

The rainforest: climate change icons under threat



Hanging out: Steve Turton, left, and Dick Cooper hitch a lift on the Australian Canopy Crane, a 45-metre structure in the rainforest at Cape Tribulation.

Photo: *The Age*

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Rising temperatures could spell doom for many of the delicate creatures in Queensland's wet tropical rainforest. By Melissa Fyfe.

Steve Williams has found a frog. Cradled gently in the scientist's palm, it is just a plain, brown thing with strange bulbous eyes.

But this nursery frog is quite rare in the amphibian world. Forget tadpoles. This species lays eggs and sits on them until little frog hatchlings emerge. The male nursery frog attracts a female by building a home. If his domestic skills aren't up to scratch, he doesn't get the girl.

Sadly, this little animal is almost certainly doomed. This species of nursery frog lives only on Queensland's highest peaks of Bellenden Ker and Bartle Frere. Like many other species on tropical rainforest mountain tops, it is susceptible to the smallest rises in global temperatures.

"This species is one of the most threatened by climate change," says Williams, as water constantly drips down from the rainforest canopy. "By the modelling, they could go extinct with less than two degrees warming."

Given that many scientists believe that we may have probably already "locked in" a two-degree warming, the Bellenden Ker nursery frog looks set to be Australia's answer to Costa Rica's golden toad, the first official global warming extinction.

"Even with the minimum climate change, these animals will be hotter than they've ever been in millions of years. They are going to be pushed to their limits," says Williams.

Queensland's world-heritage tropical rainforests centre on the Atherton tablelands, west of Cairns. They include the low-lying Daintree, but it is the mountain rainforest that scientists have

the spotlight on. These areas are home to most of the tropical rainforest biodiversity, much more than the Daintree.

Many creatures in these high rainforests are already refugees, animals that survived a cooler and more moist Australia 20 million years ago. This evolutionary heritage - "arguably the most important habitat in all of Australia", says leading scientist Tim Flannery - is the reason these areas were made the nation's first world heritage area in 1988. And it is these animals that are now most at risk of climate change.

With a two-degree warming, the wet tropics ecosystem starts to unravel, with animals moving upwards to escape the heat. With a 3.5-degree warming, half the 65 species unique to the area will vanish, with the rest restricted to tenuous habitats, extinction only a matter of time. Williams was surprised by the dramatic extinction predictions. "Even if I am 10 per cent right, it's scary."

THE SCIENCE DEATH BY DEGREES

Williams, from James Cook University, has been walking around Queensland's rugged and soggy rainforest mountains for 15 years, so he has had plenty of time to refine his techniques. He now puts his little stainless steel data loggers - which look like oversized watch batteries - in enclosed tea strainers, safe from the industrial-strength native rats.

Unlike weather stations, the data loggers measure temperature where the animals hang out: on sun spots where lizards doze, in logs where nursery frogs live, in the ground, up the trees. Williams has even crawled seven metres down in a boulder pile to measure the temperature of a frog home.

When he first began his work, as a PhD student, climate change was not on Williams' mind. Then a few years ago, he took his information and combined it with the international scientific consensus on future warming (1.4 to 5.8 degrees by the end of the century).

Science journal Nature published his work with the findings of other scientists around the world who had done similar modelling. The report predicted that climate change would bring to extinction 20 to 50 per cent of the world's plants and animals. It was front page news: 50 million Americans alone heard that news on the morning of the study's release, according to a media analysis.

At the heart of this science is the idea that - like humans, who are constantly heating and cooling themselves - climate is important to animals, and many have evolved to suit certain environments.

When things get hot, even by a few degrees, the climate-sensitive animals have two choices: they go towards the poles, a trend already noted by scientists, or they go up. In the wet tropics, scientists have worked out that one extra degree pushes an animal's habitat 200 metres up the mountain. If you already live at the top of a mountain, there is no where to go.

What is likely to kill these animals is that extra one or two degrees on an aboveaverage day. But rainforests are also likely to see stronger cyclones and periods of extreme temperature. There will possibly be more rainfall in the wet season and a longer and harsher dry season,

although the climate computer models are not clear on this. Scientists know that this last change alone will particularly affect birds and frogs, which can have trouble breeding when the dry season is drier than average.

THE CLIMATE

WHAT HAS CHANGED

The animals in today's mountainous rainforest have been around for 5 million to 10 million years and have seen a lot of climate change. Their ancestors saw the biggest shift, 40 million years ago when continental drift took Australia northward into a warmer zone. The land dried out and the cool rainforests were reduced to the east coast. Ice ages later contracted the rainforest to Queensland.

Critics of Williams' theories point out that these animals survived a few warm periods 3000 to 6000 years ago.

At times, agrees Williams, it was probably up to 1.5 degrees hotter than today. This indicates that species have a good chance of surviving a 1.5-degree global warming. But Williams points out that back then the animals did not have any other stresses, such as land clearing, logging - now stopped - and diseases. "Almost every species is in worse shape now, even before we start thinking about climate change," he says.

Williams' colleague, environmental geographer Steve Turton, argues that the past warm period was much wetter than today and this may have cooled off some species. It is also possible many did go extinct and the ones that survived sought refuge in lowland gorges, boulder piles or on the cooler side of the mountain, something modern species may also attempt.

But ultimately, Turton says, the two periods are not comparable because of the rate of change expected now. The previous period lasted for 2000 to 3000 years, says the James Cook University researcher. "It didn't suddenly warm up in 50 to 100 years, like we are saying here."

Williams says that although it is too early to detect a clear trend, some plants and animals already appear to be reacting to the warmer conditions.

ENVIRONMENT

WHAT LIES AHEAD

Heat is the common enemy of these rare mountain rainforest species, but each will have its own particular weakness. The green ringtail possum, for instance, dies if it spends more than four or five hours in temperatures of 30 degrees and above.

The possums have such a specific leaf diet that the young stay to learn the ropes with the parents until they are almost adultsized.

Like koalas, the possums are at constant risk of being poisoned from the leaves, which have built up toxins as a defence against tree-munching animals.

Work by James Cook University ecophysiologicalist Dr Andrew Krockenberger has revealed that when it heats up, the possums get stuck in a terrible Catch-22. As they dehydrate, their only source of water in the dry season are the leaves, but if they eat more leaves they risk being poisoned.

Some lizards Steve Williams has studied scurry about in an incredible temperature range - from

nine to 42 degrees (on a sunny rock). But it is their eggs that are sensitive to heat. Other animals may turn out to rely on the life-giving mists of the clouds that constantly sweep through the rainforest. If those clouds lifted, as they are predicted to do, some animals would find their water resource gone. Forced into smaller and smaller genetic pools, they may also start to inbreed, weakening the fitness of the species.

Some scientists who specialise in evolutionary biology have criticised Williams for not considering the possibility that the animals may evolve to higher temperatures. This year, such scientists found the first species to have evolved to the global warming of the past century: the fruit fly.

This fly is used widely in evolutionary experiments because it turns over a generation in 11 days. But Williams points out that a recently tested rainforest fruit fly had no genes to adapt. And anyway, the timescale of change facing the rainforest animals was just too short. "When you think about a species like the golden bower bird - which doesn't even breed until they are about seven or eight years old, and then only a few offspring - it would have no hope of adapting in 100 years. They would have trouble adapting in 1000 or 10,000 years," says Williams.

Since his initial predictions, Williams and his students have improved the models and taken in more factors, such as where the bulk of an animal's population is located. "Everything we've done so far confirms those initial models - in fact it makes them look a bit optimistic."

Williams says the rainforest will still persist, it will just change to be more like the lowland area, with the same, less rare, species that inhabit that rainforest.

Some have hope, however. "We are expecting climate change to be still very serious for this area," says Steve Turton, "but maybe not as catastrophic as the first set of modelling suggests."

THE PEOPLE

WHAT LIES AHEAD

These mountains, which sit behind the canefield coast of northern Queensland, are not just rainforests - they are cloud forests, almost constantly shrouded in mist. As the cloud meets the leaves, the mist turns to water and drips down. CSIRO's David McJannet has found this cloud-stripping effect provides a remarkable 40 per cent of the rainforest's water.

On Mount Bellenden Ker, the official records show rainfall averages 9.6 metres a year, but in fact with "cloud stripping" it is more like 10 to 15 metres. It is the wettest place in Australia; the ancient tea trees have bark like soggy cardboard.

International studies have suggested that rising temperatures will result in the cloud base lifting 100 metres for every one degree. This has not been tested in Australia, but Peter Hairsine, principal research scientist at CSIRO's Land and Water, says we may have less cloud stripping in those cloud forests.

Hairsine says that apart from the impact on wildlife, this will affect North Queensland's water budget, as many towns such as Port Douglas and Cairns rely on rainforest streams, not dams, for their water supply. A 40 per cent drop in run-off would have serious consequences,

especially in the dry season when, despite the lack of rain, the mountains still produce water.

Hydro power and fisheries, which rely on flushing flows through estuaries to move juvenile fish into the ocean, could also feel the loss if the clouds miss the mountains, Hairsine says. A report last year put the value of the mountain rainforests - in terms of supplying such resources as water - at about \$120million a year. And then there's the value of ecotourism in the mountains, which earns \$400 million a year, 10 times what logging earned.

THE FUTURE

WHAT'S BEING DONE

The Australian Canopy Crane is a 45- metre-high structure installed by Russian helicopters behind a resort at Cape Tribulation.

From it, scientists can dip in and out of the canopy across a football-fieldsized piece of Daintree rainforest.

Looking down on the canopy, the mass of vine-draped green below is comforting. It's a massive sponge or "sink" for carbon dioxide. These types of places are the lungs of the world, sucking in carbon, releasing oxygen. But research here has uncovered a disturbing fact: when the rainforest is stressed, it does the opposite. It starts to release carbon dioxide.

Steve Turton and colleague Mike Liddell blame an 18-month dry spell, which has put more stress on the trees. It is unclear if other types of forests do the same thing, but it is an unmistakable sign that we cannot rely on rainforests to be a constant sponge for greenhouse gases. "We need 10 years of data before we can really understand what is happening with our forests," says Turton. With the last year of normal rain, the rainforest has gone back to being a sink.

UNDER THREAT

THE GOLDEN BOWER BIRD

Bower birds have a flair for interior decorating, but they differ in style. While the satin bower bird prefers blue tones, the golden bower bird decorates its nest with orchids, seed pods and lichens in offwhite and pale greens. The bird's alcove of love is a U-shaped structure of sticks that is carefully constructed between two trees. The sticks can go a metre high up the tree. But perhaps the prettiest thing in the bower is the bird itself."

It's a stunning bird," says Luke Shoo, an ecologist documenting the habitat of rainforest birds. "If you get it in a good light its this stunning golden colour."


Even though the bower bird's food also occurs in the lowland forest, it prefers to live at between 650 and 1600 metres, and most live around 1000 metres. This preference for high places tells researchers like Shoo that it is a heat-sensitive animal.

The predictions are that with two to three degrees of warming, the bird loses 98 per cent of its habitat. "Potentially at two degrees we would expect to lose most of those high-density populations," says Shoo.

The golden bower bird is not alone. In research published by Shoo and Williams in May, they predicted that 74 per cent of rainforest birds in north-east Australia will become threatened under global warming.

LINKS

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