



Trouble in paradise

All is not as idyllic as it might appear on the remote Chagos Islands, where non-native plant species are threatening the native flora. But restoration work is under way, as Kew's Colin Clubbe reports

Of the 280 flowering plant and fern species on the Chagos Islands, only 45 are native



The British Indian Ocean Territory (BIOT) is one of the UK's most remote Overseas Territories, in virtually the middle of the Indian Ocean. Fifty-five tropical islands make up the Chagos Archipelago, set in 544,000 km² of pristine ocean. The whole Territory was declared a Marine Protected Area by the British Government in 2010, after extensive public consultation. Covering an area greater than France, this makes Chagos the world's biggest marine reserve, yet Diego Garcia – the largest and only inhabited island – has a land area of only 27 km².

The biodiversity of the Chagos Archipelago is very rich, particularly in the marine environment, which contains some of the healthiest coral reefs and the largest coral atoll (the Great Chagos Bank) in the world, as well as an exceptional diversity of deep-water habitats. On land, BIOT is recognised as globally important, due to the vast numbers of congregating and nesting seabirds. More than 33 seabird species have been recorded, with 17 species regularly breeding on the islands.

It's an incredible experience to arrive in a small dingy on one of the islands with large seabird colonies. The sky darkens overhead with thousands of terns, boobies and frigate birds, the noise increases to a deafening roar, and the smell of guano becomes an intense assault on the nostrils.

Large populations of coconut crabs thrive on most islands too. These are the world's largest land arthropod – adults can weigh up to 4 kg and can have a leg span of more than 1 m. And they can crack open coconuts with their massive claws. They are also adept tree climbers for such large crabs, so you need to be very careful where you put your hands and feet when walking through these forests. Meanwhile, the



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many remote sandy beaches provide perfect nesting sites for hawksbill and green turtles.

There have been plants on the Chagos Islands for probably less than 4,000 years. Seeds and spores arrived on the emerging islands by wind, sea or attached to passing birds. As a result of this relatively short period of colonisation, the original native flora is thought to be just 41 species of flowering plants and four species of ferns, plus a wide range of mosses, liverworts and fungi.

The status of the native flora is a result of past exploitation of particular islands. More than 240 non-native species of flowering plants and ferns have been recorded – either accidental or deliberate introductions arising from human activities. Some of these

non-native plants have become invasive and pose a real threat to the native plants.

During the plantation era, native forests on many islands were felled and replaced with coconut palms (*Cocos nucifera*). Coconut oil was extracted from grated copra (dried coconut flesh) and this was an important source of oil for lamps, cooking and soap. In the mid-1800s, so much coconut oil was being produced for export that Chagos became known as the Oil Islands.

Access to BIOT is severely restricted because of the presence of the UK and US military air base on Diego Garcia. So when I was asked to join the 2010 Chagos Scientific Expedition, I jumped at the chance and spent a most remarkable three weeks as a

Original *Pisonia grandis* forest contains more biodiversity than coconut forests (right)



Above: coconut palms spread rapidly to form dense forests where little else can grow

Top: the buoyant fruits of native *Barringtonia asiatica* can drift far and wide on the tides

Above: based on board ship, scientists visited 39 of the islands to assess their biodiversity

Top: vivid flowers adorn the native tree *Cordia subcordata* on the lagoon shorelines

member of a small team living on the BIOT patrol vessel *Pacific Marlin*, investigating 39 islands. This involved collecting herbarium specimens and plant data, walking many miles and becoming familiar with an extraordinary part of the world and its unique biodiversity.

Access to most of the islands was fairly straightforward – there were gaps in the fringing reefs large enough to manoeuvre a small dingy through to make a beach landing. However, a few islands were more problematic. When there was no access, we had to swim ashore – now I know why some have names like Danger Island!

My main goal was to assess the status of the flora and use the data to help prioritise

islands for restoration, which would involve the removal of non-native species and the re-establishment of native communities of plants. Islands that had been historically converted to coconut plantations have, in the absence of any management, turned into ‘coconut chaos’. Mature coconut palms can produce around 70–80 ripe nuts every year. These drop from the trees, germinate and produce a dense and impenetrable understorey of saplings around 2–3 m tall. This leaves little space for any other plants to germinate and survive.

However, some remnant stands of native trees do remain. These may have been left originally for shade, or were perhaps not completely cleared because the conditions

weren’t suitable for coconuts. Other native species survive along the coast, where they provide important roosting sites for many seabirds. Typical native tree species include *Calophyllum inophyllum*, *Pisonia grandis*, *Barringtonia asiatica*, *Hernandia sonora*, *Guettarda speciosa*, *Cordia subcordata* and *Intsia bijuga*. Coconuts were never planted on a few of the more remote, hard-to-access islands, and these now provide us with an insight into the original forest composition and a guideline for restoration.

My exciting botanical find of the expedition was an extensive mangrove ecosystem on Moresby Island. The only known mangrove system in Chagos was a small area on Eagle Island that was reported to be

PHOTOGRAPHS: COLIN CLIBBE



The coconut crab's large claws are strong enough to crack open coconut shells



Red-footed boobies favour native trees for nesting, where they raise their fluffy chicks



The beautiful fairy tern is an inquisitive companion during forest exploration



Above: Colin Clubbe isn't afraid to get his feet wet when gathering data on mangroves



Left: on islands that are free of rats, ground-nesting birds such as sooty terns thrive



Finding a previously unknown, pristine mangrove forest is a significant achievement

Landing on a rat-free island is a joyful experience – there are so many birds that the sights, smells and sounds can overload your senses

in decline. Our visit to Eagle Island confirmed this, and serious restoration activity is urgently needed to prevent the loss of this valuable habitat. It is drying out and being swamped by a combination of overtopping vines and encroaching coconuts. In contrast, the Moresby mangrove ecosystem is pristine and covers several square kilometres. We identified two species of mangroves growing there – *Pemphis acidula* and *Lumnitzera racemosa*. The open water also supports many dragonflies and several new records were identified.

Rats are the other big challenge if restoration work is to be successful. Many islands are over-run with them, and their impact on the native flora and fauna, especially birds, can be severe. Landing on a rat-free island is

a joyful experience for any biologist – there are so many birds that the sights, smells and sounds can overload your senses. The silence and relative lack of life on a rat-infested island provides a depressing contrast.

Some restoration work has already started. On Diego Garcia, the Barton Point Atoll Restoration Project is an ambitious pilot scheme to remove coconut palms and replant native hardwood trees. This area is designated a Strict Nature Reserve and is an Important Bird Area, where more than 16,000 breeding pairs of red-footed booby have been recorded.

People from the military and civilian community on Diego Garcia volunteer on local Brit-Op days to remove coconut saplings, nuts and leaves and clear sites where

large coconut palms have already been cut down by chainsaw operators. All the surviving native trees are left and supplemented by others specifically grown for this restoration work. It is also a great social day out for everyone.

This initial work has shown significant success already and the techniques learned will be rolled out to other islands in the future. There is much to do, but the focus is now firmly on restoring and protecting this entire area for the future. 🌿

Colin Clubbe leads Kew's UKOTs Programme, www.kew.org/science/ukots

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