Equipment Software & Workflow Recommendations:

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Equipment Recommendations

Cameras:

General Recommendations:

The market for digital cameras is huge. DpReview is an excellent site for camera reviews. Digital SLRs (DSLRs) have an optical viewfinder; leading brands are Canon and Nikon. Mirrorless cameras are becoming increasingly popular and are less bulky; leading brand is Sony.
Image quality depends much on the camera sensor. Sensor size is an important aspect: a larger sensor is characterized by higher resolution and higher dynamic range (i.e., the difference of light and color that it captures from the darkest black through midtones to the whitest white). [Another aspect that affects image quality is whether your camera uses an anti-aliasing in front of the sensor or not. Older camera models use this filter to eliminate repetitive patterns that can confuse pixels, but the filter causes slight interpolation artifacts and thus introduces blur. The more modern cameras now largely no longer use anti-aliasing filters.]

The most common camera sensor sizes are full format (Nikon calls it FX = 35mm film equivalent, which means the sensor is the same size analog film), and the smaller APS-C (Nikon calls it DX). Cameras that use the smaller APS-C size sensors crop the 35mm image, when traditional full frame lenses are attached. This essentially means that images appear magnified by approx.1.5x [obviously this is no true magnification, but instead a reduction of the angle of view, cropping and discarding some of the image resolution from the margin of full frame lenses]. Mounted to a camera with APS-C sensor, a standard 50mm lens (which has ±the same angle of view as the human eye) thus essentially becomes a moderate tele lens, at an effective 75mm focal length.

Relevant for the image quality is of course not only the camera, but almost more importantly the lens (see recommendations below).

Camera used at ASU:

We bought a Nikon D850 (a full frame 45MP "pixel monster"); older models should give you enough resolution as well, e.g., the D800 (full frame, 36MP), the D7000 (APS-C, 16MP), or even the now almost “antique” D300 (APS-C, 12MP).

Lenses:

General Recommendations:

When shopping for a lens DxOMark maintains a huge database of Camera+Lens combinations. For the grant it is recommended to use a true macro-lens, i.e., a lens that has a 1:1 reproduction rate, where an object in front of the camera will be reproduced on the camera sensor the same size as it really is.
This said, you will likely need a macro lens only if you plan to capture detailed images of the specimens. A normal, non-macro lens or even a wide angle or zoom lens can generally be used on a copy-stand to capture labels and even full vascular-plant-size herbarium sheets. A wide angle lens even has the advantage that it generally has much wider depth-of-field. Zoom lenses are generally not a good choice for doing copy work on a macro table in the lab. They often suffer from considerable optical aberration.

A true macro-lens is important for taking images of small detail and minute objects (lichens & bryophytes). With most regular lenses you cannot get sufficiently close to capture a large and detailed image of your specimen, but only an overview.

Another important aspect, when shopping for a lens is focal length. Professional photographers typically do not recommend "Normal" lenses (50-60mm) for macro-photography because of their limited working distance. A short working distance means you need to get close to your subject to take a macro-photo, which scares away animals. On a repro-table in the lab this is, however, not an issue. Here, getting close instead is an advantage, because you do not need a huge copy-stand, but can mount the camera closer to the specimen that you photograph.

Nikon AF Micro-NIKKOR 60mm f/2.8D
This is Nikon's older 60 mm macro lens, but it is still manufactured and optically superior to the newer 60mm model; it also has the advantage of giving you more working distance.

Nikon AF-S VR Micro-NIKKOR 105mm f/2.8G IF-ED
This 105mm lens is an excellent macro (i.e., capable of 1:1 image reproduction), but it has a much larger working distance than the 60mm, which means that you will need a large copy-stand so that the camera can be mounted high above the subject. For relatively small objects (a single lichen/bryophyte packet, a specimen or even part of a specimen) this works well. Shooting an overview image of an entire herbarium sheet with a tele lens might, however, be a challenge.

[**important if you are using Nikon**: some of the newest models, like the D850, can take a series of images at different focal planes automatically, a technique that Nikon calls '*focus shift*'. Using software like ZereneStacker or HelicoSoft these images can be stacked into a single image where everything from the front to back is in focus. An excellent tutorial how Nikon Focus shifting works can be found at Backcountry Gallery. Nikon's focus shift only works with modern lenses

that have a built-in auto-focusing motor; Nikon's AF Micro-NIKKOR 60mm f/2.can thus *not* be used for in-camera focus shift. BUT, when working on a macro table in the lab this is *not* an issue. In the lab you can use software like ControlMyNikon to drive the camera to capture a stack of images.]

[Personally, I have used Nikon for years; Canon cameras are just as excellent, and they have a fantastic, but very expensive macro lens, the Canon MP E Macro 65mm F2/.8; I still prefer Nikon, because of their wireless flash system, see below; and the Canon lens is a monster, great for insects, but for routine macro photography of lichens and bryophytes quite an overkill).

Extension Tubes & Diopters:

General Recommendations:

Extension tubes and diopters can be used to achieve image reproduction rates beyond 1:1, e.g., 2:1, 3:1, etc. - meaning that the image on the sensor will be magnified and thus become larger than life-size.
An important difference comparing tele and normal lenses for macro-photography: Extension tubes and diopters have a different effect on these lenses.
Extension tubes are mounted between camera and lens and their magnification effect is much more drastic on a normal lens (50-60mm) than on a tele lens (100mm, 200mm, etc.). For a tele lens you need a much larger extension to achieve the same magnification. Mounting an extension tube on a normal lens results in more significantly reduced working distance, the front of the lens will need to be moved *very* close to your subject. Extension tubes also have an effect on aperture, they essentially add additional f/stops, which means and decrease the light that reaches the sensor (which means you need stronger lighting to use them)

Diopters to increase magnification can be problematic because they are generally optically inferior to the lens itself and often decrease resolution or introduce optical aberration. However, they do not swallow a lot of light and their effect on aperture is negligible. Working with a tele macro lens, it is often better to use high quality diopters to achieve magnifications beyond 1:1.

The macro lens natively goes to reproduction rates of 1:1. To capture more detail of minute specimens, I rarely use Kenko Extension Tubes.

Repro Stands & Focusing Racks:

General Recommendations:

It is highly recommended to not use a tripod; using a tripod in the lab to take images of labels and specimens the legs will easily get in the way. The camera should instead be mounted on a

copy stand, ideally in combination with a focusing rack. A focusing rack can be useful, because it allows fine focus adjustments by moving the camera up and down, thus keeping reproduction rates constant. Focusing instead with the camera lens will slightly affect image reproduction size. In macro- and repro-photography it is often easier to fine-focus manually by moving the camera instead of using the camera/lens autofocusing system. The autofocus often arbitrarily selects a point in your image that is not necessarily the most important element of your image. Also, depth-of-field in macro photography can be so severely limited that at high magnifications it may be preferable to manually select, which particular part in your image needs to be in focus.

Repro Stand:

Novoflex Magic Studio Repro Stand
The quality of Novoflex equipment is outstanding and I love that you can fix this repro-stand column to virtually any table, a very flexible, almost mobile setup. However, the size of the column of this repro stand is limited and probably not ideal if you work with a tele lens; especially not if you are trying to capture whole herbarium sheets.

Focusing Rack:

Focusing the camera directly on the repro-stand column is cumbersome and doesn't work well, thus I have the camera mounted to a Novoflex Castel-Q Focusing Rack - with Arca-Type Quick Release (to connect the camera to the rack, I am using the Peak-Design Hand Strap, which has an Arca-Type plate).

Stack Shot Focusing Rail:

Cognisys sells a unique focusing rail that can be attached to a repro-stand and used to automatically capture a series of images at different focal planes, moving the camera up and down at pre-defined distances. In combination with imaging tethering software like ControlMyNikon you can thus capture a stack of images that can be combined into a single image with superior depth-of-field using software like Helicon or Zerene Stacker. This works fairly similar to Nikon's in-camera focus-shifting, where the camera automatically adjusts the focus of the lens to capture a series of images to then be stacked into a single image. A third option to capture a stack is to use a conventional focusing rail and ControlMyNikon to capture a series of images at different focal planes (this is the cheapest "focus-stacking" option; no fancy new camera with focus-shift necessary, no stack shot; simply use the tethering software to capture the stacks).

Lighting:

General Recommendations:

Good lighting is a considerable challenge in macro-photography. Generally one can distinguish between using permanent light sources and flash. They work *very* differently, but both have in common that a high light output is particularly important in macro-photography, where stopping down the aperture for increased depth of field is generally necessary (if not using focus stacking/focus shifting, an f/stop of 1/16, 1/20, 1/32 or even higher might often be necessary to obtain images with sufficient depth of field).

Permanent lights

Permanent lights need to be very bright to achieve good exposure at moderate ISO. In the past halogen light sources were often used. They are sufficiently bright, but can get very hot and are often uncomfortable to work with. LED panels are now increasingly popular. I have experimented with LED desk lamps mounted on flexible arms; they are not necessarily bright enough and I now usually use them only for focusing the tethered camera image on-screen and then shoot the image using flash.
Permanent light boxes have the advantage that you "see what you get", which means that you can assess what the image looks like before it is captured and adjust the light sources accordingly. They also generally do not need batteries. The disadvantage is that they need to be very bright to work well. Even though you are working on a macro table, fast shutter speeds are recommended to avoid vibration and thus camera motion blur. With long exposures even the mirror of your camera snapping back or an accidental knock to the table, or your computer hard disc spinning up may mess up your image. If light is insufficient high ISO may be an option. Noise increases the higher you bump up the ISO, but modern digital cameras have excellent noise reduction and it is a bit of trial and error at what time noise becomes intolerable.
Working with permanent lights, exposure compensation might be necessary to adjust for taking images of predominantly dark objects (a pitch black *Collema*, a deep brown *Frullania*), or if the lichen/bryophyte is shot against a bright wight background (the specimen cardboard). Camera metering generally is calibrated to assume that an average photo is an average gray. Thus, shooting a very bright image likely result in underexposure (and thus may need exposure compensation by +⅓, +⅔, +1...), whereas taking pictures of a very dark subject may be overexposed (compensation by -⅓, -⅔, -1 ...).

Light Boxes

Diffusers or soft boxes can be very useful to achieve even, shadowless lighting. Some soft boxes for small objects are sold with LED lights built-in; I am occasionally using this cheap one sold on Amazon. The disadvantage of these light boxes sold online: they often do not have an opening at the top and thus do not work well with a copy stand, where the camera is mounted above. Even

though the small, cheap one I bought has a hole at the top, it is *not* wide enough, but the cheap plastic can easily be cut to make it work. I previously also posted a DIY lightbox tutorial on basecamp and I found some sewing machine LED light strips that can be used as light sources. Building your own box is probably the best solution, because you can build it right to size. Generally a disadvantage of lightboxes is the necessity to arrange your subject inside the confined space of the light box. This can be a hassle. Diffusers (to soften harsh light sources) or reflectors (for indirect lighting, bouncing it back) may be a more flexible choice, but they generally require more powerful light sources.

Flash

Flash works differently from permanent light in that it puts out a very high intensity strobe of light for only a few milliseconds. Exposure time is therefore irrelevant when using flash and relatively independent from the aperture. For a properly exposed image only the amount of flash (measured by the flash guide number) is thus important. Adjusting for the correct shutter speed when using flash is nevertheless important. Most modern flashes will measure ambient light and adjust flash output for so-called “fill-flash”. This is to avoid harsh shadows and the look of artificial light. In program or aperture mode the flash then puts out just barely enough light to add to the available ambient light. In repro- and macrophotography this is problematic. Not only does ambient artificial light has a color cast, but even if a camera is mounted to a repro-stand, motion-blur can cause the images to look blurry. Working with flash in the lab it is therefore important to use the camera in manual mode at the highest sync speed possible, at least 1/60 or 1/125 (most modern cameras allow for a sync speed of 1/250).

At ASU we use Nikon's wireless R1C1 flash system, which is extremely versatile. The flash heads can be mounted via a front ring to the camera lens or entirely independently on their own little stand. This means you can position these flashes anywhere close to your specimen. You are not bound by a light-box, your sample can be tiny or large. The guide number of the flashes is fairly low, but in my experience quite sufficient. You can even use up to 8 flashes with one single controller (mounted to the camera). This is more than overkill, I routinely use 2-3 flashes. The flashes work with CR123 batteries; I use rechargeable ones. Most other Nikon Flashes are also compatible with the remote TTL-IR triggering from the controller. So, if you have huge specimens (entire herbarium sheets) you might get a broader lightning spread if you use these. The Novoflex Repro Stand also has options to attach flexible arms to which you could attach some permanent LED lights (I have NOT use those; a cheap alternative would be LED office lamps with a flexible arm).

Software Recommendations:

Image Capturing Software (camera tethering)

General Recommendations:

Several programs can be used to connect a digital camera to the computer via USB and use the computer to control the camera (tethered camera control). With some of the more simplistic programs camera control is very limited, but the following two programs can be very useful, because they both allow to preview images on the computer in LiveView and rename images automatically with a barcode and sequence number:

ControlMyNikon / ControlMyCanon

ControlMyNikon works extremely well and is cheaper and better than Nikon's own proprietary software.

Particularly useful is ControlMyNikon versatile capacity to rename images during image capture using barcodes. Although the software does not read the barcode from an image file itself, you can use a barcode scanner to scan in the barcode before capturing a series of pictures, which will subsequently all be named with the barcode as the file name and a sequence number added (until the next barcode is scanned).

Thus, the program can very efficiently be used to capture and name images automatically in batch; a detailed tutorial can be found here:
https://tetherscript.com/kbcmn/batch/

Pros:

- extremely versatile
- very fine focusing adjustment at different image preview magnifications
- excellent online tutorials
- options to shoot image focus stacks (even without a StackShot focusing rail or Nikon's in-camera focus shift)
- ability to use internal or external database for image renaming and embedding of image metadata
- individual camera profiles allow to set up different camera capture scenarios (but not possible to use several cameras simultaneously, see below)

Cons:

- Windows only

- either works only with Nikon or only with Canon cameras (ControlMyCanon with identical functionality has to be purchased separately from the same vendor)
- barcodes need to be scanned and activated manually
- not possible to control several cameras simultaneously (necessary to create separate camera profile, which, however, can also be seen as a pro, see above)

Smart Shooter

Smart Shooter from TetherTools is another powerful image capturing software. Unlike ControlMyNikon the software can automatically read barcodes from an image and use that barcode to rename the files (and all subsequent image files) during image capture, which eliminates the need for a barcode scanner and can significantly speed up batch imaging.

Pros:

- works with Windows & Mac
- supports most Canon, Nikon and Sony cameras
- connect to multiple cameras at the same time
- barcode detection from within a photo works well (you can even take one photo with one camera, then move to the next camera and photos are automatically named with barcode and sequence number; possible scenario: take image on macro-table, make a section, take photo with microscope, all with same barcode)
- (alternatively barcode scanners can also be used)

Cons:

- LiveView supports **only one zoom level** (help does not even say at what magnification, possible 1:1)
- Live View generally *very* limited (using the Loupe the image is very pixelated; image quality of 1:1 Zoom is not great (no option to enable GPU for better image feed from camera live view; this can be a problem in ControlMyNikon too; only a few high-end cameras support feeding high-resolution Live View to a computer, but at least this is supported in ControlMyNikon; apparently no support in Live Shooter 4 apart from increasing the FramesPerSecond FSP - refresh rate)
- User Interface clumsy; not particularly intuitive:
  It took me a while to figure out the difference of LiveView vs. "preview" ("preview" is actually a review image showing you what the photo looks like after having been captured)
  For my taste there are too many frames and views taking up space unnecessary screen real estate and for each view one constantly has to switch (before you take the picture, you want LiveView in the frame, afterwards you want "preview" to review what that picture actually looks like, but you cannot just select a thumbnail from the filmstrip to easily review the image)

The photo browser on the second tab is just a list with no thumbnails and one might as well use File Explorer to review images, etc., etc.

- Image Stacking Script takes a bit getting used to (perhaps my personal prejudice; but beware, when two cameras are connected they will alternate shooting images; I accidentally thus took one "stack" with two cameras ;-)
- The help file is not very thorough; ControlMyNikon Tutorials are *much* better.
- barcode code table support is limited (although the formats being supported is impressive: QR Code, EAN-13/UPC-A, UPC-E, EAN-8, Code 128, Code 39, Interleaved 2 of 5); at ASU we use 128 for lichens and 39 for the vascular plants, but if herbaria use a different format, they may be out of luck...

Summary SmartShooter (vs. ControlMyNikon)

Most of the cons of **SmartShooter** are minor and for the purpose of routine imaging *most* of the pros clearly outweigh the greater flexibility that ControlMyNikon / ControlMyCanon has to offer.

A **huge advantage is automatic barcode recognition** from the image itself (potentially an enormous time saver).

A **considerable disadvantage is the inability to review Live View at different Zoom levels**. Especially with macrophotos, I got so used to looking at images at different magnifications and for best results very carefully place the focus. This is something I would most definitely miss much. Even if you routinely stack images, being able to place the focus point exactly is a crucial aspect of macro-photography.

Image Renaming Software

General Recommendations:

Nikon sells a proprietary software called Capture Control Pro; Canon cameras are sold with their free tethering software called EOS Utility. Both software products are not as versatile as ControlMyNikon (ControlMyCanon) or Smart Shooter. They also cannot be used to automatically rename image files using a barcode during image capture.

At ASU Daryl Lafferty developed a little program called BarcodeRenamer.

BarcodeRenamer

The program scans JPGs for a barcode, automatically detects and reads the most commonly used formats (code 39 & code 128) and renames image files by their barcode number.
If cameras capture images as JPG+NEF pairs, the program can be used to rename the two files with the same name automatically.

In close-up mode one can take an image of the barcode first and subsequent images that do not contain barcodes will be renamed using this barcode+sequence number until the next close-up image of a barcode is captured (this batch rename of images without barcode currently only works for code 39).
A new version of the program will be able to batch-rename images without the need to take a close-up of the barcode. To avoid errors when barcodes in full-size images are not detected a preview window will show all images of a renaming series side-by-side.

Barcode Formatting Recommendations

Ideally use even numbers with leading zeros and your acronym as letter prefix and no hyphens or underscores (e.g., ASUL000827; reason: even numbers of digits that include leading zeros make for smaller, shorter barcodes in code 128; hyphens and underscores are symbols that different keyboard language settings interpret differently, which means if collections in Europe or Latin America try to read your barcode the reader might interpret the hyphen or underscore incorrectly).
BUT: if you *already* use any particular format, don't switch unless necessary !!!

Recommendations for renaming Images manually

If you need to manually rename image files, it is strongly recommended using a barcode reader instead of the keyboard. Don't type in the barcode on the keyboard, it's just a recipe for disaster.

Image Management, Editing & Processing

General Recommendations:

Generally three different types of software can be distinguished for *Image Management*, *Editing* and *Processing*.

Programs like Photoshop or Affinity Photo are ***destructive imaging editors***, which means any image edits change the actual pixels of the edited photos. As a workaround both Photoshop and Affinity Photo adjustments can be applied to the file as layers and Affinity Photo even permits storing the editing history with the file itself, but layers can only be stored in proprietary formats of these image editors. It is therefore recommended to always keep the original image file plus the edited JPG derivative.

Non-destructive image editors like Lightroom or PhotoLab save image adjustments in sidecar files. They work best with raw files (NEF, CR2, ARW). Using these saved adjustments JPG derivatives can be generated and exported “on the fly”. Instead of archiving the JPG derivatives

with their raw file originals it is possible therefore to just simply archive the sidecar files that contain the image adjustments. **For routine imaging both programs have the added advantage that adjustment templates can be saved and applied in batch to a series of images.**

Lightroom and PhotoLab both offer limited ***cataloging capabilities*** using a library of hierarchical image tags for organizing photos. These tags that can be embedded in the image metadata and thus exchanged between different catalogs. A much more powerful image cataloging software is PhotoSupreme, but it offers only very basic editing tools.

Adobe Photoshop

Probably still the most powerful image editor on the market. Available only as a subscription, thus expensive, incurring repeated annual costs. Another disadvantage of the subscription model is that users have to accept whatever changes Adobe adds to the new version of their products. The program includes a powerful raw editor, but options to focus stack macro images are limited. **For image editing of large batches of photos captured as part of a standard routine imaging workflow, Photoshop is *not* an ideal image editor.** Adjustments can only applied in bulk to a batch of images with advanced knowledge of macros and batch processing.

Affinity Photo

Virtually as powerful as Photoshop, but much cheaper and available as a standalone version, not a subscription. Has the ability to save image adjustment history inside the proprietary Affinity Photo image format (and thus potentially a non-destructive workflow). Its raw editor is equally as powerful as the one from Photoshop. Focus stacking works slightly better.
Like Photoshop, Affinity Photo does not really work well for bulk image adjustments of large batches of photos captured as part of a standard routine imaging workflow.

Adobe Lightroom

The most widely used and most popular image raw editor and cataloging software. **Lightroom can efficiently be used to easily apply image adjustments to a whole batch of raw files and export resized JPG derivatives using these adjustments. This makes the program particularly suited to be part of routine batch imaging**. At ASU we routinely use the program for our Vascular Plant Digitization Workflow, but we will most likely replace it by PhotoLab.
Image adjustments are non-destructive and can be saved as templates. Thus it is possible to save one template for example for labels, another one for specimens, one for overly dark images, another for overly bright ones, etc. At ASU, for simplicity we use only “one-fits-all” template as part our Vascular Plant Digitization Workflow.
Lightroom increasingly offers very versatile tools also for the correction and editing of individual images, perhaps not quite as powerful as Photoshop or Affinity Photo, but it means that images first edited in batch can still subsequently “fine tuned”, i.e., individually edited.
Lightroom can be used to build a catalog of hierarchical keywords. It saves this catalog in a database and the program can actually not be used without that catalog. This is both powerful,

but also somewhat problematic. The program can be used to embed hierarchical keyword tags in the image XMP metadata, which means images can be exchanged between different programs, the keywords being imported into a different catalog. But if you do not use this metadata catalog and only import images for routine adjustments the database can also be a drag, because it remembers any image that was ever imported and if you move images to a different folder outside the catalog, a lot of dead placeholders of images no longer available inside the catalog pile up. At ASU we do not use the program for cataloging and routinely delete the database.

DxO PhotoLab

PhotoLab is in many aspects very similar to Lightroom, but it uses its own proprietary raw editor, which has access to the gigantic DxOMark database, a wealth of standardized technical test data of camera/lens combinations. Using this database, PhotoLab will per default correct image aberration by adjusting images in bulk using the camera/lens data from its vast database and powerful built-in artificial intelligence algorithms. **This means that PhotoLab is the most powerful product currently on the market for *automated, bulk image adjustments* based on technical image correction data.** The program generally achieves good results using standard settings without the user having to know a lot about image adjustments.
Unlike Lightroom, where you will manually need to use the adjustment tools to save a template that can then be applied to multiple images in batch, PhotLab can be used to apply adjustments automatically from its database. These adjustments can still be fine-tuned before a photo is exported and, like in Lightroom, any adjustments can also be used as a template. The program is sold as a standalone version without a subscription model and it can be installed also as a plugin both for Photoshop and Lightroom so that its standard adjustments can be further modified by these programs.
Like Lightroom PhotoLab can be used for cataloging, but it's catalog is both less versatile and less intrusive.

IDimager PhotoSupreme

PhotoSupreme is possibly the most complex and most powerful image cataloging software currently available. Its catalog can be installed either as a standalone program on an individual computer (using SQLite as its database) or on a server (using PostGres). The program emphasizes cataloging images, non-destructive image editing is possible, but very limited.
It is thus not an imaging adjustment software suitable to be integrated in routine imaging workflows, but similar to Lightroom it can be used to build a catalog of images.
PhotoSupreme catalogs are built on XMP image metadata stored inside the metadata of the images (or in the case of raw files, as sidecars). The program supports embedding the full set of DarwinCore metadata into image files. As part of the TCN we will use the program at ASU to establish a Controlled Vocabulary of lichen characters to build up an Image Tagging Catalog to be integrated with the portal character matrix and identification keys. The XMP standard assures that metadata tags can be shared with any cataloging software and the Controlled Vocabulary, once tested and fully functional, will eventually be made available for image tagging also in other programs like lightroom.

Image Stacking Software

General Recommendations: Generally

Helicon

…

Zerene Stacker

…

Other Useful Programs

lichen labeler (if you want to print labels with barcodes directly onto a sheet of paper to be folded into a packet).

Workflow Recommendations:

The ASU workflow for Vascular Plants can be summarized as follows:

1. Capturing JPG+CR2 image pairs of whole herbarium sheets with Canon EOS utility.
2. Renaming all images using Daryl Lafferty's barcode renamer
3. Importing images into Lightroom and applying a routine image adjustment template
4. Exporting JPG derivatives to a subfolder of the folder where original images are stored
5. Using ABBYY Fine Print to generate text files of the image labels
6. Uploading images and OCR text files to SEINet

For routine imaging of lichens and bryophytes this workflow will be modified as follows: