

File Formats – Part 1

RAW vs. DNG (and XMP)



Image File Formats

Most Common Image File Formats



Most Common Photo File Formats



HEIC Files



What is the HEIC Format?



- File format name for Apple's new **High Efficiency Image Format**
 - Introduced in iOS 11 in 2017
 - More streamlined way of storing image files
- Uses advanced compression methods to
 - allow photographs to be created in smaller file sizes and
 - retain higher image quality than JPEGs
- **Default image capture format** for iPhones and iPads

If You Already Have HEIC files

The screenshot shows the iCloud Photos web interface in a browser. The address bar at the top contains the URL `icloud.com/photos/`, which is highlighted with a red rectangular box. Below the address bar, the browser's bookmark bar is visible with various links. The main interface features a sidebar on the left with navigation options: Library (Photos, Favorites, Hidden, Recently Deleted) and Albums (Media Types, My Albums). The main content area displays a photo library for the period of December 2020 to January 2021, containing 839 items. A selection of 14 items is shown, with a "Deselect All" link. The selected items include a sunset scene in Plano, TX (Jan 14) and a red sculpture in Dallas - Convention Center District (Jan 16). At the bottom of the interface, it indicates "838 Photos, 1 Video" and "Updated 10:30 AM".

If You Already Have HEIC files

The screenshot shows the iCloud Photos web interface. The browser address bar displays `icloud.com/photos/`. The page title is "iCloud Photos" and the current view is "Photos". The interface includes a sidebar with navigation options: Library (Photos, Favorites, Hidden, Recently Deleted) and Albums (Media Types, My Albums). The main content area shows a photo library for "December 2020 – January 2021" with 839 items. A red box highlights the "Share" icon in the top right corner of the photo grid. The photo grid displays two albums: "Plano, TX Jan 14 · Sandalfoot Cir & Steeplechase Dr" and "Dallas - Convention Center District Jan 16 · Texas". The Dallas album contains 14 selected photos, including several images of a red sculpture. The bottom of the page shows "838 Photos, 1 Video" and "Updated 10:30 AM".

If You Already Have HEIC files

The screenshot shows the iCloud Photos web interface. The browser address bar displays `icloud.com/photos/`. The page title is "iCloud Photos" and the current view is "December 2020 – January 2021" with 839 items. The left sidebar shows the "Library" section with "Photos" selected. The main content area displays a photo album titled "Plano, TX Jan 14 · Sandalfoot Cir & Steeplechase Dr" with four photo thumbnails. Below it is another album titled "Dallas - Convention Center District Jan 16 · Texas" with two rows of photo thumbnails. A red-bordered dialog box is open in the top right corner, titled "Download 14 Items". It contains two radio button options: "Unmodified Originals" (with the subtext "Originals as captured or imported.") and "Most Compatible" (with the subtext "Including edits."). The "Most Compatible" option is selected. At the bottom of the dialog are "Cancel" and "Download" buttons. At the bottom of the page, it says "838 Photos, 1 Video" and "Updated 10:30 AM".

icloud.com/photos/

Photos Moments

Library

- Photos
- Favorites
- Hidden
- Recently Deleted

Albums

- Media Types
- My Albums

December 2020 – January 2021
839 Items

Plano, TX Jan 14 · Sandalfoot Cir & Steeplechase Dr

Dallas - Convention Center District Jan 16 · Texas

Download 14 Items

- Unmodified Originals
Originals as captured or imported.
- Most Compatible
Including edits.

Cancel Download

838 Photos, 1 Video
Updated 10:30 AM

If You Already Have HEIC files

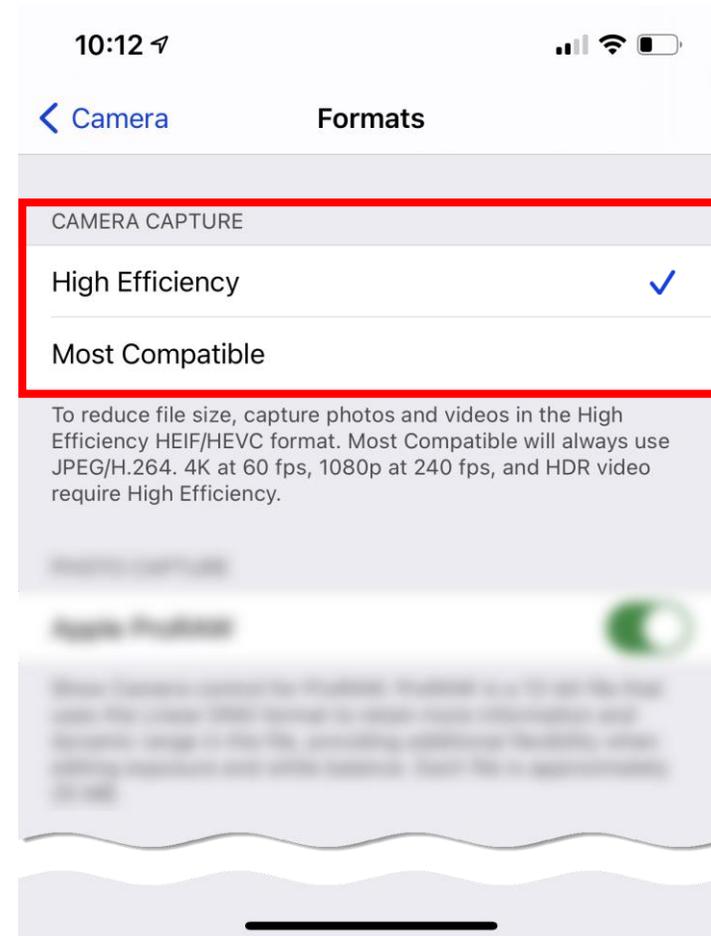
The screenshot shows the iCloud Photos web interface. The browser address bar displays `icloud.com/photos/`. The page title is "iCloud Photos" and the current view is "Photos". The left sidebar shows the "Library" section with "Photos" selected, and "Albums" with "Media Types" and "My Albums" visible. The main content area displays a photo album titled "December 2020 – January 2021" with 839 items. The album is divided into two sections: "Plano, TX Jan 14 · Sandalfoot Cir & Steeplechase Dr" and "Dallas - Convention Center District Jan 16 · Texas". The "Dallas - Convention Center District" section shows a grid of photos, including several images of a red sculpture. A download menu is open over the album, showing "Download 14 Items" with two options: "Unmodified Originals" (radio button) and "Most Compatible" (radio button, selected). The "Most Compatible" option includes the text "Including edits." Below the options are "Cancel" and "Download" buttons. A red arrow points to the "Download" button. At the bottom of the page, it says "838 Photos, 1 Video" and "Updated 10:30 AM".

Editing Support for HEIC

- iOS Photos and in Apple Photos
- **Current versions** of Adobe products
 - Lightroom Classic
 - Lightroom
 - Photoshop
 - Photoshop Elements
- Support in other editors – including plugins – is hit-or-miss
 - Capture One – Yes
 - ON1 Photo RAW – Yes
 - GIMP – Yes
 - Skylum Luminar AI – No
 - DxO PhotoLab 4 – No
 - Exposure x6 – No

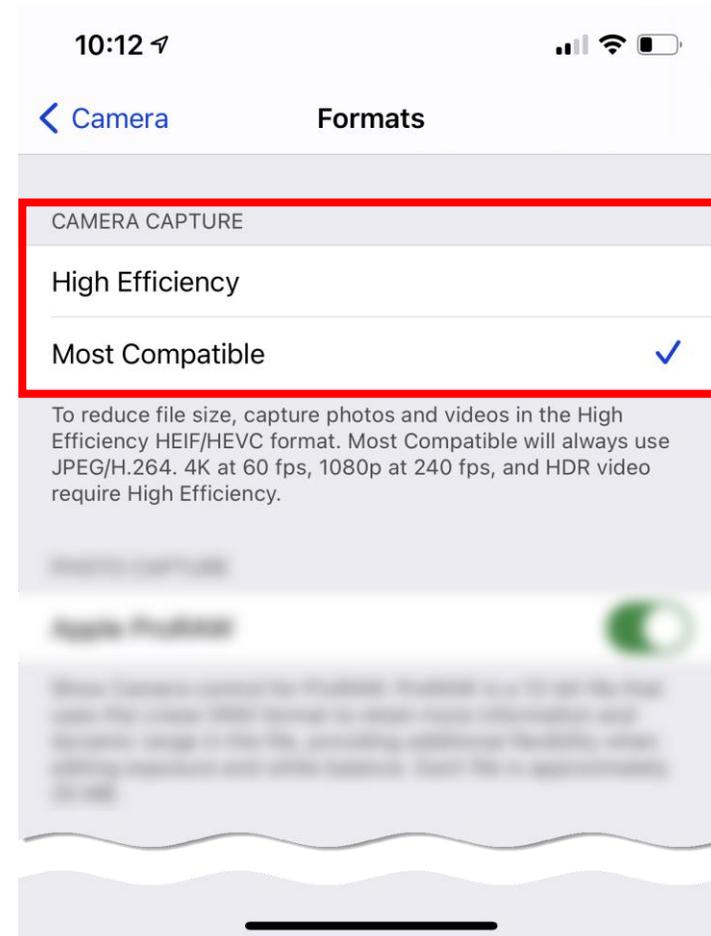
How To Turn Off HEIC in iOS

- Settings | Camera | Formats
- **CAMERA CAPTURE** section
 - **High Efficiency** for HEIC files



How To Turn Off HEIC in iOS

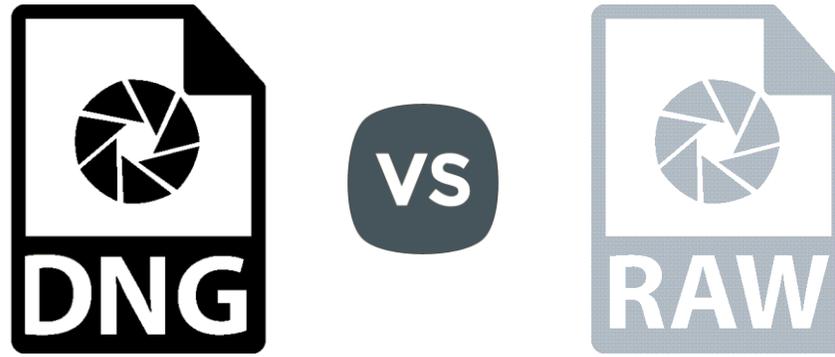
- Settings | Camera | Formats
- **CAMERA CAPTURE** section
 - **High Efficiency** for HEIC files
 - **Most Compatible** for JPEGs



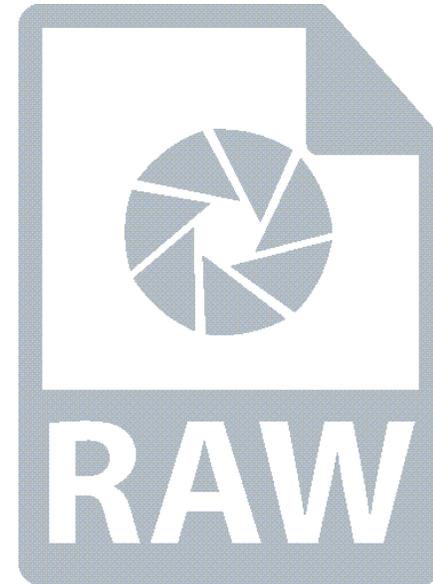
Most Common Image File Formats



Let's Compare and Contrast



RAW Files



RAW Files

- Contain **minimally processed data** from image sensor
- Preserve **most** amount of information about an image
- Each manufacturer has a proprietary RAW format
 - Canon - .crw, .cr2, .cr3
 - Fujifilm - .raf
 - Nikon - .nef, .nrw
 - Olympus - .orf
 - Sony - .arw
- Resources
 - https://en.wikipedia.org/wiki/Raw_image_format
 - <https://photographylife.com/dng-vs-raw>

Benefits of RAW Files

- **Highest quality image** is captured
- More **freedom in post-processing** to correct mistakes made during the shoot
- Fully supported by their manufacturers and therefore **work with camera-specific software packages** such as Canon Digital Photo Profession and Nikon Capture NX
- Resources
 - <https://www.lightstalking.com/advantages-disadvantages-shooting-raw/>

Negatives of RAW Files

- **Must** be edited
- **Increased time needed to post-process** photos
- **Bigger file sizes** require more storage
- Not all software packages can open latest RAW files
- RAW files **cannot be modified** by third-party software
- Changes in settings must be stored either in
 - a database/catalog (e.g., Lightroom Classic) or
 - a separate **sidecar (XMP) file**, which means more storage and more challenging file management
- Resources
 - <https://www.lightstalking.com/advantages-disadvantages-shooting-raw/>

DNG Files



Digital NeGative (DNG) File

- **Created by Adobe** to store data in generic, highly-compatible format
- Publicly available archival format (**is itself a RAW file**)
- Stores raw pixel data from sensor, **along with**
 - standard EXIF metadata,
 - date/time,
 - camera used, and
 - other camera settings
- Can be **created natively or converted** from RAW files
- Resources
 - <https://helpx.adobe.com/photoshop/digital-negative.html>
 - <https://photographylife.com/dng-vs-raw>

Benefits of DNG Files

- **Can be edited** by most image processing software programs
- **Can be made smaller** than original RAW files
- Contains **all information about a file**, including adjustments
 - No need for sidecar (.XMP) files
 - Useful when handing file off for retouching by others

Benefits of DNG Files

- Includes checksum information to detect / prevent file corruption
- Open / archival format
 - eliminates need for **third-party support for newly released camera files**
 - guards against inability to access specific file types in future

Negatives of DNG Files

- **Extra time needed** to convert RAW files to DNGs
- Does not work with most **manufacturer image-processing programs**
- **Conversion strips out most of the unrecognized metadata** (such as Active D-Lighting, Picture Controls, Focus Point, etc.) from RAW files
- Must be backed up **every time you make changes to them**
- Resources
 - <https://photographylife.com/dng-vs-raw>
 - <http://blog.barrypearson.co.uk/?p=1513>

Converting RAW Files to DNG

3 Methods For Converting RAW to DNG

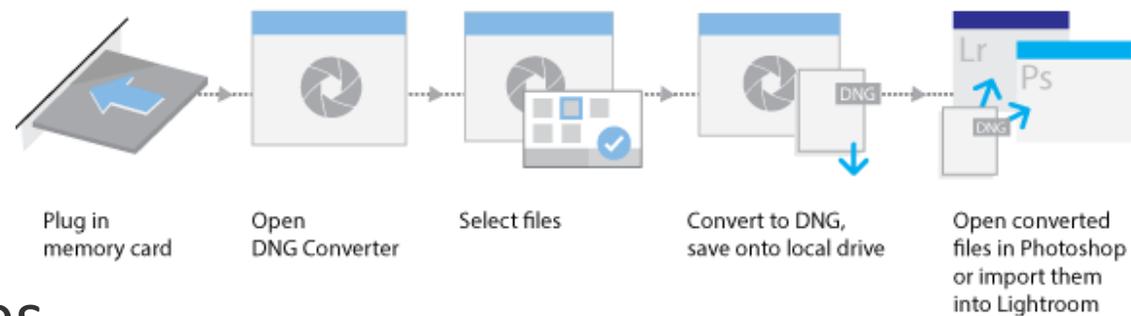
- **Adobe DNG Converter**
 - Best option for non-Lightroom users
 - Convert individual files or batches of files
 - Very fast
 - Free
- **After** import into Lightroom Classic
- **During** import into Lightroom Classic

Method 1: Adobe DNG Converter



DNG Converter Overview

- Converts camera-specific RAW files to more universal DNG RAW file
- Available for MacOS and Windows
- General workflow

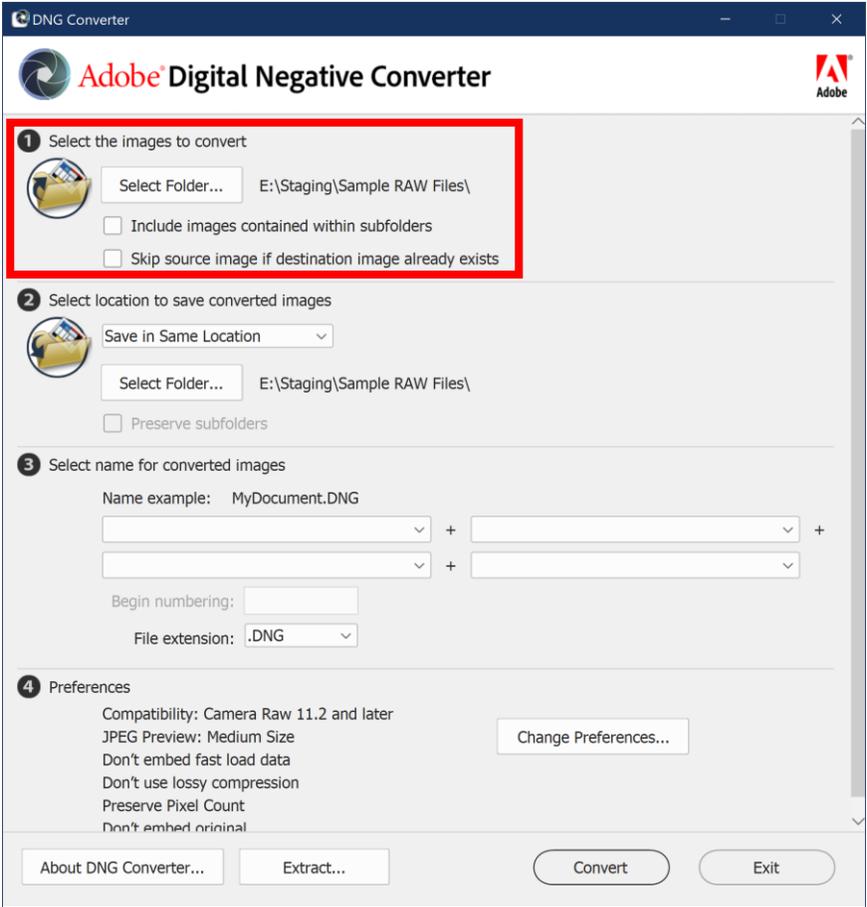


- Resources

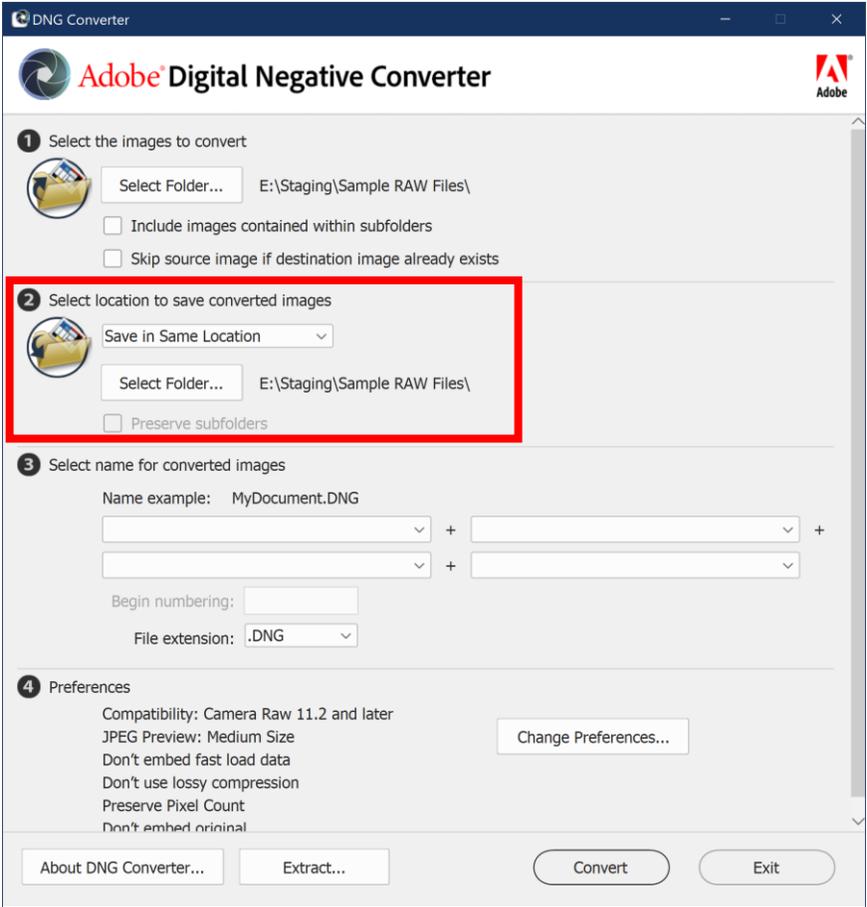
- <https://helpx.adobe.com/photoshop/digital-negative.html#downloads>
- <https://helpx.adobe.com/photoshop/using/adobe-dng-converter.html>



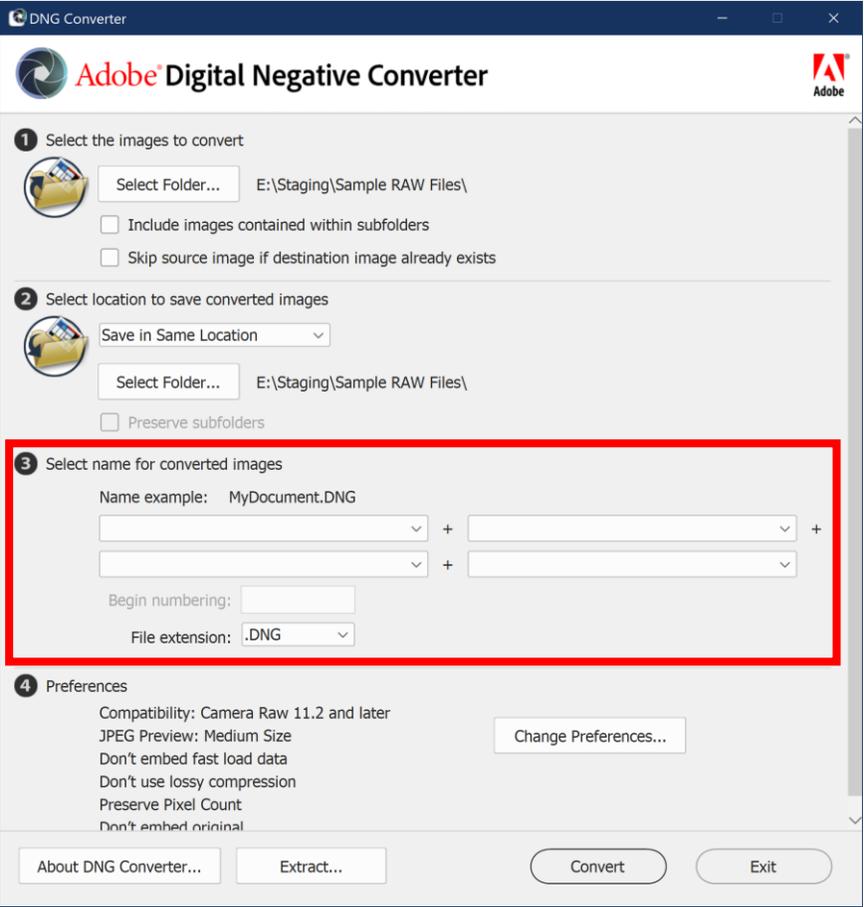
Adobe DNG Converter Interface



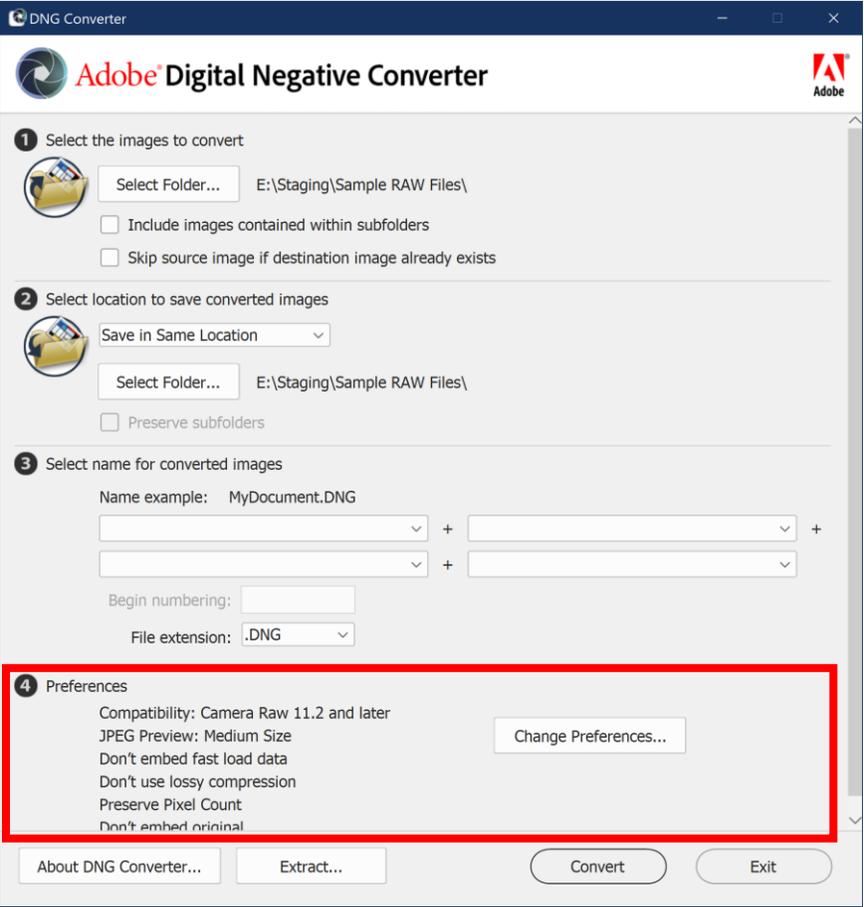
Adobe DNG Converter Interface



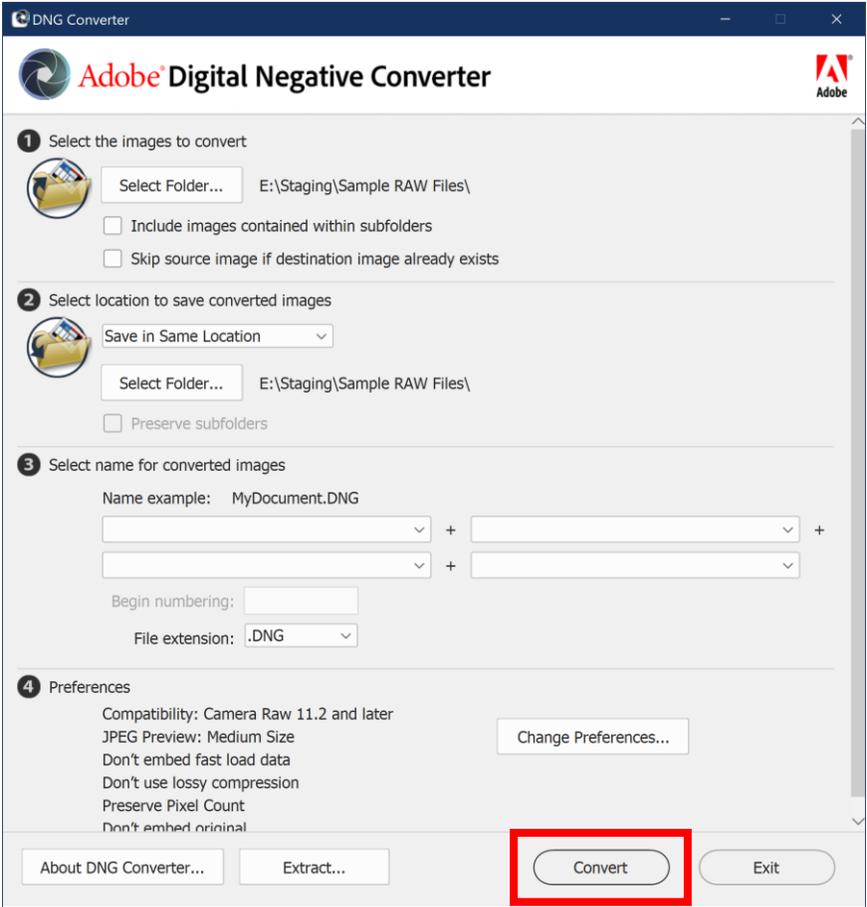
Adobe DNG Converter Interface



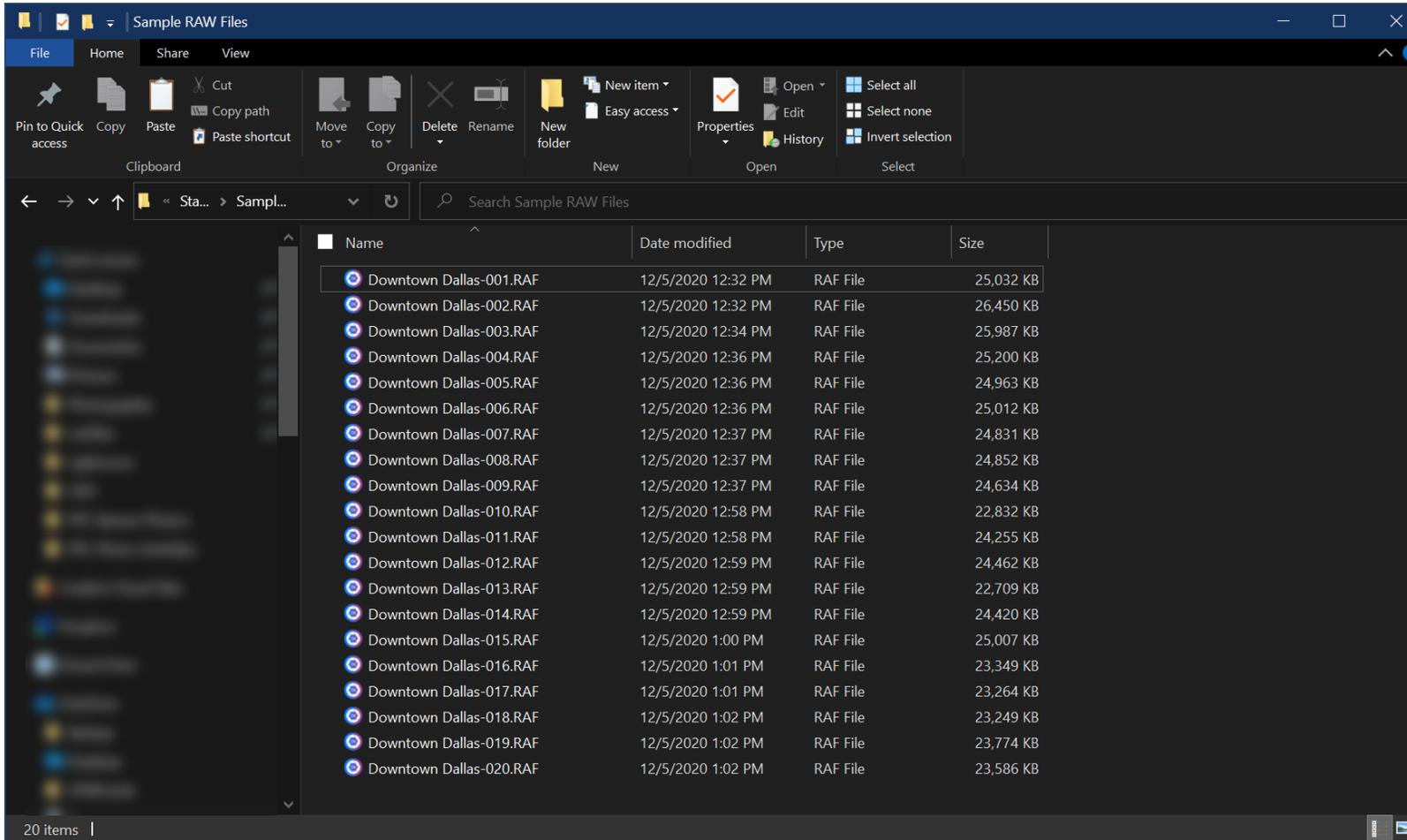
Adobe DNG Converter Interface



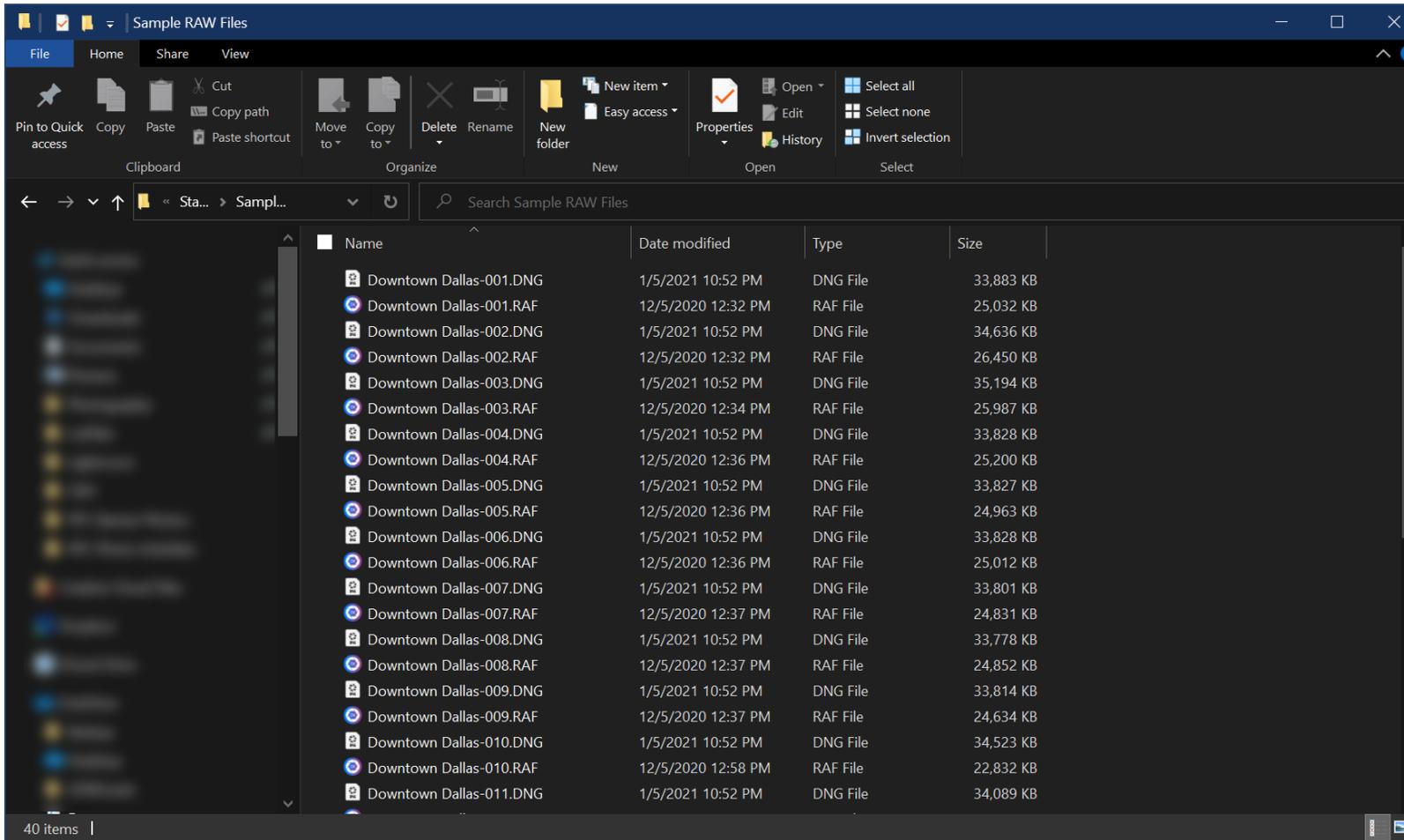
Adobe DNG Converter Interface



RAW Images for Conversion

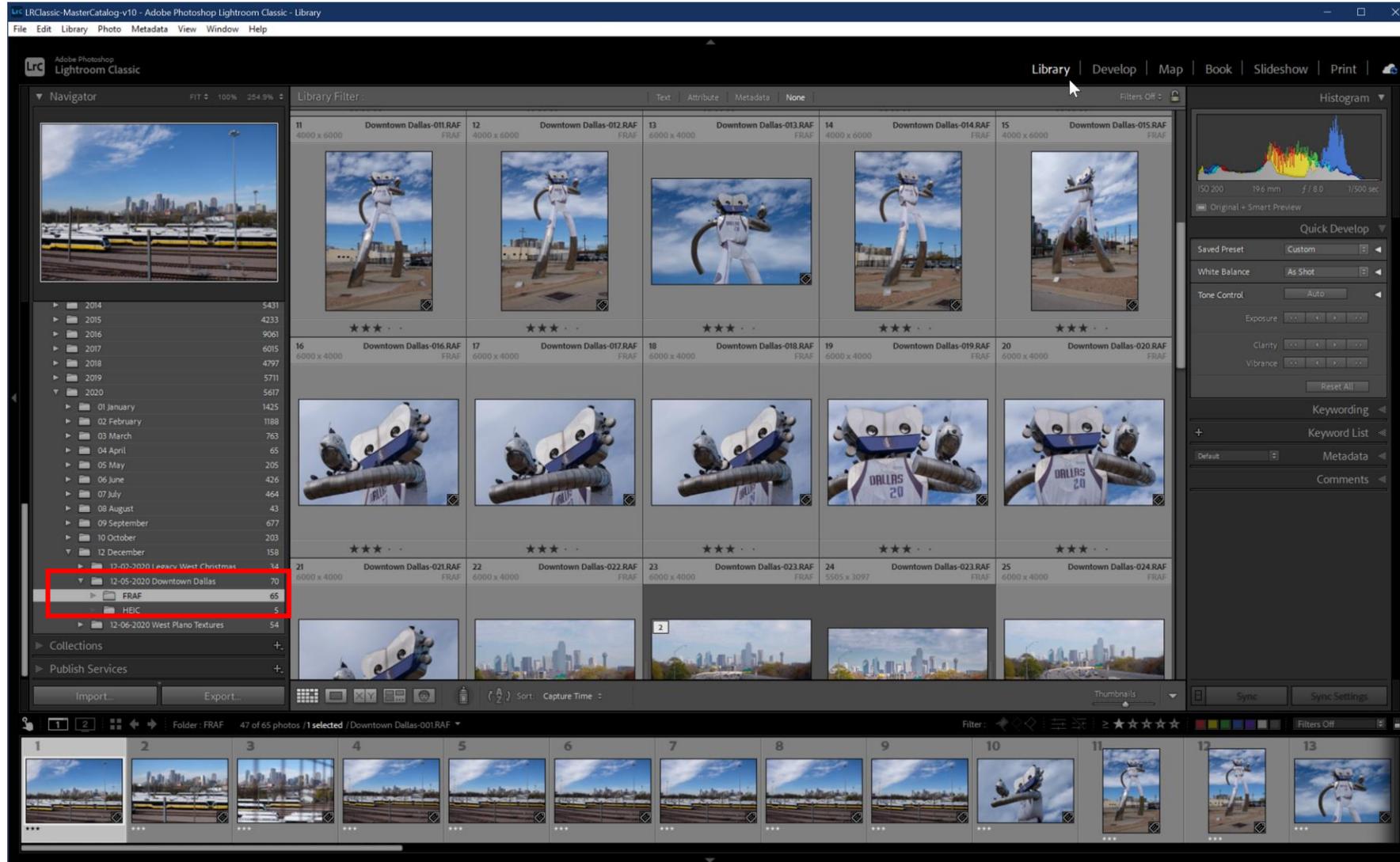


RAW & DNG Images After Conversion

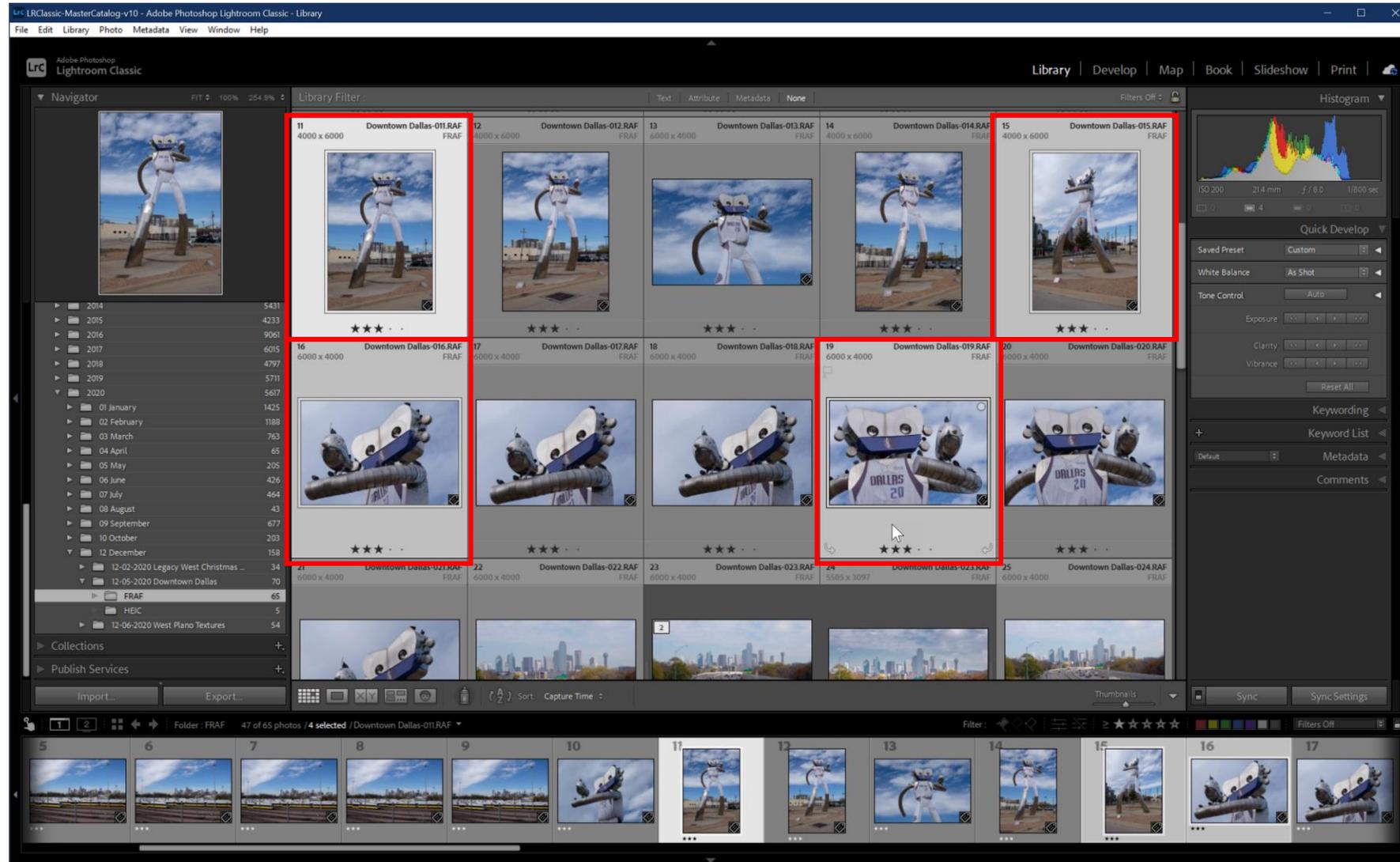


Method 2: After Import into Lightroom Classic

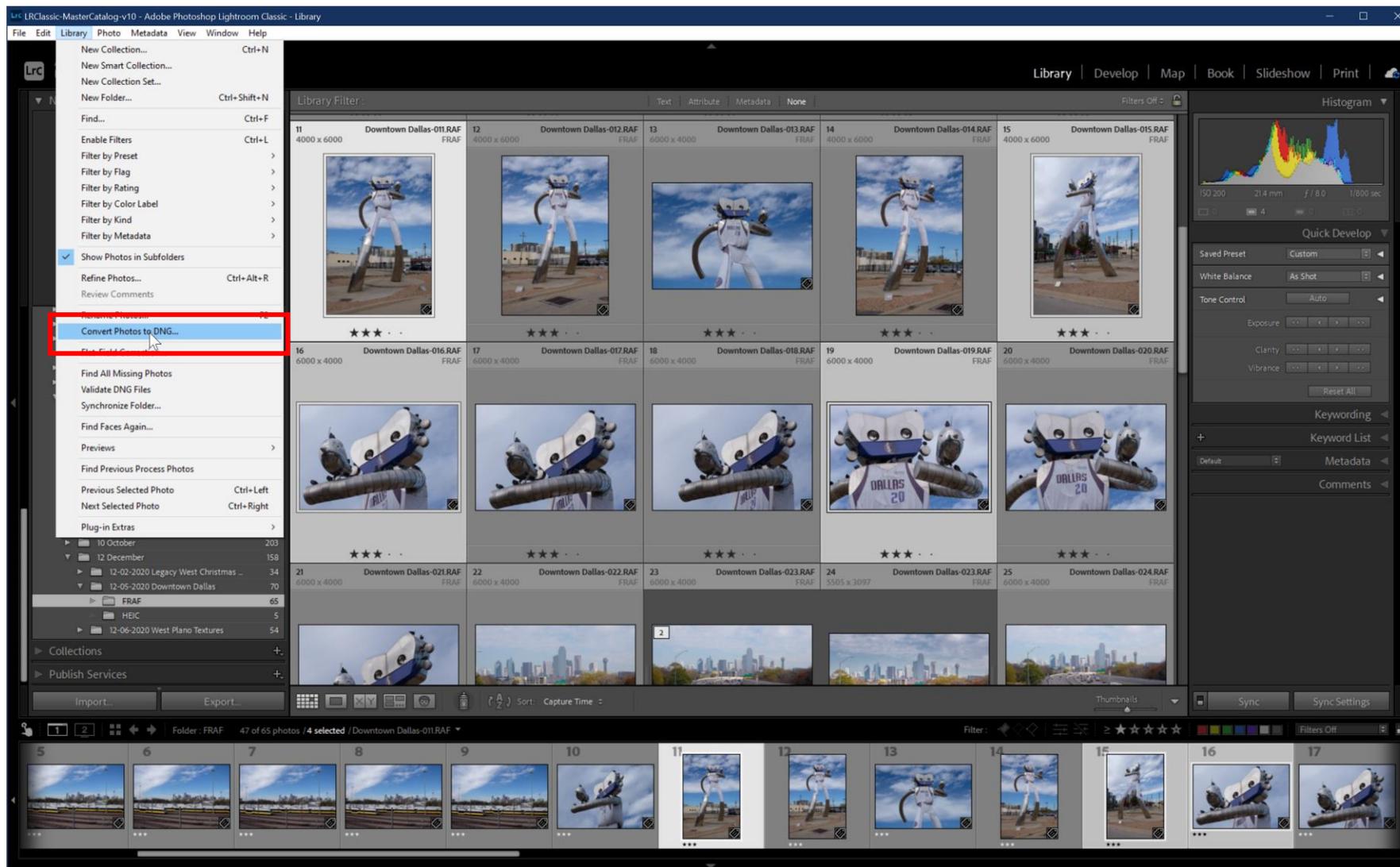
Navigate to Library Module



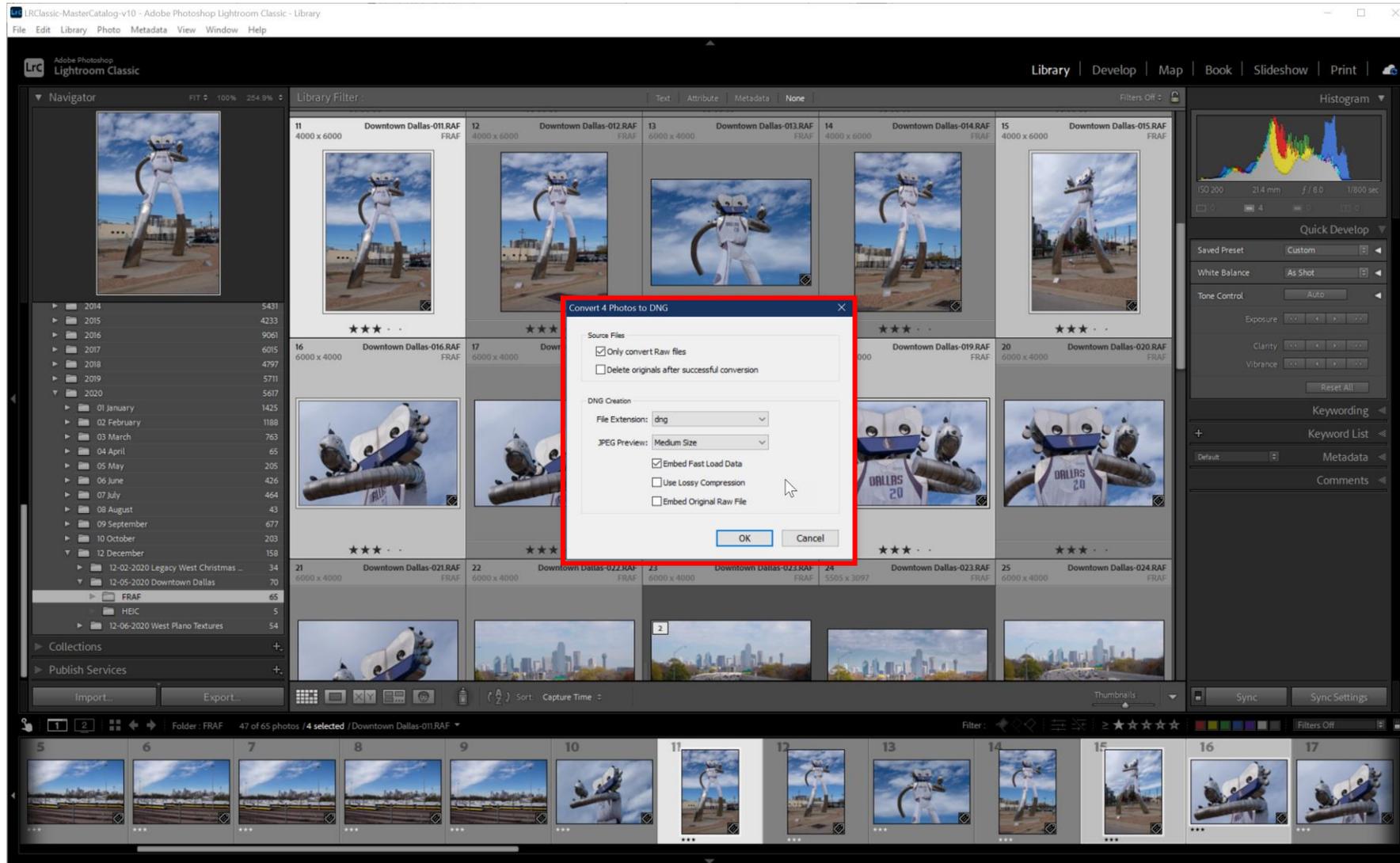
Select Photos To Be Converted



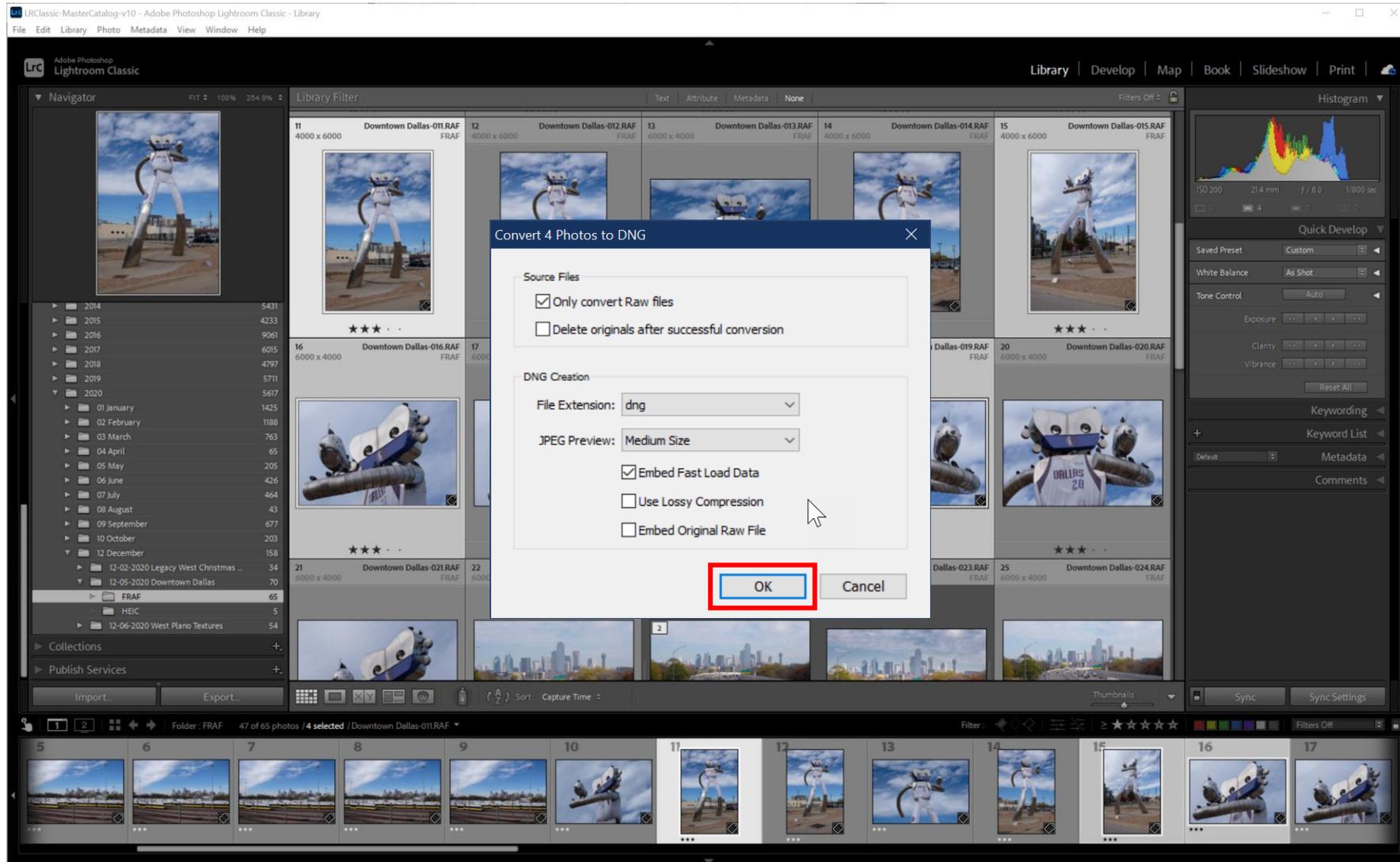
Library | Convert Photos to DNG...



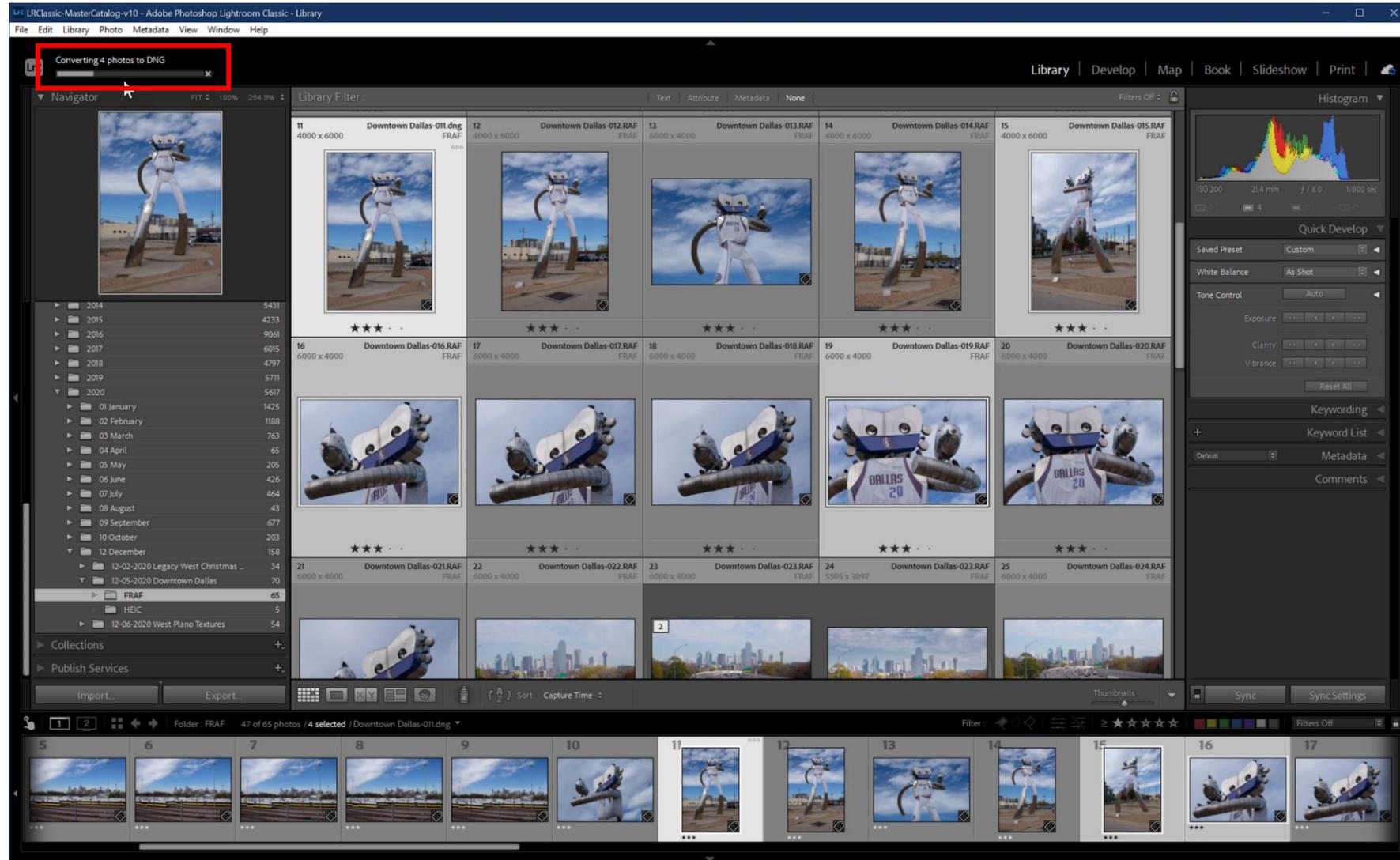
Specify Conversion Options



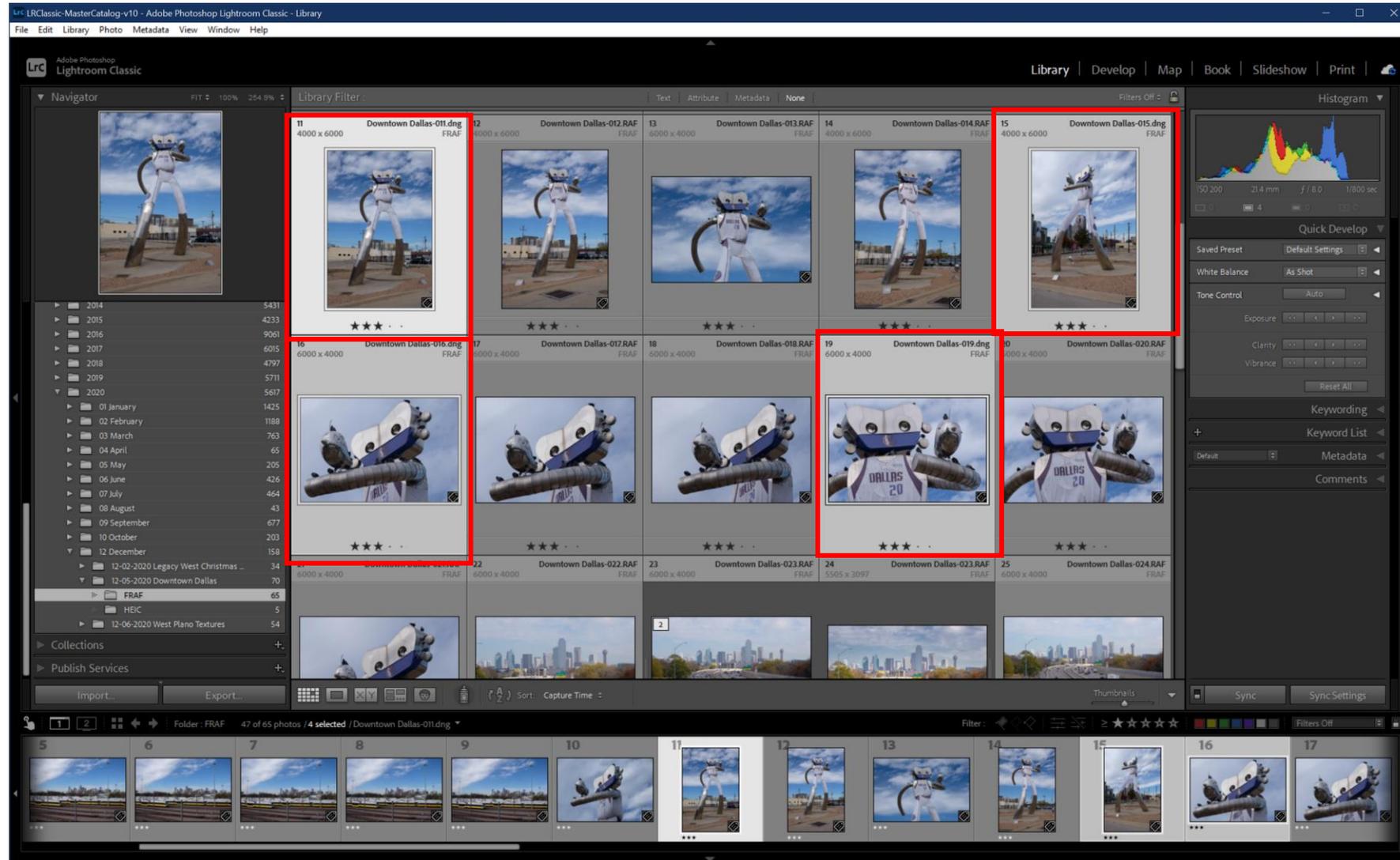
Specify Conversion Options



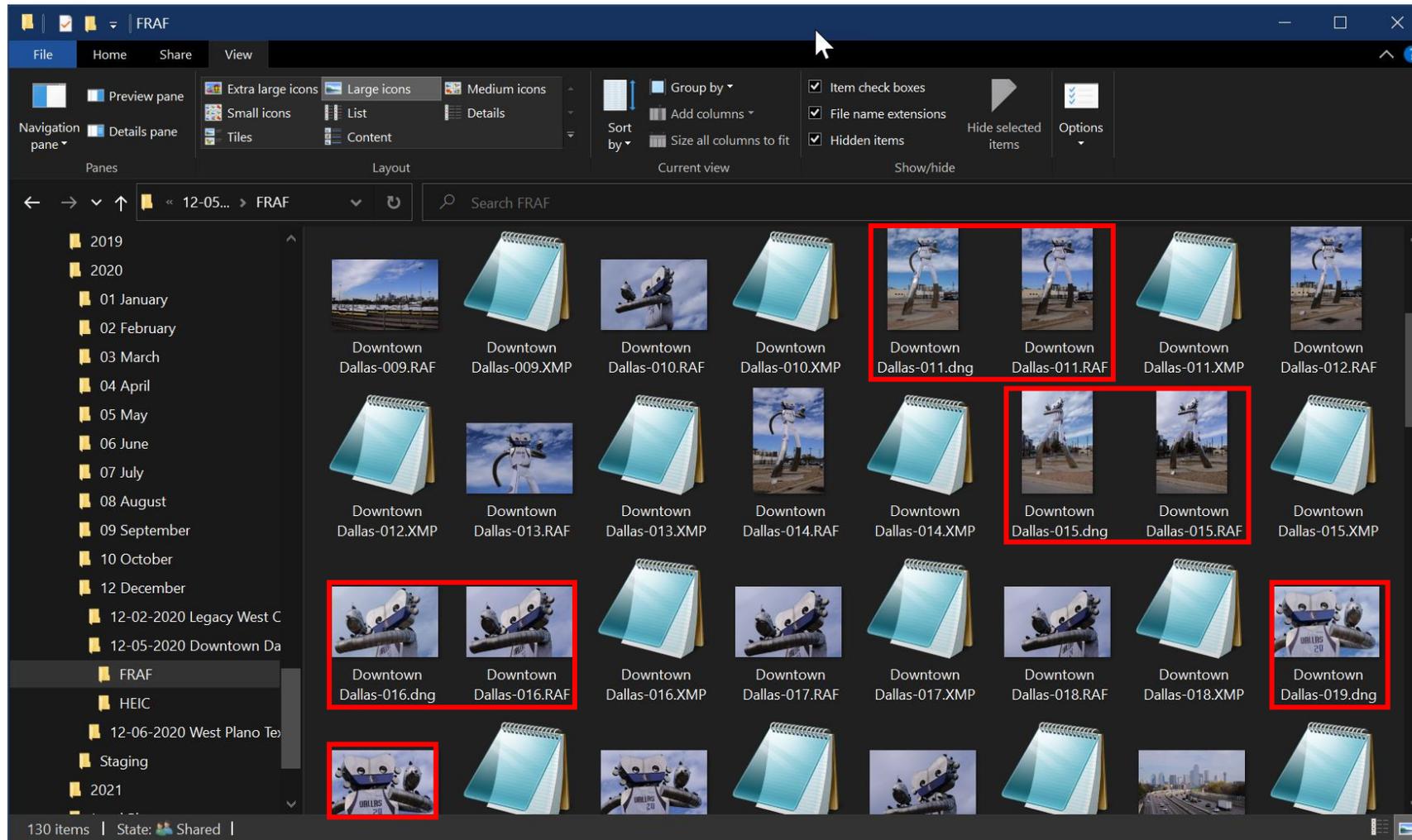
Conversion Process Begins



DNG Files Now Visible In Catalog



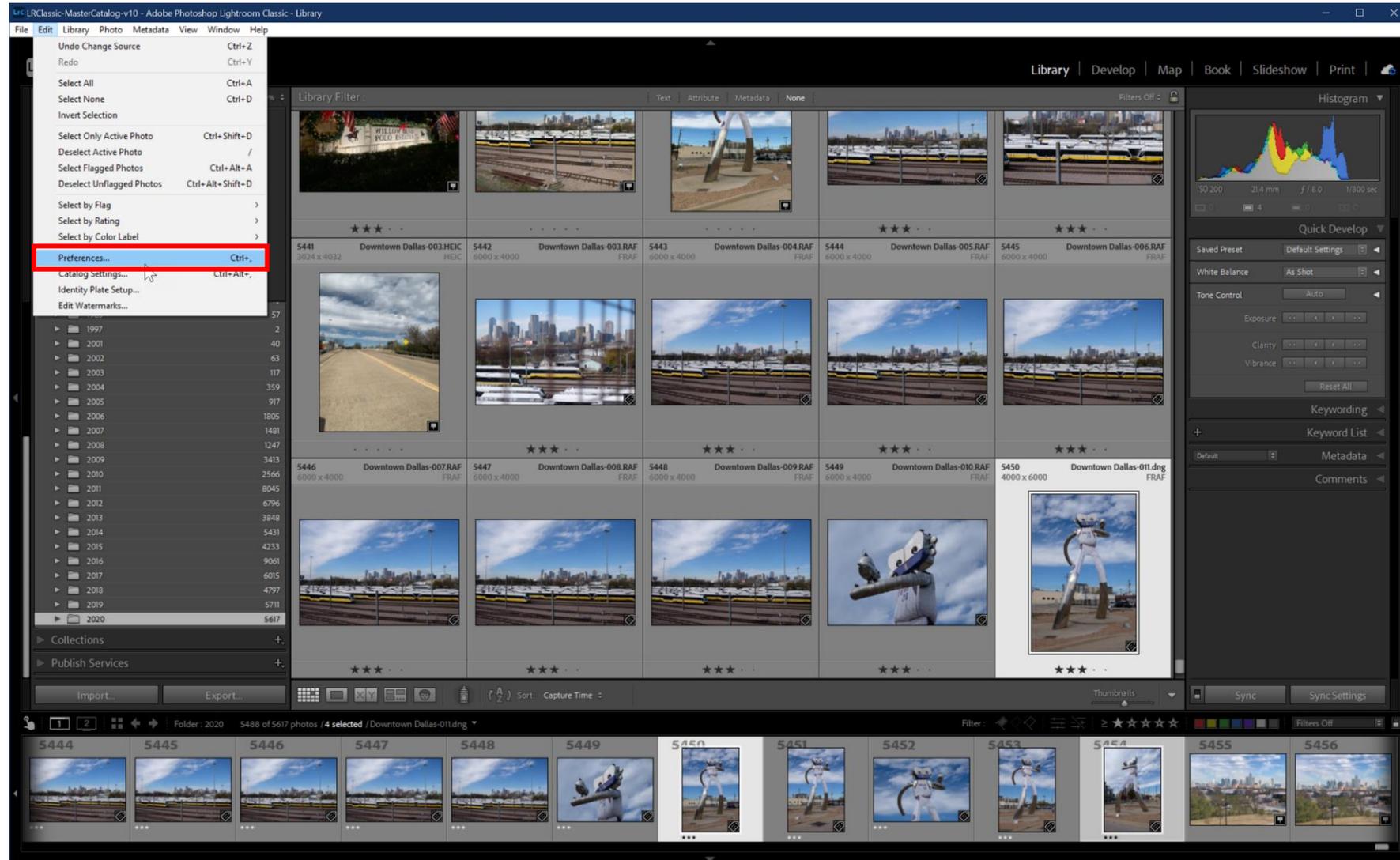
Original RAW Files Still in Directory



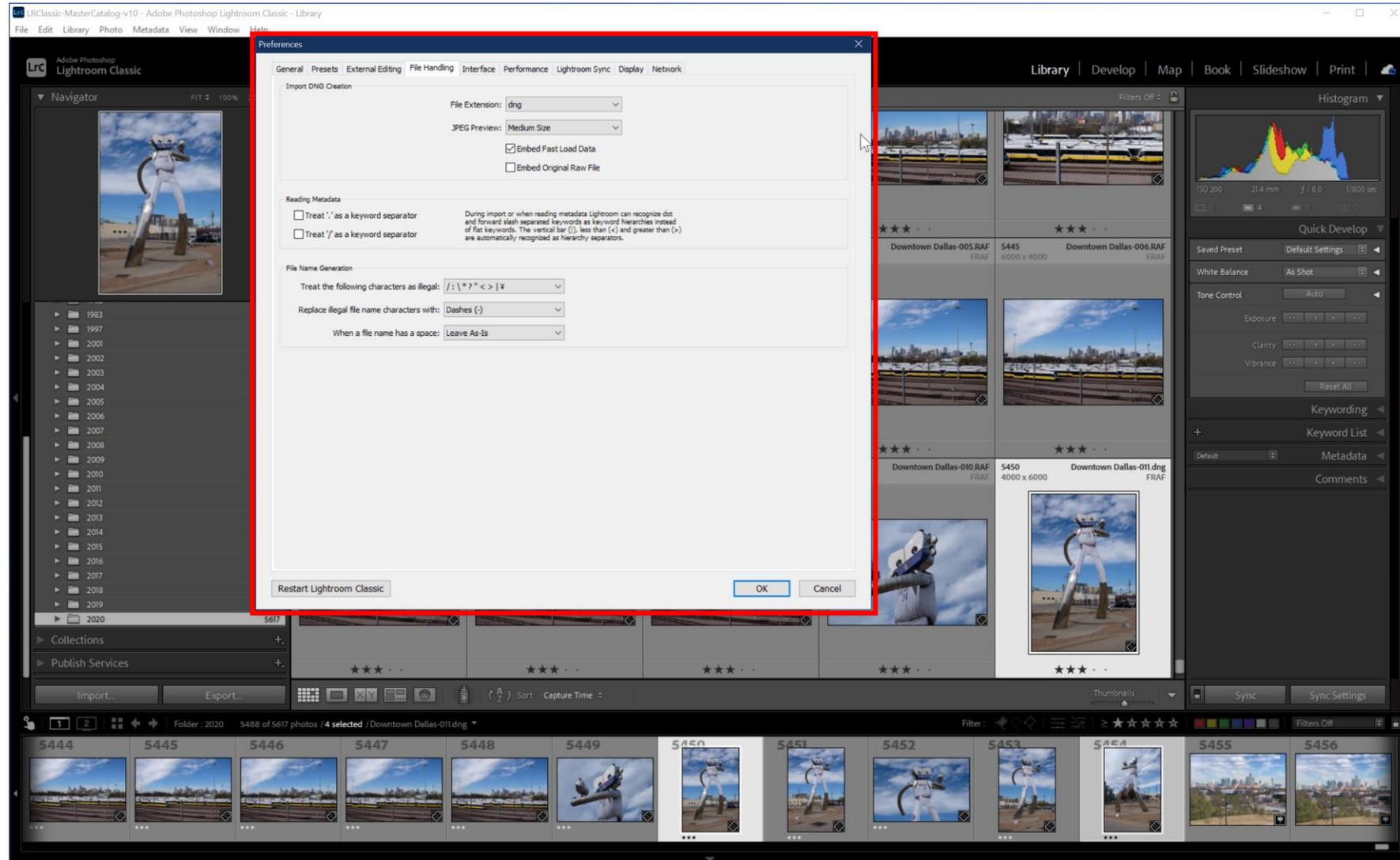
Method 3:

During Import into Lightroom
Classic

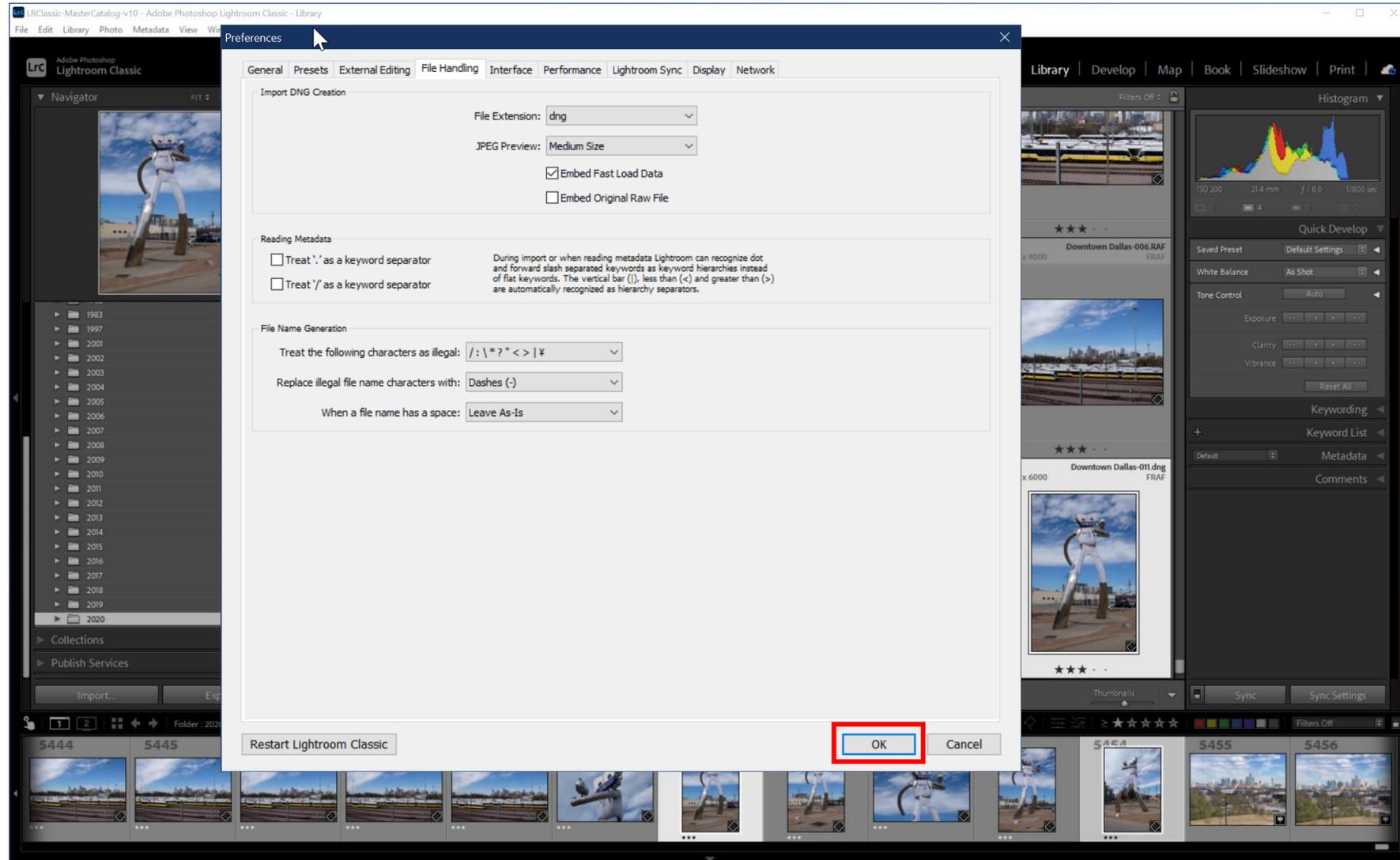
Configure File Import Preferences



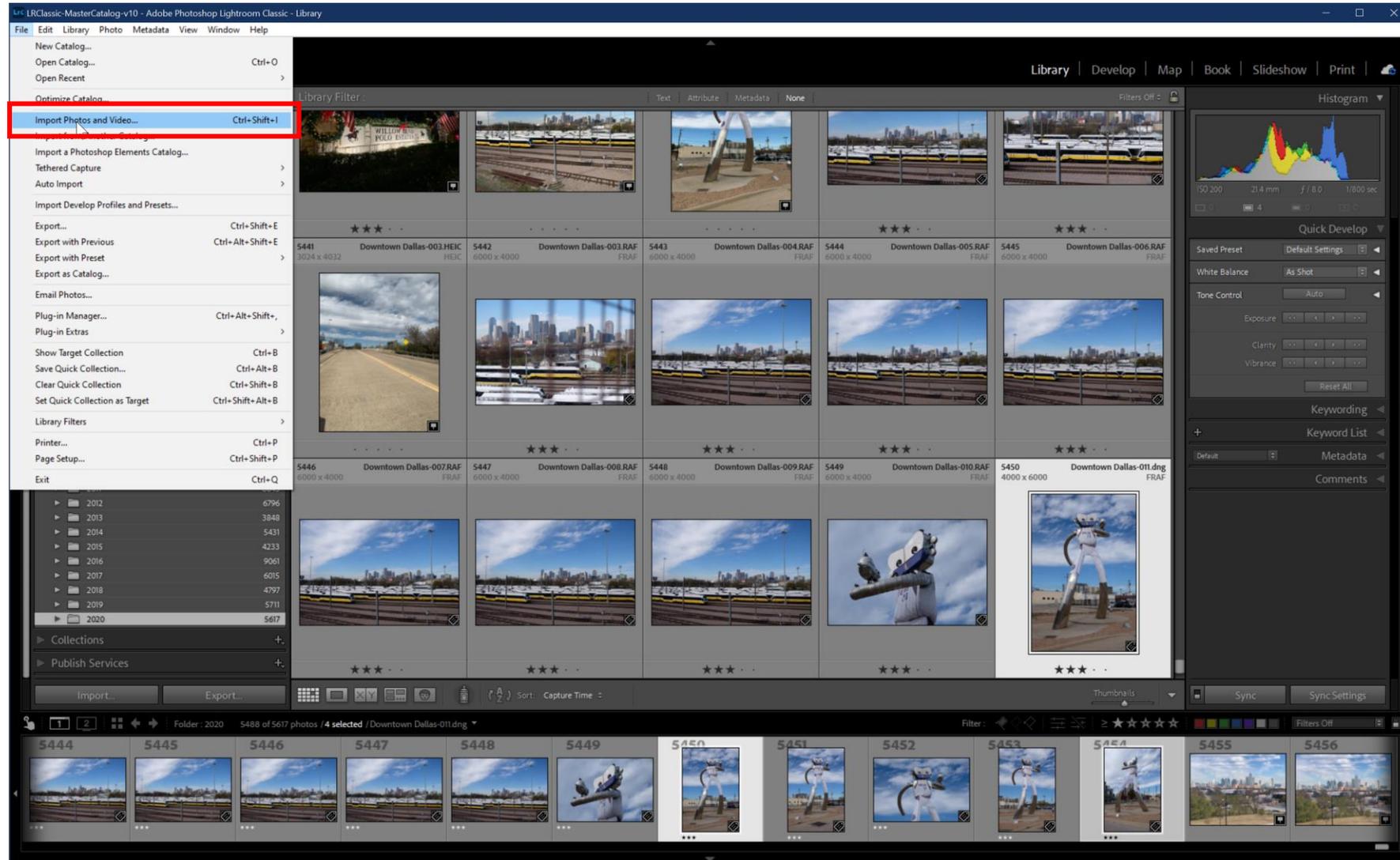
Configure File Import Preferences



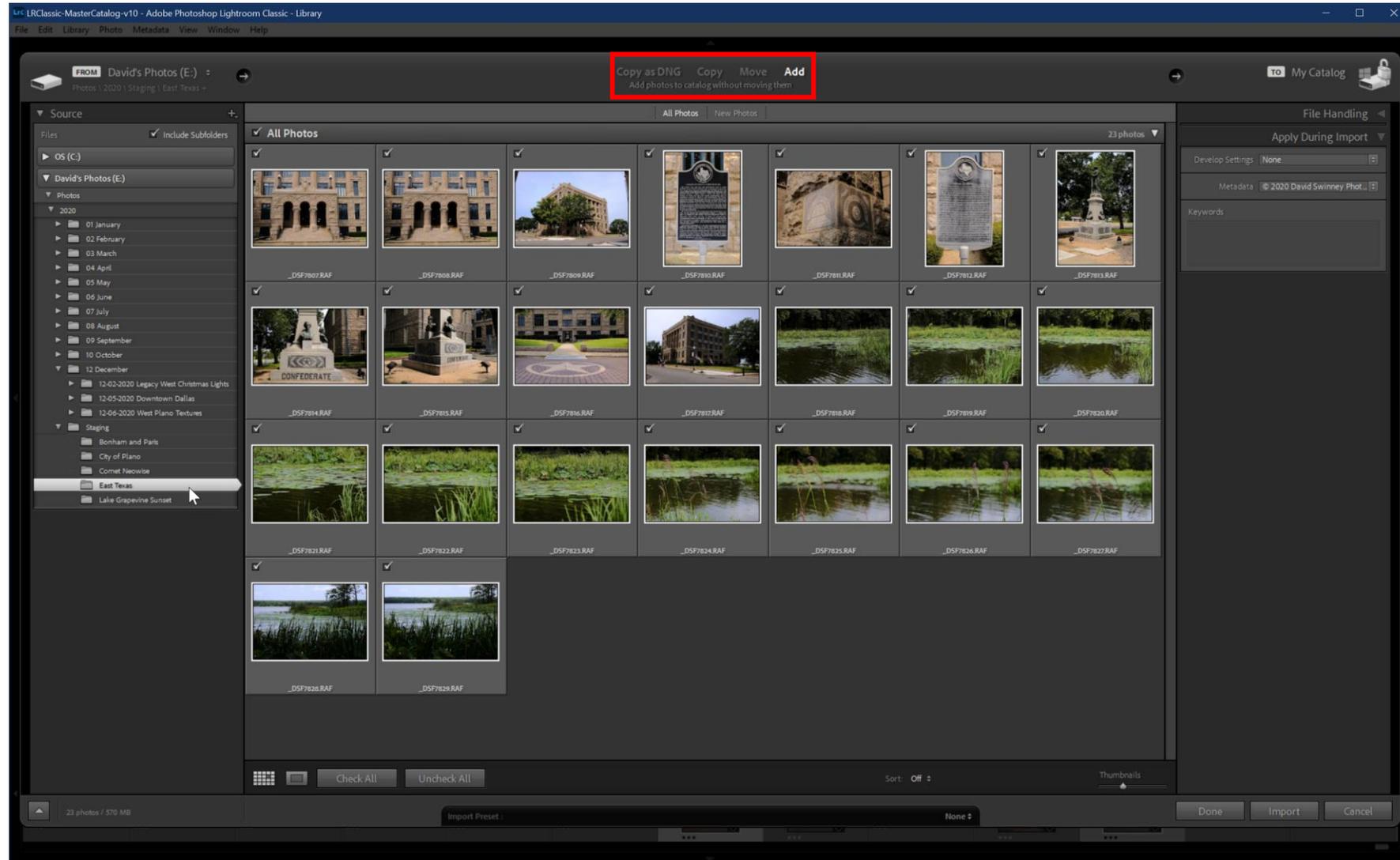
Configure File Import Preferences



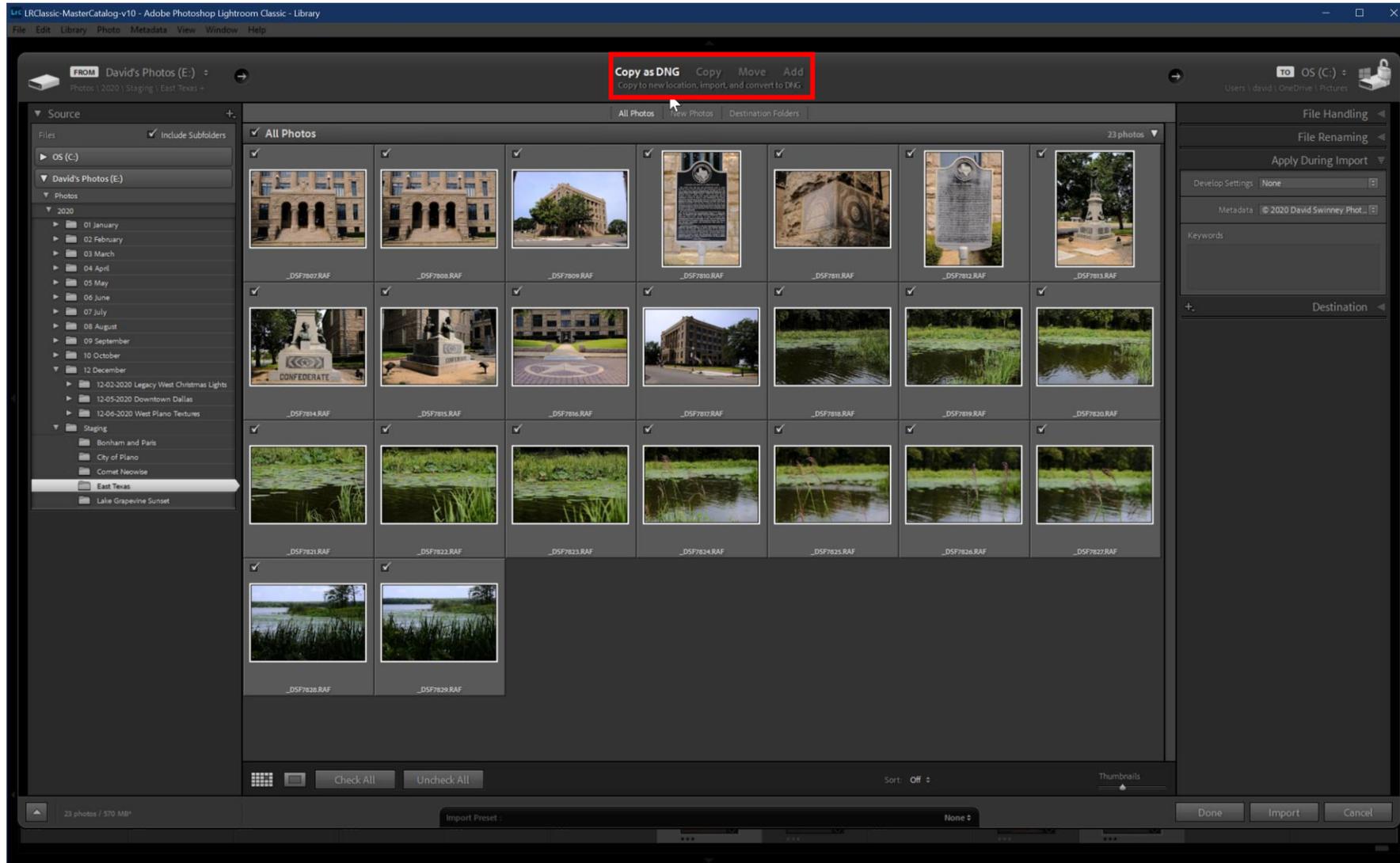
Start File Import Process



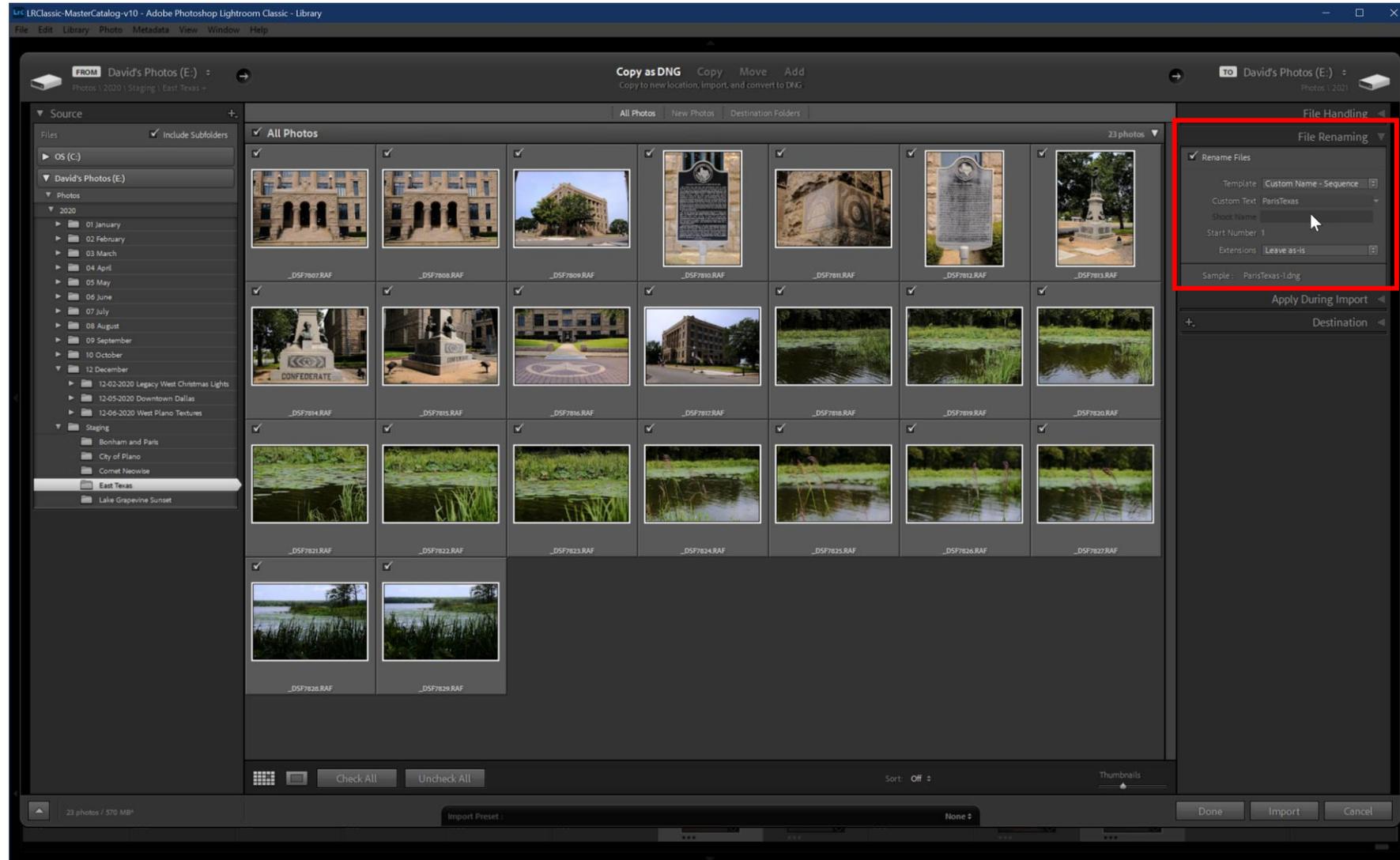
Default File Import Interface



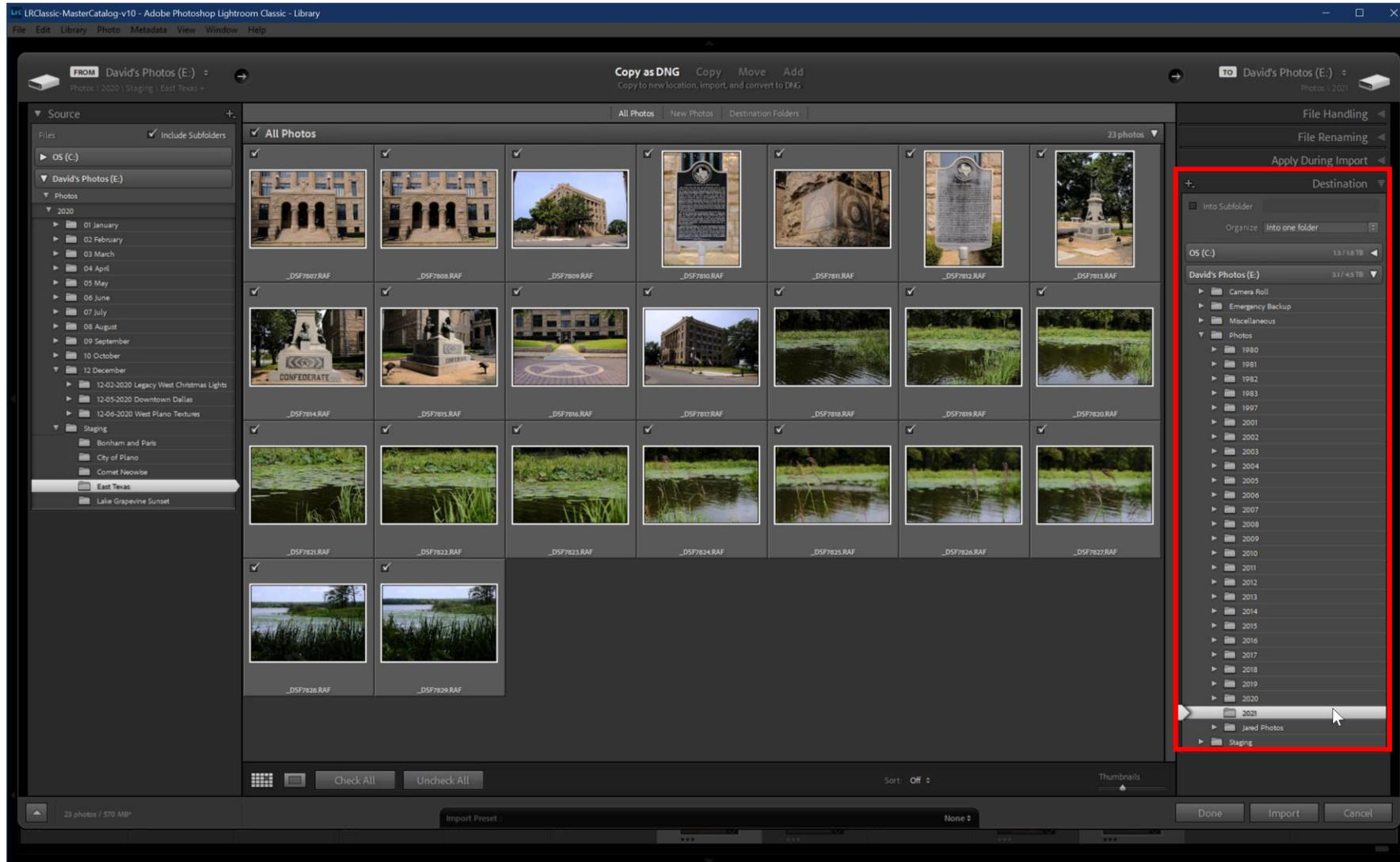
Select “Copy as DNG”



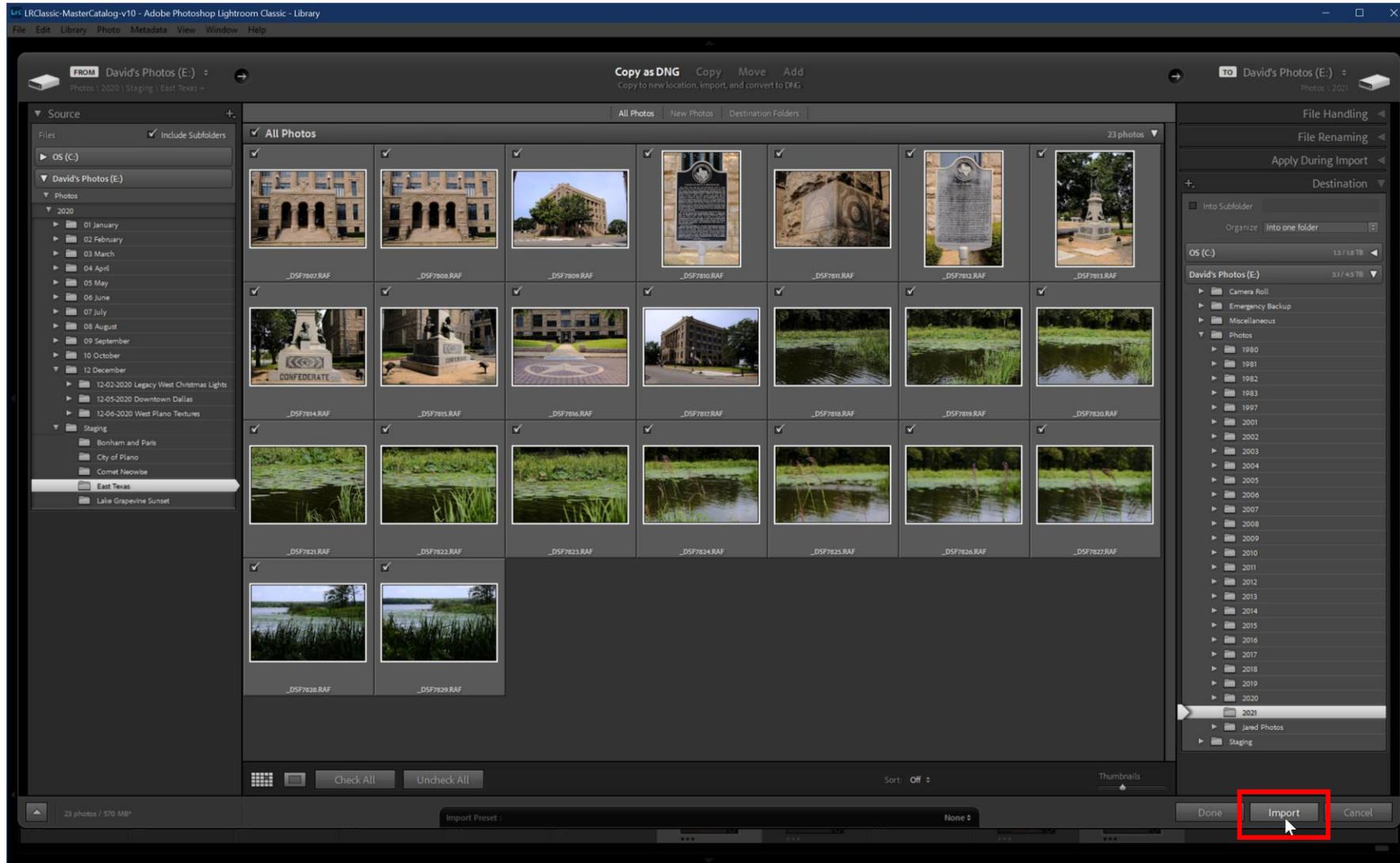
Specify File Renaming Options



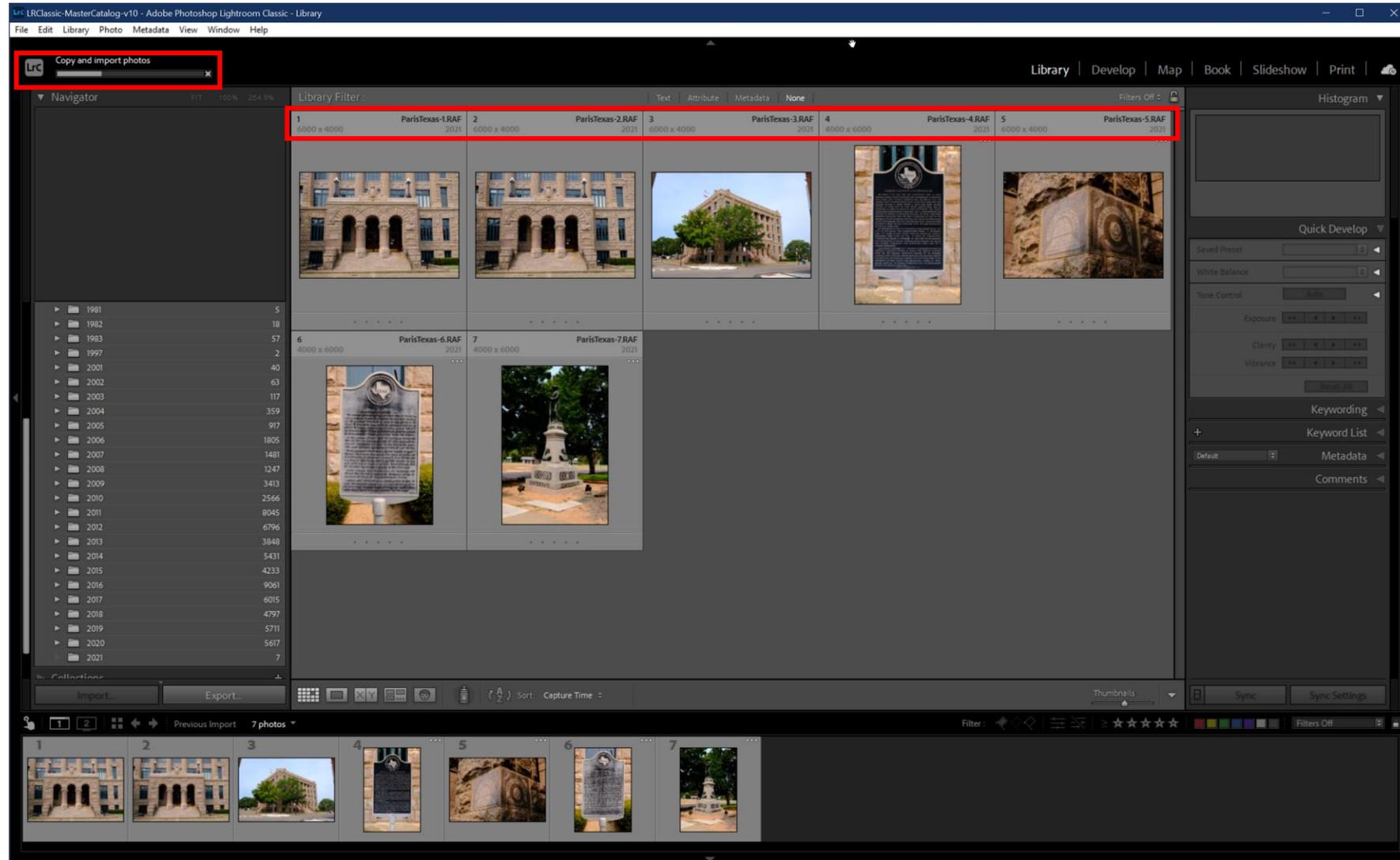
Specify File Import Destination



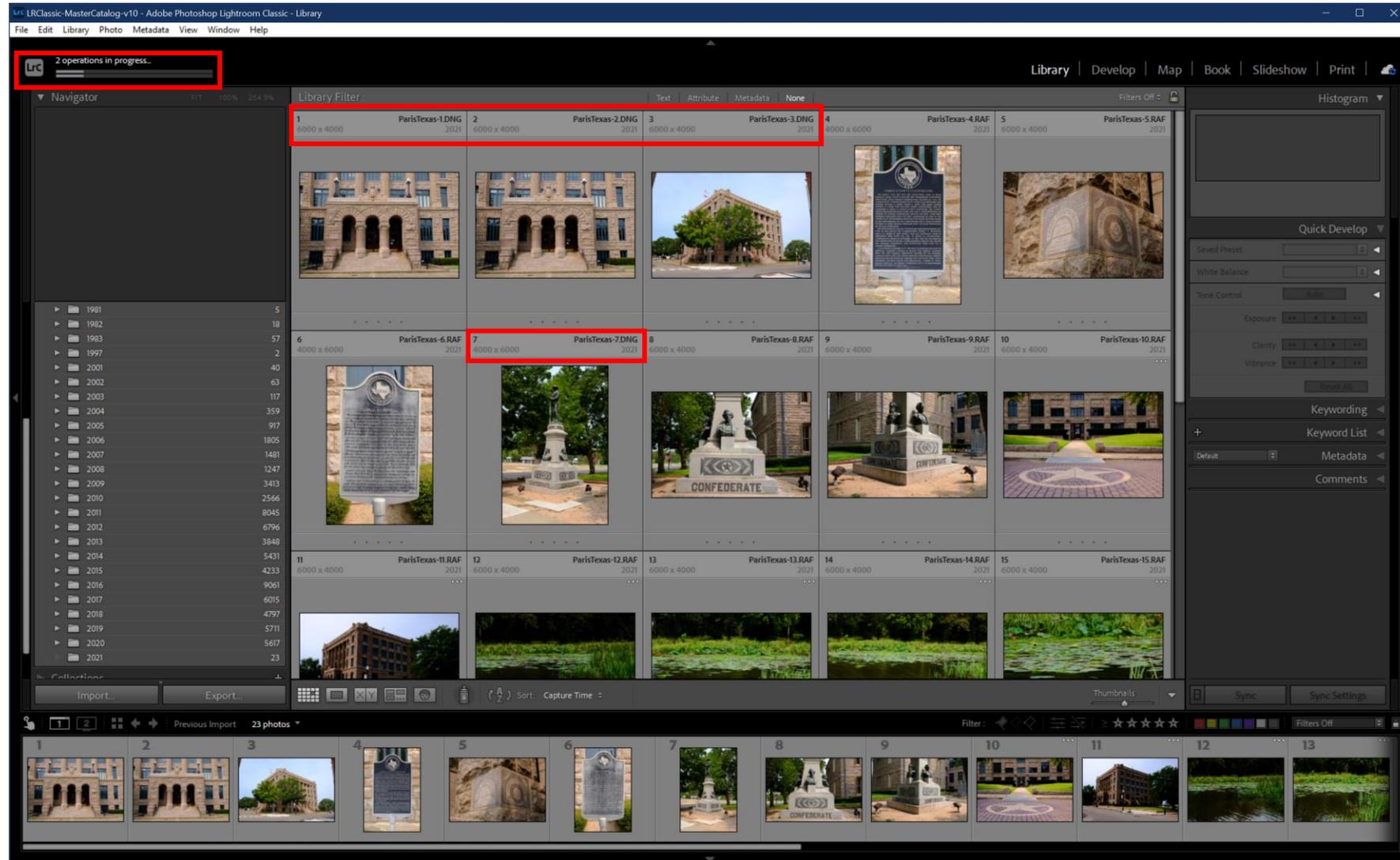
Start File Import / Conversion



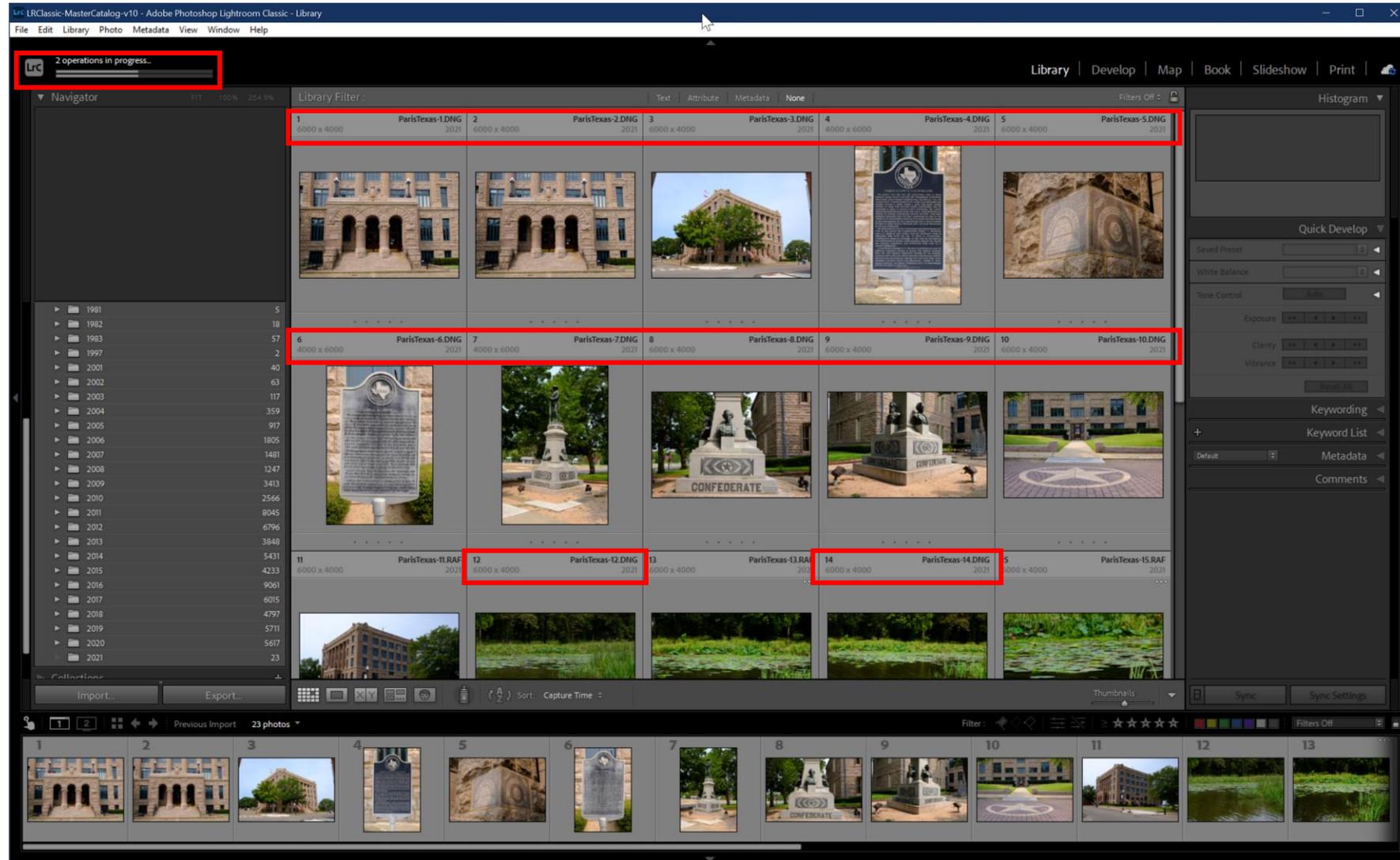
Original RAW Files Seen at First



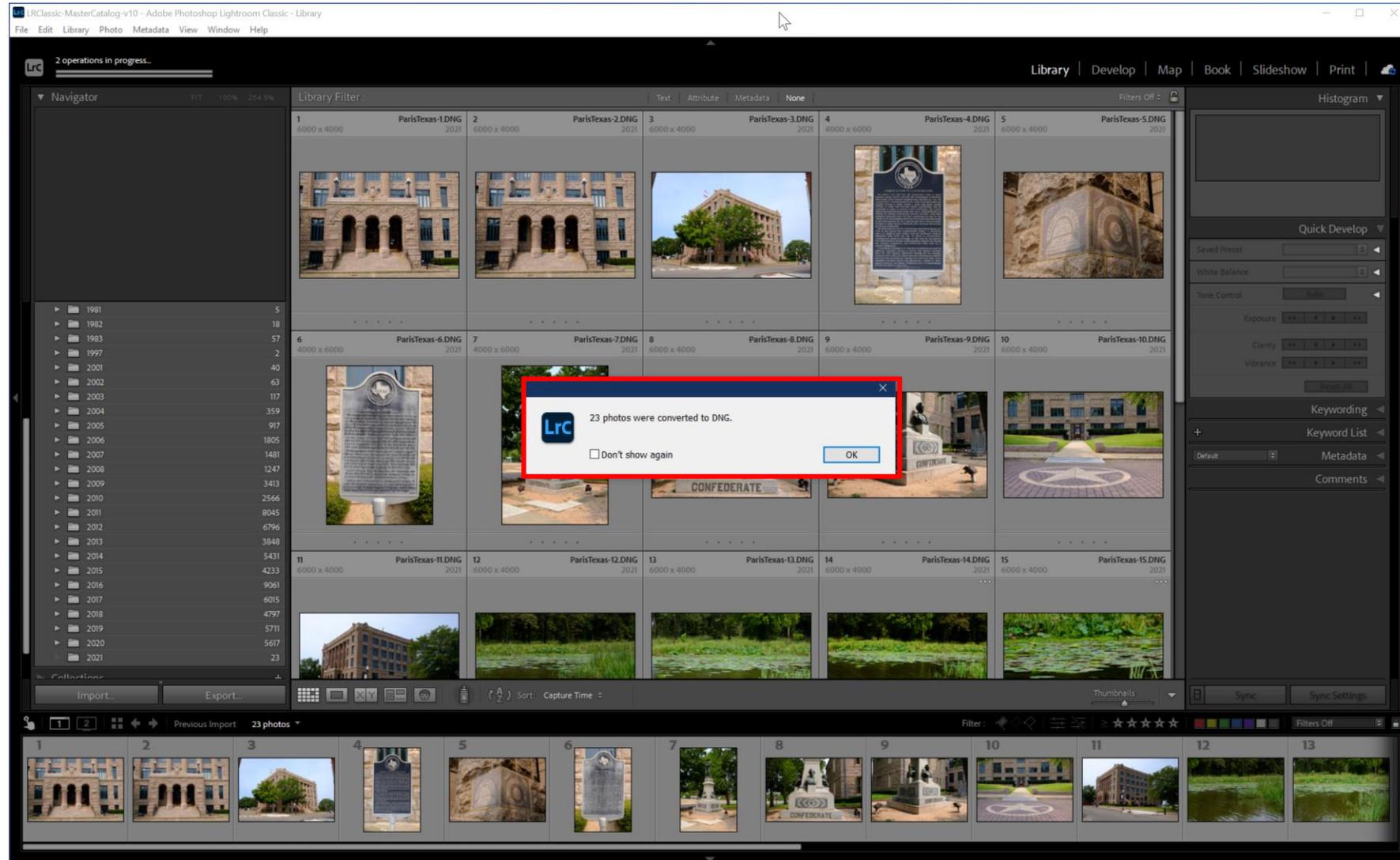
Conversion to DNG Begins ...



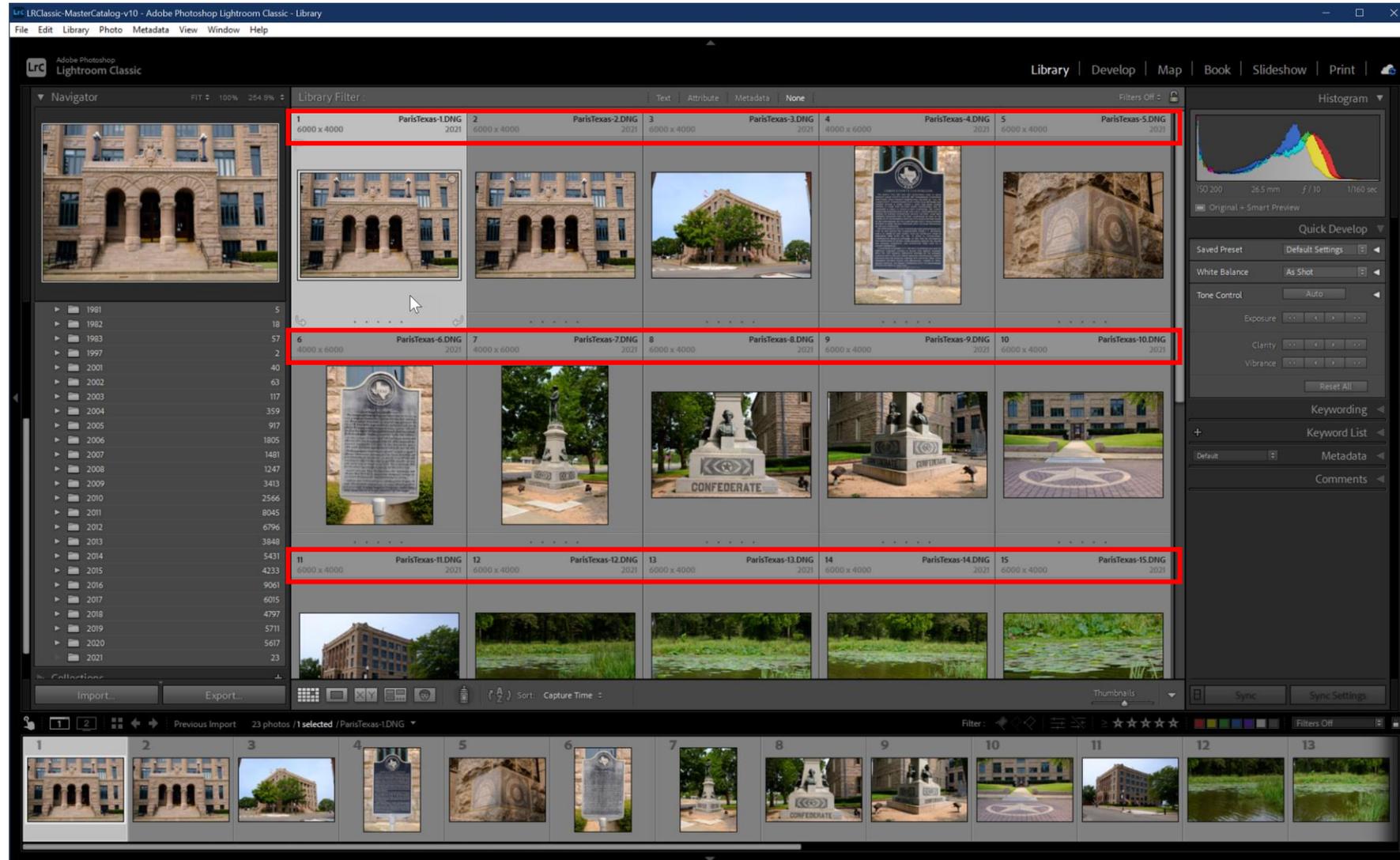
Conversion to DNG Continues ...



Conversion to DNG Completes



Configure File Import Preferences



XMP Files



XMP (Extensible Metadata Platform) File

- ISO standard created by Adobe
- Introduced in 2001 along with Photoshop 7
- Supports **creation, processing** and **interchange** of standardized and custom **metadata**
- Resources
 - https://en.wikipedia.org/wiki/Extensible_Metadata_Platform
 - <https://www.photometadata.org/META-Resources-metadata-types-standards-XMP>

What IS Stored In Lightroom XMP Files?

- Metadata information **about edits made** to camera RAW file
 - Develop Module Changes
 - EXIF data
 - Copyright information
 - Creator information
 - Keywords
 - Star Ratings
 - Snapshots
 - Website
 - More ...

Example of an XMP File

```
NYE.Fireworks-008.XMP - Notepad
File Edit Format View Help
<x:xmpmeta xmlns:x="adobe:ns:meta/" x:xmp:tool="XMP Core 5.6.0">
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
<rdf:Description rdf:about=""
xmlns:photoshop="http://ns.adobe.com/photoshop/1.0/"
xmlns:xmpRights="http://ns.adobe.com/xap/1.0/rights/"
xmlns:xmp="http://ns.adobe.com/xap/1.0/"
xmlns:Iptc4xmpCore="http://iptc.org/std/Iptc4xmpCore/1.0/xmlns/"
xmlns:Iptc4xmpExt="http://iptc.org/std/Iptc4xmpExt/2008-02-29/"
xmlns:photomechanic="http://ns.camerabits.com/photomechanic/1.0/"
xmlns:aux="http://ns.adobe.com/exif/1.0/aux/"
xmlns:dc="http://purl.org/dc/elements/1.1/"
xmlns:tiff="http://ns.adobe.com/tiff/1.0/"
xmlns:exif="http://ns.adobe.com/exif/1.0/"
xmlns:exifEX="http://cipa.jp/exif/1.0/"
xmlns:xmpMM="http://ns.adobe.com/xap/1.0/mm/"
xmlns:stEvt="http://ns.adobe.com/xap/1.0/sType/ResourceEvent#"
xmlns:crs="http://ns.adobe.com/camera-raw-settings/1.0/"
xmlns:onone="http://www.ononesoftware.com/vcb/1.0/"
xmlns:lr="http://ns.adobe.com/lightroom/1.0/"
photoshop:City="Dallas"
photoshop:State="Texas"
photoshop:Country="United States"
photoshop:Credit="Photo: David Swinney Photography"
photoshop:CaptionWriter="David Swinney"
photoshop:Headline="Dallas NYE 2020"
photoshop:DateCreated="2020-01-01T00:01:02"
photoshop:SidecarForExtension="raf"
photoshop:EmbeddedXMPDigest="00000000000000000000000000000000"
xmpRights:Marked="True"
xmpRights:WebStatement="www.davidswinney.com"
xmp:CreateDate="2020-01-01T00:01:02"
xmp:Label="Green"
xmp:Rating="3"
xmp:CreatorTool="Digital Camera X-T2 Ver4.20"
xmp:ModifyDate="2020-01-01T00:01:02"
xmp:MetadataDate="2020-06-18T14:33:29"
Iptc4xmpCore:CountryCode="USA"
Iptc4xmpCore:Location="Trinity River Bottom"
Iptc4xmpCore:Copyright="© 2020 David Swinney Photography"
Iptc4xmpCore:Caption="Captured near the Trinity River Bottom in Dallas,
Texas on 01 Jan, 2020 by David Swinney Photography."
Ln 1, Col 1 100% Unix (LF) UTF-8
```

```
NYE.Fireworks-008.XMP - Notepad
File Edit Format View Help
dc:format="image/x-fuji-raw"
tiff:Make="FUJIFILM"
tiff:Model="X-T2"
tiff:Orientation="1"
tiff:ImageWidth="6000"
tiff:ImageLength="4000"
exif:ExifVersion="0230"
exif:ExposureTime="6/1"
exif:ShutterSpeedValue="6/1"
exif:FNumber="8/1"
exif:ApertureValue="6/1"
exif:ExposureProgram="1"
exif:SensitivityType="1"
exif:BrightnessValue="-296/100"
exif:ExposureBiasValue="0/1"
exif:MaxApertureValue="300/100"
exif:MeteringMode="5"
exif:LightSource="0"
exif:FocalLength="39/1"
exif:SensingMethod="2"
exif:FileSource="3"
exif:SceneType="1"
exif:FocalLengthIn35mmFilm="59"
exif:CustomRendered="0"
exif:ExposureMode="1"
exif:WhiteBalance="0"
exif:SceneCaptureType="0"
exif:Sharpness="2"
exif:SubjectDistanceRange="0"
exif:FocalPlaneXResolution="83663736/32768"
exif:FocalPlaneYResolution="83663736/32768"
exif:FocalPlaneResolutionUnit="3"
exif:LensMake="FUJIFILM"
exif:DateTimeOriginal="2020-01-01T00:01:02"
exif:PixelXDimension="6000"
exif:PixelYDimension="4000"
exifEX:LensModel="XF18-55mmF2.8-4 R LM OIS"
exifEX:LensMake="FUJIFILM"
xmpMM:DocumentID="E7DCAC0EB98F45477FC8423B9A4A2662"
xmpMM:PreservedFileName="NYE.Fireworks-008.RAF"
xmpMM:OriginalDocumentID="E7DCAC0EB98F45477FC8423B9A4A2662"
Ln 1, Col 1 100% Unix (LF) UTF-8
```

```
NYE.Fireworks-008.XMP - Notepad
File Edit Format View Help
<dc:rights>
<rdf:Alt>
<rdf:li xml:lang="x-default">© 2020 David Swinney Photography</rdf:li>
</rdf:Alt>
</dc:rights>
<dc:description>
<rdf:Alt>
<rdf:li xml:lang="x-default">Captured near the Trinity River Bottom in Dallas,
Texas on 01 Jan, 2020 by David Swinney Photography.</rdf:li>
</rdf:Alt>
</dc:description>
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<rdf:li>David Swinney</rdf:li>
</rdf:Seq>
</dc:creator>
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<rdf:li>2020</rdf:li>
<rdf:li>Dallas</rdf:li>
<rdf:li>David Swinney</rdf:li>
<rdf:li>Family</rdf:li>
<rdf:li>Swinney</rdf:li>
<rdf:li>Fireworks</rdf:li>
<rdf:li>Fuji</rdf:li>
<rdf:li>Fujifilm</rdf:li>
<rdf:li>Happy New Year</rdf:li>
<rdf:li>River</rdf:li>
<rdf:li>Texas</rdf:li>
<rdf:li>Trinity</rdf:li>
<rdf:li>Trinity River</rdf:li>
<rdf:li>Trinity River Bottom</rdf:li>
<rdf:li>United States</rdf:li>
<rdf:li>X-T2</rdf:li>
<rdf:li>USA</rdf:li>
</rdf:Seq>
</dc:subject>
<exif:Flash
exif:Fired="False"
exif:Return="0"
exif:Mode="0"
Ln 1, Col 1 100% Unix (LF) UTF-8
```

What's NOT Stored in Lightroom XMP Files?

- Edit History
- Virtual Copies
- Pick Flags
- Collections and Stacks
- Disabled Edits
- Resource
 - <http://www.lightroomfanatic.com/export/what-is-not-included-in-lightroom-xmp-files>

Benefits of Storing Metadata in XMP Files

- Keeps the original RAW file intact so you can work non-destructively
- Metadata – including editing data – stored in separate file that can be read by Adobe products and 3rd-party tools
- Provides enhanced security (another backup) in the event of your Lightroom catalog getting corrupted

Negatives of Storing Metadata in XMP Files

- Every edited RAW file has a **new file** to manage
- Reading/writing to XMP files can **slow down** Lightroom and Camera RAW during edits
- **Data management** of potentially thousands of XMP files is probably biggest drawback to using them
 - Overcome this by converting your RAW files to DNG, which embeds associated XMP files into them
 - This eliminates the extra files but requires adding the conversion as part of your workflow

XMP Files: Usage Scenario One

Protection Against Damage to Catalog

“I use Lightroom for all my personal photographs.

I’ve spent thousands of hours adding information about people, places, geotagging, and categorizing my images.

What if my library becomes completely corrupted?”

- Lightroom lets you write all metadata to XMP files in addition to the data being stored in the catalog.
- Slows the software down a bit but gives you an additional level of security.
- If you back up XMP files with the images, you won’t lose any metadata.

XMP Files: Usage Scenario Two

Managing/Editing Photos With Different Apps

“Most of my RAW processing for casual images is done in Lightroom Classic.

I really like the organization tools that Lightroom provides. The face identification, geo-tagging, and keyword management tools are second to none for a home user.

But I prefer the user interface and editing options that Capture One provides so my workflow is split between these two applications.”

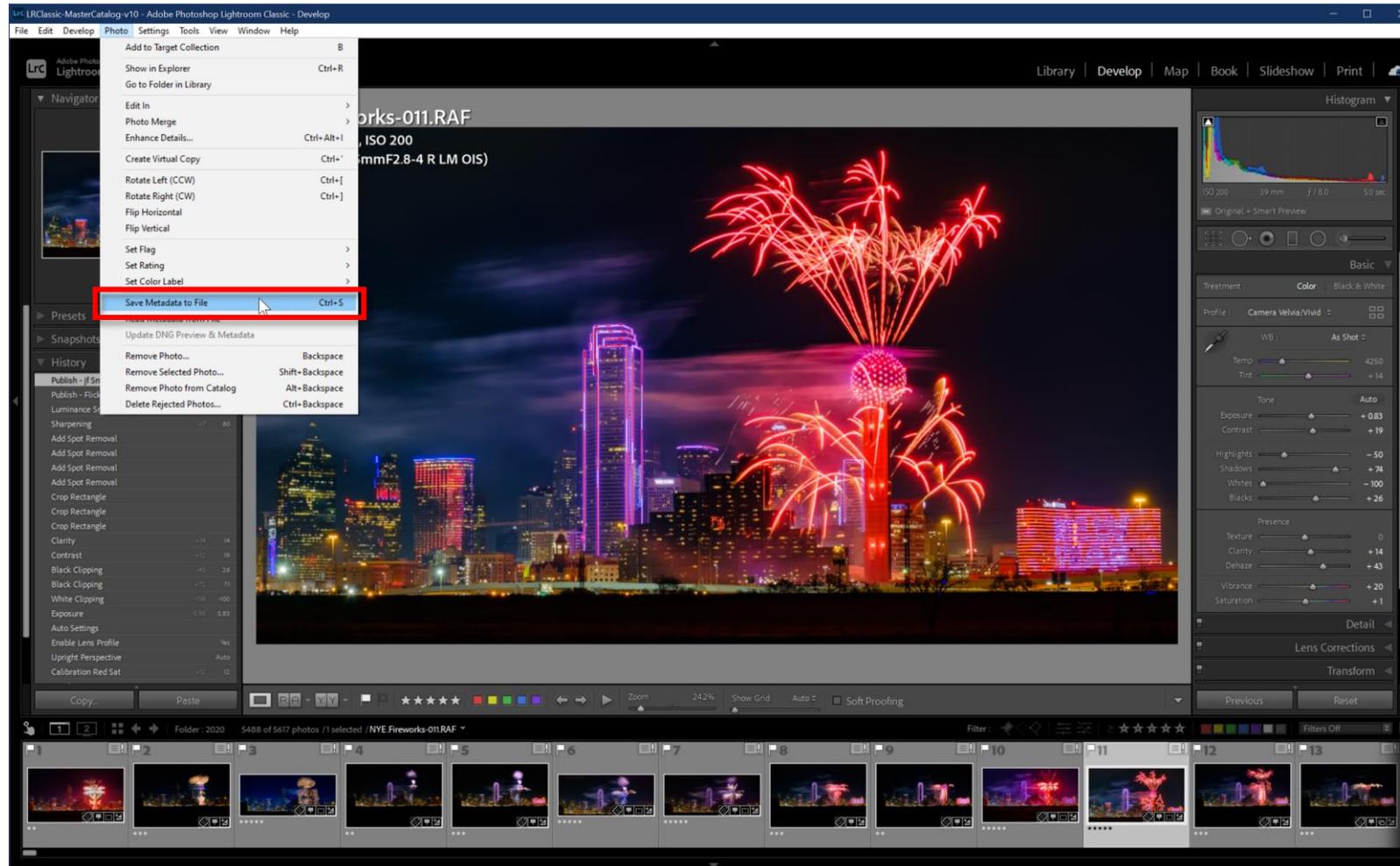
- To enable this mixed-environment approach to handling images, use XMP/sidecar files to transfer the metadata from Lightroom to Capture One.
- Capture One reads the XMP files and all the people tags are instantly recognized.
- You can process images with your preferred editor and know you can always find desired images by previously saved metadata.

Creating XMP Files in Lightroom

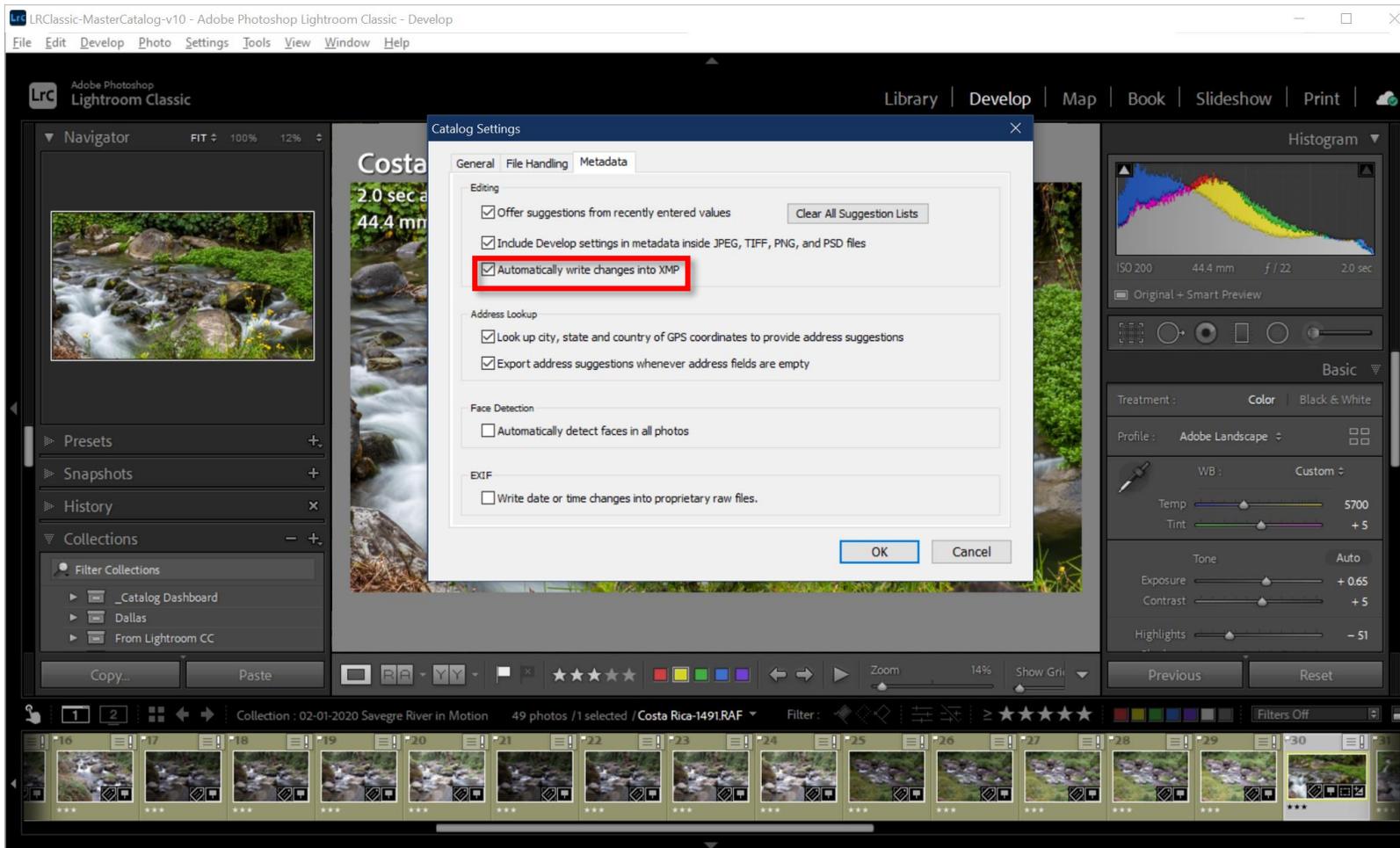
Methods For Creating XMP Files in Lightroom

- Manually for image file **currently being edited**
- Manually for one or more image files **in the current library**
- Automatically for every image file **as it is imported into Lightroom**

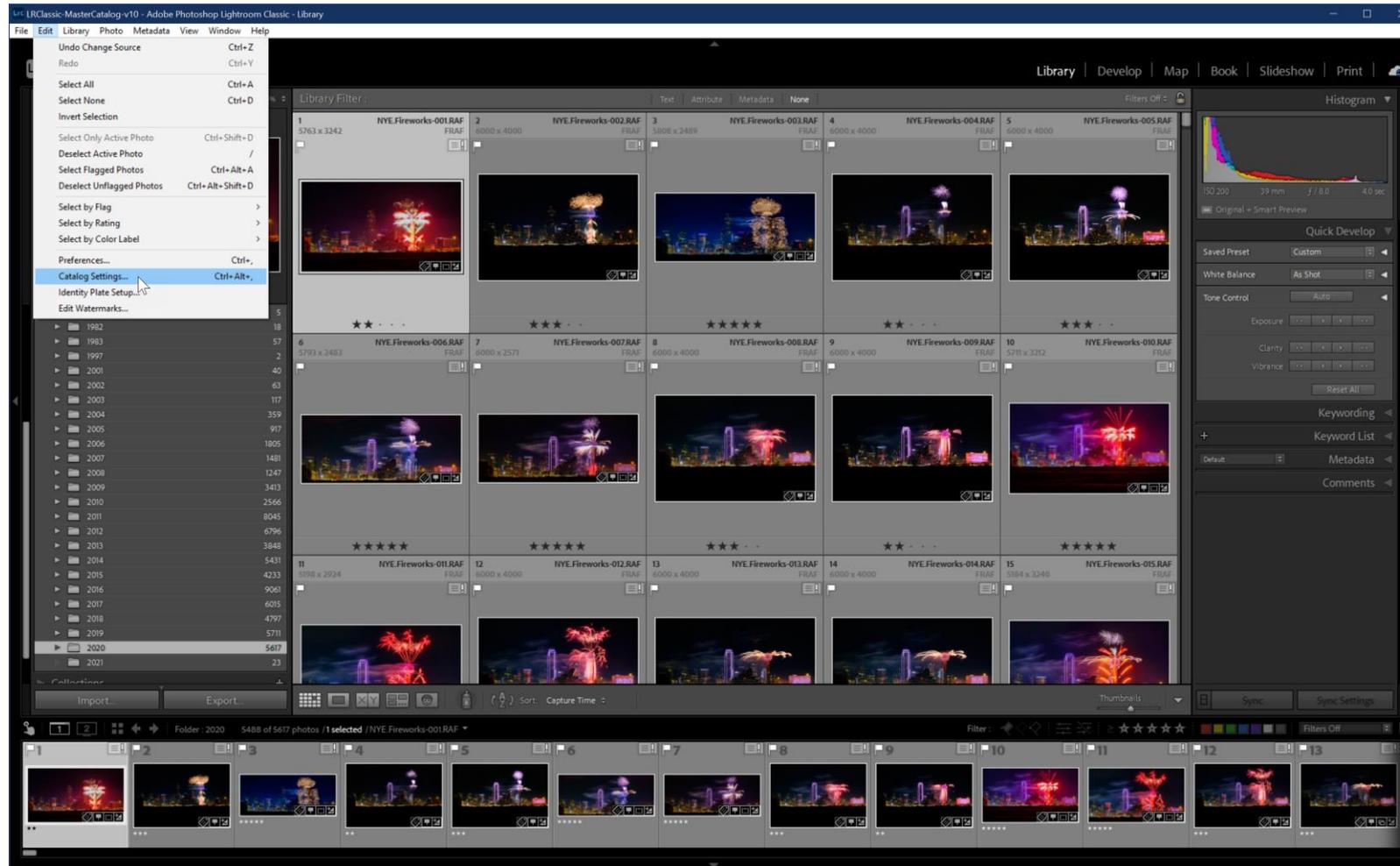
How To Manually Create XMP Files



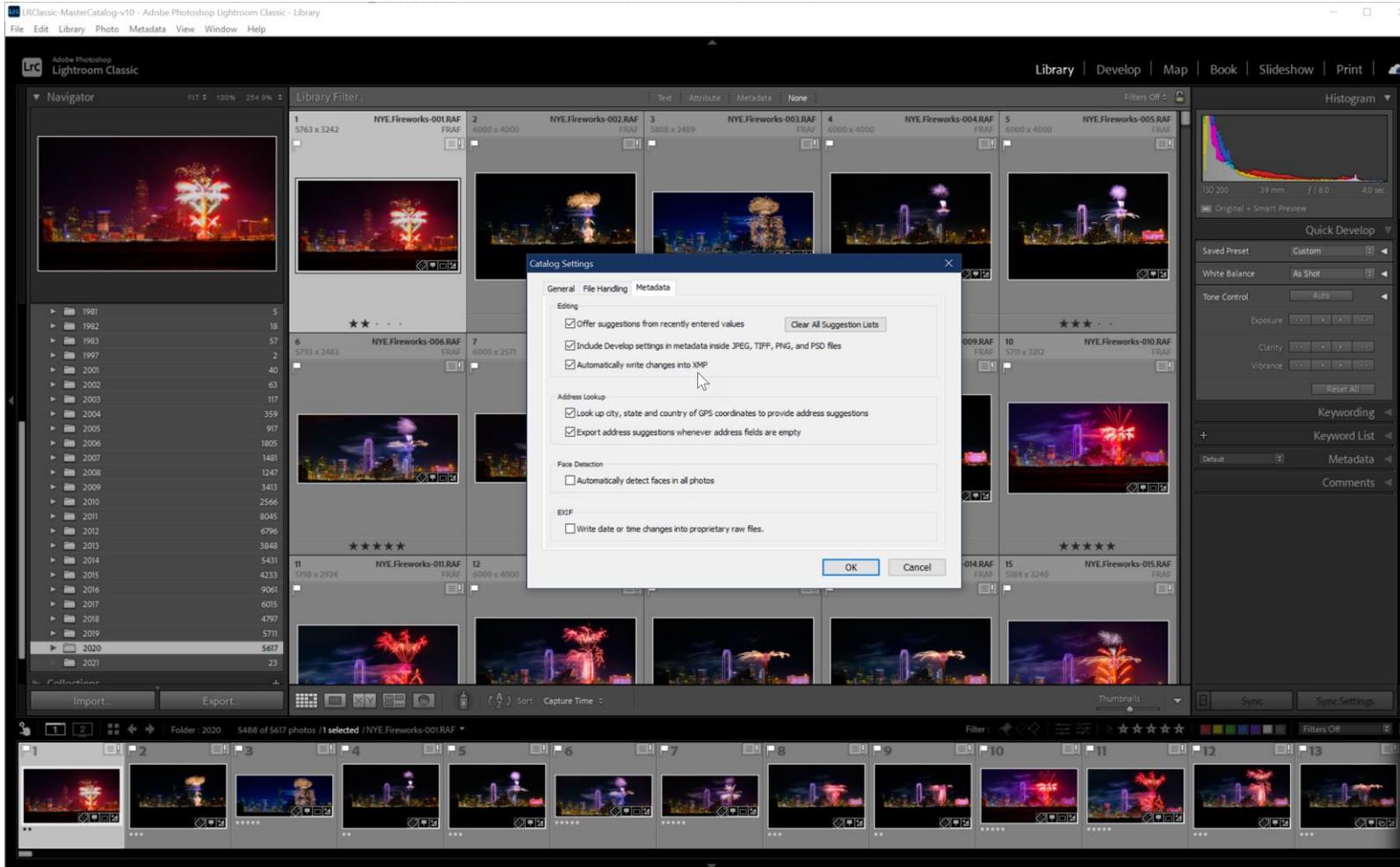
How To Enable Sidecar (XMP) Files in Lightroom Classic



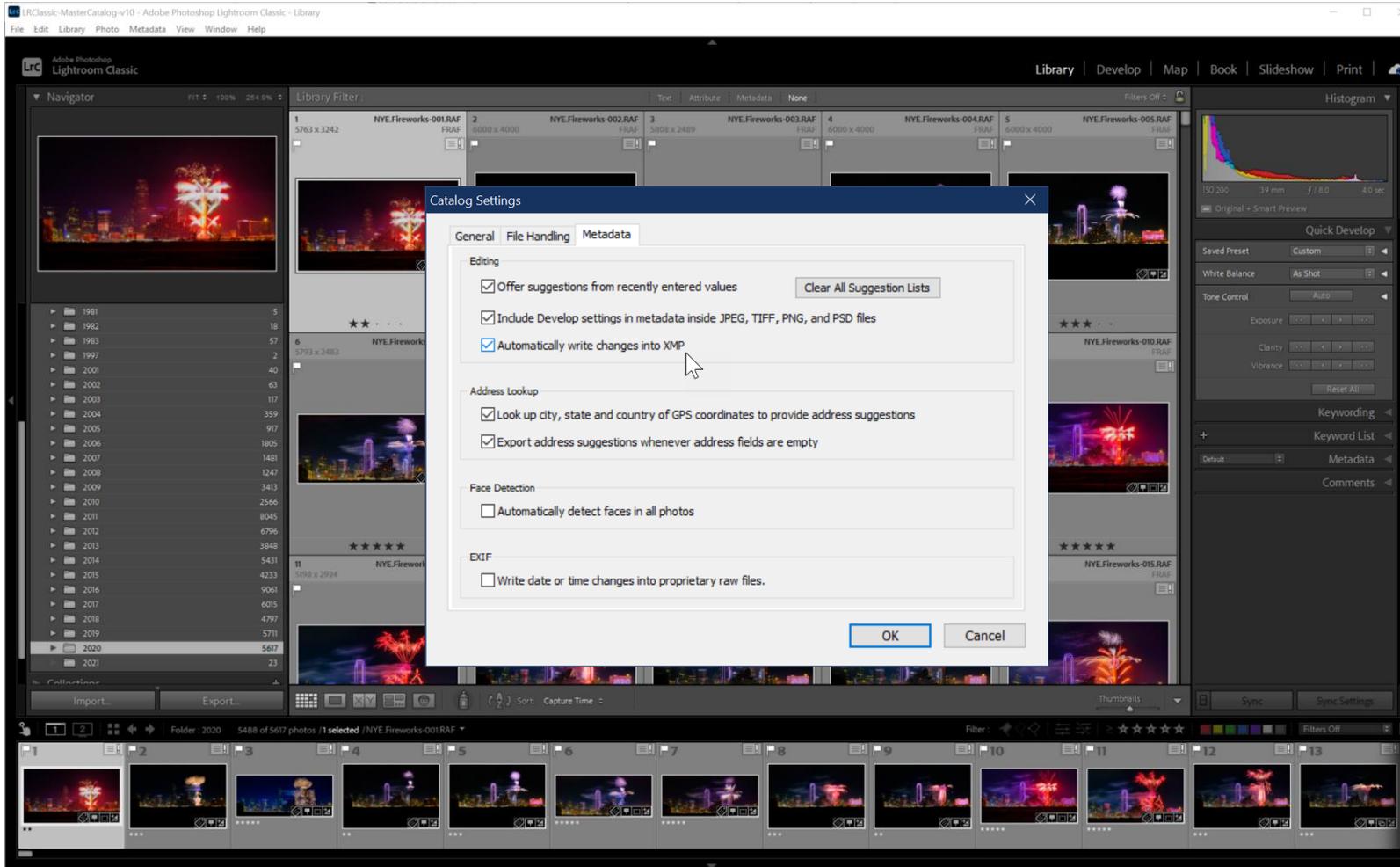
How To Enable Sidecar (XMP) Files in Lightroom Classic



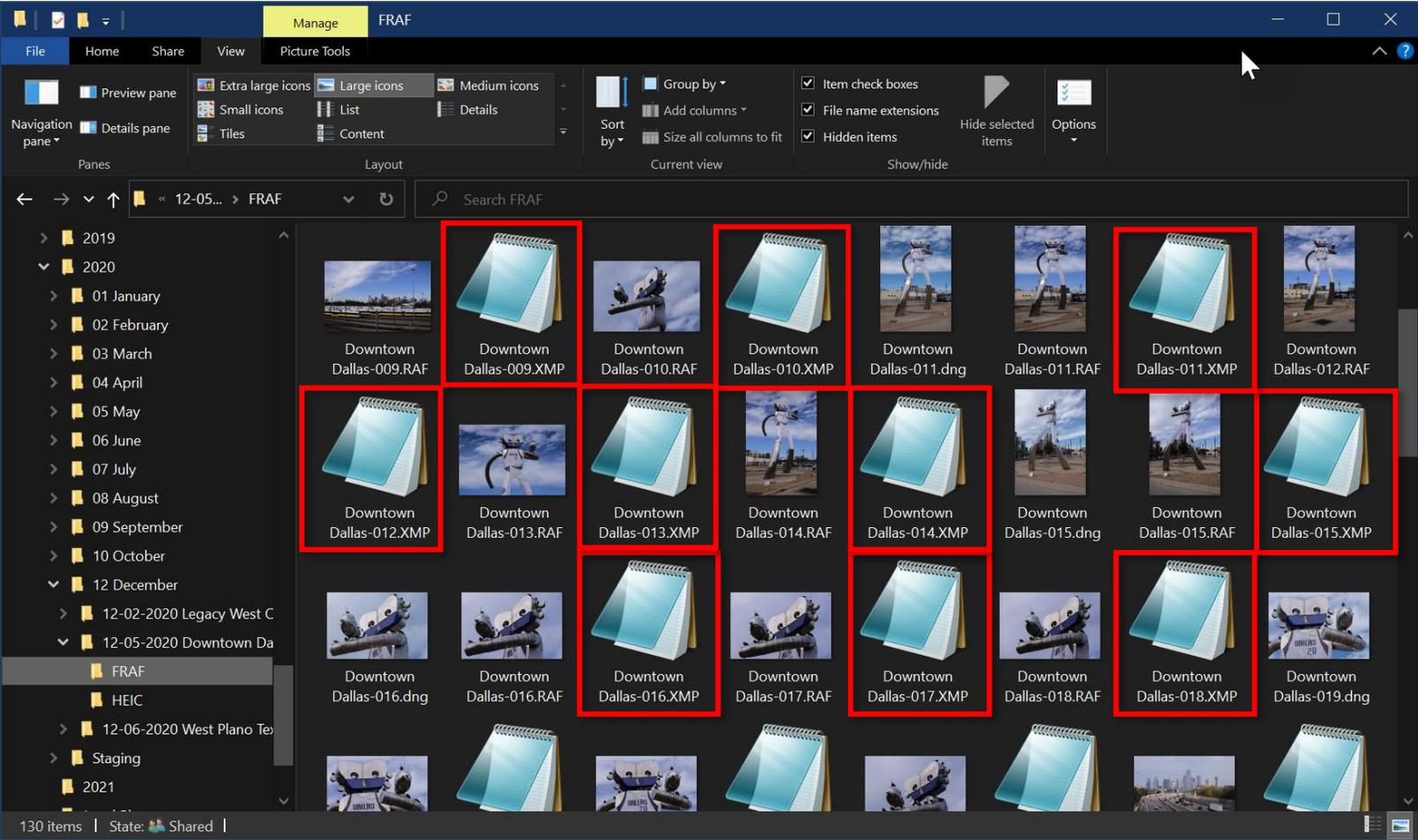
How To Enable Sidecar (XMP) Files in Lightroom Classic



How To Enable Sidecar (XMP) Files in Lightroom Classic



XMP Files Reside With RAW Files



Summary of XMP Files

- Open standard
- Provides a backup for much of data in Lightroom catalog
- Allows sharing of some metadata between applications
- Create XMP files in Lightroom in 3 ways
 - Manually for single files
 - Manually for multiple files
 - Automatically on import

Coming In Two Weeks: File Formats – Part 2

- Comparisons of other file formats (TIFF, PSD, JPEG)
- Why/when you would use each of those file types
- Roundtripping between Lightroom Classic and
 - Photoshop
 - Third-party plugins
- Optimal export settings from Lightroom Classic for
 - Competitions
 - Portfolios
 - Prints
 - Social media



Questions

