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Special edition: The UN Decade on Ecosystem Restoration

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Coral restoration in a warming world
Mangroves: the roots of the sea
A sea turtle haven in central Oceania



Climate emergency: are we heading for a disastrous future?
Tropical laboratories in the Atlantic Ocean | Environmental change and evolution of organisms



MBA Fellow Michael White, Ru Taime, and Marangi Taime describe how a community on a remote Pacific atoll is planting trees to save turtles.

Tongareva is the largest and remotest atoll in *Kuki Airani* (the Cook Islands). It is a haven for biodiversity, especially seabirds (*manu* in the local language, Fig. 3d) and sea turtles (*honu*). The human population is around 180 people leading a mainly subsistence way of life, gathering resources directly from nature.

The atoll is 77 km in circumference, and the lagoon has an area of 233 km² (see Fig. 1). The *motu* (islets) are traditionally owned by extended families but are uninhabited and used for resource gathering. Forests are mostly coconut trees and a few hardwoods, such as Pacific mahogany, Pacific rosewood, and tepuka. Hardwoods tend to grow more slowly, but can reach substantial

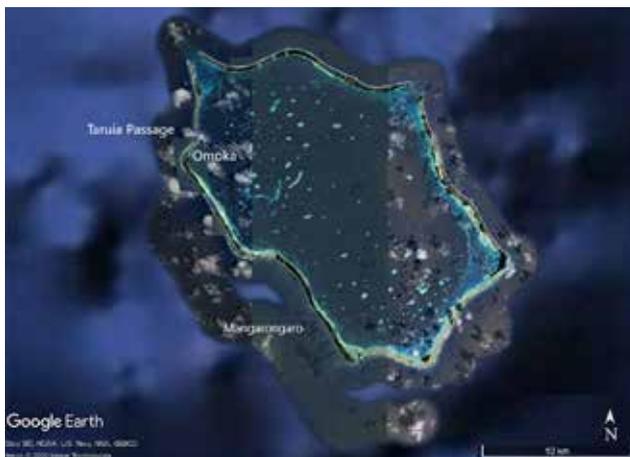


Figure 1. Tongareva Atoll (09° South; 158° West) in the central South Pacific Ocean. Image Google Earth. Data SIO, NOAA, U.S. Navy, NGA, GEBCO Image © 2020 Maxar Technologies

Figure 2. A rescued green turtle hatchling. Image © Michael White.

heights and provide important habitat for birds.

This important maritime ecosystem was near-pristine, but is now badly impacted by climate change. Impacts include: considerable tree loss, death of giant clams (*Tridacna maxima*) and coral bleaching, and pollination failure. In addition to this, oceanic plastics and industrial fishing-gear litter all shorelines and pollute our food supply.

Hakono Hararanga Incorporated is Tongareva's Community Environmental Society. It monitors our biodiversity year-round, and records all marine sightings and animal behaviour (see Fig. 3c). The Society also conducts community education—running field days for the school and beach cleans—and undertakes extensive tree planting. We also promote low-carbon living, including solar-charged electric vehicles and outboard motors. Our intention is to create an abundant, sustainable and biodiverse future for our atoll.

Endangered green sea turtles *Chelonia mydas* (Fig. 2) are present in Tongareva throughout the year, while critically-endangered hawksbills *Eretmochelys imbricata* have only been observed five times since 2012.

In most places around the world, including Palmerston Atoll, green sea turtle nesting is distinctly seasonal, but at Mangarongaro motu we have observed successful nesting *every month* since August 2014. This is the most important green sea turtle rookery in the central South Pacific. All sea turtle nesting occurs on the ocean side of the atoll, and juvenile development occurs year-round in the lagoon and on outer reefs. Mating is often observed in Taruia Passage and at Omoka wharf.

Reef-top gaps or *ava* provide opportunities for turtles to emerge from the sea. Large waves can carry turtles to

Year	2014	2015	2016	2017	2018	2019
Nests	534	555	565	1,374	1,767	1,030+†

† The 2019 tally was until mid-September, when our research was disrupted due to logistical challenges.

Table 1: Annual green sea turtle *Chelonia mydas* nest totals at Mangarongaro, 2014–2019.

the back of the beach, where good quality nesting sand is found a short crawl away. The habitat is highly dynamic and often steeply sloping; at times all the sand is stripped away and the honu then go into the forest and dig nests there. Egg predation is absent, so clutches tend to be successful. We stay off the beach at night allowing the honu to nest undisturbed: nesting has steadily increased (see Table 1).

Sexual differentiation of sea turtle embryos is determined by nest incubation temperature: females hatch from warmer nests, males from cooler ones. Global warming will favour the production of females. Mangarongaro’s beach faces west and receives full sun from noon until sunset, but climate change impacts had killed many trees just inland, meaning the rookery received full sun all day. In response, Hakono Hararanga has planted over 6,000 trees in the last 18 months (Fig 3a & b), the aim being to create canopy cover, which can shade the beach, provide local cooling and retain soil moisture in the forest.

Sea turtles are well adapted to life on our planet, having changed little in millions of years. Human activities are now their greatest threat, impacting directly—for example by building on nesting beaches, or taking sea turtles and eggs; or indirectly—for example through fishery

bycatch, oceanic pollution, and now climate change. Our solutions must be holistic, addressing every aspect, if we wish to have a sustainable and biodiverse future.

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Disclosure

Michael is President of Hakono Hararanga, Ru the Chairman, and Marangi the Waste Manager.

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Further reading

White, M. (2014) Tongareva Atoll: The most important sea turtle habitat in the Cook Islands. *Testudo* 8: 19-37. <http://library.seaturtle.org/8489>

White, M. (2016) Too hot in Paradise! *The Marine Biologist*, April 2016: 26-27. The Marine Biological Association <https://www.mba.ac.uk/marinebiologist/http://library.seaturtle.org/9685>

White, M. (2019) *Initial Assessment of a New Coral Bleaching Event at Tongareva Atoll in the Northern Cook Islands*. <http://library.seaturtle.org/11235>



Figure 3. a: Saplings are brought in to Mangarongaro’s beach to replace trees lost due to global warming impacts. b: Saplings after one year. c: Tallying the eggshells. d: Masked booby (*Sula dactylatra*) on eggs. Images © Michael White.