



THE NEW YORK BOTANICAL GARDEN

Specimen Imaging: From photography basics to backing up an archive

Part 2 of 5

Presented by Kimberly Watson

17 January 2014

Data Capture Course – Accra, Ghana

Overview

- ✓ Terminology
- Equipment
 - Hardware
 - Software
- Image capture process
 - Herbarium sheets, packets
 - Pinned objects (Christiane)
 - Spirit collections (Christiane)
- Image processing post-capture
- Image storage

EQUIPMENT

Imaging Equipment: Hardware

- Camera, scanner
- Lens
- Structural support for camera
- Light source
- Computer
- Cables
- Image storage space



Camera

Recommended:

- Digital single lens reflex (DSLR) camera
- At least 18 megapixels
- Full frame image sensor
- Capture RAW image file format



Image Sensor

Converts optical image to an electronic signal



Recommend full frame sensor

Blue box = Full Frame (35 mm)



APS-H (Canon)
28.7 x 19 mm
548 mm²



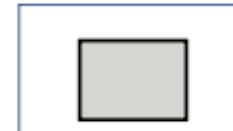
APS-C (Nikon DX,
Pentax, Sony)
~23.6 x 15.7 mm
~370 mm²



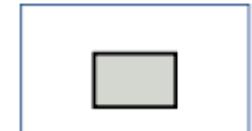
APS-C (Canon)
22.2 x 14.8 mm
329 mm²



Foveon (Sigma)
20.7 x 13.8 mm
286 mm²



Four Thirds System
17.3 x 13 mm
225 mm²



Nikon 1/CX
13.2 x 8.8 mm
116 mm²



1/1.7"
7.6 x 5.7 mm
43 mm²



1/1.8"
7.18 x 5.32 mm
38 mm²



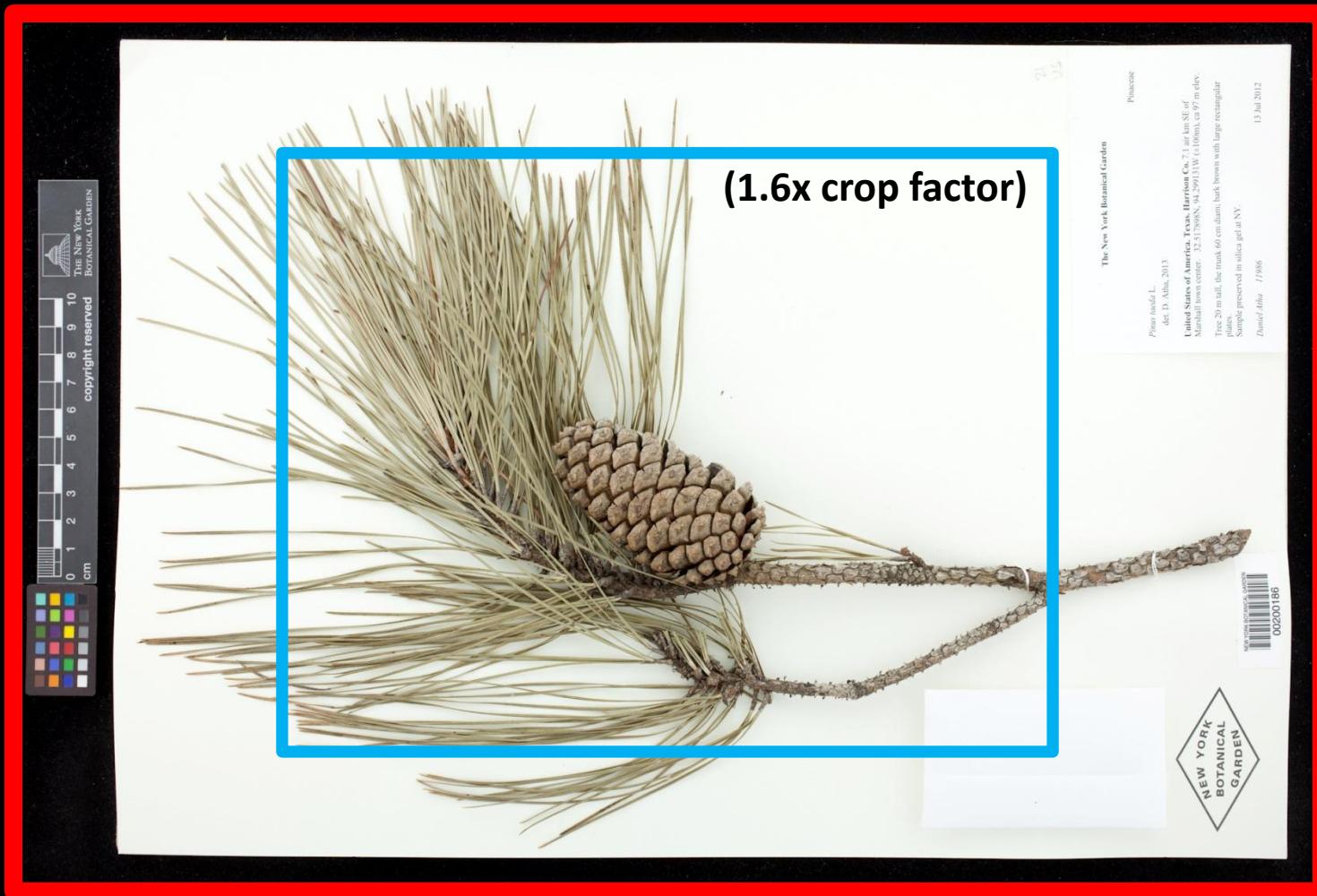
1/2.5"
5.76 x 4.29 mm
25 mm²

Full Frame vs. Cropped sensor

(36 × 24 mm)

(25.1 × 16.7 mm)

Same lens, same distance from specimen, different sensor size



Camera

Less expensive alternatives

Mirrorless interchangeable-lens camera:

- Highest number of megapixels possible
- With full frame image sensor
- Captures RAW image file format
- Macro lens

Point and shoot camera:

- Highest number of megapixels possible
- Largest image sensor possible
- RAW image file format, if possible

Compare Camera Specifications

Digital Photography Review: search for and compare cameras
<http://www.dpreview.com/products/compare/cameras>

Side by side			
3 cameras compared			
ADD CAMERA ...	 Nikon D800E	 Canon EOS 5D Mark II	 Fujifilm X-M1
move left move right move left move right move left move right			
Basic Information			
Buying options	Check prices	\$2,900 - \$3,630	Check prices
Review / Preview	84% Read review... Jun 11, 2012	79% Read review... Feb 13, 2009	77% Read review... Sep 17, 2013
Announced	Feb 7, 2012	Sep 17, 2008	Jun 25, 2013
Price			
MSRP	US: \$3,299.95 UK: £2689.99 EU: €3171		\$699 body only, \$799/£679.99 with 16-50mm
Body type			
Body type	Mid-size SLR	Mid-size SLR	Rangefinder-style mirrorless
Body material	Magnesium alloy		
Sensor			
Max resolution	7360 x 4912	5616 x 3744	4896 x 3264
Other resolutions	6144 x 4912, 6144 x 4080, 5520 x 3680, 4800 x 3200, 4608 x 3200, 4608 x 3056, 4080 x 2720, 3840 x 2560, 3680 x 2560, 3360 x 2560, 3056 x 2560, 2720 x 2560, 2560 x 2560, 2304 x 2560, 2048 x 2560, 1920 x 2560, 1600 x 2560, 1440 x 2560, 1280 x 2560, 1152 x 2560, 1008 x 2560, 896 x 2560, 768 x 2560, 648 x 2560, 544 x 2560, 432 x 2560, 324 x 2560, 216 x 2560, 144 x 2560, 96 x 2560, 64 x 2560, 43 x 2560, 27 x 2560, 18 x 2560, 12 x 2560, 8 x 2560, 5 x 2560, 3 x 2560, 2 x 2560, 1 x 2560	4080 x 2720, 2784 x 1856, 5616 x 3744, 3861 x 2574, 2784 x 1656	S: (3:2) 2496 x 1664 / (16:9) 2496 x 1408 / (1:1) 1664 x 1664

Camera Lens

For photographing herbarium specimens with a full frame image sensor, you will need:

50 – 60 mm Macro Lens

Goal: size of the object on the sensor \geq the size of the actual object
Reproduction ratio greater than 1:1

Example



Canon EF 50mm
f/2.5 Compact Macro

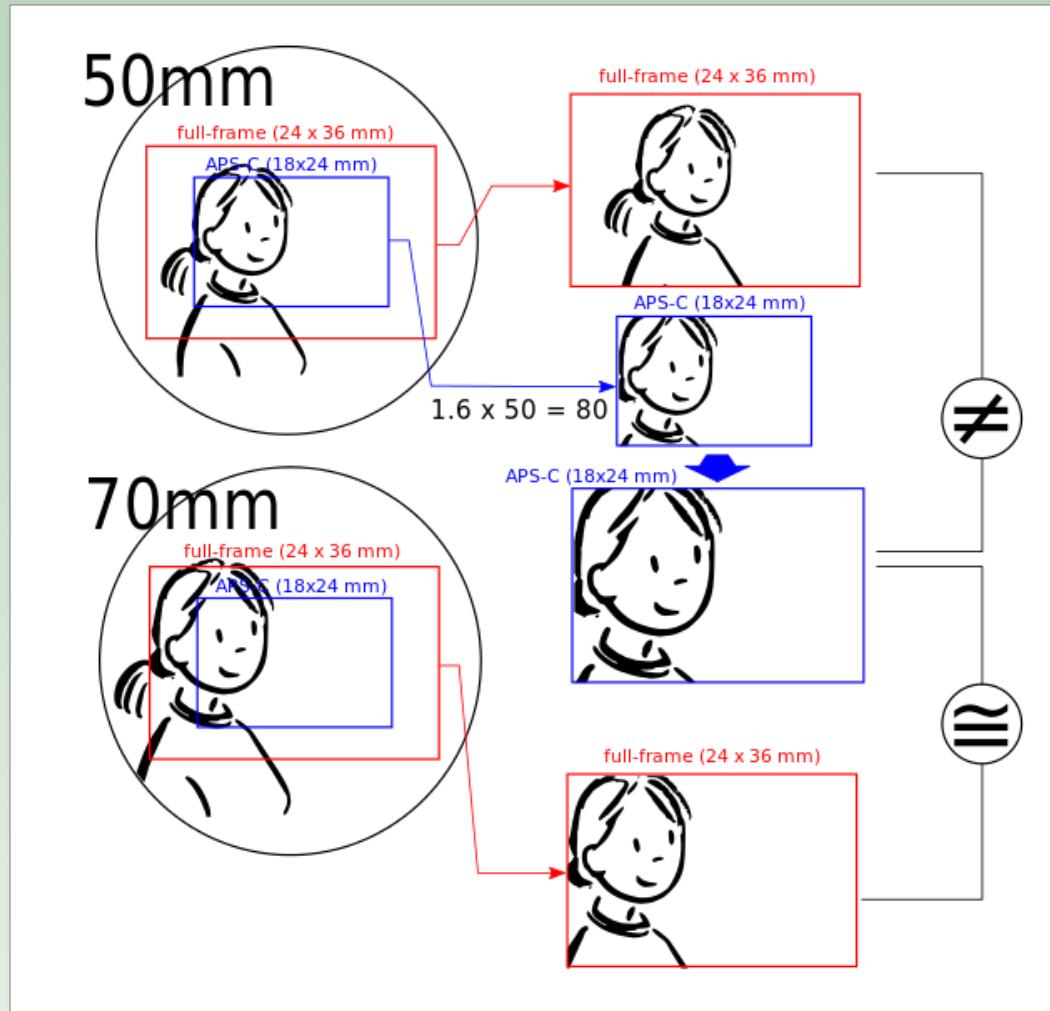
Example



Sigma 50mm f/2.8 EX DG Macro Lens
for Nikon DSLR Cameras

Full Frame Sensor vs. Cropped Sensor

With 50 mm and 70 mm lenses



Calculate Focal Length

Be sure the combination of camera image sensor and lens focal length will capture the entire specimen in the image.

Required Focal Length Calculator

Subject Distance	27	inches
Subject Size	19	inches
Camera Type	35 mm (full frame)	

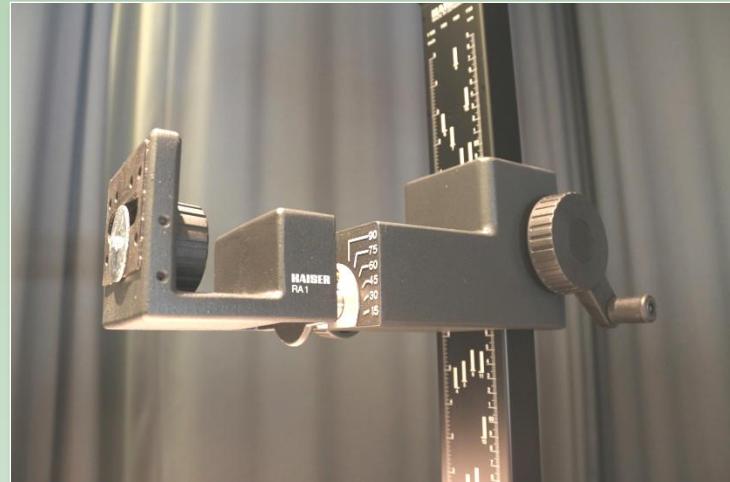
CALCULATE Required Focal Length: **47.6 mm**

Note: Calculator assumes that camera is oriented such that the maximum subject dimension given by "subject size" is in the camera's longest dimension.
Calculator not intended for use in extreme macro photography.

A camera with full frame sensor raised 27 inches above an herbarium specimen with a long edge of 19 inches requires a focal length of 47 mm.

<http://www.cambridgeincolour.com/tutorials/camera-lenses.htm>

Kaiser RS 1 Tabletop Copy Stand



- RA-1 Arm
- 40" counterbalanced, "low vibration" column
- 18 x 20 inch baseboard
- Can place MK Photo eBox on baseboard or use other light source

Bencher Copymate II Tabletop Copy Stand



- Fluorescent lights included
- Color temperature 5200K
- Working Area 20"W x 16"D
- Column 36" long

http://www.bencher.com/photo/copymate2_90061.php

Copy Stand

Advantages:

- Easy to assemble
- Adjustable
- Lights may be included

Disadvantages:

- Lights may not be included
- Environmental illumination
- Shadows



Example: imaging workstation with Bencher Copymate II copystand, lights included

MK Photo-eBox™

“NYBG Modified Version – Model 777000”

Advantages:

- Even illumination
 - 8 Fluorescent lights, 2 per side
28W, 6500K (“flicker-free”)
 - 1.5 ft. strip LEDs, 5500K
- Self-contained
- Easy to operate
- No need to crop image
- Small footprint: 2 ft. x 4 ft.



<http://mkdigitaldirect.com/products/lighting-systems/mk-photo-ebox.html>

Then...



Now.

Using the Photo-eBox

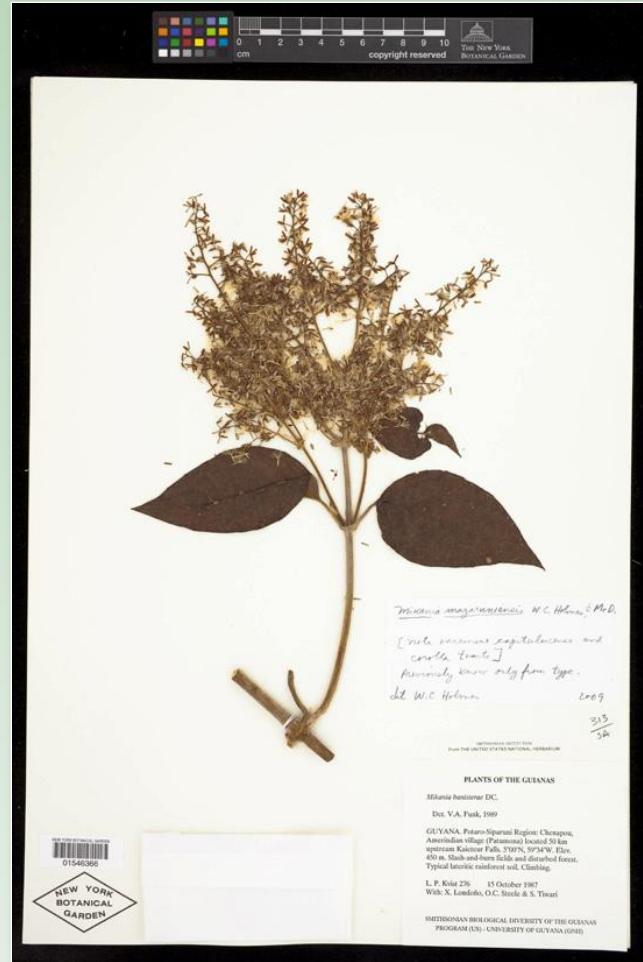
Improved Quality *and* Quantity

Then...

Now.



50-60 exposures/hour



80-90 (-120) exposures/hour

MK Photo-eBox™

“NYBG Modified Version – Model 777000”

Disadvantages:

- Limited size of subject
- Shipping lead time: 5 weeks
- Price = \$1,780 + shipping
- Replace bulb, fan
- No door knobs
- Some assembly required



HerbScan: Inverted Flatbed Scanner

Advantages:

- Very large images
- Consistent results
- Easy to operate

Disadvantages:

- Slow (5-6 min./scan)
- Limited subject matter
- May be discontinued



Computer

- Laptop or Desktop computer
 - Recommended minimum:
 - i5 processor
 - 4GB RAM (preferably more if plan to run image editing/processing software)
 - 500GB hard drive
 - Laptop: 17.3" display, USB mouse

Cables

- **AC Adapter** – connect to wall outlet, replaces dependence on battery. Is camera specific. May need to purchase separately.

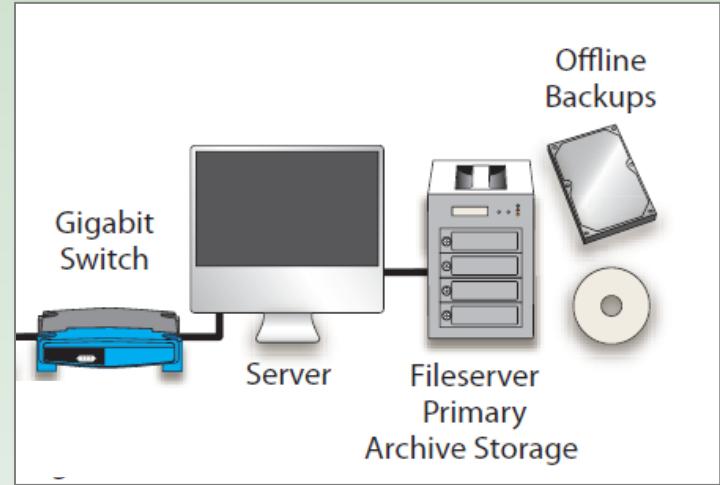


- **USB Interface Cable** – connect camera to computer
 - Allows for remote shooting
 - Save images directly to computer hard drive



Image Storage Space

- Multiple external hard drives
- Optical Disks (CDs, DVDs, Blu-Ray)
- Network server space
- Consider using backup storage space online:
 - Article: *“40 Online Backup Services Reviewed”*
http://pcsupport.about.com/od/maintenance/tp/online_backup_services.htm
 - Google Drive Storage 100 GB for \$5/month or 200 GB for \$10/month
<http://www.google.com/drive/storage.html>



Station Assembly: MK Photo e-Box

- Assemble copy stand
- Remove center feet from bottom of box*
- Remove plastic, lay velvetine on the glass*
- Place velvetine between box and copy stand*
- Center box on copy stand



Station Assembly

If using the MK Photo-eBox and the Kaiser RS 1 Copy Stand, an adapter is needed to extend the camera over the opening in the top of the light box.



1/4" screw



1/4" + 3/8"
Double Female Stud



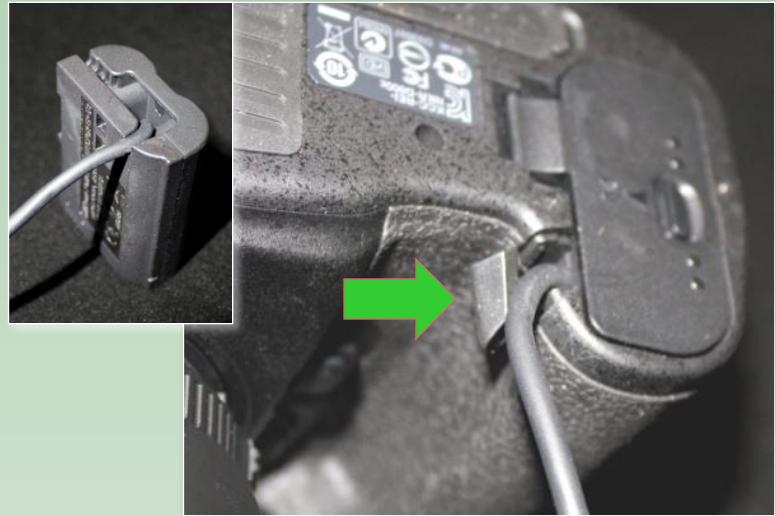
3/8" + 1/4"
Adapter Spigot



Flat washer

Station Assembly: Camera set-up

- Insert AC adapter
- Install & update software
 - Canon EOS Utility
 - Digital Photo Professional



Station Assembly: Camera set-up

- Insert AC adapter
- Install & update software
 - Canon EOS Utility
 - Digital Photo Professional
- Connect camera to computer



Station Assembly: Camera set-up

- Insert AC adapter
- Install & update software
 - Canon EOS Utility
 - Digital Photo Professional
- Connect camera to computer
- Shooting mode: Manual
- Power: On

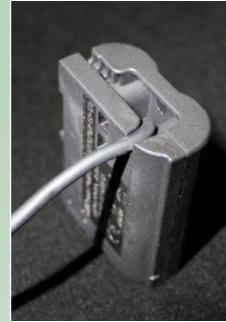


Photo e-Box vs. Copy stand



MK Photo e-Box 1419

1/50 of a second at f11



Copy stand

1/80 of a second at f20

Both photographed using Canon EOS -1Ds Mark III with a 50mm Macro lens

Image from e-Box shows more detail, due in part to the wider aperture, but also to the wrap-around lighting.

Camera vs. HerbScan

100% Magnification

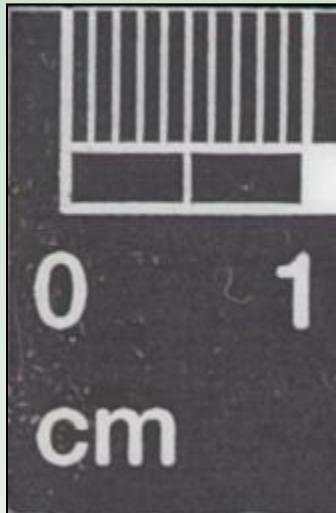
HerbScan

7158 x 10144 pixels, 600 dpi

Canon EOS 5D Mark II

50 mm lens,
f/9, 1/40 sec

3744 x 5616 pixels
300 dpi



Equipment Costs for NYBG Set-up

NYBG Herbarium Imaging and Equipment Specifications

Kaiser Copy Stand RS 1 with RA-1 Arm, 40" Column, 18 x 20" Base	\$575.74
Manfrotto 3/8" + 1/4" Adapter Spigot	\$5.59
Manfrotto 066 Double Female Stud for Super Clamp	\$4.50
MK Direct Photo-eBox , Model #777000 (shipping not included)	\$1,780
ColorGauge Nano Target	\$165
Rosco 48mm x 25 m Gaffer Tape (Black)	\$10.80
Photoshop Lightroom (optional)	\$149
TOTAL	\$2,690.63

Total does not include camera, lens, computer, barcode scanner, or image storage space.

Imaging Equipment: Software

- Remote image capture software
- Image viewing software
- Image editing software
- Image cataloging software
- Image focus-stacking software
(if photographing insects)

Remote Image Capture Software

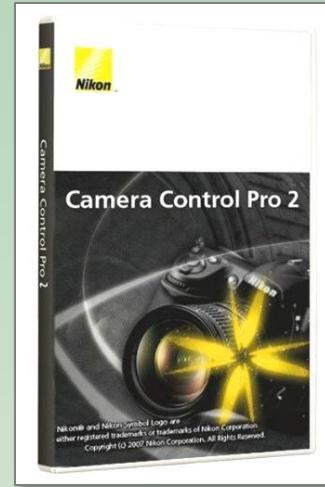
Canon camera

- EOS Utility
- Free with camera
- Windows or Mac



Nikon camera

- Camera Control Pro 2
- Sold separately
- Windows or Mac



Adobe Photoshop Lightroom

- Independent of camera brand
- Windows or Mac
- Costs \$150 (Student & Teacher Edition \$79)



Aperture

- Independent of camera brand
- Mac only
- Costs \$80

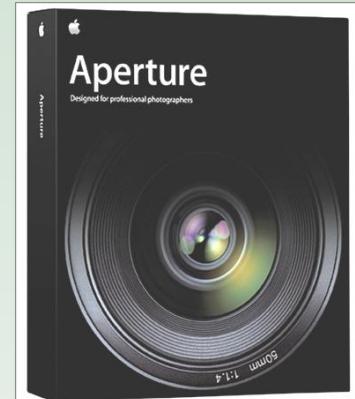
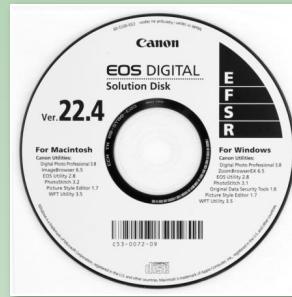


Image Viewing Software

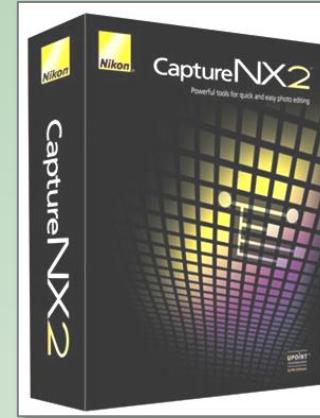
Canon camera

- Digital Photo Professional
- Free with camera
- Windows or Mac



Nikon camera

- Capture NX2
- Sold separately
- Windows or Mac



Adobe Photoshop Lightroom

- Independent of camera brand
- Windows or Mac
- Costs \$150 (Student & Teacher Edition \$79)

Aperture

- Independent of camera brand
- Mac only
- Costs \$80

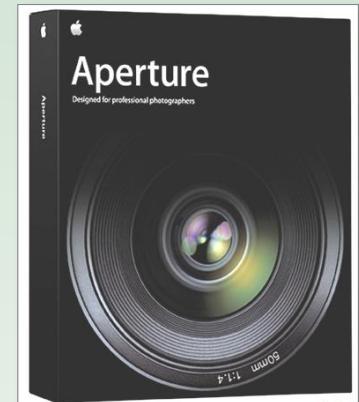
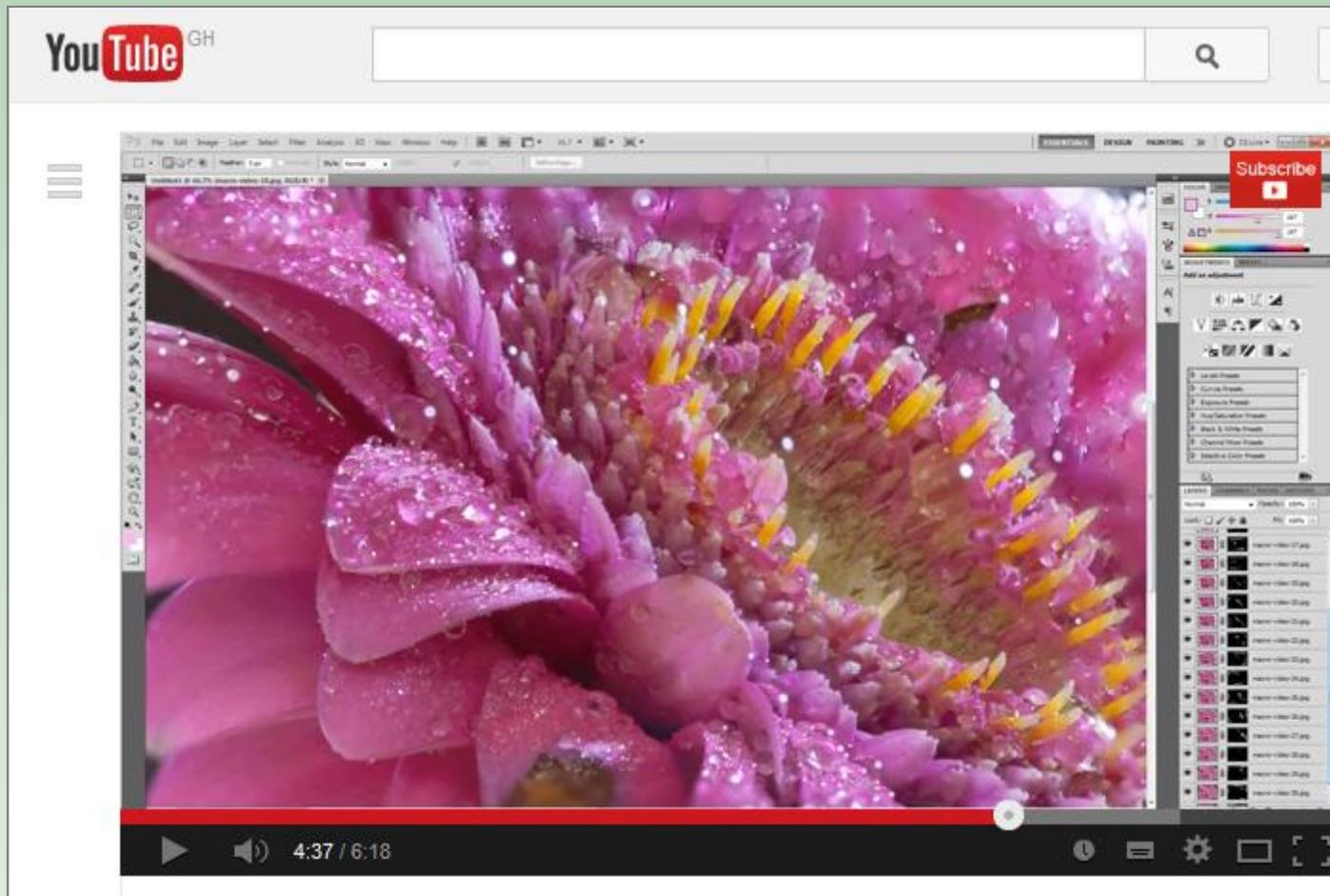


Image Editing & Cataloging Software

Software	Image Editor	Non-destructive image editing	Image Catalog	Cost	Operating System
<u>Lightroom</u>	X	X	X	\$134	Win/Mac
<u>Photoshop</u>	X			\$670, \$20/month	Win/Mac
<u>Aperture</u>	X	X	X	\$80	Mac
<u>Capture 1 Pro 7</u>	X	X	X	\$300	Win/Mac
<u>GIMP</u>	X			Free	Win/Mac/Linux
<u>AfterShot Pro</u>	X	X	X	\$50	Win/Mac/Linux

Select Software of interest in table above and link to website.

Image Stacking: Photoshop



Macro Focus Stacking/Image Stacking Tutorial
<http://www.youtube.com/watch?v=F3Dz34MMjQ0>

Image stacking: Helicon Focus Pro

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JW Player



Helicon Focus 6. Makes unlimited depth of field possible.

Source files: 2005_XP083.jpg, 2004_XP081.jpg
Rendering method: Method A (weighted average)
Method B (stacked)
Method C (blended)
Downsample: Decimated (50%)
Radius: 10
Iterations: 4
Output: Focus.tif (8 x 8 x 4 50.0%)

Order License

Download

Helicon Focus

- Quick Start
- Focus Stacking Parameters
- Gallery
- Articles
- Video Tutorials
- Versions and Licensing
- History of Changes (Win)
- History of Changes (Mac)

[Helicon Focus](#): Stacks the images.

[Helicon Remote](#): Control Canon or Nikon DSLR cameras remotely and automates focus (DoF) bracketing.

[Helicon Focus Pro](#): Includes Focus and Remote. Annual subscription \$55, Unlimited license \$200.

Image stacking: Zerene Stacker

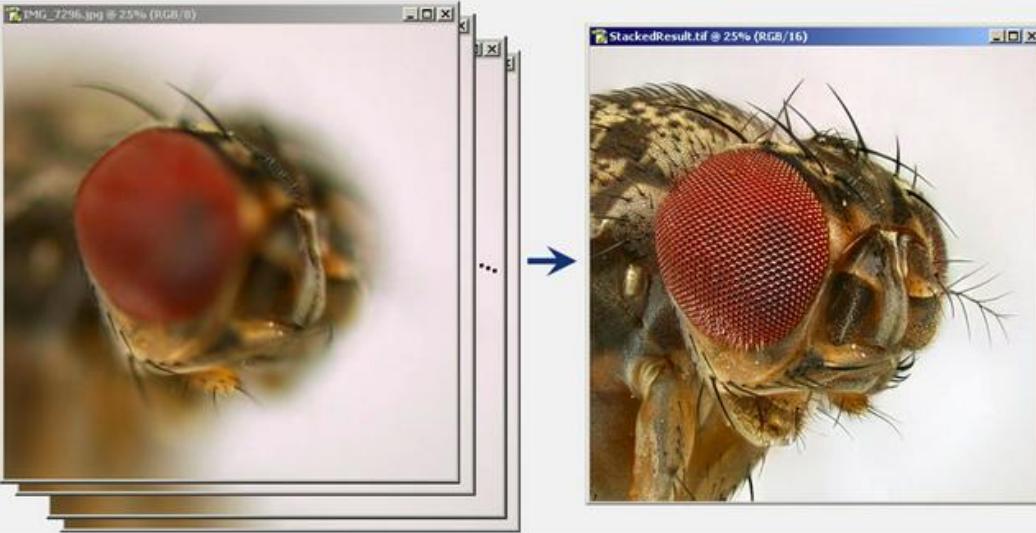
Zerene Stacker -- The Basics

[Download a free 30-day trial](#)

[Or purchase a license now](#)

Zerene Stacker is "focus stacking" software designed specifically for challenging macro subjects and discerning photographers. Of course it works great with simpler subjects, close-ups, and landscapes also!

This subject is a common fruit fly, as seen through a 100X microscope. Individual image on the left, stacked result on the right.



The screenshot shows two windows side-by-side. The left window is titled 'IMG_7296.jpg @ 25% (RGB/8)' and displays a close-up image of a fruit fly's head, showing a shallow depth of field with the fly's eye and antennae in focus while the background is blurred. The right window is titled 'StackedResult.tif @ 25% (RGB/16)' and shows the same fruit fly head, but with a much deeper depth of field, where the entire head, including the eye and antennae, is sharp and in focus. A blue arrow points from the left window to the right window, indicating the transformation from individual images to a stacked result.

\$40 Student Edition, up to \$290 for Professional Edition
Windows, Mac, Linux

<http://zerenesystems.com/cms/stacker>

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