire folder hierarchy (everything within and including the "PNWHerbaria\" folder) over to the C:\ drive on the laptop. You should end up with the folder hierarchy shown in Figure 5.
7) Create a desktop shortcut to the "imagemetadata.pyw" script (Figure 4). This script is located in C:\PNWHerbaria\Scripts\". Make sure Windows is set to open .pyw files using python.exe as the default option.

Figure 4. Software icons.

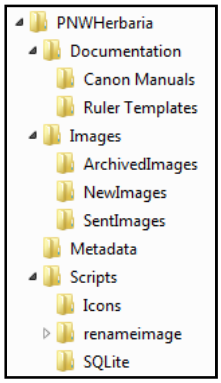


Figure 5. Folder hierarchy.

4.4. Configure the laptop to auto-start EOS Utility when the camera is connected:

1) Connect the camera to the laptop via the USB cord and turn on the camera.
2) If this is the very first time the camara is connected, you should see a Windows dialog asking you what you want to do with this device. Select the option "download images to computer using EOS Utility." This will tell Windows to automatically open EOS Utility whenever the camera is connected.
3) The window shown in Figure 6 should appear. Click the "Preferences" button.
4) Another window will appear (Figure 7). Under the "Basic Settings: tab, select the option for "Show [Camera settings/Remote shooting] screen" and check the box for "Start EOS Utility automatically when the camera is connected"

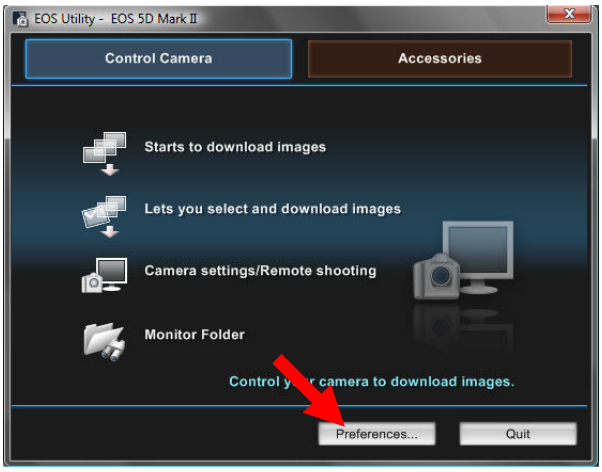


Figure 6. EOS Utility main window.

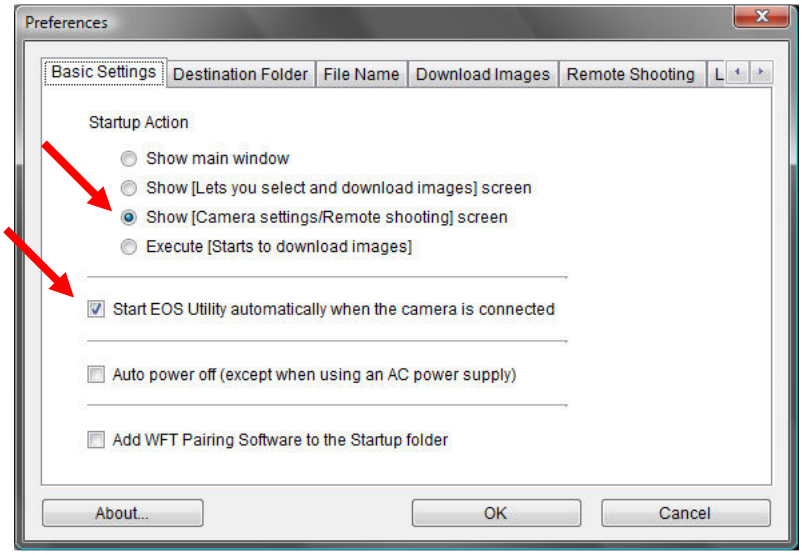


Figure 7. EOS Utility preferences.

5. Setting up the imaging workstation in each herbarium

These steps should be performed each time the imaging workstation is moved to a new herbarium. Some of these steps may not need to be done every time, but you should at least check to make sure the camera and other equipment are still configured as given here.

5.1. Find a suitable location for the equipment:

The Lightbox should be placed on a sturdy table or other surface that will not transmit vibrations up to the camera. The surface must be large enough for the lightbox (24" x 24") and the laptop (16" wide). Specimens can be placed on this same surface to one side of the lightbox or, preferrably, on a separate cart or table at a right-angle to the lightbox and at the same height (Figure 8). Positioning the specimens this latter way may increase the ease with which they can be inserted into and removed from the lightbox.

- It is OK if the room is brightly lit or there are windows. The inside of the lightbox is well-enough covered to keep ambient light out as long as the curtain is used.
- Make sure there are enough power outlets nearby (three are needed, for the lightbox, camera, and laptop).
- Find a chair that is at the right height to allow the imaging person to comfortably move specimens in and out of the lightbox and operate the laptop.
- Check the lightbox to make sure it does not wobble when pushed from any of the four upper corners. If it does, then adjust the feet on the bottom of the box until the box is stable.

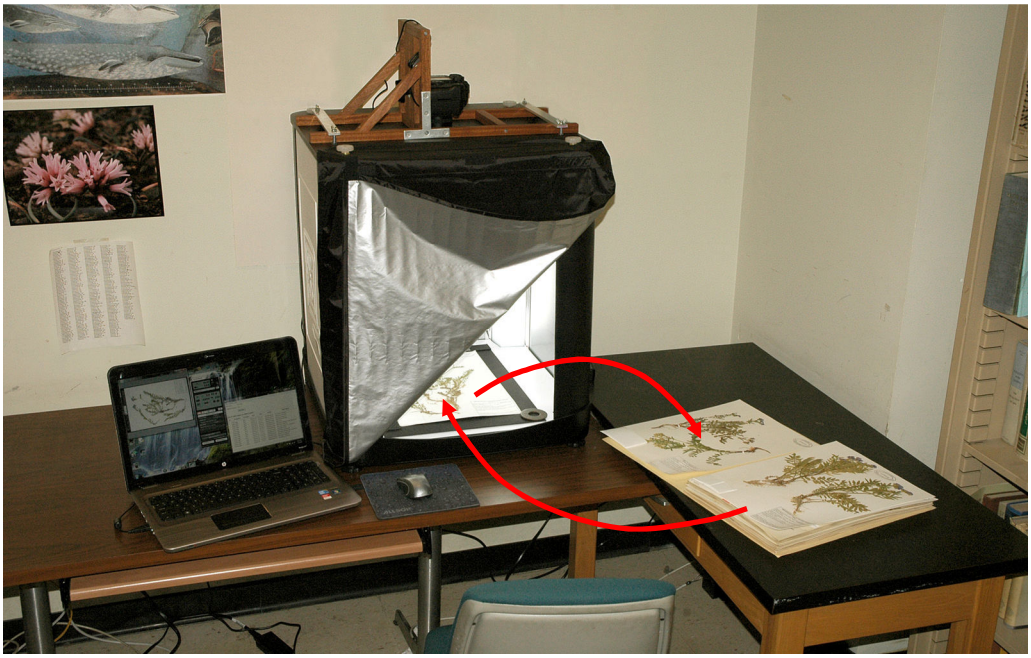


Figure 8. Suggested arrangement of imaging equipment, and movement of specimens.

5.2. Check the specimen holder and ruler:

Check the black specimen holder to make sure it hasn't shifted from its proper position. It should be centered from left to right, with the back edge pushed against the white power plug in the back of the box (Figure 9). If the holder appears to be out of alignment, refer to "Specimen Holder.pdf" for instructions on alinging the holder. If the holder is frayed or dirty from use, then contact Ben Legler to obtain a new one.

Each herbarium requires a custom-made ruler with the name and logo of the herbarium or institution printed on it (Figure 10). If there is another ruler attached to the specimen holder, remove it and replace it with a ruler for the herbarium being imaged. Rulers can be obtained from Ben Legler. The ruler should beplaced along the top edge of the specimen holder and centered above the specimen. Use removable double-sided tape to attach it so it can be replaced once imaging is completed.

Figure 9. Proper position of specimen holder.

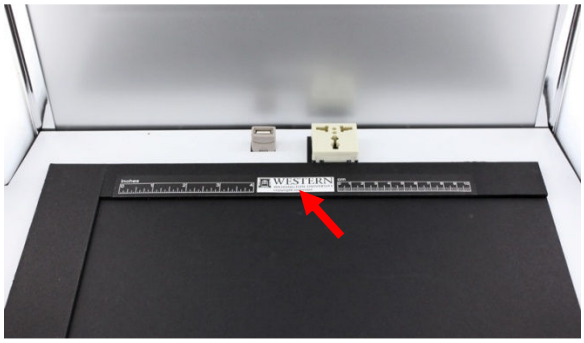


Figure 10. Custom ruler with logo, positioned at top of specimen holder and held in place using removable, double-sided tape.

5.3. Attach the camera mount to the top of the lightbox:

The mount should be positioned as shown in Figure 11. If correctly positioned, the cork-padded surface to which the camera is attached will be facing to your right when you are looking at the front of the lightbox, and the cork surface will be positioned just to the left of the circular opening on the top of the box.

Once positioned, place the aluminum bars over the ends of the mount and use the provided wingnuts to gently tighten down the bars to hold the mount in place. CAUTION: do not over tighten the wingnuts or you may damage the plastic. It doesn't take much pressure to hold the mount securely in place.

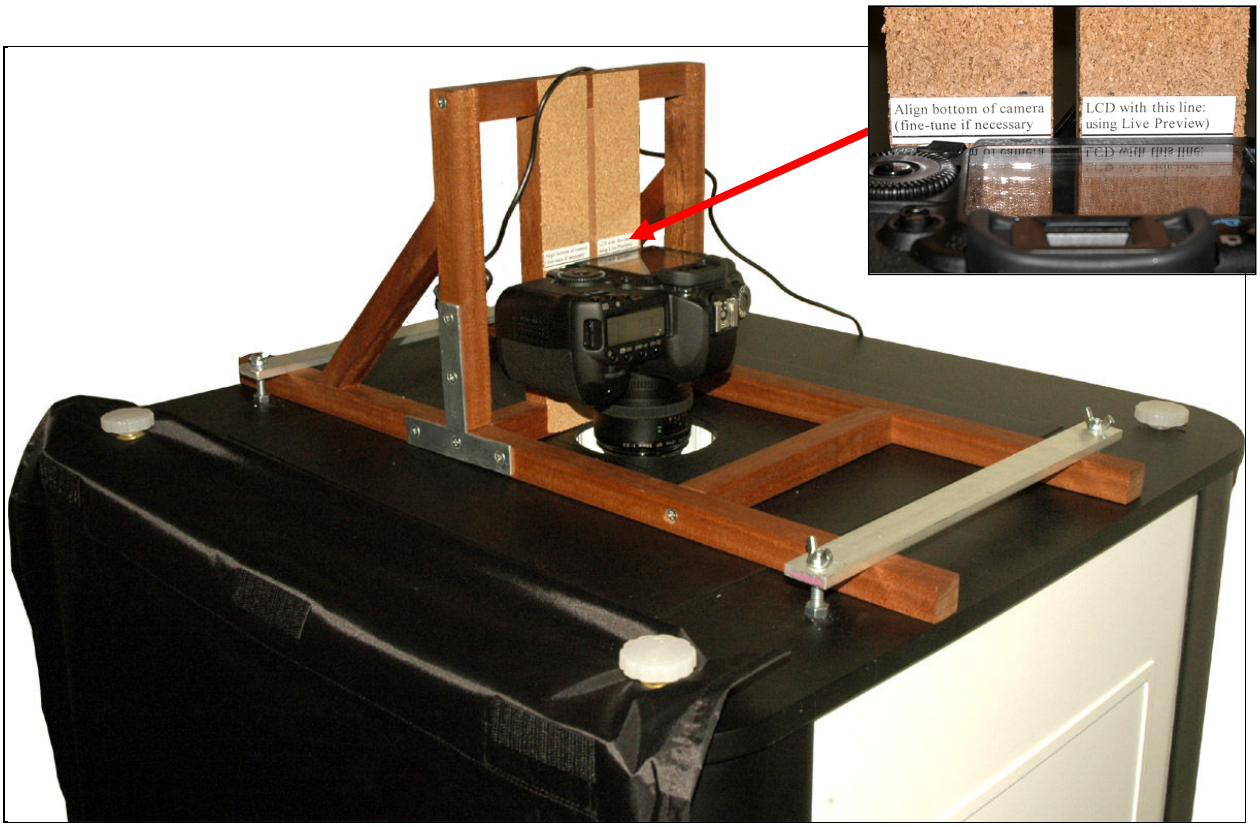


Figure 11. Custom camera mount attached to top of the Lightbox and oriented at a right angle to the front of the Lightbox. The aluminum bars and wingnuts are used to secure the mount in place. Position the AC adaptor and USB cords out of the way of the lens. Use the alignment guide shown in the inset to position the camera.

5.4. Plug it all in and connect the camera to the mount and laptop:

1) Plug in the lightbox.
2) Plug in the laptop.
3) Plug in the camera's AC adaptor, and insert the battery adaptor into the camera's battery slot. There is a small rubber flap on one side of the battery slot that can be removed to expose a hole for the adaptor's cord. Do not force it. If not obvious, refer to the instruction sheet that came with the AC adaptor.
4) Plug the camera's USB cord into the port on the left side of the camera body (beneath a large rubber flap), and the other end into a free USB port on the laptop.
5) Use the thumb bolt to attach the camera to the mount on top of the box. There should be a mark on the cork pads indicating the proper position for the camera. However, don't worry about precisely positioning the camera right now; you'll fine tune it later. Make sure the cords are out of the way of the lens.
6) Remove the lens cap.
7) Turn on the lightbox (power switch is on left side near the back).
8) Start up the laptop.

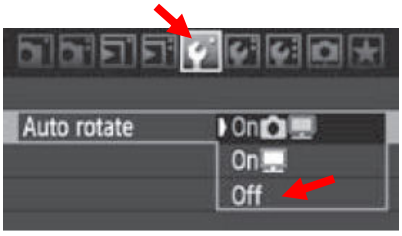
5.5. Configure the camera settings:

These steps are all you need to do on the camera itself. All other camera settings will be specified using the EOS Utility software.

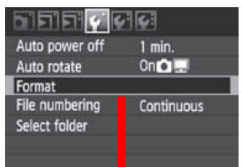
1) Turn the power switch (located near bottom right corner of LCD) to the line directly above the "ON" position.

2) Turn the large dial on the top left side of the camera to the "M" (Manual mode).

3) Enter the camera's Menu, select the 5th menu tab (the icon of a wrench with a single dot), and go down to the "Auto Rotate" entry. Select "Off".

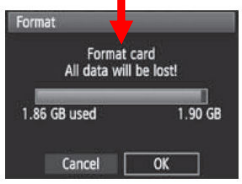


4) While still in this 5th menu tab, go down to the "Format" entry and format the Compact Flash card to clear out any images from previous imaging sessions.



1 Select [Format].

- Under the [🔧] tab, select [**Format**], then press <SET>.

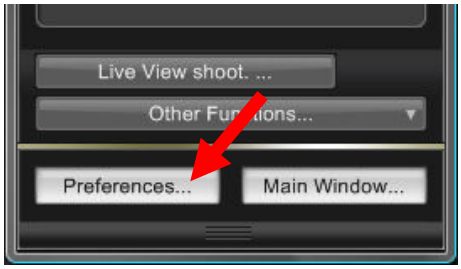


2 Select [OK].

- Turn the <dial> dial to select [**OK**], then press <SET>.
- ▶ The card will be formatted.
- ▶ When the formatting is completed, the menu will reappear.

5.6. Configure the EOS Utility:

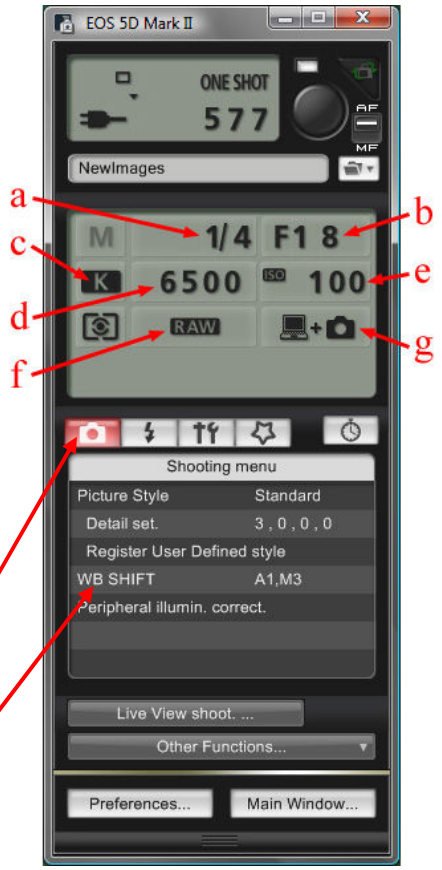
The EOS Utility should have opened when the camera was turned on. If not, click the icon on the Windows Desktop. The remote shooting window should be open by default. If not, refer to section 4.4. Click the "Preferences …" button at the bottom of the remote shooting window to bring up the EOS Utility preferences dialog (Figure 7).



Set preferences as follows:

1) On the "Destination Folder" tab, set to "C:\PNWHerbaria\Images\NewImages".
2) On the "File Name" tab, change the drop-down list to "Prefix + Number". Set the "File Prefix" to the acronym of the collection being imaged. Set the "Number of Digits" to 6 (regardless of how small the collection is), and the "Start" number to 1.
3) On the "Remote Shooting" tab, check the box for "Save also on the camera's memory card". On this same tab, uncheck the box for "Rotate image".
4) On the "Linked Software" tab (may not be visible until you click the arrow to the right of the tabs), set "Software to link" to None, unless you are renaming images to barcodes. In that case, select "C:\PNWHerbaria\Scripts\renameimage\renameimage.exe"
5) Click OK to dismiss the preferences dialog and return to the remote shooting window.

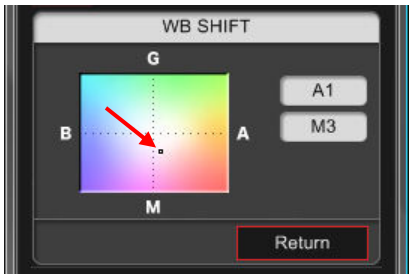
Configure camera settings using the remote shooting window:



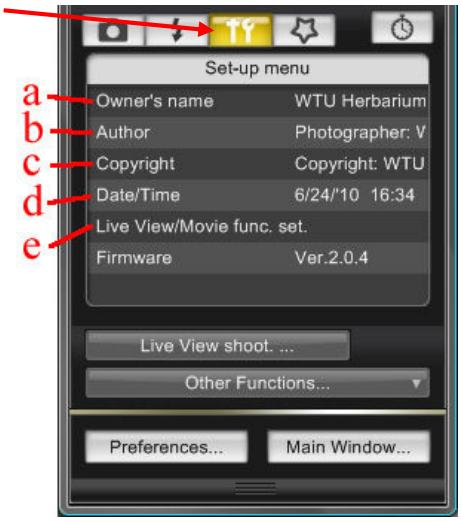
1) In the upper half of the window is a gray panel of camera settings. Each of these settings can be adjusted by clicking the setting to highlight it, then using the mouse scroll wheel or the left/right arrow keys on the keyboard. Adjust the settings to the following values:
    a. Shutter speed: 1/4 second
    b. Aperture: F18
    c. White balance: Kelvin (the "K" symbol)
    d. Color temperature: 6500
    e. ISO: 100
    f. Image quality: RAW (not SRAW1 or SRAW2)
    g. Storage mode: Computer + Camera

2) Click the Camera icon (about halfway down the window on the left side). Adjust the WB SHIFT (white balance shift) as follows:
    a. Click the "WB Shift" entry to bring up a dialog with a color chart (shown on next page).

b. Use the mouse to select the position corresponding to (A1, M3), and click the "Return" button. This setting produces images that are closer to neutral because the lightbox's lights apparently diverge slightly from their 6500K rating.

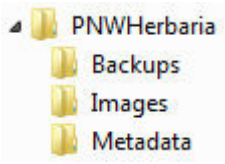


3) Click the Set-up menu icon (icon of a cross and a wrench, to the right of the Camera icon) and enter settings as follows:
   a. Owner's name: enter the herbarium and/or institution name
   b. Author: herbarium/institution name
   c. Copyright: herbarium/institution name
   d. Date/Time: select the option for "Always match the computer time". It is important that the images are stamped with the computer's date and time, not the camera's.
   e. Live view/Movie func. set.: click this entry and, in the window that appears, select the "Stills only" option and the "Still display" option.



5.7. Configure the external hard drive:

1) Connect the hard drive to the laptop using an available USB port.
2) Open Windows Explorer and browse to the external drive.
3) Make sure the following folders exist on the external drive. If not, create them:

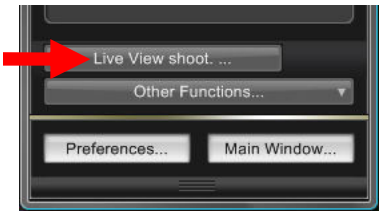


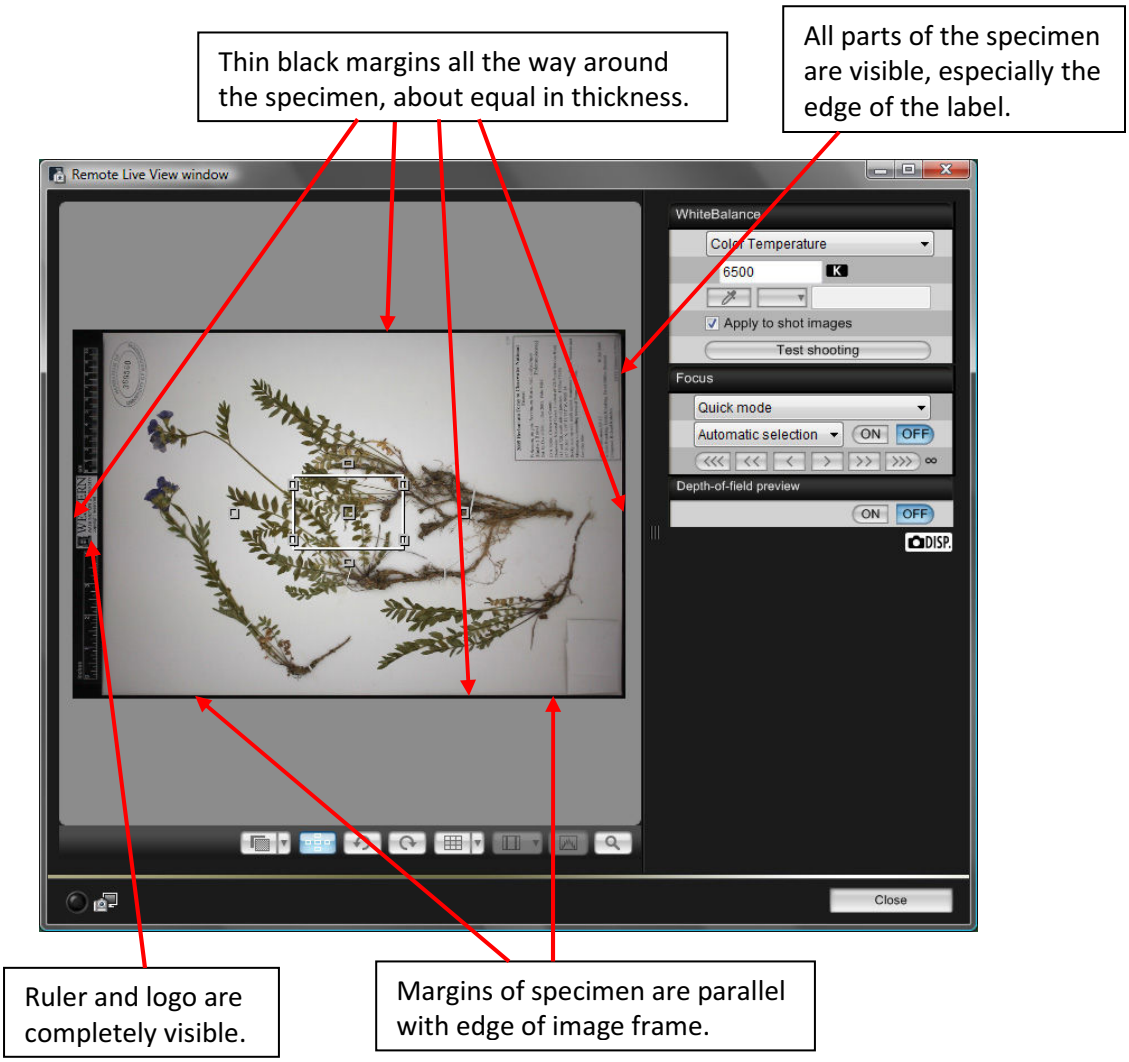
4) Make sure the Images, Metadata, and Backups folders are empty. If there are any existing images or metadata files (.db extension), then these may need to be deleted. In most cases, the external drive will arrive at a collection already empty. However, if more than one collection is imaged between transfers to WTU then the existing images and metadata must not be deleted.

5.8. Position the camera using Live View:

Use Live View to adjust the position of the camera and/or the camera mount to precisely frame the specimen within the view finder.

1) Place a normal-sized specimen in the lightbox and hover the mouse over the shutter-release button to make the camera focus on the specimen.
2) Open the Live Preview window by clicking the "Live View shoot…" button near the bottom of the EOS Utility window.
3) A new window will appear, similar to that shown below. This window shows the specimen as it appears through the camera's sensor. Don't worry if the exposure looks incorrect.
4) Check for the following, adjusting the camera and/or mount as needed:





5) Once you are satisfied that the alignment is correct, close the Live View window. If you adjusted the camera mount, remember to re-tighten the wingnuts.

6. Imaging workflow: preparing for imaging

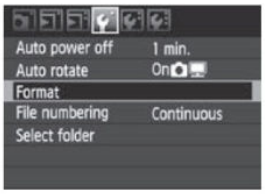
This section describes the steps that imaging personnel should follow to begin each day's imaging session. The steps described under section 6.3 and 6.4 should not always be necessary, but should still be quickly checked to ensure no changes to the software settings or camera position occurred since the previous day's imaging session.

6.1. Turn on the imaging equipment:

1) Check that everything is plugged in and connected. The laptop, lightbox, and camera should be plugged in to a wall outlet. The camera should be connected to the laptop via the USB cord.
2) Turn on the lightbox first. This will allow the bulbs to warm up and reach a stable color temperature before imaging. Also check the black specimen holder inside the lightbox and make sure it is clean of excessive dust or plant fragments.
3) Start up the laptop.
4) Then, once the laptop is fully up, turn on the camera. Make sure you turn the camera switch past the ON position to the angled-line below the scroll wheel, as shown at right.
5) Remove the camera's lens cap.

6.2. Format the compact Flash card:

Press the Menu button on the back of the camera (left side of the LCD), and navigate to the first Tools icon (wrench with a single dot above it). Use the Format entry to format the card, as depicted below. This will clear out the previous day's images to ensure sufficient space is available for today's images.



1 Select [Format].

- Under the [🔧] tab, select [**Format**], then press <(SET)>.

2 Select [OK].

- Turn the <dial> dial to select [**OK**], then press <(SET)>.
- ▶ The card will be formatted.
- ▶ When the formatting is completed, the menu will reappear.

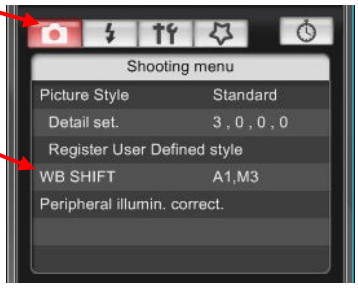
6.3. Open the EOS Utility and check settings:

The EOS Utility should have automatically opened when you turned on the camera. If it didn't, start it now by clicking the desktop icon (shown at right). If you see the window shown in Figure 5, click the "Camera settings/Remote shooting" option.

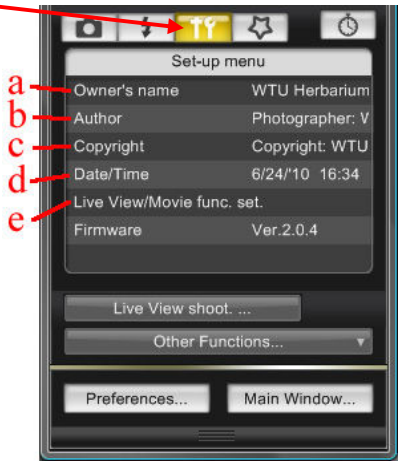
Quickly check the settings displayed in the EOS Utility window to ensure they are still set properly. If not, adjust the settings until they match the values below and on the next page. If necessary, refer to section 5.6 on page 9.

1) Images should be sent to the "NewImages" folder.
2) In the upper half of the window is a gray panel of camera settings that should be set as follows:
    a. Manual mode
    b. Shutter speed: 1/4 second
    c. Aperture: F18
    d. White Balance: K (Color Temperature)
    e. Color Temperature: set to 6500
    f. ISO: 100
    g. Image quality: RAW (Not SRAW1 or SRAW2)
    h. Storage mode: camera + computer

3) Click the Camera icon (about halfway down the window on the left side). Make sure the WB SHIFT is set to A1,M3



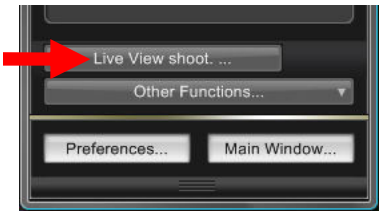
4) Click the Set-up menu icon (icon of a cross and a wrench, to the right of the Camera icon) and quickly check the following settings:
    a. Owner's name: herbarium/institution name.
    b. Author: herbarium/institution name.
    c. Copyright: herbarium/institution name.
    d. Click the "Date/Time" entry to bring up a dialog and make sure the option for "Always match the computer time" is selected. This stamps images with the computers date and time, not the camera's.
    e. Live view/Movie func. set.: select the "Stills only" option and the "Still display" option.

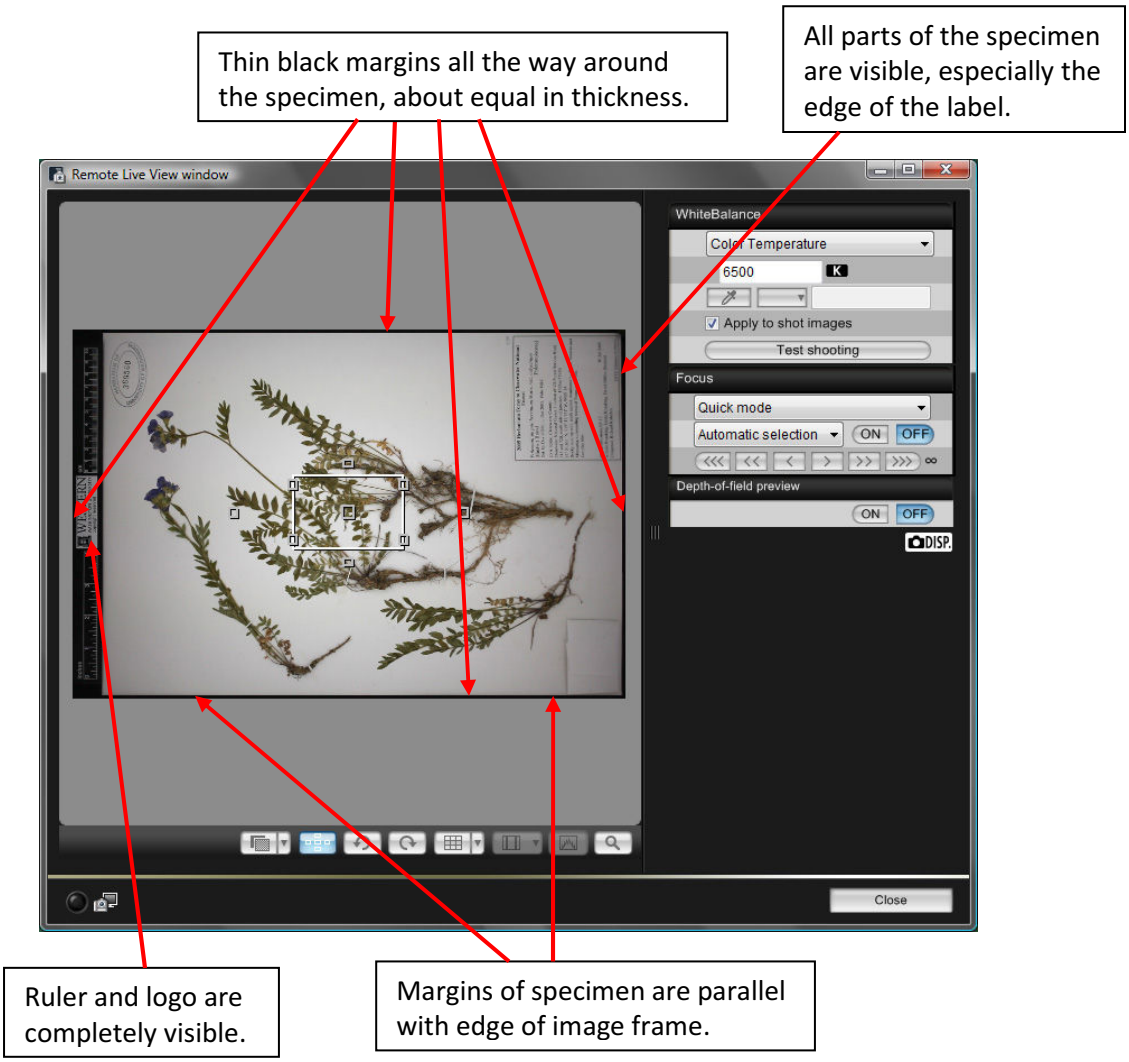


6.4. Use Live View to double-check camera alignment:

Use Live View to double-check that the specimen is still properly framed within the camera view finder.

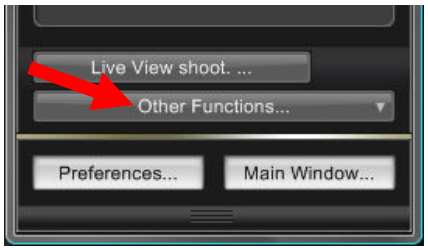
6) Place a normal-sized specimen in the lightbox and hover the mouse over the shutter-release button to make the camera focus on the specimen.
7) Open the Live Preview window by clicking the "Live View shoot…" button near the bottom of the EOS Utility window.
8) A new window will appear, similar to that shown below. This window shows the specimen as it appears through the camera's sensor. Don't worry if the exposure looks incorrect.
9) Check for the following, adjusting the camera and/or mount as needed:





10) Once you are satisfied that the alignment is correct, close the Live View window. If you adjusted the camera mount, remember to re-tighten the wingnuts.

11) 6.5. Open the Quick Preview window:



1) Click the "Other Functions…" button near the bottom of the EOS Utility window (shown at right).
2) A drop-down menu of options will appear. click the "Quick Preview Window" option to open the Quick Preview window (Figure 12). Keep the Quick Preview window open while capturing specimen images. It will allow you to visually check the images as they are captured.

Figure 12. Quick Preview window. Use this to quickly check each specimen image during image capture.

6.6. Open the metadata entry form and check settings:

Open the Metadata entry form by clicking the desktop icon (shown at right). Check the values in the fields for "Your Name" and Collection Acronym" (Figure 13, upper left corner of window). If necessary, overwrite these values with your own name (as the person doing the imaging), and the acronym of the collection being imaged. If you are not sure what acronym to use, contact your imaging coordinator or Ben Legler.

The metadata entry form allows for the capture of basic metadata for each image, including who is doing the imaging, the herbarium acronym, and the folder where the specimen is stored. Each entry in this form represents a single herbarium folder. The images for each specimen in that folder will be associated with the metadata entry via the timestamps embedded in the image file and recorded in the metadata entry. For this reason, it is important that the metadata entry be captured BEFORE any specimens are imaged from a folder. Otherwise, the specimen images will end up associated with the previous folder.

Image Metadata, PNW Herbaria

File Admin Help

Your name: Elise LaVanaway

Collection Acronym: ID

Add Folder

List of folders, in order imaged:

	Imaged By	Acronym	Date	Time	Family	Scientific Name	Folder Code
1	Harriet Hughes	ID	2010-10-08	10:57:01	Araceae	Arisaema	non-Idaho (cream)
2	Harriet Hughes	ID	2010-10-08	11:11:16	Araceae	Calla	non-Idaho (cream)
3	Harriet Hughes	ID	2010-10-08	11:15:46	Lemnaceae	Lemna	non-Idaho (cream)
4	Harriet Hughes	ID	2010-10-08	11:25:42	Lemnaceae	Lemna minor	Idaho (red)
5	Harriet Hughes	ID	2010-10-08	11:38:31	Lemnaceae	Lemna minor	non-Idaho (cream)
6	Harriet Hughes	ID	2010-10-08	11:48:34	Lemnaceae	Lemna trisulca	Idaho (red)
7	Jacob Donton	ID	2010-10-08	12:35:42	Lemnaceae	Lemna trisulca	non-Idaho (cream)
8	Jacob Donton	ID	2010-10-08	12:38:57	Lemnaceae	Lemna turionifera	Idaho (red)
9	Jacob Donton	ID	2010-10-08	12:41:06	Araceae	Lysichiton americanus	Idaho (red)
10	Jacob Donton	ID	2010-10-08	12:47:14	Araceae	Lysichiton americanus	non-Idaho (cream)
11	Jacob Donton	ID	2010-10-08	12:52:15	Araceae	Orontium	non-Idaho (cream)
12	Jacob Donton	ID	2010-10-08	12:53:47	Araceae	Peltandra	non-Idaho (cream)
13	Jacob Donton	ID	2010-10-08	12:54:46	Zosteraceae	Phyllospadix	non-Idaho (cream)
14	Jacob Donton	ID	2010-10-08	12:55:26	Araceae	Pistia	non-Idaho (cream)
15	Jacob Donton	ID	2010-10-08	12:56:30	Lemnaceae	Spirodela polyrhiza	Idaho (red)
16	Jacob Donton	ID	2010-10-08	12:59:42	Lemnaceae	Spirodela polyrhiza	non-Idaho (cream)
17	Jacob Donton	ID	2010-10-08	13:03:16	Araceae	Symplocarpus	non-Idaho (cream)
18	Jacob Donton	ID	2010-10-08	13:05:23	Lemnaceae	Wolffia	non-Idaho (cream)

Figure 13. Metadata entry form.

7. Imaging workflow: metadata and image capture

Imaging personnel should follow these steps during each imaging session to capture images and their metadata. The general workflow is to pull a batch of folders out of a cabinet and, for each folder, first create a folder entry using the metadata form then image each specimen in the folder. The folders are then returned to the cabinet. It is important that you capture the metadata for a folder BEFORE imaging its specimens and AFTER imaging the previous folder's specimens. Do not enter metadata for multiple folders at once.

We are imaging the following states and provinces: Alaska, Idaho, Montana, Oregon, Washington, British Columbia, and Yukon Territory.

7.1. Metadata capture for each folder:

1) Click the "Add Folder" button on the metadata entry form (Figure 13). A dialog box will appear (Figure 14) where you can select the species and family for the folder.
2) Click in the "Name Code" field to place the curser there. Then type in a code that identifies the name on the folder. This code combines the first three letters each of the genus, the species, and optionally the subspecies or variety (e.g, "pinconlat" for *Pinus contorta* var. *latifolia* or "achmil" for *Achillea millefolium*). You can enter partial entries ("pin" will match all *Pinus* species). If the folder is for an entire family or genus, then enter the first three letters of the family or genus ("equ" will match Equisetaceae). Manually type in alphabetical ranges if present (e.g., "*Penstemon* A-F").
3) After entering the name code, tab to the "Folder Name" field and either use the up/down arrows on the keyboard or the mouse to select the folder name from the list. Manually enter the name if it does not appear in the list, or modify the name if needed.
4) Once you've selected a folder name, the family name should auto-fill. If it does not, or if you had to enter the folder name manually, then manually type in the family name.
5) Use the Folder Code field to enter an optional code to more precisely identify the folder.
6) Click the "Save" button to save this entry and return to the main metadata entry window. You should see a new row appear at the bottom of the list of folder names.

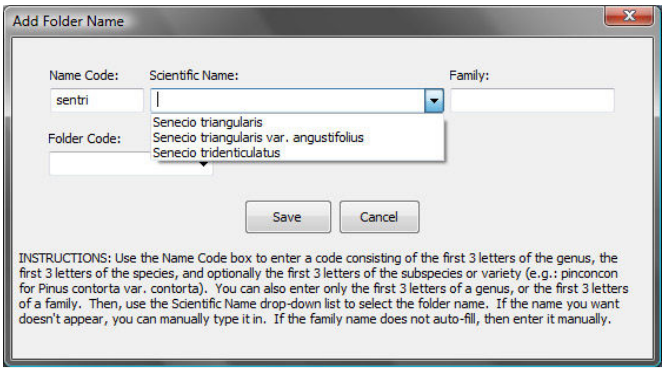


Figure 14. Folder name dialog box showing the code "achmil" entered and the drop-down box displaying names that match "achmil".

7.2. Image capture for each folder:

Be sure to handle the specimens with care, using the following guidelines:

a) Most sheets should be held with two hands.
b) Do not bend the sheet.
c) Watch for loose pieces of material that may fall off the specimen.
d) Do not flip any specimens up side down.
e) Do not slide one specimen across another. Instead pick them up and place them down.

Repeat the steps below for each specimen sheet within the folder. When you are finished with the folder, remember to create a metadata entry for the next folder before imaging that folder's specimens. If you experience any problems, refer to section 9 (page 23).

1) Insert the specimen into the lightbox. The specimen goes in with the top of the sheet oriented to the back of the box and the label towards you (Figure 16). Push the sheet in until it tightly abuts the raised edges of the black specimen holder. Make sure the specimen is not crooked and is not pushed over the top of the raised edges.
2) If any part of the specimen sheet sticks up more than about ¼ inch, refer to section 9.1.
3) If there are any packets on the sheet that contain material, refer to section 9.2.
4) Close the fabric curtain on the front of the lightbox.
5) Use the mouse to click the shutter release button near the top right corner of the EOS Utility window (indicated by the red arrow in Figure 15).
6) The camera will focus (making a slight whirring sound), then take the picture. If the focus fails, refer to section 9.3. It will take a second or two for the image to transfer to the computer. Once transferred, the image will appear in the Quick Preview window. Use this to quickly check that the image looks OK; if it does not, refer to section 9.6.
7) If renaming images to the barcode, a popup window will appear. Use a barcode reader to scan the barcode into the field on this window, then click the "Rename" button.
8) Remove the specimen from the lightbox and place it into a pile of completed specimens.
9) Return to step 1 and insert the next specimen into the lightbox.

Figure 15. Shutter release button on the EOS Utility window.

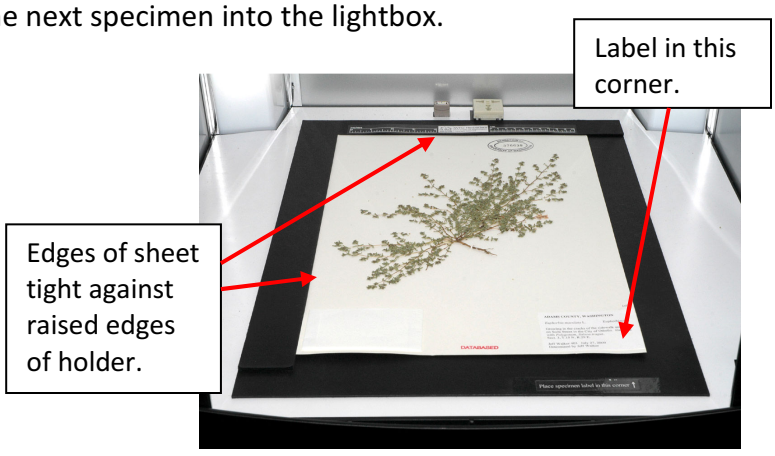


Figure 16. Proper placement of the specimen sheet.

8. Imaging workflow: finishing image capture and shutting down the imaging workstation

8.1. Back up the metadata and images:

The following steps should be performed at the end of an imaging session, before you leave for the day. These steps are designed to keep the images well organized and ensure that there are always at least two copies of the images and metadata in two separate locations to minimize the chances of losing images or data. Please follow these steps exactly or problems will arise!

1) Connect the external hard drive to a free USB port on the laptop.
2) Create a backup copy of the metadata list. In the metadata entry form (Figure 14), select the “File -> Save List to File” menu command. Save this file to the external hard drive in the folder “PNWHerbaria\Backups\” using the default name given. At this point, DO NOT clear the metadata list.
3) Using Windows Explorer, copy all images in "C:\PNWHerbaria\Images\NewImages\" to the folder “PNWHerbaria\Images\" on the external drive.
4) While still in Windows Explorer, move all images in this same folder "C:\PNWHerbaria\Images\NewImages\" to "C:\PNWHerbaria\Images\ArchivedImages\" for storage until the images are sent to WTU. This process makes it easier to track which images have already been backed up to the external drive and which have not, and which have been sent to WTU.

8.2. Shut down the imaging workstation:

The following steps can be skipped if another person will continue imaging immediately after you.

1) Close the metadata entry form. There is no need to save anything.
2) Close the EOS Utility window.
3) Turn off the camera and place the lens cap back on the lens.
4) Turn off the lights on the lightbox, and make sure the fabric door is covering the opening of the lightbox. Make sure there isn’t a specimen left in the lightbox. If there are plant fragments or excessive dust on the black specimen holder, then clean these off.
5) Shut down the computer.
6) Optionally, store the computer and hard drive in a location where they are out of sight or more secure against potential theft.

9. Imaging workflow: dealing with problems during image capture

Most specimens can be imaged quickly by simply placing them in the lightbox and clicking the shutter release. However, occasional specimens will present problems that must be dealt with to obtain a good image. Also, you may inadvertently make errors or perform certain steps out of order, and these will need to be corrected. If you encounter a problem not covered here, please contact your imaging coordinator or the project coordinator.

9.1. Specimen sheet does not lie flat (due to curves or bends in the sheet):

Use either the short black weights (Figure 17) or the hinged bars (figure 18) as needed to hold down the edges of the sheet. Try to keep the weights as close to the edge of the sheet as possible to minimize their visibility in the final image. Don't bother trying to get the specimen perfectly flat. As long as no parts are sticking up more than about ¼ inch there should be sufficient depth of field to capture a sharp image. The corner of the sheet at the specimen label is often the only part that needs to be weighted down. Small white weights can be placed directly on the sheet to hold down the top and left edges.

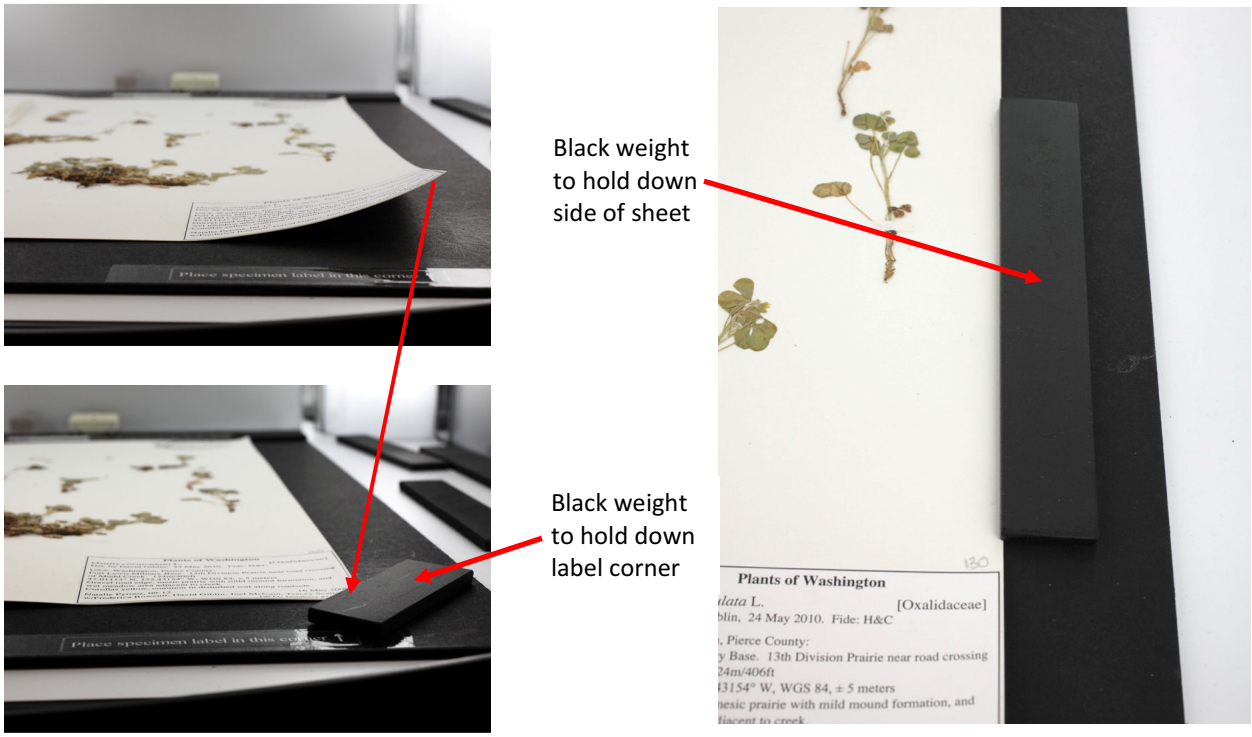


Figure 17. Using the black weights to hold down curved edges of a specimen sheet. Shown here is a curved label corner held down by barely overlapping the weight with the corner of the sheet, and the side of a sheet held down with a longer black weight.

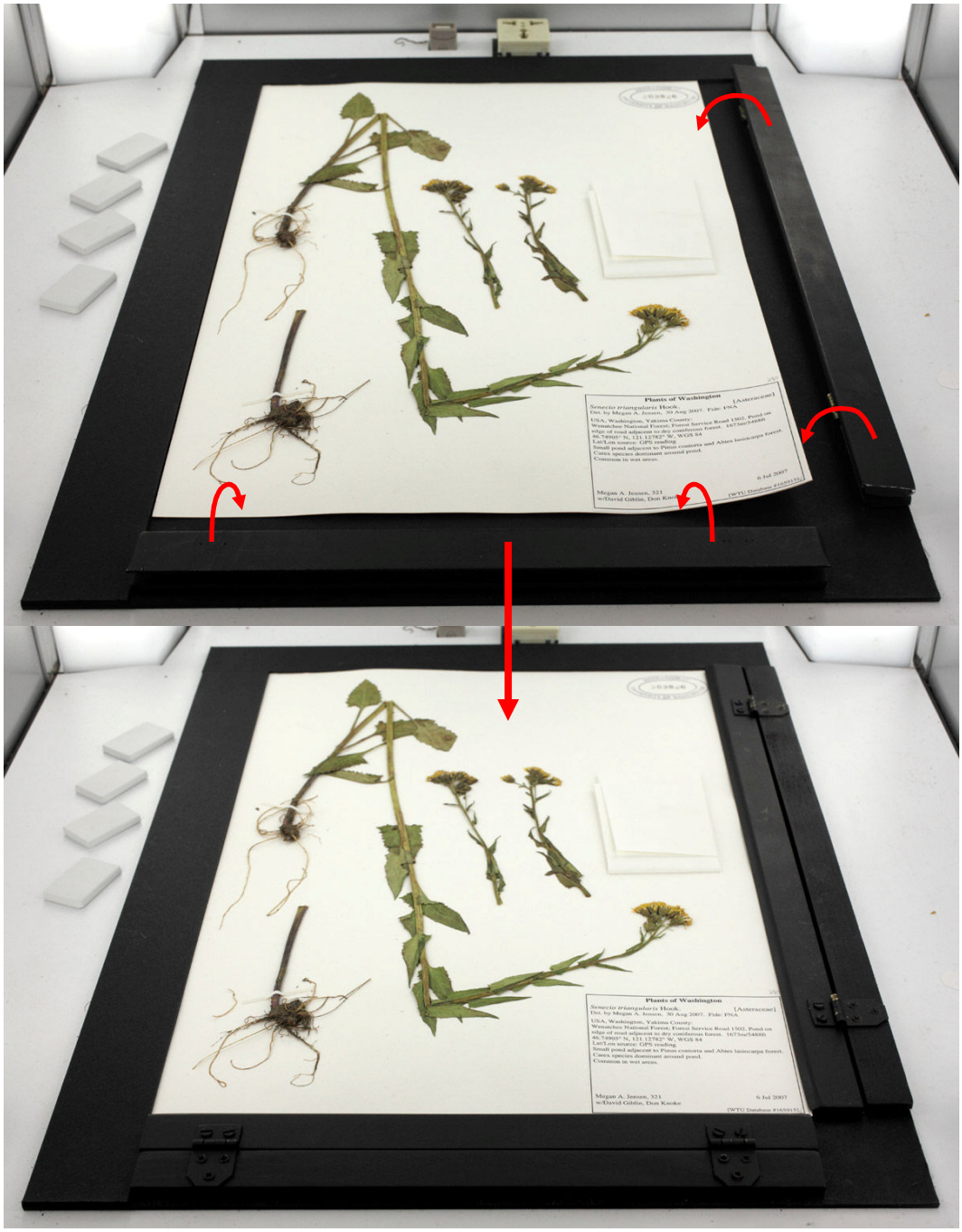


Figure 18. Using the hinged bars to hold down the edges of the specimen sheet. Top photo shows the bars flipped out of the way, with the sheet not held flat. Bottom photo shows the bars flipped onto the edge of the sheet. Use the finger indentations on the end of the bars to flip them back out of the way.

9.2. Specimen sheet contains a packet with plant material inside:

If there is a packet on the sheet, open it up to see if there are any plant fragments inside. If so, it is desirable to include this material in the specimen image. There a three possible ways to accommodate material in packets, depending on the packet's position and its contents:

1) Take the image with the packet flaps held open and the plant material left inside the packet (Figure 18). Use the small white weights to hold down the packet flaps. This works if there is nothing around the packet so that the opened flaps do not cover any part of the specimen, label, annotations, or other text.

Figure 19. Taking a single image of the specimen with the packet opened to reveal contents. Use the small white weights to hold the packet flaps open.

2) Carefully remove the contents of the packet, then re-close the packet and set the contents on top of the closed packet (Figure 19). Do not set the contents elsewhere on the sheet. Take the image, then remember to return the contents to the packet. This won't work for packets containing many small objects such as seeds that are cumbersome to remove.

Figure 20. Contents of packet placed on top of closed packet.

3) Take two images of the same specimen (Figure 20). Take the first image according to the usual procedure, with the packet closed. Then open the packet, using the white weights to hold the flaps out, and take a second image. Now, open Windows Explorer and find the two images you just captured. Rename the second image so it is identical to the first (same acronym and same number), but with a suffix appended to identify the image as a second copy of the same specimen. The suffix must consist of an underscore followed by a lower-case letter beginning with "a" for the duplicate image (e.g., "WTU_013937.CR2" and "WTU_013937_a.CR2"). If a third image is needed, use "_b" as its suffix. DO NOT rename the first image; it should not have any suffix.

WTU_013937.CR2 WTU_013937_a.CR2

Figure 21. Taking two images of the same specimen. In the first, the packet is left closed. In the second, the packet is opened. It is ok if the packet flaps cover other parts of the specimen.

9.3. The camera won't focus:

Specimen sheets that contain large blank areas near their center may cause problems for the camera's autofocus. If the camera will not focus when you move the mouse over the shutter release button or click the button, then try this trick:

1) Move the mouse completely off the shutter release button and wait until the camera stops trying to focus.
2) Place your hand under the fabric door and into the light box and hold it gently on the specimen sheet near the middle of the sheet.
3) With your hand in place, move the mouse back over the shutter release button and hold the mouse in position without moving it. The camera should then focus on your hand.
4) Then, without moving the mouse even a tiny bit, remove your hand from the lightbox (don't disturb the specimen sheet), and click the mouse button to trigger the camera shutter. If the camera tries focusing again, it probably means you moved the mouse slightly after removing your hand from the lightbox or while clicking the button.

9.4. The folder name was incorrectly entered into the metadata entry form:

If you have not yet taken any images from that folder, you can simply delete the entry by right-clicking the row number next to the entry and selecting "Delete Row", then use the "Add Folder" button to recreate the entry with the correct folder name.

If you have already started taking images, then keep the entry for that folder and instead use the mouse to click into the Folder Name field on that entry and manually change or correct the name. You may also need to change the Family name. You can also use this technique to correct any of the other fields, such as Imaged By, Acronym, Date, and Time.

9.5. The folder name was not entered before imaging specimens in that folder:

The easiest way to fix this is by creating an entry for that folder, and then manually adjusting the Time value in that entry to reset it to a time just before the first image from that folder was taken. The time must also be set to a value later than the time for the last image captured from the previous folder.

1) Open Digital Photo Professional (there should be an icon on the desktop), and use it to browse to the folder containing the images ("C:\PNWHerbaria\Images\NewImages\").
2) Use the thumbnail previews in this program to identify the first image from the folder.
3) Right-click on this image and select "Info" from the popup menu. This will bring up a window with metadata extracted from the image file.

4) Look for the "Shooting Date/Time" value and make a note of the time. Convert this time to 24-hour format (e.g., 3:53:09 PM = 15:53:09) and subtract a second so the time is slightly earlier than when the image was taken (e.g., 15:53:08 in this example).
5) In the Metadata entry form, create a new entry for this folder, and save it. Then, find the entry in the Folder Names list, and click into the Time field. Enter the time you noted from the image info window, in the 24-hour format (HH:MM:SS), and click out of the field to make sure it saves your change.

9.6. How to re-shoot or delete an image:

Reasons for which an image may need to be retaken or deleted include:

1) The specimen sheet was not properly aligned (crooked, or part cut off from view).
2) Part of the sheet is curved and sticks up too high to be in focus.
3) After taking the image you noticed a packet on the sheet that needs to be opened.
4) The specimen is not part of the set being imaged (e.g., not a Pacific Northwest locality).

Follow these steps to delete the incorrect image and possibly re-shoot it:

1) Open Windows Explorer and browse to "C:\PNWHerbaria\Images\NewImages\".
2) Find the image that needs to be deleted and delete it (probably the very last one; if you can't tell, then open Digital Photo Professional and use the thumbnail views to identify and delete the image).
3) Put the specimen back into the lightbox and take a new image according to the normal procedures. There is no need to rename the new image to match the old image's number, and there is no reason to be concerned about having a gap in the image numbering sequence.

9.7. The Compact Flash card is full:

A 16 GB CF card will hold about 550 CR2 images, while a 32 GB card will hold about 1100 images. At 150 images per hour, the 16 GB card will fill up in less than 4 hours, and the 32 GB in about 7 hours. The CF card is used mostly as a redundant backup for images also sent to the computer. When the card fills up, do the following:

1) Refer to section 8.1 on how to copy images from the laptop to the external hard drive. This ensures there are still two copies of the images even after the CF card is cleared.
2) Then, reformat the card to clear out the images. Refer to the instructions in section 6.1.
3) Once the card is cleared, continue with imaging as normal.

10. Sending images and metadata to WTU

Images should be sent to WTU for processing and uploading to the web server when imaging is completed at an herbarium, or the laptop's hard drive is close to full (a 500 GB drive can hold about 16,000 CR2 images).

Images are transferred by mailing the external drive to Ben Legler at WTU, as follows. Please follow these instructions exactly!

1) Make sure the last day's images are copied over to the external drive according to the instructions in section 8.1.
2) On the laptop, move all images in "C:\PNWHerbaria\Images\ArchivedImages\" to "C:\PNWHerbaria\Images\SentImages\" so you know which have been sent to WTU.
3) Open the Metadata entry form and use the "File -> Save List to File" menu command to save the metadata to the external drive. This time, place the file into the folder "PNWHerbaria\Metadata\". This metadata file should contain entries for all images on the hard drive. But it is OK if the metadata is divided among several separate files.
4) Use the "File -> Save List to File" to also save copies of the metadata file(s) to the laptop in the folder "C:\PNWHerbaria\Metadata\" to serve as a backup in case the hard drive is lost or damaged during transit (both images and metadata should be on the laptop).
5) Now, clear the metadata list on the laptop by selecting the "Admin -> Clear List" menu command. This will ensure the same metadata is not sent again to WTU.
6) Package the hard drive into a small padded box, such as the ones used to ship CDs or video cassettes at the post office. Use extra padding (crumpled paper, foam, bubble wrap, etc.) to make sure the hard drive does not jostle around inside the box. You don't need to include the USB cable with the hard drive.
7) Mail the hard drive via USPS (not UPS or FedEx) to the following address:

   Ben Legler
   Herbarium
   University of Washington
   P.O. Box 355325
   Seattle, WA 98195

While the drive is in transit, continue shooting using the second drive. Once the drive arrives at WTU the images will be transferred to the PNW Herbaria server, then the drive will be cleared of all images and metadata and mailed back.

Don't delete the images from the laptop just yet. After you receive confirmation that the images have been transferred to the server at WTU, the images can optionally be deleted from the folder "C:\PNWHerbaria\Images\SentImages\" on the laptop's hard drive.

11. Disassembling the workstation for transport

The following steps will help ensure all equipment is accounted for and packaged safely for transport between herbaria. Use the provided plastic storage bin (Figures 21, 22) to hold all gear except the lightbox and camera mount.

1) Unplug the camera, lighbox, and laptop. Remove the battery adaptor from the camera and insert the regular battery into the camera. Place all the power cords and the camera's USB cord into the large cubby in the plastic tub.
2) Place the camera into its cubby in the plastic tub. Make sure the lens cap is on.
3) Remove any loose objects from within the lightbox (such as weights), and place these into the cubbies in the plastic tub. The black specimen holder, ruler, and hinged weights should remain inside the lightbox.
4) Remove the camera mount from the top of the lightbox, and set it aside. Place the wing nuts and thumb knob into the small cubby, and the aluminum bars into the large cubby. There should be four white plastic caps that can be placed over the exposed bolts on top of the lightbox.
5) Place the external hard drives into their small cubby in the corner of the plastic tub.
6) Insert the mouse's USB receiver into the bottom of the mouse, and place in a cubby.
7) Place the laptop into the provided foam tray, and place this into the plastic tub on top of the other cubbies. Cover the laptop with the large, flat foam insert.
8) Place all documentation and papers into the top of the tub, and close the tub.

Figure 22. Lower set of cubbies for placement of camera and small items.

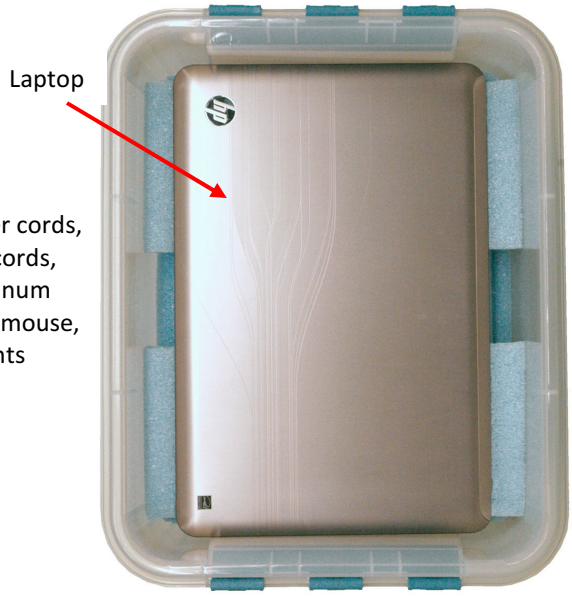


Figure 23. Laptop in its tray, set on top of the lower set of cubbies.

Make sure the following equipment is accounted for before leaving the herbarium:

1) Lightbox
2) Camera mount
3) Aluminum bars, wingnuts, plastic caps, and thumb knob for camera mount
4) Specimen holder, rulers, and hinged weights.
5) Paper weights (four 6" black, one 3" black, and five 1-½" white)
6) Camera
7) Camera battery and lens cap (both should be in/on the camera)
8) Compact flash card (should be inside the camera)
9) Laptop and mouse (and mouse's USB receiver and spare AA battery)
10) Power cords for lightbox and laptop, AC adaptor for camera, and USB cord for camera
11) User manuals (imaging documentation, cheatsheets, camera manual)
12) External hard drives with their USB cords
13) Plastic tub and its foam inserts

When finished, you should have only three items to transport: lightbox, camera mount, and plastic tub.