

# Teleconverter or Crop the Image for the Best Quality?

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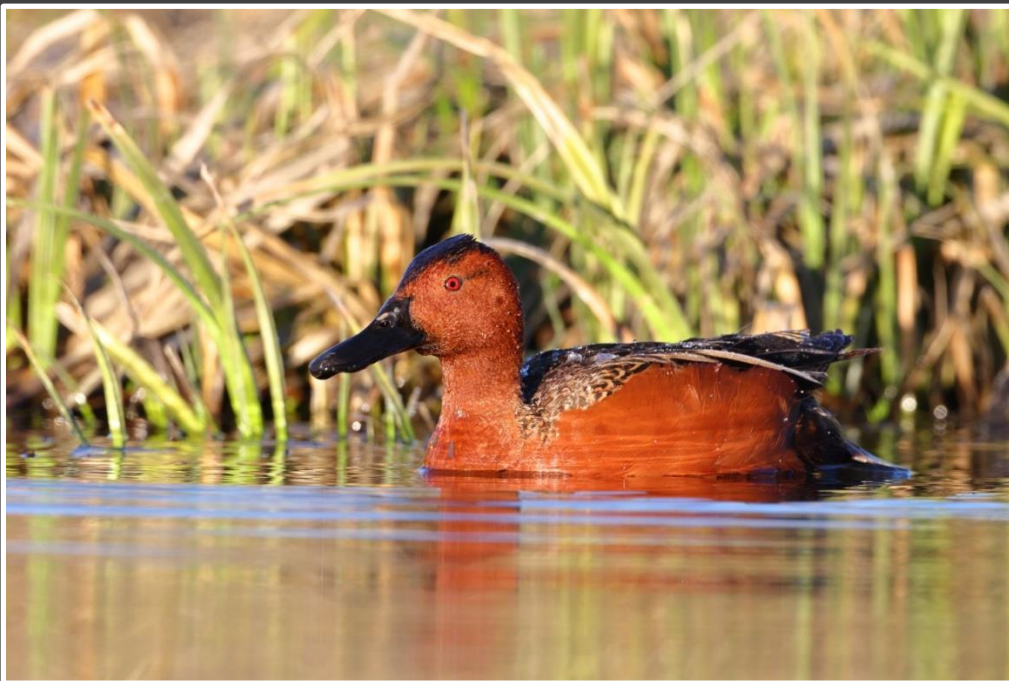
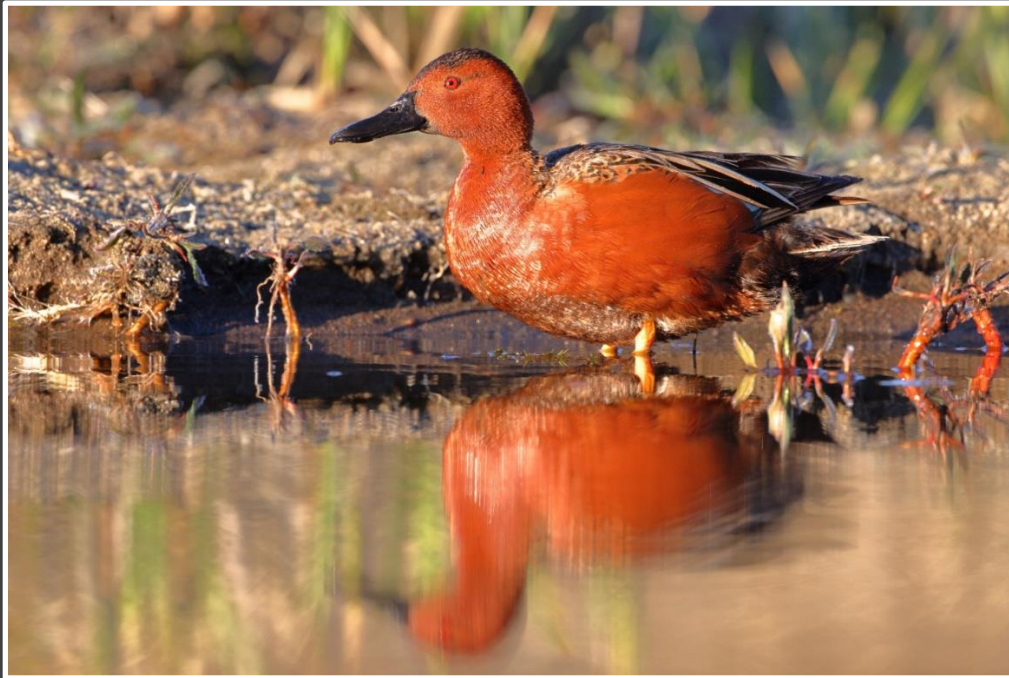
*Figure 1 One huge advantage over using the 1.6x in-camera crop mode over a 1.4x teleconverter is you do not lose lens speed with the 1.6x crop. The Canon 600mm f/4 lens remains f/4 even at 960mm FOV. This is an American white pelican in the fog at dawn on my local lake near West Yellowstone, MT.*

Not so long ago when many digital cameras produced a raw file around 20MPs, the obvious answer was to use a teleconverter as the file is too small for making prints around 13 x 20 inches if you crop a 20MP image much. While small file sizes look fine when posted on the Internet, small files of 10MP or so limits how large a print you can make if you go by the common guideline of 300ppi (pixels per inch). However, the raw file size produced by my new Canon R5 is around 45MP. When the 1.6x crop is used in the Canon R5 camera, the resulting file size for raw remains a respectable 17MP or a little more. Is using the crop mode to make the subject larger in the viewfinder a better way to go than using the teleconverter?

Let us run a simple test. This morning was cold and calm. With no wind, the lake near my home was still as glass, so I was photographing wild ducks at dawn while wearing chest waders and hiding inside my floating blind. Shown here are two images I made of a drake cinnamon teal. One was made using the full sensor (3:2) and the other was made using the Canon R5's in-camera 1.6x crop mode. Here are the file sizes when I was done doing some minor image adjustments using Canon's DPP4 software.

Canon R5 Camera	RAW – 3:2 format and no crop	RAW – 1.6x crop

MP Amount of the RAW image	59.4	23.5
PPI	8192 x 5464	5088 x 3392
Print Size in inches (300ppi)	27.3 x 18.21	16.7 x 11.3



Can you tell which image is made with the 1.6x crop in the Canon R5? Look closely! Give up? I cannot tell the difference here either. The top image is using the full sensor and the second is made with the

1.6x crop mode. On the Internet, and for a print size of 16.7 x 11.3 inches, it seems there is no difference in sharpness as you have ample resolution.

It appears to me there is no significant image degradation shooting in the crop mode if you do not make the image too large. Since small images of 1MB look fine on the web, it appears the crop mode has more than adequate detail for this use. Of course, a smaller file size could be limiting when it comes to printing the image. But only for large prints. The typical guideline for print making is 300ppi. Any more than that really does not help and less makes the image sharpness decline. So, with the example above, if I am not wanting to make prints larger than 11 x 17 inches, there is no disadvantage in using the crop mode in the Canon R5. And I seldom make large prints anyway so smaller file sizes work fine for my professional needs.

### **It is all the same camera!**

I have seen many comparisons between full frame sensor cameras and other camera models that have a smaller sensor. Since the cameras have different sensors with different sized photosites, it is not surprising the difference in image quality might be due to sensor factors, such as pixel size, rather than the crop factor. But, in this case, the Canon R5 offers both full frame and crop modes, all with the same sensor. So now we can compare the cropped image versus the uncropped image using the same sensor.

### **The Elephant in the Room**

Before moving on, let me right away address the most frequent criticism I hear of using the in-camera crop mode. Frequently I read, "There is no reason to crop in the camera. Do cropping in processing if necessary, as there is nothing to be gained by doing it in-camera."

Actually, there are many benefits to in-camera crop modes. Here are a few of them and I will save the most important ones for last to keep you in "suspense."

1. In-camera cropped images are smaller files that load to the memory card faster
2. These small files also load to your computer or external storage device faster
3. The camera buffer is harder to fill up so you can keep on shooting
4. The memory card holds more images
5. Since the files write to the card faster, your camera battery will last longer

All of these are advantages for smaller file sizes produced by the crop factor, but to be honest, using large 256GB memory cards, big 5TB external hard drives back in the office, and having multiple batteries to pop into the camera largely negates the above possible problems.

6. I like the crop factor primarily for what it does to the lens field of view (FOV). My Canon RF 100-500mm lens suddenly has the FOV of a 160 – 800mm zoom lens when I set the camera to 1.6x crop factor. While the lens focal length does not change in reality, the FOV does and that makes the lens appear to be a longer focal length. This is quite handy because now I can use a lighter and less expensive lens to get the reach I really want. For example, my Canon RF 100-500mm lens is much lighter and less bulky than my Canon 600mm f/4 lens. A big, long lens does not do you much good if it too difficult to get to the optimum photo spot. This is one big advantage for relying on in-camera crops and smaller telephoto lenses.



*Figure 2 When confined in a photo hide like this one at Laguna Seca Ranch in South Texas, it is useful to shoot a zoom lens to accommodate birds that vary in size. Here is a painted bunting taking its daily bath.*

And a big lens like the Canon 600mm f/4 III locks you into 600mm. Using a prime lens has rarely been a problem for me when stalking wildlife since I begin shooting as soon as I stalk close enough to the subject to make it big enough in the image. However, when hiding in a blind or car where it is not possible to adjust the subject to camera distance, then being able to zoom the lens is the best option and being able to adjust the FOV with the crop mode is enormously useful. For example, while on safari in Kenya, I might have the perfect composition with the 600mm lens on a lioness with cub from the parked safari vehicle. Then the lions get up and walk toward the vehicle and now I am too tight. It is much easier to photograph the lions with a zoom lens where different focal lengths can be selected quickly. I also do considerable bird photography from photo hides. Whether at the magnificent bird photo blinds at Laguna Seca Ranch in Texas or on my own property, a prime lens is a problem. Since I must remain in the blind, a prime lens forces me to be ready for a certain subject of a given size. If I am using a lens that is perfect for the larger green jays in Texas or western tanagers in Idaho at my home, I do not have enough focal length for smaller birds. If I select a lens most suitable for small birds, then I am too tight on larger birds. It is better to be able to change the focal length by using a zoom lens and/or switching to different crop factors.

7. An even more important advantage to using the 1.6x crop in-camera over cropping the image later in processing is what it does for me as I shoot the images. The Canon R5 is a mirrorless camera, my first one, and it took me a while to get used to thinking of the viewfinder and the LCD as being the same thing. So, when I set the 1.6x crop mode, I actually see a larger image of the subject in the viewfinder than I do not see if I shot full frame and crop it later. That means since the subject is larger, say an American bittern, I can see if the eye is open, if the bird's head



is turned slightly toward me or away, if twigs or other obstacles are in the way, the position of its feet, and consider other factors that I might not see if the bittern is much smaller in the viewfinder. Seeing the subject up close using the crop mode helps me enormously to know when to shoot images and when not to shoot. Using the camera full-frame, and planning to crop the image later in post, is not nearly as effective when the subject is rather small in the viewfinder.

I tend to shoot a lot of images when the subject's pose, light, background, and other key factors all come together. But when something is clearly wrong because I can see it, I do not shoot at all. So, I shoot a lot, but very selectively – if that makes sense.



*Figure 3 When using the 1.6x crop mode of the Canon R5, the subject appears large in the camera's viewfinder. This makes it easier to tell when to shoot photos. As this American bittern hunted, I watched its feet and shot when the feet were most visible, and one foot was forward of the other. And with the eye focus on the R5, the camera changed the focus as needed to be precisely focused on the bird's eye at all times.*

#### Crop Factor Advantages

1. The subject is larger in the viewfinder making it easier to know when to shoot photos
2. Smaller file size loads to your in-camera memory card faster (I use a 256GB and a 128GB card in my camera and that holds a lot of images)
3. Keep the maximum aperture of your lens available in case you need it due to low light (normally I stop down some for better sharpness and depth of field, but sometimes shooting wide open is necessary).

4. You get more reach with the 1.6x in-camera crop and you do with the 1.4x teleconverter. Some call true magnification more reach because it puts more pixels on the subject, but I use it interchangeably for both the 1.4x converter or the in-camera crop.
5. When both a teleconverter and a crop factor are used simultaneously, that gives you a tremendous amount of reach.

#### Crop Factor Disadvantages

1. The field of view of the lens is narrower, so sometimes it is difficult to find the subject in the viewfinder. That is especially true for fast action where you must get on the subject quickly.
2. Should you be tight on a subject and it rears up or flaps its wings, you might cut an important portion of the subject out of the image. For this reason, when doing a lot of action or flying birds, I always shoot full frame and plan to crop later.
3. If the subject is still too small in the cropped image, you really do not have a lot of ability to crop a lot more, especially if you wish to make a print.

#### Teleconverter

##### Advantages

1. The subject is larger in the image, so it is easier to see (but the crop factor does that too on the Canon R5 – do not know if all cameras do that)
2. The image file is larger so you can crop it more in post or not crop and print it larger
3. You see the subject larger so once again it is easier to know when the pose is best for photos

##### Disadvantages

1. Adding any extra glass to the optical path always results in a slight loss of contrast and sharpness. Admitted, a high-quality teleconverter on an excellent prime lens delivers good quality, but every time I have run a test between teleconverter and no teleconverter, I could always see the slight loss of quality. I use teleconverters, but only the latest Canon 1.4x teleconverter. My recent sharpness tests showed me how much sharper the image is when using the in-camera crop mode over adding a teleconverter to the optical path. But that test was where I had set the lens wide-open to f/4.

I later retested the two Canon 1.4x III extenders I own and stopped down to f/8. The results showed the 1.6x crop remains slightly sharper, but the difference is tiny as I struggled to detect the difference in image sharpness between the 1.6x crop mode and the 1.4x converter! All images shot were easily acceptable. Stopping my 600mm f/4 lens down to f/8, rather than shooting with the maximum aperture of f/4 really helps the teleconverter out with much better sharpness. I need to test stopping down only one stop to f/5.6 to see if it also greatly improves image sharpness over f/4. This means if you have enough light to stop down to say f/8, it is quite possible to use both the 1.6x crop factor and the 1.4x teleconverter simultaneously. That gives you a FOV of 1344mm!!!!!!

2. A teleconverter is fairly expensive
3. The teleconverter is more weight and bulk to carry with you and one more thing to keep clean

4. If you must remove the teleconverter or put it on due to changing subject distances, then that eats up valuable time
5. Teleconverters cost you light. A 1.4x costs 1-stop of light and the 2x costs two stops of light. That means you must use a slower shutter speed, open up the lens more, or increase the ISO.
6. The teleconverter may not give you the “reach” of the crop factor. For example, with my Canon 600mm lens, the Canon 1.4x teleconverter which I frequently used in 2020 to shoot more than ¼ million bird images in my floating blind extends the lens to 840mm. ( $1.4 \times 600\text{mm} = 840\text{mm}$ ) The 1.6x crop factor on the 600mm lens gives me the FOV of 960mm. ( $600\text{mm} \times 1.6 = 960\text{mm}$ ). What this means is I do not have to approach my wild duck as closely. There is less chance of disturbing it as I can be further away from it. As the subject is more at ease with me due to the greater distance I am from it, I tend to photograph natural behavior more often such as preening, wing flapping, diving, etc.
7. The 1.4x teleconverter absorbs one stop of light. That effectively makes my Canon 600mm f/4 lens a 600mm f/5.6 lens. The lens is one stop slower. Autofocus might slow down and be less accurate, and not being able to open up to f/4 means I would have to use one stop more ISO than I prefer, or a shutter speed one stop slower than I would like. Both the slower shutter speed and the higher ISO could be detrimental to image quality.
8. Though not a problem for the mirrorless Canon R5 since autofocus is done at the sensor plane, teleconverters require you to AF microadjust your DSLR camera and lens with the teleconverter in use. Every lens/camera combo I have used with a teleconverter required some AF microadjustment for precise focus. And it is amazing to see how the teleconverter changes the adjustment. I have had many lenses where I needed a negative AF microadjustment for some back focusing problems. When the teleconverter is added to the optical path, it always changed the AF microadjustment some and in surprising ways. I typically needed a negative AF microadjustment when I used a long lens without the converter, but add the converter to the optical path, and suddenly I needed a positive AF microadjustment for precise focus. Never have I found a lens where the AF microadjustment was identical between the lens by itself and the lens with the teleconverter added to the optical path.

Notice the negative column for teleconverter use is far longer than the positive column. While I did get pleasing results with the new Canon 600mm f/4 lens with 1.4x teleconverter with my Canon R5 mirrorless camera using the adapter to use the lens, it is not quite as sharp as using the crop mode without the teleconverter, and the crop mode gives me more reach as the subject is larger in the viewfinder and it lets me use the maximum f/4 aperture when I must in low light conditions.

As I write this on May of 2021, I have abandoned how I took bird photos in 2020 by using the 600mm lens on a Canon 1DX Mark III DSLR and now use the Canon 600mm f/4 lens on a Canon R5 mirrorless camera. I use the Canon R5 mirrorless camera with the Canon 600mm mounted to a Wimberley head in the Mr. JanGear floating blind with the camera set to 1.6x crop mode. That gives me the FOV of a 960mm lens! That means I photograph my wild subjects from a greater distance. I use the electronic shutter that shoots at a fixed 20fps (frames per second). I like the electronic shutter because it is silent but do wish Canon would let me set how many images per second are shot using the electronic shutter. No longer will wild birds and mammals react to the sound of my camera! In the floating blind camera noise is seldom a problem, but it is an enormous problem when I photograph warblers, vireos, and

tanagers right after they land in the forest on my property during the September migration. Half of them immediately fly away when they hear the camera noise. A soundless camera solves the problem.



*Figure 4 Cassin's finch with the Canon R5, 600mm f/4 lens, and the camera's 1.6x crop mode. F/6.3, 1/1250 second, ISO 640 using Auto ISO with exposure compensation set to + 1/3 stop.*





*Figure 5 While I was using the Canon 600mm f/4 lens with the 1.6x crop mode of the Canon R5 for small birds, when this large green jay flew in, I quickly switched to the full frame mode to avoid cutting its tail out of the image.*

The 960mm reach of the 600mm with the 1.6x crop mode is awesome. Being able to use f/4 in the fog for wild birds in the floating blind to keep the ISO lower, and not losing any sharpness due to extra glass (the teleconverter) being in the optical path is incredibly beneficial. Plus, should the subject swim closer to me, I can quickly change from 1.6x crop mode to full frame, changing my FOV from 960mm to 600mm in a second or two. That sure beats having to take the teleconverter off inside a floating blind where a slight mistake adds the expensive teleconverter to the bottom of the lake. (By the way, I assigned the crop mode to the star button on the rear of the Canon R5. To change from full frame to 1.6x crop, all I do is press in the star button, the crop menu appears, and one click of the main dial on top of the camera switches it to 1.6x crop or full frame. That is quick and easy!



*Figure 6 A drake ring-necked duck in the fog right at sunrise is the time when I must use f/4 to keep the shutter speed up and the ISO down a little.*

And for birds at my seed feeder, reflection pond, or water drip, then I will use the Canon 100-500mm f/7.1 lens. With the 1.6x crop factor, it makes the FOV equivalent to a 160mm to 800mm lens. That is perfect where my distance to the setup is fixed since I am hidden in a stationary photo blind – unlike my floating blind where I can move closer or further away to suit the circumstances – and that lets me nicely compose subjects of different sizes. For example, sometimes I have hummingbirds bathe in my water drip and then that is immediately followed by a much larger western tanager. Being able to quickly zoom the lens makes it easy for me to accommodate different sized subjects!

I realize many still advocate using the teleconverter to convert their lens to a longer focal length. But here is my argument against doing that. A teleconverter is expensive, you have to put it on and take it off at times, carry it with you, keep it clean for image quality, and the image quality is slightly less. Both sharpness and contrast drop by adding extra glass to the optical path. Granted, an expensive teleconverter paired with an expensive lens delivers nice images, but they still are not quite as good as cropping the image either in the camera or when processed. On the other hand, if you need a large file for big print purposes, or you need the extra reach, then a quality teleconverter is helpful. Going forward, I expect I will mostly use the in-camera 1.6x crop for 960mm, but when I need even more reach, I will add the 1.4x teleconverter to the Canon 600mm f/4 lens and shoot in crop mode for 1344mm FOV!

## Summary

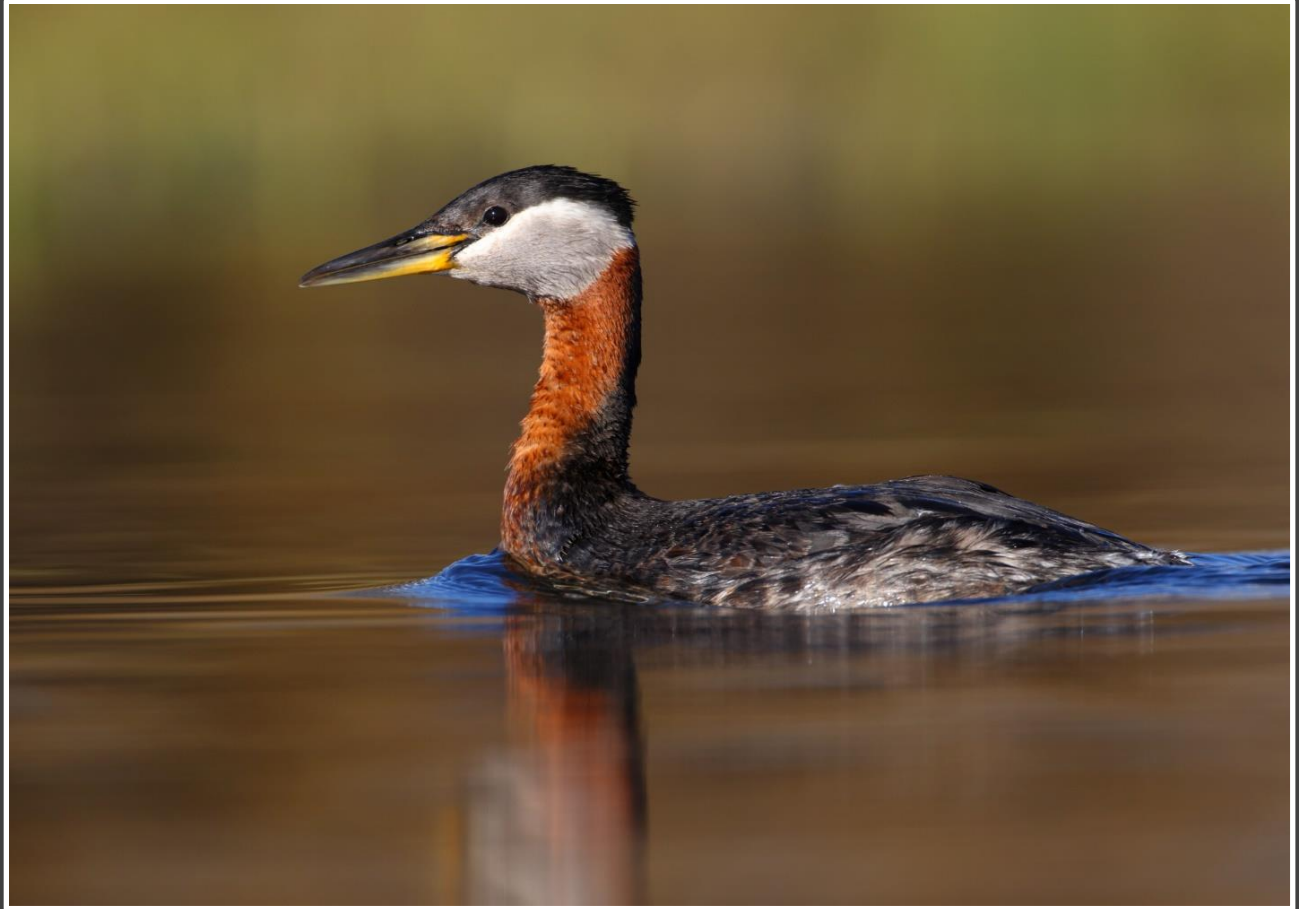
The Canon R5 is my favorite camera for many reasons. The eye focus is incredible, but not perfect, and I forgive it when it fails. What a delight to get such good autofocus and not have to AF microadjust the

camera and lens. The quiet electronic shutter that shoots 20 images per second is handy to have and I use it a lot. The Touch and Drag AF point is also incredible, and the electronic viewfinder works far better for me than the optical viewfinders I once used.

For the best in quality, I prefer the Canon R5 paired with the Canon 600mm f/4 III. It gives me a wonderful 600mm reach with f/4 should I need to shoot that wide open due to dim light. When I switch to the 1.6x crop mode in the camera, then I have a 960mm FOV and still have super quality, though the file size drops to around 17MP but that is plenty for most of my needs. And when I want a larger file size, I add the Canon 1.4x converter III. That gives me 840mm f/5.6 behind a 600mm lens, but I do lose a tiny fraction of sharpness and one full stop of lens speed. Therefore, in dim light, I try to get by without the 1.4x to allow an f/4 aperture. Also, I tested how sharp the 600mm is paired with the 1.4x converter and if the lens is used wide open at f/4, the sharpness is not quite up to my standards, but stop down to f/8 and then I could barely tell the difference in sharpness. So, with the 600mm and 1.4x combo, I have the immediate choice of 840mm, or I can turn the 1.6x crop mode on to reach the FOV of 1344mm!!!! Lots of options with this combo, and the quality is superb if your photo technique is sound!

#### Final Thoughts about the Canon R5 mirrorless Camera

This camera has profoundly changed the way I shoot landscapes, macro, and wildlife images today for the better. My backup camera is the Canon flagship 1DX Mark III, and I hope I do not have to use it. Having the tools offered by the R5 and not offered by other Canon DSLRs is enormously beneficial to me. The R5 makes me a better photographer – no question about it! Already I am looking forward to the new Canon mirrorless R3 that will be an upgrade to the R5. I have ordered it already, but no idea when it will become available. I realize it cost plenty of money to switch from DSLRs and their lenses to a new RF system, and DSLR are excellent for shooting photos, but let us not kid ourselves, the mirrorless system is far better.



*Figure 7 Once the sunshine is strong, I add a Canon 1.4x teleconverter to the 600mm lens. When I first tested the 1.4x, I was not impressed by how sharp it was at f/4 but stopping down a little greatly improves sharpness of the Canon 600mm f/4 lens and 1.4x tele combination. In this way I have a lot of reach. The 600mm with 1.4x tele is an 840mm lens. When I need more reach as I did here with the red-necked grebe, I set the Canon R5 to 1.6x crop mode giving me a field of view (FOV) of 1344mm!!!! How did I arrive at that figure?  $600\text{mm} \times 1.4 \times 1.6 = 1344\text{mm}$ ! In brighter light where you get to use more shutter speed, this combo is effective. For this image, I used 1/2000 second, f/8, and ISO 1000. Once I reach full sunshine where the ambient light does not vary much, I tend to use full manual exposure. At dawn when I know the light will steadily increase, I normally use Auto ISO, manual aperture and shutter speed, and exposure compensation with that assigned to the Set button on my camera. Auto ISO continually adjusts for changes in the amount of ambient light.*

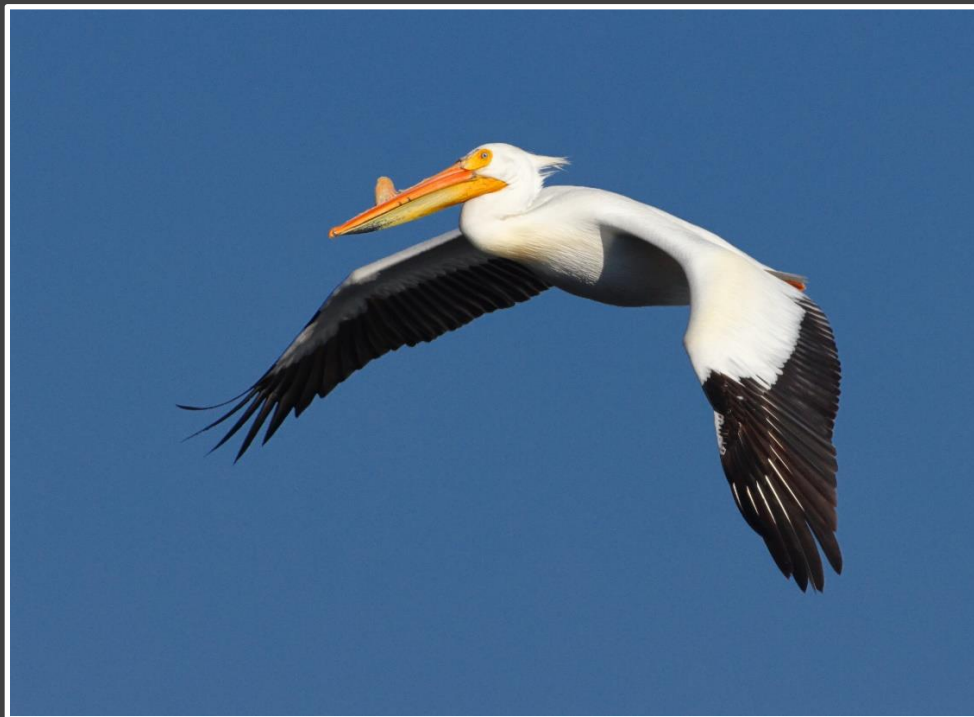




*Figure 8 A yellow crowned night heron photographed with a Canon R5, 600mm f/4 lens, and using the 1.6x crop mode of the camera for a total field of view of 1344mm!!!!*



*Figure 9 Drake Bufflehead with the Canon 600mm, 1.4x tele, and the 1.6x crop mode of the Canon R5. ISO 1000, f/10, 1/1600 second.*

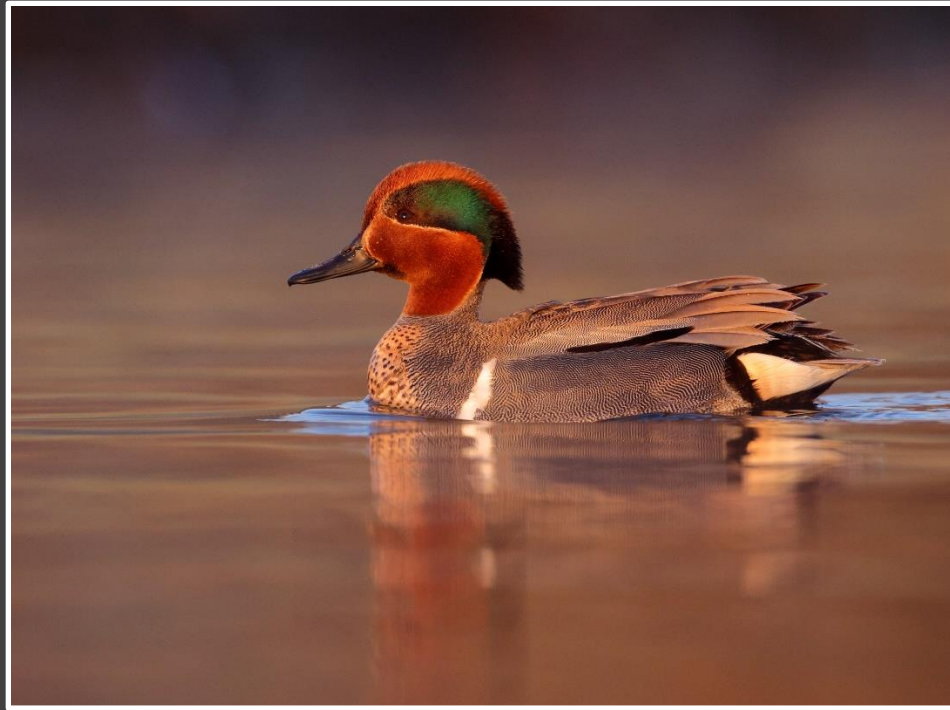


*Figure 10 American white pelican with the Canon R5 and 600mm f4 III lens, 1.4x converter, and 1.6x crop factor using eye focus to lock on to the eye as this pelican prepared to land. F/9, ISO 1000, and 1/4000 second.*

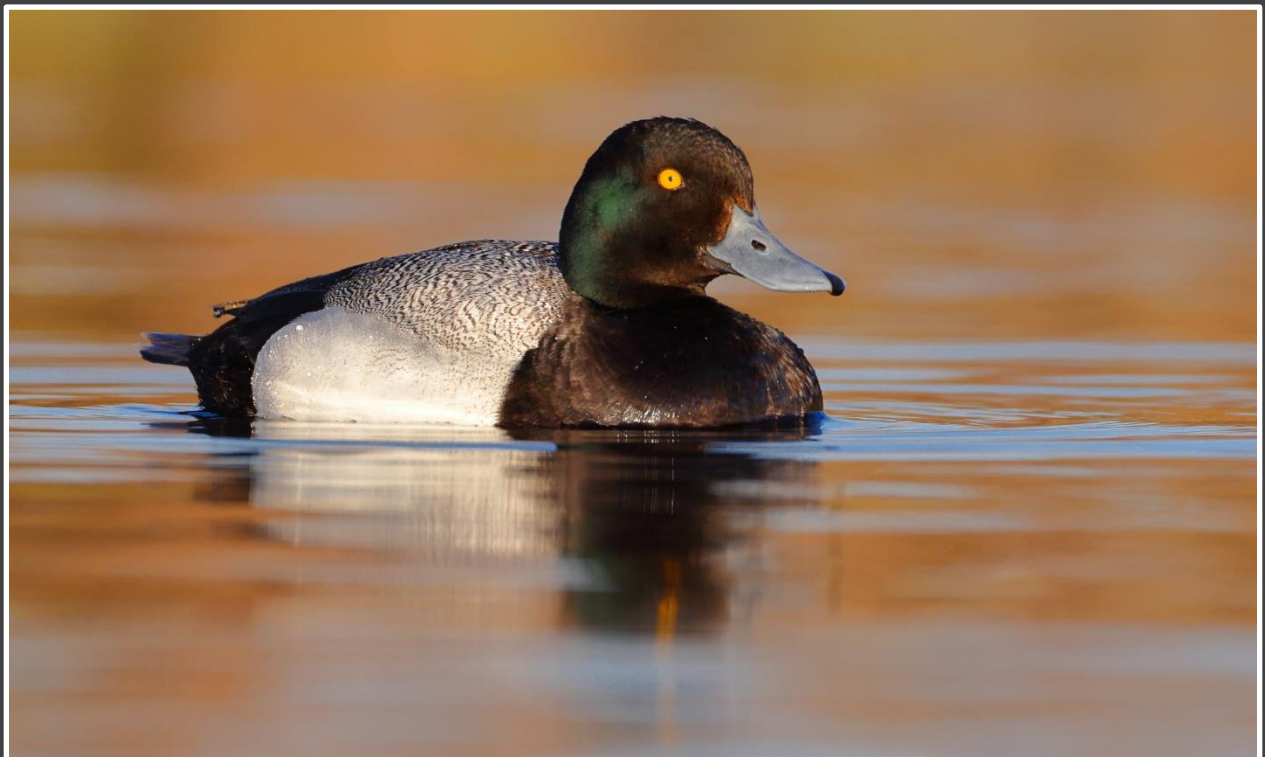




*Figure 11 Male yellow warbler with the Canon R5, 600mm f/4 lens, in 1.6x crop mode for a total FOV of 960mm.*



*Figure 12 A green-winged teal swam past me at first light in the fog. Due to low light, I used only 1/640 second, f/6.3, and ISO 2000!*



*Figure 13 A lesser scaup with only the Canon R5, 600mm f/4 lens, and the 1.6x crop mode. Exposure is 1/1250 second at f/8 with ISO 1000. I waited for the scaup to swim to my right a little to get the golden background and that is produced by sunshine reflecting off willows.*