



Ely Photographic
Club

CAMERA SETTINGS & TECHNIQUES

The Lightroom Classic guides have focused on Post Processing but if the original photo has issues these may not be possible to correct.

Therefore, I suggest you may like to watch a few YouTube Videos on exposure, general photography settings, photography techniques and the difference between settings on the different types of camera (Full Frame, APS-C & 4/3rds), which I note at the end of these setting guides.

Most videos on photography unless specifically for a certain camera / lens will give the settings for a full frame camera. If you don't have a full frame camera these settings may not give you the best results and I try to explain this as we go through these notes. These are just my findings and you may find something different works for you when you experiment for yourself.

Remember there is no such thing as "the best" camera settings as it depends on what you want to convey, the camera you are using, the lens, are you using a tripod, the quality of the light, the weather conditions. All of these play a part in the settings to use.

As the manual that comes with most cameras is very poor, I strongly suggest you get a book or ebook on your specific camera. David D. Busch does some very good paperback books and Kindle books covering a wide range of Sony, Canon and Nikon cameras, so worth a look. Gary Friedman also does some excellent books and eBook's on Sony cameras and some Canon cameras. To get the most out of modern cameras understanding how they work and how to adjust the settings is very important. When I mention the "manual" in these notes this could be either the manual that came with your camera or preferably one of these books.

Whatever camera you have the lens will make the biggest difference to image quality. "Glass" as they say is crucial as it's the quality of the glass lenses within the lens that delivers the light to the sensor. Quality lenses will nearly always provide the best results and in normal situations (unless the camera manufacturer changes the lens mount) the lenses will last for a very long time, whereas the camera will probably be outdated by more modern technology within 5 years. So, a set of lenses will probably last through 3 or 4 camera body changes.

The faster the lens (the lower the lowest f stop the lens can achieve the faster the lens is described so f2.8 is quite fast whereas f5.6 is very slow) the more light you can allow through to the sensor and the narrower depth of field, which provides better out of focus backgrounds known as "bokeh". Some zoom lenses will have a range of f stops say f4 – f5.6 and this means the f4 applies when the lens is at its shortest zoom and f5.6 at the longest zoom. Unfortunately, fast lenses are much more expensive than slow lenses.

Focusing

The first thing to understand is focusing and depth of field and here the apertures stated are for Full Frame Cameras. If a photo is not sharp this is very difficult to correct in post processing.

Focus and depth of field are linked in that for all types of photography the depth of field will determine the zone within which you can get a sharp photograph.

For landscapes you want a reasonable front to back sharpness and this relates to a depth of field normally found between f9 – f13 when focusing approximately one third into the scene. You can rarely decrease this past f8 but could increase this up to f16 or even f18 if required but you have to be careful of diffraction, which I discuss in the aperture section.

There are some mathematical formulas for different lenses but I find for more distant shots just focus on infinity (or the furthest object in the frame) and for wider views I focus approximately one third in to the scene and find that these methods give reasonable results and you can easily gauge this for yourself in practice.

Remember that wide angle shots have a greater depth of field so its easier to ensure everything is reasonably sharp front to back and this is where the 1/3rd focusing works best.

Telephoto (longer lenses) or Zoomed in shots have narrower depths of field so this is where focusing on infinity or the furthest subject can work better.

Its always worth checking the photo in playback, possibly magnifying to check focus in various points around the image.

For landscapes I use the Single Shot Auto Focus (AF-S) and then using the flexible spot move this over to the focus location on the ground or the furthest subject, whilst framing the overall image. Then when you take the shot the focus will be in the right place.

For portraits move the focus point to the nearest eye of the subject. For example, for a portrait, if their right eye is closer to the camera the focus point would be in the upper left half of the view. If they are straight on then either eye will do. If doing a close up make sure the focus is on the eye ball not the eye lashes.

For wildlife and sport with reasonably stationary targets, you can change the aperture to say f6.3, f7.1 or f8, still use flexible spot but change to Continuous focus (AF-C) and a reasonably high frames per second setting as I know some photographers sniff at what they call “spray and prey” but mathematically the more photos you take the higher the probability of a sharp shot especially when starting out; Frame up as for portraits and take say 3 – 5 images in a burst. This way on more modern cameras the camera will maintain focus for each image. You could use method this for portraits if your subject is not still.

If the target is moving just use centre spot focus or a larger flexible spot located in the centre of the view, with Continuous focus (AF-C) and a reasonably high frames per second and take say 5 – 7 images in a burst. Remember to increase the shutter speed for fast moving subjects.

If the target is quite small and moving fast, such as a bird flying across the sky, you can use Wide or Zone focusing areas and these will probably enable you to keep the bird within the focus area more easily than trying to keep a small focus point on the bird.

Manual Focus

I mainly use Auto-Focus for landscapes, wildlife, sports, street, etc but I do occasionally use manual focus for landscapes if I want to be sure about my focus point but I mainly use manual focus for macro.

Turn off Auto-Focus on the lens or camera (this can vary according to the camera & lens you have).

Then turn the focus ring on the lens until the subject is in focus.

I set focus peaking which adds a colour to the areas of the image in focus. You can normally change the focus peaking colour if it clashes with the image so it doesn't stand out. This is only an indication of the focus. Its normally ok for landscapes but not usually accurate enough for macro.

Some cameras have a hybrid mode for part auto and part manual. I personally don't use this but use back button focusing (see explanation below) which allows for a similar effect.

Focus Magnification

My camera has several buttons that can be configured to different functions. This is the same on many cameras but not all, so you need to check your camera manual on this. There will also be YouTube videos on camera set ups that you can watch.

I have my C3 button, which is under my left thumb, configured so when I press it, the scene is magnified and you can move the box that appears around using the joystick to select areas to check that they are in focus. There may be another button that allows you to do this on your camera or it may not be available at all, so check the manual.

This is useful in landscape photography where you have focused on a tree and want to be sure that that tree is in sharp focus or in portrait photography where you can check if you are focused on the eye or the eye lashes.

You can also use this in static wildlife when shooting through branches, reeds, etc to make sure the focus is actually on the subject not on a branch or reed in the way.

It also works in manual focus mode allowing stepped magnification to check focus.

Back Button Focus

To understand this its important to understand how the camera focuses normally. The camera normally focuses when half pressing the shutter button and takes the photo when you fully depress the shutter button. This appears to be all one action in normal use.

To use Back Button focus we change this to focus with a different button thus separating focus from taking the shot. The focus mode should be continuous focus (AF-C or Servo on Canon).

This is the focus system I use when photographing wildlife and sport. I don't tend to use it as much for landscapes but you could if you wanted to. I use this with high shutter release rates to maximise the chance of shots in focus.

The AF-ON / + Focus zoom in button; is the button I use for back button focus. On most cameras it's right under your right thumb.

This button is by default set to Auto-Focus on in shooting mode and Magnify in playback / review mode. Therefore, this button does not need to be reprogrammed but the shutter button does. You will need to go into the cameras menu and set Focus with shutter button to "OFF".

Why use back button focusing; This is a point that causes lots of discussion, with some photographers loving it and some thinking it's unnecessary with modern focusing systems.

It started when older focusing systems and lenses used to hunt for focus and it took some time for them to reacquire focus, resulting in missed / out of focus shots.

Using the back AF-ON button fixes the focus so it stays focused on the bird even if the focus area touches other things causing the camera to refocus on the wrong thing. Its for this reason I do use Back Button Focusing.

With this focus method the camera will only focus when I press this AF-ON button and doesn't focus or refocus when pressing down the shutter button so the focus point remains where it was when I pressed the AF-ON button.

This can be very useful in wildlife photography even though focus hunting is much less common with modern cameras, especially mirrorless cameras but even so I believe there are several reasons to use it.

The first reason is if you have focused on a bird on a perch and got it in sharp focus and you can't hold the camera absolutely still so the camera moves around a little, then depending on the focus area you have selected, when pressing the shutter button it may refocus on a close branch or on the perch instead of the bird making the bird out of focus.

The second reason is that if you have focused on a perched bird in a tree and its windy and the branches and leaves are moving around. If you have the shutter button set to focus on half press of the shutter button then the focus will change for every time you press the shutter button as things get in the way, sometimes focusing on the bird and sometimes on the branches and leaves.

Thirdly if your subject is partially hidden by some reeds or branches you get as close a focus as you can using the back button, which may focus on the reeds or branches then you can then manually fine tune onto the subject by turning the focus ring and the focus is fixed and when taking the shot the camera will not refocus. If you are using the normal shutter button focus the camera would try to refocus as you took the shot and probably focus on the reeds or branches again instead of the subject. You could obviously do this in full manual focus but I prefer not to have to keep jumping from auto to full manual and back button focus avoids this.

Forth, if you have a DSLR whose focus points are arranged in the centre or in a cross around the centre, how do you place a subject towards one of the corners 1/3 points and then focus, without going into manual focus mode. This is possible with back button focus and recompose. If you select focus with the back button, then recompose placing the subject in the required placement it doesn't matter if there are any focus points there or not as the camera will not refocus when you take the shot. This is one reason it's not so popular with mirrorless camera users as the focus points cover most of the screen so this is not an issue. But even if you have focus points in the required position moving a focus point is slow compared to having the focus set and just moving the camera.

Fifth, the focus and recomposing method allows you to focus and recompose before something happens and not have the camera refocus when the subject moves into frame. If you want to get a bird in flight when it's leaving a perch it's almost impossible to react fast enough to frame the shot and for the camera to focus in time. I have tried and failed many times. So if you have seen birds fly off from a tree in a certain direction you find a reed or branch just in front of or just past the bird as appropriate, focus on that with a reasonable f stop to give some depth of field, recompose and then wait for the bird to take off and when the bird flies through this preselected zone you will be ready and with the correct focus set. This obviously is a bit hit and miss but gives you a chance of getting the shot.

This fifth point also works to get photos of birds coming or going to a bird feeder. Back button focus on the bird feeder then recompose to one side so the feeder it's just out of shot and take the photo on continuous high-speed shutter as the bird flies in or away. If you had the normal shutter button focus set the camera would try to refocus as you took the shot and it's not usually quick enough to focus correctly on the bird so will often focus on the background or at best not quite sharp on the bird.

As noted above for wildlife and sports, I use continuous focus mode (AF-C) and in this mode the camera will automatically keep focusing on the moving subject whilst you are taking multiple photos in theory. Newer cameras also have focus tracking modes that improve on this by sticking to a moving subject as it moves around in the frame so I do use this quite a lot.

It's true that modern cameras have got a lot better at focusing and focus tracking with AF-C and with continuous shooting set and some people feel that this is so good now, you should just let the camera do its thing and it will maintain focus on its own. This is true to some degree but birds in flight can pitch and roll whilst moving back and forth so much that the camera can still fail to get sharp focus and I find that using back button focus by keeping the AF-ON button pressed when necessary, whilst firing away can help overcome this.

As with most things in photography it's trial and error and finding what works best for you.

Aperture

This section is about moving away from the Auto setting on the camera. The reason for moving away from this is that the camera doesn't know exactly what type of photography you are doing so cannot select which of the Shutter speed, Aperture or ISO is the most important. Some cameras do have pre-set Auto settings for different types of photography but these do not provide the accuracy of the Manual or Semi-Manual approach or allow you to fine tune the effect you want to show.

If you don't want to use full Manual control use one of the Semi-Automatic controls.

Aperture works with focusing in that aperture sets the depth of field so the shallower the depth of field the more accurate the focusing needs to be.

The Aperture Priority (A) setting for landscapes can work well and I use this about 50% of the time and Manual the other 50%.

Then you can use either Aperture Priority (A) (for the f stop and depth of field) or Shutter Priority (S) (for shutter speed) for wildlife and sports depending on the situation. You would think it's always Shutter speed for these uses and it mostly is but sometimes depth of field is more important.

This setting is usually on a dial on the top of the camera. On Sony, Nikon and Fuji this is A or S (nice and easy); on Canon its Av and Tv (weird), on some Fuji cameras its completely different as the f stop is on the lens so check the manual if it's not clear.

Another way is to use full Manual control (M) but set the ISO to Auto and for wildlife and sports this is what I use most often. This way you set the shutter speed and aperture and the camera automatically sets the ISO to suit the available light. This is very useful when shooting wildlife or sports when the subject is moving in and out of the light or the light is constantly changing. You can set a maximum limit on the ISO and when this is exceeded it won't go above this (some cameras flash the ISO number when it should go higher) and the image may be a bit dark and then require brightening in post.

In conjunction with these Manual or Semi-Automatic controls and the Manual + Auto ISO method you can use the Exposure Adjustment dial usually located on the top of the camera to adjust the exposure settings on the fly. However, the exposure adjustment function is disabled on some cameras when using Auto ISO so check this on your camera.

Another useful feature of many cameras is the "zebra pattern", which is a feature that overlays a set of stripes onto the image that indicates improper exposure levels. It acts as an aid to exposure levels by showing this striped patterned over areas that are overexposed (blown out / clipped) allowing you to turn the exposure adjustment dial until they are gone.

To understand these options, you need to understand the relationship between aperture, shutter speed and ISO. These are described as an exposure triangle that work together.

When people talk about settings and in particular aperture (the f number) they often don't explain which type of camera they are referring to but its normally Full Frame. This can then cause issues for those using APS-C or 4/3rds cameras due to their crop factors. Exposure is not affected by the crop factor but focal length / zoom length and depth of field are.

So first let's set out the basic principle, which is the Shutter speed – Aperture – ISO Triangle.

The most brightness is achieved from slower shutter speeds, the larger apertures and the higher ISO setting.

Apertures can be confusing as f2.8 is a small number but a large aperture (i.e. the hole is large) so it lets lots of light through, whereas f22 is a high number but a very small aperture (a tiny hole) and only lets a very small amount of light through.

ISO should be kept low (100 is good) to avoid noise but can be raised as required to achieve the balance required depending on which of the three is the most important at the time. It's probably not advisable to go above ISO 2400 on most cameras, as once past this point noise will become a serious issue.

However, sometimes you may have no choice to get the shot and accept that it will be noisy. Some newer cameras can deal with slightly higher ISO values so it's very much a try them and check the results to see just how far your camera can go before the noise becomes too much to deal with in post. Some photo journalists like a bit of noise in their images as they think it makes the image look gritty and real, especially in black and white.

ISO doesn't actually create the noise as this is caused by the lack of light getting to the sensor in the first place and ISO is just a way of amplifying the information on the sensor and thus amplifying the noise. There is some debate about does the amplification itself add noise and that may be true. All that is important is allow enough light to get to the sensor if possible and thus keep the ISO low.

Shutter speed will depend on what type of photography you are doing. Landscapes usually require slower shutter speeds and wildlife or sports a higher shutter speed.

ISO, Aperture and Shutter Speed all work together and must be kept in sync for a balanced exposure.

An example would be on a sunny day for a landscape photo you may want an aperture of f11, for front to back sharpness, focusing 1/3rd into the scene, so you set this parameter first; then you want low noise so you set an ISO of 100 and on a sunny day it may result in a shutter speed of 1/200 sec, which is fine for landscapes as they aren't moving, if you have a tripod, something to balance the camera on or you are confident you can hold the camera steady enough for the image stabilization in the camera or lens to deal with any slight movement.

If you can't hold the camera steady enough you may have to increase the ISO to increase the shutter speed to something that you know works for handheld shots for you. Even if you are confident it never hurts to take a second shot with a slightly higher ISO and shutter speed just in case, as there is nothing worse in getting home to see that the image is shaky and blurred.

Obviously, this depends on the available light and if you actually want a standard balanced image. You may want a darker moody shot so will underexpose on purpose by pushing up the f stop or decreasing the shutter speed or and "Exposed to the right" image (explained below) where you deliberately overexpose the image slightly being careful not to clip the highlights.

Then when using a tripod use a shutter release or the shutter timer to avoid camera shake when pressing the shutter button.

If it's very windy you may need to fix your camera bag under the centre of the tripod so I always have a bungy cord in my bag to do this. The bag just needs to be touching the ground not swinging free.

If you don't want to carry a heavy tripod at least get a lightweight travel tripod as these won't be as stable as a big heavy tripod but they still help a lot.

I often take shots with multiple settings and from multiple positions just in case, especially if its somewhere a long way from home that you can't easily re-visit. This is the advantage of modern digital cameras over old film cameras, there is basically no limit on the number of shots you can take.

Some basic settings that I recorded on my full frame camera with a 24 – 70 mm lens at 2:30 pm in bright sunlight are as follows: -

ISO 100; f4; 1/1250 sec

ISO 100; f8; 1/400 sec

ISO 100; f11; 1/200 sec

ISO 100; f16; 1/100 sec

ISO 400; f4; 1/5000 sec

ISO 400; f8; 1/1250 sec

ISO 400; f11; 1/800 sec

ISO 400; f16; 1/320 sec

ISO 800; f4; 1/8000+ sec

ISO 800; f8; 1/3200 sec

ISO 800; f11; 1/1250 sec

ISO 800; f16; 1/800 sec

It's worth doing this with your own camera to see what the figures look like and if your camera and lens combination gives slightly different results. This also helps you understand the impact of changing one setting on the other two settings.

To do this set the ISO, then the aperture (f stop) and adjust the shutter speed until the arrow in the view finder or rear screen sits on 0.

Some people like to "Expose to the Right" and here they are referring to the right-hand side of the histogram, which shows the lighter tones. If this can allow more scope for recovery of detail from the shadow areas without introducing noise.

You do need to be careful not to go too far as you will blow out the highlights. If you want to try this then allow the settings to be $+1/3^{\text{rd}}$ of a stop to slightly overexpose your images. Have a look at the histogram to check it's still within bounds but slightly pushed towards the right.

You can see that with each of the ISO settings the shutter speed decreases as we close the aperture with the higher f stops, as less light gets through in a set period of time (remember the larger the f stop number the smaller the hole the light travels through, so f16 is quite a small opening and f4 is quite a large opening).

Therefore, depending on what photography I was doing, I can have a good idea of the settings required on that day. The first setting you set is the one most important relative to what you are photographing.

For landscapes, as depth of field is probably the most important, you would set this first so an aperture of say f11 would be ok; then as it's important to have the lowest noise possible we set ISO 100; then you adjust the shutter speed for the correct exposure. In good light as seen above this could be around 1/200 sec and if it is that would usually be fine for landscapes.

When the light is poor the result will be different and then it depends on how well supported the camera is. If on a solid tripod the shutter speed doesn't really matter unless you are photographing trees on a windy day and want the leaves to be still. If you want some movement to bring the windy conditions into play then a slower shutter speed may be fine, it really depends on what you want to convey.

Shutter Speed

Shutter speed is another very important part of the exposure triangle.

The one thing its hardest or even impossible to rectify in post processing is blurry images caused by movement blur. This can be either because the subject was moving or you were hand holding the camera and it wasn't steady.

Even for landscapes, it's important wherever possible to use a tripod to avoid camera shake. If this is not possible increase the shutter speed to compensate.

Also look to see if there is anything you can place the camera on or against or even lean yourself against as this will help. In there is nothing then try to lock your elbows in tight against your body and create a triangle between the elbows and forehead.

If you use a camera strap this can be pulled tight if you have to use the rear screen instead of the viewfinder eye piece.

It gets a bit more difficult for wildlife and sports as the depth of field has to take account of the subject, trying to achieve a blurred background at the same time, whilst the shutter speed has to be set for what you want to convey, fast to freeze the action, slightly slower to show movement.

For birds in flight the background is often not relevant as usually it's just sky behind the bird but we need quite a high shutter speed as the bird will be moving fast, so we would set this first.

A shutter speed on a full frame camera with a 20 – 24MP sensor of between 1/1,500 – 1/2500 sec is reasonably good but 1/1000 sec may be ok depending on the speed of the bird or if its sports the speed of the subject. For higher density sensors such as cropped 18 – 20 MP or full frame sensors of 30 MP and above you generally need higher shutter speeds of 1/3000 – 1/3500 sec and this obviously has an impact on the aperture as these are directly related as noted above.

Then we want to control the depth of field so possibly on a full frame camera f6.3, f7.1 or f8 could be ok depending on the situation. Possibly start with f8 as this provides the best depth of field. Again, on cropped or Micro 4/3rds sensors this will be different due to their increased depth of field at any given aperture.

This then leaves the ISO to be set as required to get the correct exposure. if the ISO gets a bit too high you would pull back on the aperture trying f7.1 and then f6.3 and then the shutter speed and hope the light is good enough to not have to go any lower but sometimes you have to. The thing is you can't reduce too much is the shutter speed or you will get movement blur.

For static birds etc that may be moving a bit but with no close background behind them it may be that a much lower shutter speed will be ok so even speeds as low as 1/320 or 1/500 sec can be ok, then set f7.1 or f8 and see what ISO is required to get the correct exposure. Even with static birds you sometimes need faster shutter speeds than you think as their heads can bob up and down quite quickly so take this into account.

The difficulty is for static birds etc that may only be moving a bit but with a reasonably close background behind them is you need a sharp object but a blurred background. This may not actually be possible as the only way to achieve a really blurred background it to have a significant distance behind the subject, basically the more the better and where possible you should try to manoeuvre around to achieve this as sometimes a different angle can make all the difference.

In this situation it's more about trying different settings to see what works best but it could be that nothing works that well. In this case it's probably the depth of field and the background blur that's most important so select a suitable aperture of say f4 or f5.6, then a shutter speed of 1/320 or 1/500 sec and then set the ISO as required.

In low light but still needing a reasonably fast shutter speed you have no choice but to increase the ISO and reduce the aperture as far as you dare (remembering at f2.8 or f4 the depth of field will be very narrow) as it's easier to deal with noise in an image in post-production than movement blur and having the head of the subject sharp with the tail slightly blurry is ok.

I think the best thing to take from settings is to start with the basic guides and then try different settings as you get more confident to see what works for you. There is no perfect group of settings for a photo, it's all what looks and works best on the day to suit the light and conditions.

These are a few videos below that may help explain all of this in practice.

Nigel Danson – You Tube video on Mastering Exposure

<https://www.youtube.com/watch?v=Av-WDSJsxyY>

Very informative video on the subject

Mads Peter Iveson - You Tube Video on Landscape photography settings (remember he is using a Full Frame camera)

https://youtu.be/5_qIXaQkNRE

This is a useful video on Camera settings. He is a very good photographer and explains things well.

It's interesting he uses such a wide range of settings for landscape photography depending on the light and conditions and goes further than I normally do, down to f5.6 and up to f22 on occasions. I would generally say for landscape photos to be between f9 – f13 and only start to experiment outside this range as you get more experience.

His view, which I agree with, is that the settings are only a guide and you should use what's required to suit the conditions. However, he is an experienced photographer and is possibly more able to make these judgment calls but sticking within the normal boundaries when starting out is not a bad place to start and will help you gain confidence.

Then as you gain more experience start to experiment with different settings and observe the effects and use these creatively. Don't let anyone tell you that you must use certain settings as settings create the image and you may have chosen them deliberately for the image you are trying to convey. However, understanding what the settings do is important.

Everything he sets out is great but for less experienced photographers what can we take from this video

There are a few points to understand when looking at the settings too use and the first is that's most lenses have a sweet spot usually around f8 so the further you move away from this the less sharp the image can become especially at the edges, which is why f4 – f16 is a good range to work within unless you are looking for a specific effect.

Apertures of f9, f11 or f13 are a good general range of aperture settings for front to back sharpness in landscapes with Full Frame cameras with the focus point on approximately a third into the scene, unless conditions etc cause you to move out of this zone for whatever reason. With APS-C and 4/3rds Sensor cameras the f stop is usually slightly lower to achieve the same result based on the crop factor, which is explained in the next recommended video.

If however you want those distant mountains in the mist to be slightly out of focus on purpose then pull the aperture back to f2.8, f4, f5.6, f6.3 or f7.1, f8 and see what it looks like at each aperture, of course adjusting shutter speed and ISO accordingly for the exposure you want.

Also, the less expensive lenses are less expensive for a reason so can't be pushed as far as the more expensive.

The next point is that generally prime (fixed length lenses) are sharper than zoom lenses and zoom lenses are less sharp at the extreme end of their zoom. Therefore, when using a zoom lens, its sometimes worth pulling back slightly from the maximum zoom length if you can and crop later in post processing.

Then it's worth remembering that diffraction starts to appear above f11 or so in full frame cameras (a bit lower at somewhere around f8 – f9 in APS-C cropped sensors and Micro 4/3rd sensor cameras) but the effects are usually not visible in normal sized images until you get over f16 - f18. It then become a balance between getting the shot and risking the diffraction that may occur.

Diffraction is where the light coming into the front of the lens is directed through the aperture opening and then has to spread out again onto the sensor. This means the smaller the aperture opening the greater the angle of the light reaching the full area of the sensor and clipping adjoining pixels creating a ghosting / softening effect.

Also, there may be light bouncing off the edge of the aperture opening as the smaller the opening the greater the ratio of circumference to opening area.

Then there is the issue of the more tightly packed the pixels are on the sensor the more impact this affect seems to have, which is why smaller sensors can suffer more than a full frame camera, with the same overall number of pixels and the same aperture.

I don't know how the new very high pixel sensors have overcome this effect but they seem to have at least matched the effect on the lower pixel densities of earlier sensors.

This is a very technical subject with many dissenting voices but it's probably worth staying below f16 generally and f18 or possibly f22 when pushed if possible, on all types of camera.

Diffraction, seems from my observations to only be really apparent in very bright sunlight on landscape images but try some high apertures for yourself and see if the diffraction softness is noticeable with your camera and lens set up.

Mads Peter Iveson - You Tube Video on focusing in Landscape photography settings (Again remember he is using a Full Frame camera)

<https://www.youtube.com/watch?v=fAnW4UPubJ8&t=200s>

In this video Mads shows how he focuses for landscape photography and explains some of the points in my notes.

Pangolin Wildlife Photography – You Tube videos on using Manual with Auto ISO, using Back Button Focusing, using Exposure Compensation, explaining Depth of Field and Shutter Speed.

There are also videos explaining how to set up back button focus on both Nikon and Canon cameras.

<https://www.youtube.com/watch?v=6RTnxzSI-9E>

https://www.youtube.com/watch?v=IAI_qwqeYbk

<https://www.youtube.com/watch?v=wSrPkXD00JI>

<https://www.youtube.com/watch?v=-UeoXgSckpQ&list=PL9Vb8bfMUDtAlzZZIIdq80g8xqMNG371X&index=8>

<https://www.youtube.com/watch?v=HHdttS5QeUQ&list=PL9Vb8bfMUDtAlzZZIIdq80g8xqMNG371X&index=25>

https://www.youtube.com/watch?v=9L_qQcsRzfY&list=PL9Vb8bfMUDtAlzZZIIdq80g8xqMNG371X&index=31

<https://www.youtube.com/watch?v=ufu9u60QIS4&list=PL9Vb8bfMUDtAlzZZIIdq80g8xqMNG371X&index=32>

In these videos Sabine, Janine and Danielle explain how and why they use these techniques and settings for wildlife photography but they also apply in general photography.

They explain the reasons in a straightforward manner that's easy to follow.

Tony Northrup – You Tube video on the different types of camera and the F Stop effects on each.

Another good video on the different types of camera and how to get the same results (within certain limitations) for each type is this You Tube video by Tony Northrup

https://www.youtube.com/watch?v=hi_CkZ0sGAw

It shows that it's understanding the crop factor that is the way to adjust your setting to suit the sensor size rather than trying to use the full frame settings and expecting the same results.

It shows you generally don't need a full frame camera for most standard photography situations to achieve a good result.

Quite a lot of maths in the video but basically, it's about adjusting both focal length and aperture by 1.5x (1.6x for Canon) for APS-C and 2.0x for 4/3rds.

So 50mm at f16 on full frame is 33mm at f10 on a Canon APS-C camera to get the same result. The ISO is obviously affected as the larger the aperture opening the more light will get in, so reduce the ISO accordingly until it looks ok. There is a formula but as you wouldn't know the ISO the full frame camera would be using you can't actually do the conversion so just adjust until it looks ok.

It does prove you don't need a full frame camera for most situations but there does become a point where using low f stops or needing long lenses in low light can take you outside the smaller sensor's abilities mainly due to the lenses available, not the sensor size itself.

This would become apparent in photographing wildlife in low light. If you were using a 600 mm lens at f4 to keep the shutter speed up, the ISO down and to put the background out of focus. This would be 300mm at f2 on a 4/3rds camera, to achieve the same result but this lens is not available as the Olympus 300mm is an f4 lens so you have to reduce the shutter speed which may result in a blurry image or increase the ISO to compensate thus increasing noise in the image.

On a Canon APS-C body the crop factor is 1.6x so the 600 mm f4 equivalent would be 375 mm at f2.5 and you can get a Canon 400mm f2.8 lens but the APS-C sensor would only use the centre part of the lens. The sensor pushes you towards the low f stop lenses both in portraits and wildlife, which are the much more expensive lenses if they are even available.

For example, the Nikon D500 is a great wildlife camera, with a very good focusing system and a 20.9 MP APS-C sensor. It's especially good at birds in flight or any subject at distance with nothing close behind them. The 20.9 MP at APS-C is a similar pixel density as a 30+ MP full frame sensor so you will get lots of detail.

One reason why the Nikon D500 is so good at wildlife is that, although as with full frame sensor cameras with the same overall pixel density you need higher shutter speeds as noted above, you therefore have to drop the aperture so the correct amount of light can get to the sensor without increasing ISO. Low f stops on the full frame camera such as f4 will give a very narrow depth of field but on the D500 this is not so apparent as a setting of f4 is equivalent in depth of field terms to f6.3 on a full frame camera and the greater the depth of field the more chance of the subject being within this zone and consequently sharp. This gives the cropped sensor an advantage.

However, the increased depth of field works against the D500 and similar cropped sensor cameras when you need to separate the background from the subject and the background is too close behind it. However, if you want a habitat shot where the background explains the location and the conditions the animal or bird lives in, then this is not as relevant.

To compare this effect with a 500mm lens at f6.3 on a Full Frame camera, is the equivalent of 330mm at f4 on a Nikon D500, which is achievable on more expensive lenses but not the most popular lenses and economic lenses, such as the Nikon 70 – 300 f4.5 – f6.3 because as you can see at the long end it's at f6.3 when you need f4. A Nikon 200 - 400 mm f4 would be good but these are seriously expensive. You could get reasonably close to the required settings with the Nikon 80-400 mm f4.5 – f5.6 (so only one stop away) which is still quite expensive but a bit more affordable than the 200-400mm f4.

This is why you can achieve equally good photos with a cropped sensor or Micro 4/3rds cameras but you need to be aware of the differences in operation and you may need more expensive fast (f2.8 or f4) lenses.

The basic rule with both APS-C sensors and Micro 4/3rds sensors is if you want blurred backgrounds you really do need even more distance between the subject and background than full frame cameras and full frame cameras need a good distance themselves.

Macro is another area where using the APS-C and 4/3rds sensors come into their own as the greater depth of field at a given aperture can actually help.

This is where the “effective aperture” comes into play. When you focus on something very close to the front of the lens the Depth of Field seems to get narrower so it’s harder to get all of an object in focus so you need high f stops such as f22.

This is the advantage of APS-C and 4/3rd cameras as their apparent depth of field is greater for any given f stop. This means where a full frame camera may need f22 a 4/3rds camera could get away with f11 but would probably push it slightly further going into areas where the full frame can’t go as f16 on the 4/3rds camera would be f32 on a full frame camera and most full frame lenses just don’t go this far.

The Sony 90mm macro G lens is a very good lens and it’s great at the low end as it goes to f2.8 to give out of focus backgrounds but it only goes to f22 at the high end and it’s this limit on a full frame camera that means the probable need for multiple macro images and focus stacking in post.

Extension tubes are an economic way to improve the image size of standard lenses. These are hollow tubes that fit between camera and lens. They usually disable autofocus and also mean you cannot focus to infinity but for macro this doesn’t matter so they can be worth a try.

People say that equipment doesn’t matter but in some cases without the right equipment it’s simply not possible to get the shot you require and this especially applies to wildlife, sport, portraits and macro.

Conclusions

The conclusion is that we often see the same aperture settings being used on all three types of camera in portraits, wildlife and sports, which is why the background is not being thrown out of focus as much on images taken with APS-C and 4/3rds cameras.

These lens limitations are not just with the smaller sensor cameras as with say a Sony Full Frame camera using the Sony 100 - 400mm f4.5 – f5.6 lens and if you add the 1.4x teleconverter to get 560mm zoom length, then as 1.4x teleconverters add one stop to the lens, its lowest aperture is increased to f8, which is not good in low light and doesn’t throw the background out of focus unless it’s a long way off. The reason this is still a good lens, is it’s so light it can be carried all day but you have to be aware of its limitations and take these into account as best you can.

Sometimes you will take or just have with you the camera and lens to suit the situation whether it’s a holiday, a long trek, etc and not necessarily the specific photography moment and understanding the strengths and limitations of the camera and lens combination you have with you is so important to get the best photos possible.

Experiment with your camera and lenses and check the results and work out the best settings for your own combinations. I hope these notes help you take some great photos.

The tables below show the setting differences between different sensor types.



FOCAL LENGTH COMPARISON

This is the normal way this is expressed; As equivalent field of view at a given Full Frame length

Focal Length Equivalent Comparison			
Full Frame Length in mm	Crop Factor / Length in mm		
	1.5x	1.6x	2x
12	18	19	24
16	24	26	32
24	36	38	48
32	48	51	64
50	75	80	100
70	105	112	140
90	135	144	180
125	188	200	250
150	225	240	300
200	300	320	400
300	450	480	600
400	600	640	800
500	750	800	1000

This is due to the sensor size so you are only seeing a reducing part of the full frame sensor size, similar to cropping a full frame sensor image in post processing

Looking at this the other way round to have the same size image in the view finder it would be

Focal Length Equivalent Comparison			
Full Frame Length in mm	Crop Factor / Length in mm		
	1.5x	1.6x	2x
12	8	8	6
16	11	10	8
24	16	15	12
32	21	20	16
50	33	31	25
70	47	44	35
90	60	56	45
125	83	78	63
150	100	94	75
200	133	125	100
300	200	188	150
400	267	250	200
500	333	313	250

If a full frame camera sees a scene at 24mm a Micro 4/3rds camera would need to be at 12mm for the same view of the scene



APERTURE COMPARISON

To have the similar background blur of items at a similar distance behind the subject as with full frame cameras the suggested f-stops are as follows: -

Aperture / Depth of Field Equivalent Comparison using best fit 1/3rd stops			
Full Frame	Crop Factor f-stops		
f-Stop	1.5x	1.6x	2x
2.8	1.8	1.8	1.4
3.2	2.2	2.0	1.6
3.5	2.5	2.2	1.8
4.0	2.8	2.5	2.0
4.5	3.2	2.8	2.2
5.0	3.5	3.2	2.5
5.6	3.5	3.5	2.8
6.3	4.0	4.0	3.2
7.1	4.5	4.5	3.5
8.0	5.0	5.0	4.0
9.0	6.3	5.6	4.5
10.0	7.1	6.3	5.0
11.0	7.1	7.1	5.6
13.0	9.0	8.0	6.3
14.0	9.0	9.0	7.1
16.0	11.0	10.0	8.0
18.0	13.0	11.0	9.0
20.0	13.0	13.0	10.0
22.0	16.0	14.0	11.0
25.0	18.0	16.0	13.0
32.0	22.0	20.0	16.0

Crop factor does not affect exposure so f2.8 is f2.8 as far as exposure is concerned on all cameras / lenses

Crop factor does affect the depth of field so the Bokeh behind the subject will not be as out of focus at the same rear distance to the background depending on the crop factor, therefore if the full frame camera is at f5.6 the micro 4/3rds camera needs to be at f2.8 but as a lot more light will be passing through the larger aperture the shutter speed will have to be increased (i.e. less time for the light to pass) to compensate.