Title: 'Middlemarch rocks'

Description: Storm clouds gathering over the Taieri Ridge area of Strath Taieri

Photographer's name: Noelle Bennett

Where and when: Taieri Ridge, Strath Taieri, Middlemarch. August 2017.

Sustainability: Strath Taieri is a classic basin-and-range landscape, formed from old rocks and young mountains. The schist bedrock is up to 200 million years old but the mountain ranges which flank the valley – the Rock and Pillar Range to the west and the Taieri Ridge to the east – are still geologically young at 'only' three million years old. They have been thrust up by tectonic forces along parallel faults. Erosion of the ancient surfaces has left the harder, quartz-rich outcrops of schist exposed as 'tors'. These irregularly shaped and imposing rock structures rise straight out of the tussock.

The whole area is spectacularly beautiful, but also a biodiversity hotspot with a fascinating geological history. Although the Strath Taieri may appear to be a U-shaped glaciated valley, it has actually never hosted a glacier. Instead, about 20 million years ago, volcanic activity peppered the landscape with cones and craters, one of which, The Redan, has been hoisted up onto the Taieri Ridge over the past three million years. At Foulden Hill, there is a nationally significant deposit of diatomite. Diatomite is a near pure sedimentary deposit consisting almost entirely of silica and is the naturally occurring fossilized remains of single-celled aquatic algae known as diatoms. This particular diatomite was formed in a crater lake from the silicon skeletal remains of microscopic water-borne diatoms. Leaves of many species of now-extinct trees are also preserved as fossils in the diatomite. Diatomite for a variety of uses (a filtration, abrasive used in metal polishes and toothpaste, insecticide, absorbent for mopping up spills, filler in plastics and rubber, cat litter, stabilizer for dynamite, insulation and soil for potted plants like bonsai.

A recent proposal to mine Foulden Maar has sparked controversy because of it's potential to destroy the fossil record

there. "Scientific Reserves" or "Sites of Special Scientific Interest" are common in New Zealand and throughout the world. For some this care of the past biodiversity record is a waste and lament of something no longer relevant. For others it is an important part of our environmental history and identity and whakapapa of the land, and potentially a source of surprising knowledge that might eventually be useful (we don't know what we don't yet know). Mobilising support for conservation of microscopic critters, let alone extinct ones, is a tough ask especially when it requires foregoing an immediate and short-term financial reward from mining the area.

Much more charismatic is the mountain stone wētā (*Hemideina maori*). Wētā is the common name for a group of about 70 insect species which are native to New Zealand. The mountain stone wētā, which lives on the summit areas of the Rock and Pillar Range, is the smallest of them measuring up to 65 mm long. They are found primarily in cavities under flat rocks on isolated tors like those in the photo, hiding during the day and coming out to feed at night. They are actually a type of tree wētā which have simply adapted to living on rocks instead of trees because the terrain they inhabit has no trees. They are omnivores, feeding on insects as well as plant material. They have an interesting sex life – dominate males can guard a harem of females if the rock crevices have room for them all.

Potential mammalian predators aren't common where they live whilst native nocturnal predators of the mountain stone wētā are most likely to be reptiles such as geckos and skinks or birds such as ruru (morepork). When they are threatened by predators, mountain stone wētā lie on their backs with their legs in the air, jaws wide open pretending to be dead. But if that doesn't work, they scratch, bite and vomit on their enemies! Reckon that should work.

Stone wētā sheltering in those rock tors can survive temperatures as low as minus 10°C for long periods of time, even managing to survive when 82 per cent of their body fluids are frozen. It's one of the largest species known to be able to virtually freeze and come back to a healthy life again. 'Cryobiologists' have been trying to discover how an animal of this size can survive the freezing because it could be valuable for medical treatments and operations like organ storage – but it sounds like the makings of a "Return of the Wētā' sci-fi drama doesn't it? Special proteins in their haemolymph (insect blood), acts as a sort of natural antifreeze, preventing ice from forming in wētā vital organs!

Numerous gecko and skink species live in the schist landscape shown in this photograph, including the common skink, green skink and two species of endangered giant skinks. Otago skinks (*Oligosoma otagense*) and Grand Skinks (*Oligosoma grande*) can grow up to 300mm in length and are unique to Otago. They are one of New Zealand's rarest reptiles, only being found in certain locations amongst schist rock tors which they use for "sunning" themselves so that they warm up ready for activity.

There are certain biological features that seem to make giant skinks more vulnerable to extinction than other lizards. These include their large size, their highly specific habitat requirements, the fact that they have small, isolated populations, that they reach sexual maturity late and they have low productivity when they do finally reach sexual maturity. But by far their greatest threat is predation particularly by introduced animal species such as feral cats, stoats, weasels, ferrets - even hedgehogs have been implicated. It doesn't help that the Otago skinks are also quite naive - that is that they simply don't seem to be aware of the threat cats, stoats and other mustelids pose. Because of this, they can easily fall prey to these predators. Large predator-proof enclosures have been built around groups of tors like those in the photograph to protect their rock shelters and prevent them being killed while travelling between the tors.

Photographer's notes: This was something of an opportune image. It was late winter (August) but the weather was good which encouraged us to go for a drive from Dunedin up to Middlemarch. As we got closer to the Taieri Ridge these amazing cloud formations started to gather over the tors and seemed to be crying out to be photographed.

Can I urge photographers to be very careful if they go in search of those amazing stone wētā in the tors. In the past people have rolled many of the shist slabs that make up the tors to find the wētā and other invertebrates sheltering there – the trouble is that when the slabs are rolled back in place, there is a real risk that the fat wētā get squashed if the "roof" rock is not replaced in exactly the same place. It's best not to roll the rocks at all.

Photo specs: This image is a composite of three images which have each been taken using different exposure levels

in order to maximise the dynamic range of the finished photograph. Technical specs: The main image was taken using a Panasonic DMC-GH4 camera and a Panasonic Lumix G-Vario 12-35mm f/2.8 lens. Exposure details - 1/320sec at f/8 with an ISO of 200 and a focal length of 14mm (28mm full frame equivalent).

Digital specs: 7272 x 5787 pixels (43.24MP) @ 300dpi

Key words: Middlemarch, stormy, clouds, strath Taieri, tors, schist, mountain stone wētā, cryobiology, Otago Skink, Grand skink, tussock, volcanic, predator-proof fences, Noelle Bennett, Ecosystems Photography, sustainability.

Price: $250 (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 Halo Project*, Dunedin. https://www.haloproject.org.nz/

We recommend that the donation goes to *The Halo Project*, Dunedin because they are following a "Sources to Sea" (*Ki uta, ki Tai*) approach to restore whole landscapes with planting and predator control in the Otago region. The weta and giant skinks are persisting in farmed land, so there is a need to integrate productive farming and conservation outcomes. Rocks like those photographed are very important biodiversity refuges in these landscapes where plants and animals can escape agricultural disturbance.

Image ref: NB#036 (please use this reference in all orders and correspondence).

Noelle Bennett
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