

FIBRE CLASS

WORDS: ANNA DUNLOP / IMAGERY: MIKE HEYDON

Harakeke has traditionally been the fibre that bound Aotearoa as a society, but an innovative Kiwi company says it has vast potential uses in 21st-century technology



With its towering, vibrant flowers and tall, sword-like leaves, harakeke – or New Zealand flax (*Phormium tenax*) – is one of Aotearoa’s most recognisable plants, a perennial commonly found in wetlands, near rivers and on the coast.

What many might not know, however, is that this striking plant (which, despite its name, isn’t actually a flax but a species related to lilies) played a pivotal role in the development of New Zealand’s human landscape. It’s also one of the strongest natural fibres in the world.

It’s this strength that has reignited the interest of scientists and engineers, among them Ben Scales and Will Murrell, who came across the unique properties of harakeke while studying for their degrees in industrial design at the University of Canterbury Te Whare Wānanga o Waitaha.

“We were trying to solve the issues relating to cabbage tree leaf and harakeke as waste materials,” says Ben. “The plants can’t go into the green bin because they can damage the compost shredders, and we thought, either the machines are really weak or the fibre is really strong. That was our introduction to harakeke.”

The pair founded KiwiFibre Innovations in 2020, which aims to replace environmentally damaging carbon fibre and fibreglass with a harakeke-based composite material. So far they’ve used it to make pickleball paddles, snowboards, surfboards – and even the bumpers and roof of race driver Hayden Paddon’s electric rally car.

“Harakeke fibre is very exciting from the perspective of 21st-century technology,” says Ben. “It’s longer, stronger, stiffer and hollower than hemp, linen, jute and other natural fibres, so it could have applications in almost any industry, whether as a composite material, a textile, or even something as rudimentary as a roadside stabilisation fabric.”

“The potential uses for harakeke are vast,” agrees KiwiFibre Innovations Director Mark Henderson, who runs Biotenax Limited at the company’s Tāwiniwini Bio-discovery Gardens in Wellsford and is a director and business and biodiversity advisor of Ngāti Ruapani ki Uta ki Tai Co-operative Society.

Mark also chairs and founded (with the co-op) Te Hononga Hapori Harakeke|The Harakeke Community Alliance, which was established in April 2022 by iwi, research institutes, universities and various experts and other members (including KiwiFibre Innovations) to, as Mark says, “sustainably revitalise the harakeke industry”.

Revitalise is the operative word. Aotearoa once had a thriving – but now largely forgotten – flax milling industry, and for a time harakeke fibre was the country’s biggest export, shipped worldwide to make rope and twine.

Of course, Māori have long known the incredible properties of harakeke, which is a sacred taonga. “Harakeke is part of our whakapapa,” says textile conservator Rangi Te Kanawa. “In the past, every marae had an established pā harakeke, and it was an integral part of being Māori.”



hauora: health
kākahu: clothes
kaupapa: principles, ideas
kete: bag/s
kono: baskets
kupenga: fishing nets
mākoī: mussel shells
pā harakeke: flax bushes or plantation
rongoā: traditional Māori medicine
taonga: treasure
taura: rope
tikanga: customary practices
whakapapa: genealogy
whānau: family
whāriki: mat/s
whenua: land

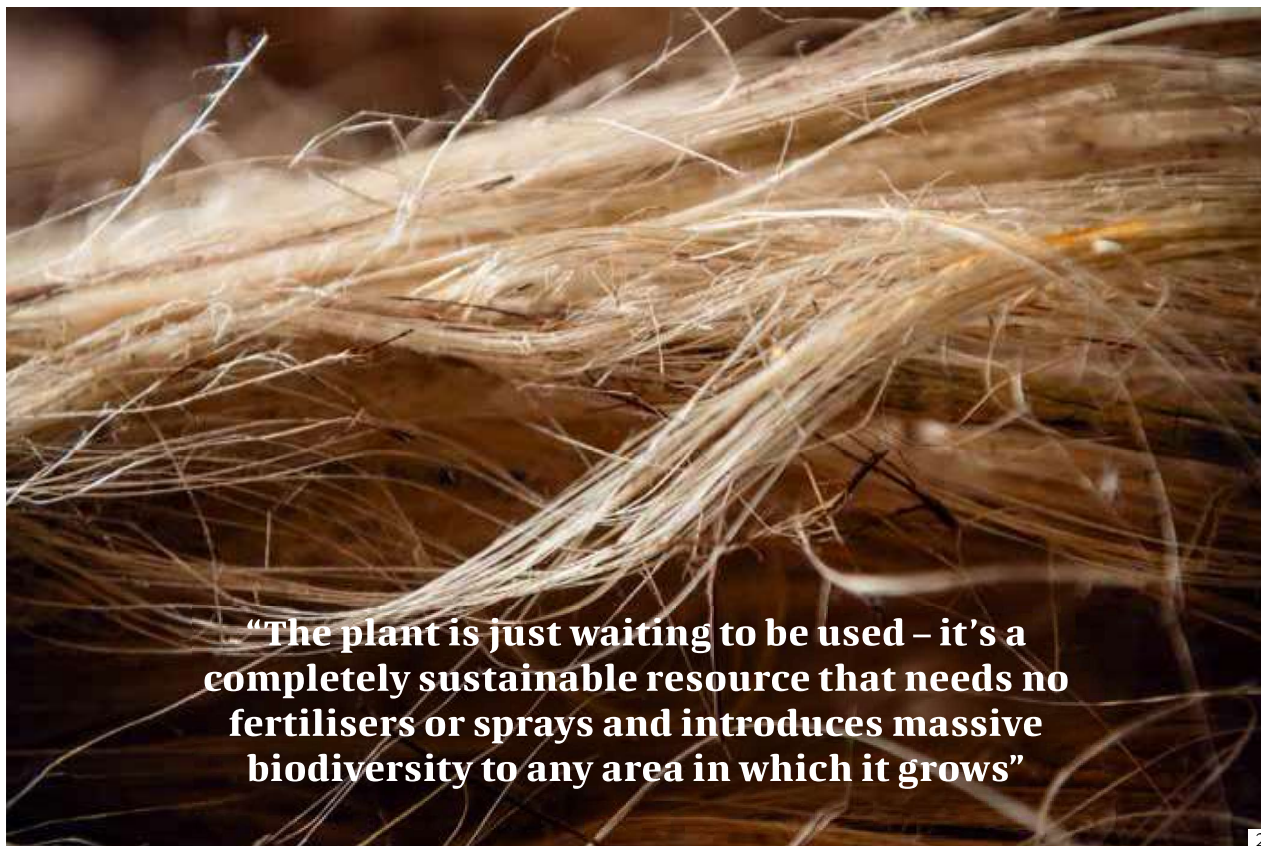
1. Harakeke thrives on unproductive land, such as wetlands, floodplains and riparian zones.
Image: William Murrell

2. Flax fibre is one of the strongest natural fibres in the world.

3. KiwiFibre Innovations has made rally car parts from a harakeke-based composite material.

4. Will Murrell (left) and Ben Scales founded KiwiFibre Innovations in 2020.
Imagery: KiwiFibre





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Rangi has strong whakapapa in Māori textiles, and she recently completed a two-year project at Massey University Te Kunenga ki Pūrehuroa to produce an upholstery-quality woven textile successfully using just harakeke and water.

She says harakeke represents whānau and grows in a whānau structure.

“There’s the rito [child or inner shoots], which are protected on each side by the awhi rito [parent leaves] and then the tūpuna [grandparent or outer leaves],” says Rangi.

“According to tikanga, only the tūpuna are harvested, and the rito and awhi rito must be left untouched until matured for harvest.”

Early Māori used harakeke in rongoā: pia harakeke, the sticky gel found at the base of the sheaths, was used to heal wounds and burns; the juice from the roots was applied as a disinfectant; and the leaves were used as dressings and to bind broken bones. The leaves were also used in weaving, to make whāriki, kono and kete.



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However, it was the discovery of muka, or flax fibre, that was the game changer. Māori stripped muka from a harakeke leaf using mākoī, softened it by pounding and plied it into thread to weave kākahu, kupenga and taura.

“Muka is beautifully strong, it has a lovely sheen, like silk,” says Rangī. “Whatu – the twining technique employed by Māori to make fabric – is one of the oldest weaving techniques known to mankind.”

Māori were active with Pākehā in the early flax trade and sold hand-dressed harakeke and muka made into ropes as early as 1793, often in return for goods such as muskets and blankets. Trade also began with Australia, peaking in the 1820s and 1830s, but soon declined, predominantly because hand stripping could not provide the amount required.

Thirty years later, the invention of a mechanical stripper in the late 1860s (a machine that beat leaves between a revolving metal drum and a fixed metal bar to expose the fibre) vastly increased output – although it didn’t produce fibre of the same quality as muka – and led to the development of flax milling as an industry in New Zealand.

Flax milling played a big part in the country’s economy until the 1970s. It was, however, a boom-and-bust industry, heavily influenced



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by world events, including World War I, the American Civil War and, perhaps most significantly, the Great Depression of the 1930s. The industry was saved during the latter by the domestic market for flax woolpacks but, eventually, harakeke couldn't compete with the proliferation of cheaper synthetic fibres.

"At its peak in the 1890s and early 1900s, there were around 700 flax mills across New Zealand, but by 1972 there were just six," says Vaughan Templeton, who runs Templeton Flax Mill in Ōtaetae/Otaitai Bush near Riverton, which now operates as a museum.

"The harakeke industry was hugely important for New Zealand – it was a big employer and, as far as I know, the only one to use a sustainable native plant."

Templeton Flax Mill, a Category 1 historic place, is thought to be the only surviving flax mill with its machinery in working order and on the site on which it operated, and has been in Vaughan's family for generations.

"My great-grandfather, William Templeton, started flax milling here in 1911, then it passed to my grandfather in 1924," says Vaughan.

"The family ran it through ups and downs until 1971 when it finally closed."

1. Vaughan and Megan Templeton run the Templeton Flax Mill Museum near Riverton.

2. Vaughan harvests harakeke from the mill's pā harakeke ...

3. ... and prepares it for processing.

4. The flax mill still has its machinery in working order.



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The Templeton Flax Milling Heritage Trust was set up in 2000 to restore and preserve the buildings, structures and machinery, and the museum opened in 2004. It now showcases relics and memorabilia related to flax milling in Southland and runs live demonstrations of fibre stripping and scutching (a combing system that removes the flax tips from the fibre), using leaves from the mill's pā harakeke.

“Commercial stripping uses a lot of water and forces a lot of the harakeke juice through the fibre, so it looks quite green, and it also has notches on it where the blades rip off the vegetation,” says Vaughan.

“Those are the key difference between harakeke fibre stripped by machine and traditional hand-dressed muka, which is beautifully white and smooth.”

KiwiFibre Innovations’ Ben and Will used Templeton Flax Mill’s stripping machine as a model for their own, with the intention of improving it because, as Vaughan points out, “you can do things so much better now”. Rangi has also engineered a machine to extract fibre of the same quality as muka that is manually extracted using mākoī, and is preparing to make it portable and available to anyone who wants to grow harakeke.

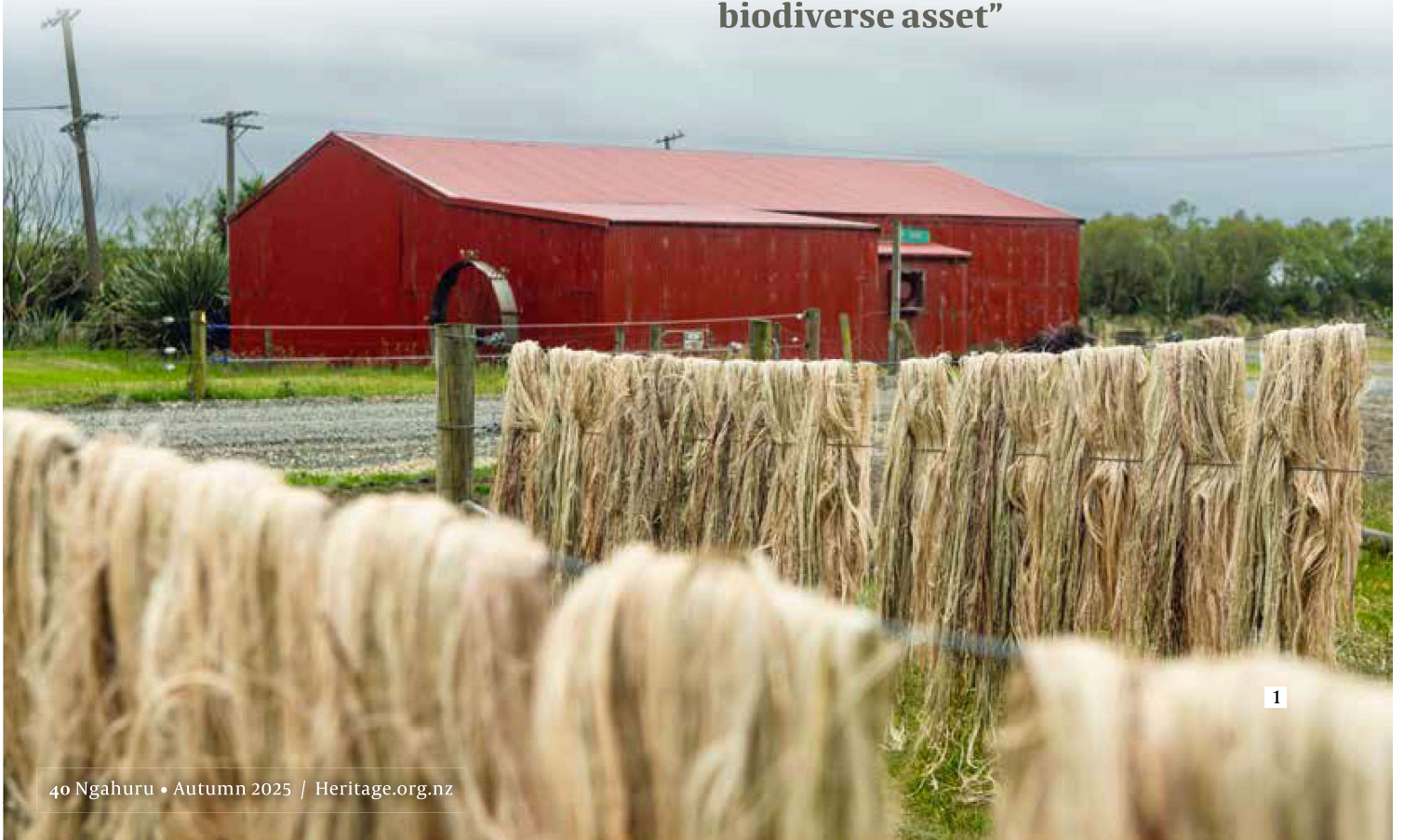
The Templeton Flax Milling Heritage Trust is a member of Te Hononga Hapori Harakeke, and, in its role as a keeper of the machinery, techniques, knowledge and ‘old ways’, is keen to support the alliance, says Vaughan.

“Harakeke has traditionally been the fibre that’s bound New Zealand as a society,” he says. “The plant is just waiting to be used – it’s a completely sustainable resource that needs no fertilisers or sprays and introduces massive biodiversity to any area in which it grows.”

Sarah Gallagher, Area Manager Otago/Southland for Heritage New Zealand Pouhere Taonga, says that the Templeton Flax Mill complex is incredibly significant, as both a working mill and a place to learn about the history of the industry. “That value is amplified given the history and knowledge of the Templeton family, who continue to run the mill more than 100 years after it was built.”

She adds: “It’s very exciting to think that this industry could be reinvigorated in New Zealand. Informed by tikanga and our industrial heritage, we could see huge biodiversity, climate and economic benefits from a revitalised harakeke industry.”

“Much of the land within Māori land trusts is not practical for horticulture or agriculture, but it’s perfect for harakeke. That land could be turned into a resilient, biodiverse asset”





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Mark agrees, adding that the significant environmental benefits of harakeke extend well beyond its use as a sustainable replacement for synthetic fibres, and it has huge potential in repairing the whenua and fighting climate change, while also providing a plethora of extracts and other byproducts.

“Like many of Aotearoa’s native plants, harakeke grows in clusters and is pollinated by birds, such as the tūi and korimako, which improves biodiversity,” he says. “It also has an extensive root system that, along with other native plants, stabilises the land and riverbanks better than introduced species such as pine, willow and poplar.”

In addition, he continues, unlike hemp and linen, which are commonly grown commercially on food-producing land, harakeke thrives on unproductive land such as wetlands, floodplains and riparian zones.

Mark says Te Hononga Hapori Harakeke envisages the development of underutilised land unsuitable for traditional horticulture,

agriculture and forestry to grow harakeke, incorporating much-needed biodiversity enhancement. This ‘architecture of planting’ involves riparian (planting riparian strips and cleaning up waterways), revegetation (planting native flora to improve biodiversity and environmental protections), restoration (particularly of wetlands) and transition (retiring non-productive farmland, such as floodplains, for harakeke planting).

He adds that a revitalised harakeke industry would provide an opportunity to reconnect Māori with their heritage.


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Rangi agrees. “My kaupapa is about restoring pā harakake,” she says. “It’s in our DNA and I believe we should use it the way we used to.”

In 2024 KiwiFibre Innovations harvested harakeke from two farms in Canterbury – one near Lake Ellesmere and the other near the Rakaia Gorge – and Ben says following tikanga and drawing on lessons learned from the past are important to the company.

“I believe part of the reason that the flax milling industry died out is because it didn’t follow tikanga – they cut away the entire plant and it would take eight years to grow back,” he says.

“Tikanga just makes so much sense; it’s sustainable and you get much better commercial and economic yields if you harvest just the tūpuna – and it’s better for the hauora of the plant.”

He adds: “The entire world – even that out in space – is reliant on synthetic, manmade, incredibly environmentally and societally damaging materials, and harakeke can play a central role in replacing them.” 

1. Once stripped, the harakeke fibre is hung out to dry.
2. Vaughan believes harakeke fibre has vast potential as a sustainable resource.



To learn more about harakeke, view our *Templeton Flax Mill* video story here: youtube.com/HeritageNewZealandPouhereTaonga

