

# Fresh water is scarce in the Marshall Islands so rain must be collected in creative ways

ABC Science / By science reporter [Belinda Smith](#) for [Pacific Scientific](#)

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The Marshall Islands are surrounded by ocean, but fresh water is in short supply. (Getty Images: Doug Wilson)

Tuvuki Ketedromo has known how precious water is since he was a kid.

In the late 1990s, he and his family were living in the Marshall Islands' capital, Majuro, when a drought hit the Pacific nation, causing a severe shortage of fresh water.

Tanks ran dry, and mains water was turned on for just a few hours each week.

In a state of emergency, the government provided limited volumes of fresh water, either pumped from a rapidly depleting groundwater source or produced by reverse-osmosis systems, which filtered salt and other substances out of seawater.

"I remember going out to collect gallons of water with my mum and brothers," Mr Ketedromo says.

"We'd walk out, fill up our two containers each, one in each hand, then come back home."

This went on for months before the drought finally broke in mid-1998.

Mr Ketedromo still lives in Majuro, and is now chief of the Water Quality Division at the Republic of the Marshall Islands' Environmental Protection Agency.

That severe drought of 1997–98 is just one of several he has lived through, and — as the country faces a warmer future — it's expected there will be more on the horizon.

So he and others in the Marshall Islands are harnessing traditional knowledge and new research to better prepare for what the future holds.

## Water, water everywhere

Despite water making up most of the Marshall Islands' total area — which comprises almost 2 million square kilometres of the Pacific Ocean — the nation continually grapples with fresh water shortages.

Northern islands, which get less rainfall than their southern counterparts, tend to get hit by more frequent and severe droughts.

But even the lush green islands down south, such as Majuro Atoll, regularly experience dry spells.

In a typical year, Majuro receives more than 3,200 millimetres of rain. That's about twice Sydney's average annual rainfall.

While that sounds like a lot of water, only a tiny fraction can be captured and stored for later use. The nation's entire land area covers just 180 sq km, with little in the way of water catchments.



Tuvuki Ketedromo was born in Fiji but has spent most of his life in the Marshall Islands. (ABC Science: Belinda Smith)



ijuro is only a couple hundred metres wide in parts. (ABC Science: Belinda Smith)

And if there's little rainfall during the dry season — January to March — fresh water supplies on Majuro run perilously low, too.

This happened most recently in 2015–16, with a drought driven by one of the strongest El Niño events in recorded history.

From January to April of 2016, Majuro received just 22 per cent of its average rainfall for that period. By May, more than 20,000 people across the Marshall Islands were affected by severe drought conditions.

Risks extended past the need for drinking water. Without fresh water for bathing and washing, diseases spread faster.

The country takes an economic hit with each drought, too. When there's little water around, coconut palms — an important economic crop — reduce the number of female flowers they make and produce smaller coconuts that drop before they mature. Seedlings and even some mature trees die.

Food, water, soap and reverse-osmosis units were flown or shipped around the nation until the drought finally broke in May.

## Surviving and thriving on little rain

Lee Jacklick, a meteorologist with the National Weather Service in Majuro, is part of a project that's collecting and documenting traditional weather forecasting knowledge from the outer islands.

This knowledge has helped Marshallese people navigate the oceans and survive on little rainfall for thousands of years.



Jacklick says he grew up on the nearby atoll of Jaluit, where he also experienced droughts. (*ABC Science: Belinda Smith*)

"Throughout the ages, we in the Marshall Islands have been known to be very good weather people," Mr Jacklick says.

"If there are cockroaches all of a sudden flying all over the house ... [or] you see a mother spider gathering and protecting her babies, that is another sign of adverse weather approaching the islands."

Many buildings now have rainwater tanks. But in the days before, coconut trees could be used as "living buckets" of sorts to store rainfall.

This involved gouging a bucket-sized hollow into the base of a tree, which collects rain dribbling down the trunk.

"It can collect maybe a gallon or two of water, and that would be enough for one or two individuals," Mr Jacklick says.

"This was the common practice back then."

Taking rainfall collection and storage to a much grander scale is the Majuro's airport runway and surrounding pavement areas.

It's the biggest paved area on the atoll by far and the main water harvesting site.

As rain falls on the concrete and runs off the side into the sand, a network of pipes ferries the water to a nearby reservoir.

This is the main water supply for half the atoll, including the main city of Majuro.

The other half of the atoll relies on a subterranean source.



Hollowed-out coconut trees are still used to supply fresh water on some islands. ([Water hole in coconut tree](#), United States Navy, [CC0](#))

Large roofed areas, such as this school gymnasium, act as water catchments too. (*ABC Science: Belinda Smith*)

## Precious underground reserve

Keep driving past the airport, and you'll eventually reach the end of the road. This is a community called Laura, and here, the thin strip of land broadens like the clasp of a safety pin.

The land here is a couple of kilometres wide, allowing farms to grow fruit and vegetables and to rear animals.

It's also home to a huge reservoir of fresh groundwater.

As rain falls on Laura, it trickles through sand and coral until it meets sea water.

Being lighter than seawater, the fresh water floats, creating what's known as a "lens". Like the lens in your eye, the Laura groundwater lens is thicker in the centre and thinner towards the edges, which are closest to the coast.

Majuro Atoll's Laura groundwater lens covers the orange-shaded region. (*Google Maps/ABC Science: Belinda Smith*)

Fresh lens water is drawn from wells and pumped out to supply houses further away on the atoll. During drought, it can also reinforce the airport reservoir's supplies.

Keeping tabs on this underwater reserve is Mr Ketedromo and his colleagues. This is made possible by 10 clusters of innocuous-looking pipes scattered across Laura.

One end of the pipes sticks up out of the ground while the other plunges deep into the lens below, some all the way through the fresh water and into the seawater underneath.

Mr Ketedromo's team regularly makes rounds of the monitoring sites, dropping probes down the pipes to measure the salinity and depth of the water below.

ou don't know what to look for, the monitoring boreholes are easy to miss. *(ABC Science: Belinda Smith)*

"Because the groundwater system has to be recharged by rain, if it's the dry season, you expect it to be saltier, and if it's the wet season, you expect it to be fresh," Mr Ketedromo says.

This data, which stretches back decades, is being used to model how the lens will change in a warming world.

## The road ahead

The Marshall Islands are already feeling the pressure brought by climate change.

It's a low-lying nation, sitting an average of a metre or two above sea level. Battering waves erode the coastline, and some areas already flood regularly with high tides.

This includes the airport, which can get swamped with seawater when high winds push lagoon water over the land.

This inundation is why a low stone wall has been built alongside the airstrip, Mr Jacklick says.

"We have to protect the airstrip, which is our lifeline towards getting the much-needed rainfall."

ly a road separates the airport from the lagoon. *(ABC Science: Belinda Smith)*

Laura is not immune to flooding, either. As ocean waves inundate the land there, salty water can trickle into the freshwater lens from above.

As sea levels rise, climate scientists predict such ocean floods will happen more often. How rainfall changes is yet to be seen.

Mr Jacklick is helping people living on outer islands to more accurately predict the weather in this era of climate change.

"Traditional knowledge is based on observing for a very long time," he says.

"You get to a point where you know the averages. But when you put climate change into the equation, then there it goes — you get wrong forecasts."

Combining traditional and modern science means communities can now make more accurate forecasts, he adds.

"When we introduced the scientific part of it, then there was a big change. Now we can respond more appropriately in time."

irm, moist air creates fat, fluffy clouds swollen with rain, but no-one knows where that rain will fall. *(ABC Science: Belinda Smith)*

He's also helping to formulate the Marshall Islands' National Drought Contingency Plan, which he says will help the nation better monitor drought conditions and prepare to respond to limited water supplies.

Mr Ketedromo, who now has kids of his own, is concerned about the Marshall Islands' water prospects and says it's crucial to start preparing now.

"We already see impacts now, and I'm very worried that king tides, land erosion and dry periods and droughts are going to happen even more in the future.

"I don't know how the population will change in the coming 30 years, but for people who rely on rainfall and groundwater for daily purposes, and who don't have water companies to supply them, it's a real worry."

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