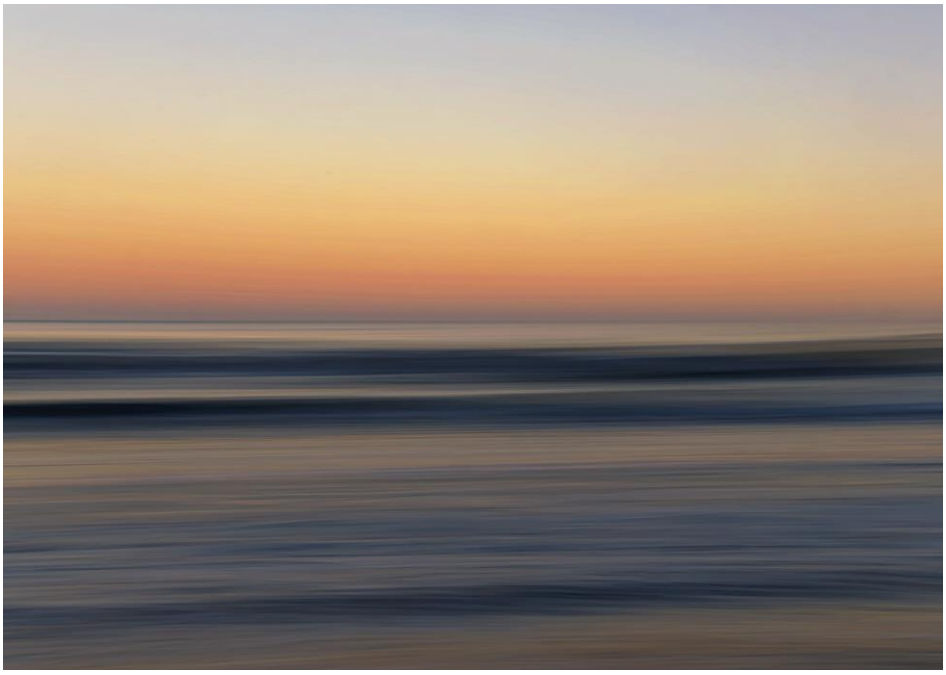

Title: ‘Sunset strip’

Description: An impressionistic version of a Rarangi sunset

Photographer’s name: Noelle Bennett

Where and when: Rarangi Beach, Marlborough. May 2021.

Sustainability: I don’t know about you, but I’m a sucker for a good sunset. But have you ever stopped to wonder why sunsets are so many different colours? Or perhaps you’ve heard people claim that pollution makes sunsets more colourful. I know I’ve heard that one - but is it true? I thought I’d see if I could make some sense of the science.

The colours we see in the sky are caused by sunlight interacting with molecules of primarily nitrogen and oxygen in the air. They cause the sunlight to be deflected in all directions. And although all wavelengths of light are scattered, they are not scattered equally. Colours with shorter wavelengths are scattered the most. So that would be violet, followed by blue, then green, and so on, up to red.

During the day, when the sun is directly overhead, light only has to travel a relatively short distance through a thinner section of the atmosphere. But when the sun is closer to the horizon (at sunrise and sunset), the light must travel through increasing amounts of atmosphere. This means it is scattered by more air molecules. By the time we observers see it, most of the blue has been scattered out of the beam and what remains are the warmer hues of yellow, orange and red, which blend into a yellowish-orange sunset.

What about those amazing red sunsets we sometimes see? Those really rich red skies are caused by ‘aerosols’. Aerosols are either solid or liquid particles which are suspended in the air. Natural aerosols come from things like forest fires, mineral dust generated by the likes of sandstorms, sea spray and volcanic eruptions. In fact, volcanic eruptions have been responsible for producing some of the most spectacular sunsets in history thanks to their ability to inject sulphuric acid droplets into the stratosphere (the layer of atmosphere between 10 and 35 miles in altitude). These droplets can be swept around the globe, painting brilliant crimson skies wherever they go.

In urban environments, aerosols produced by human activity far exceed those from natural sources. Human-

generated aerosols enter the atmosphere directly as, for example, the soot emitted by car and truck engines. Aerosols can also be produced when gas molecules enter the atmosphere and react with other chemicals. For example, when we burn fossil fuels, they release sulphur dioxide that turns into sulphuric acid aerosols.

Sunsets can appear bright but washed out when large numbers of big particles accumulate in the layer of the atmosphere closest to the ground. Aerosols that are about the same size or larger than the wavelengths of visible light tend to scatter all colours indiscriminately. This increases the overall brightness of the sky whilst at the same time dampening colour contrast. Particles of any kind, even those much smaller than the wavelength of visible light, will generally make the sky brighter but always at the expense of its purity of colour. That effect is even more pronounced when there is a high concentration of large aerosols. So, although aerosols may make a sunset red, excess pollution will also dampen the overall sunset experience. Just think how much more beautiful those sunsets might be without excess pollution.

.. and hopefully you'll appreciated this spot of physics to better understand that gorgeous sunset and beautiful photographs as the light rises and falls in your own anchor spot.

Photographer's notes: Rarangi Beach is quite close to where our boat is moored. It is quite possibly my favourite beach around here in Marlborough. I took this photograph one evening at the end of May, so heading towards winter and all the portents looked promising for a good sunset. But I wanted something a bit different from a standard sunset photograph - I wanted it to be an expression of colour. So I put my camera on a tripod, set my exposure to 0.6 sec and simply panned the camera as I pressed the shutter (this is known as intentional camera movement or ICM). It was the best way I could think of to do the sunset justice. And I got what I'd hoped for - an image that was all about colour … and physics?

Photo specs: I used ICM as the technique to produce this image in order to achieve not only the impressionistic feeling, but also a celebration of colour. Technical specs: The image was taken using a Panasonic DC-G9 camera and a Panasonic Lumix G-Vario 12-35mm f/2.8 lens. Exposure details - 0.63sec at f/14 with an ISO of 100 and a focal length of 26mm (52mm full frame equivalent).

Digital specs: 7841 x 5292 pixels (39.52MP) @ 300dpi

Key words: Rarangi, Rarangi Beach, Blenheim, Marlborough, sunset, sea, ocean, colour, orange, waves, wavelength, atmosphere, pollution, aerosols, ICM, Noelle Bennett, Ecosystems Photography, sustainability.

Price: $300 (incl. GST) for use of the digital image. Visit www.ecosystemsphotography/sales for details & to order, or to get a quote if you would like a high-quality print.

Donation: the price includes a $100 donation to a sustainability organisation or project of your choice, or otherwise to *the Environmental Defense Society https://www.eds.org.nz/.*

We recommend that the donation goes to the *Environmental Defence Society* to support its big picture work on government policy and legislation, urban and built environments, industrial uses of resources and land. It is this broadscale level of work that is needed to reduce human-made aerosol contaminants that are the subject of this sustainability commentary and photograph. EDS is a not-for-profit environmental organisation comprised of resource management professionals.

Image ref: NB#037 (please use this reference in all orders and correspondence).

Noelle Bennett
06 Jan 2022