

KIA URUTAU ADAPT

DEEP SOUTH CHALLENGE
CHANGING WITH OUR CLIMATE

PORT ROAD
Climate risks at our urban edges

THE LIVING NET
Kai in a changing climate

**MAY
2019**





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Where the Hāparapara River
meets Omaio Bay, in the
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climate change adaptation.**

With over 65% of New Zealand's population living within 5km of the sea and \$5.1 billion of community owned infrastructure at risk from one metre of sea level rise, adapting to the effects of climate change is a huge challenge for New Zealand.

That's why councils across the country are working with our communities to increase understanding of climate change, and how we can adapt to our changing environment. We are on the frontline of the battle to adapt to the effects of climate change.

To find out more about our work visit lgnz.co.nz/climate-change-project

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Climate Change Risks in Auckland

To help develop a Climate Action Plan for Tāmaki Makaurau, Auckland Council has published a series of climate change risk assessment reports. These reports describe the ways Auckland is being impacted by climate change and examines how impacts are expected to intensify over the next century. We hope you will help us and contribute to the development of Auckland's Climate Action Plan by participating in our upcoming consultation.

Visit knowledgeauckland.org.nz to read the Climate Change Risk Assessment summary report and join us at climateAKL.nz to learn how you can be involved in developing a climate action plan for Auckland.



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WELCOME



KIA ORA KOUTOU. Welcome to this one-off edition of the Deep South Challenge magazine, “Kia Urutau | Adapt”. We decided to produce a magazine that was not full of scientific or technical jargon – one that would make what we do properly accessible. We also wanted to reflect on our research to date, by asking our key communities – partners, stakeholders and researchers – about their views of the Challenge’s past and potential future. This might have been a risky move – and, indeed, the views presented here are not uniform and not without complexity. But, overwhelmingly, they show the Challenge is moving in the right direction. We have been listening closely to our key audiences to ensure we’re meeting the growing need for research and engagement on our shared future. Climate change research is complex, but our communities are more than aware of the importance of linking science with society; and they’re eager to work with us. This magazine is not a comprehensive research guide. The articles presented here are a snapshot of the research underway. You can find detailed information about all our research on our website. We hope you find this magazine to be an enjoyable and informative read. We also encourage you to get in touch with your feedback, questions or collaboration ideas for the next five years.

MIKE WILLIAMS Director // Deep South Challenge: Changing with our Climate



TĒNĀ KOUTOU KATOĀ. I’m delighted the Challenge was successful in securing a further five years of funding, after last year’s Mid-way Review. Our first phase is drawing to a close, although a good number of research projects have yet to publish final reports or communicate findings with research and community partners. Our short-term focus is on making sure that the groundwork laid in our first five years – towards establishing and maintaining earth system modelling capability in New Zealand – comes to fruition. Beyond this, our emphasis will increasingly switch from outputs to outcomes, and to understanding impacts for Māori and our key stakeholders, including through a deeper and broader engagement programme. To this end, the Challenge’s Leadership Team has begun planning our Phase 2 research programme, which addresses the impact of climate change in four key domains: Māori, Communities, Infrastructure and the National Economy. I’m confident the Challenge is well-placed to make a major contribution to the development of effective adaptation strategies, which will be critical for New Zealand’s long-term social and economic well-being.

ROGER FRANCE Chair // Deep South Challenge Governing Group

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The Deep South Challenge: Changing with our Climate focusses on supporting our communities to adapt to climate change. But we know that mitigation is urgent. The faster we cut our carbon emissions, the easier our collective adaptation journey will be. Big picture mitigation stories are for others to tell, but it's important to know where the

Challenge stands. In these tiny spotlights, we asked our researchers to let us in on their personal lives – to tell us how they're taking responsibility to reduce their own carbon footprints. Researchers are notoriously shy, but with a bit of coaxing we were amazed to learn their stories.



THE LIVING NET

Kai in a changing climate



ALEXANDRA KEEBLE

|



SYLVIE WHINRAY





MEET PETER INSLEY on a low promontory that rests above the Hāparapara River. Kids have built a rickety jumping platform in the pūriri and mānuka above us, but the water below – blue and glistening – looks treacherous. It’s hard to gauge the depth or see the snags. The river has always behaved like this. It beelines out of the hills and hits this hard rock, pooling and gathering before sweeping off again towards Omaio Bay in the Eastern Bay of Plenty.

In the days of Peter’s childhood, the river flats and coastal terraces of Omaio were in sheep and beef, which the community worked collectively. His parents and grandparents, and their peers, chose to take water from this location, installing a pipe and pump to serve their farming operations.

Today, it’s once more the site of close environmental monitoring. The whānau of Omaio again need water. They need drinking water, for people’s homes and

for their marae. And they need water to realise their development plans, which include planting out the kinds of crops that attract top-dollar on local and international markets. They need to know if their rivers can sustain them, especially as the climate changes.

“This summer,” says Peter, cautious to speak at first, “we haven’t had much rain. One of our rivers, Tikinui, the whole length of it dried out, that’s about three kilometres.” It’s never happened before to Peter’s knowledge, and he’s been up in the hills since he was a boy. He seems to wear these waterways, this bush, all over him. He’s ahi kā, and while he’s in high demand across the motu, he has no interest in leaving.

Peter Insley is the man on the ground in the Deep South Challenge Vision Mātauranga project, “Climate-friendly, high-value crops for the whānau of Omaio.” A partnership between Te Rau Aroha Trust and NIWA, the project is supporting Omaio landowners to learn more about their

water, their weather and their changing climate.

This project represents one piece of a complex puzzle the whānau need to solve before they decide which crop to invest their precious time and resources into. Other puzzle pieces include the shifting appetites of export markets, changing regulatory requirements, whānau buy-in, and the imperative that landowners consider multiple land-use options to build and maintain resilience.

At the moment, kiwifruit is looking like Te Rau Aroha’s most likely choice. But frosts are becoming fewer and far between, spring’s arriving earlier and vines are flowering sooner, our days are warming up, summers are becoming longer and drier, pest and disease profiles are changing, the wind’s increasing in strength and storms are getting worse, as floods waters wrestle with the rising seas. The Trust needs to be certain that the crop they choose, and even the cultivar, will be sustainable for at least the next 20 to 30 years.



Peter Insley gets ready to take water samples from the Hāparapara River.

The project is providing the community of Omaio with the tools and the training to monitor essential climate, weather, hydrology and soil data – so they can better consider and respond to changing climatic conditions – now and into the future.

ON THE 19TH of every month, Peter comes to the Hāparapara to test the water. At 7am – later than Peter would ordinarily start – I find him wading back and forth across the river, testing for water flow, sediment, e-coli, phosphates and nitrates.

By every measure, the river is clean, despite inputs from logging and other activities.

“Yep,” Peter chuckles. “I drink it and I’ve never gotten sick. I haven’t heard of anyone dying from it. The pigs, the deer, the birds and bees, they all drink it. Up river,” Peter gestures towards the mountains in the distance, “there’s big, healthy shags nesting, those noisy plovers, and kōtuku.”

The high bush is also home to a community of kōkako, which need constant predator protection by Peter and others.

The terraced fields of Omaio step gently up from the coast until they’re blocked by towering, bush-covered hills. This is Te Whānau a Apanui country, highly fertile and mostly still in Māori ownership – not such a common combination in modern-day Aotearoa.

Unlike the highly developed blocks in the Western Bay of Plenty, the remote coastline here is planted mainly in maize – stock feed – on land leased by landowners to growers from out of town. What whānau (represented by various small trusts) earn from their land only just covers the rates.

“It’s rubbish stuff,” says Chris Karamea Insley, Peter’s brother, and a trustee of Te Rau Aroha. “It’s low-value, and it brings the rats. Come out here with night glasses on, you’ll see rats everywhere.” Maize provides no local employment and contributes nothing to the local economy.

Still, the land feels lush and clean – more sheltered than Te Tairāwhiti round the cape, and less commercial than the country I drove through from Tauranga (on a coastal road that in parts was falling away, the result of coastal erosion and remnant Pacific cyclones). Whakaari is a constant smoking presence on the horizon. It feels quiet and peaceful, but Karamea is adamant that I look deeper.

Here in Omaio, there’s no mobile reception. There’s only one shop, but it no longer sells the saddles, dynamite or fresh produce it sold back before New Zealand’s export market for wool and meat dried up, and one generation and then another moved to the city in search of work. Unemployment and its associated strife is high.

Like a logging truck, you could barrel through Omaio, seeing and hearing nothing except the sound of your own engine.

We spend a moment talking about the differences between today and the Omaio of Peter and Karamea’s childhood.

“Unemployment?” Peter laughs. “That’s not a word that ever entered anyone’s brain. If you weren’t helping out your grandfather, grandmother, uncle, your mum or dad, well you were down the road helping someone else out – hay baling, sheep, whatever. It was communal, everyone helped. No one ever really got paid... so I guess we didn’t know about full employment either...!”



Above: Peter on the Hāparapara.
Below: Kiwifruit orchard lit up in the sun, on whānau land in Omaio.



Chris Karama Insley at the
gates of Te Whānau a Apanui
Area School.



“In those days,” Peter nods at our photographer, “everyone’s names were together. Down the marae, we all scratched our names into the wood. No one ever took a photo, you didn’t need to. Everyone was around, everyone was busy, we were always active, out in the garden... When we weren’t doing that we were fishing, swimming, diving, roaring [for deer], taking the dogs to go hunting for pigs or possums. The old ones, even to relax they’d sit down and do their weaving. There was never an idle moment.”

Peter and Karamea hope, and have good evidence to support their hopes, that shifting into high-value crops will generate enough jobs and other activity in the local economy to bring whānau home.

“They want to come home,” says Karamea. “And science will be the enabler.”

AT THE HĀPARAPARA, Peter tests the water manually, but on other key sites throughout Omaio, environmental monitoring is being automated.

Karamea takes me to visit a land block owned by Te Rau Aroha, which the Trust hopes will become the first whānau-owned and managed orchard in Omaio. The paddock is lying fallow at the moment. The trustees negotiated a rates abatement with council, for the period in which they need to plan and then to plant.

We scramble off the edge of the block into a dark, bush-clad gully – *kō Wherurere te ngahere*. Piwaiwaka lead and follow us down the soft earth track. The Mitiwai stream cuts through the rock – a trickle when we find it, but the steep sides of the gully show us what can happen in big rain.

Te Rau Aroha are looking to have a covenant placed over this gully. Restricting the water they themselves can take, and locking future generations into careful water usage, means any irrigation will have to depend on careful planning and finely tuned water storage.

Peter and the NIWA technicians have been here long before us, installing a water pressure gauge and embedding markers in the rock from which the height of the stream is measured. Up in the paddock, roped off and in full sun, a sophisticated weather station gathers this and other information from Omaio’s various monitoring sites – soil temperature and soil moisture, rainfall, wind strength and solar radiation. Once a day, the entire data set is beamed, via satellite, to the NIWA office in Christchurch.

The NIWA team are building an online dashboard, accessible via smartphone, which gives Peter and others at Omaio real-time access to their environmental information.

NIWA hydrologist MS Srinivasan gives me a virtual tour, showing me how the tool will help whānau make on-the-fly decisions about irrigation and fertiliser use – maximising water availability for



NIWA weather and climate modelling station on Te Rau Aroha land.



Danny Poihipi, with
“native” pears in
the foreground.

the plants and minimising environmental harm. The tool also integrates historical weather and soil moisture data, to give an accessible picture of how the soil in each location behaves when it rains, and provides weather and climate forecasting.

As the project moves forward, whānau members will be trained in how to use the tool to inform decision making around the use of water, for commercial and community purposes.

Such comprehensive data, coupled with other climate and scenario modelling, including for Bay of Plenty kiwifruit, means the whānau can work with crop specialists (Plant and Food, for example) to assess the strengths and vulnerabilities of one crop over another.

BUT SUCH AN INTIMATE analysis of local conditions, and the development of technology to capitalise on those conditions, is not new in Omaio.

Danny Poihipi is a renowned Te Whānau a Apanui fisherman and gardener, and an expert in the tikanga that governs these practices. His vast knowledge of the Omaio environment guides the Insley brothers, and the Trust, in their decision-making processes.

Danny arrives at the Insley family homestead bearing two mismatched pears and a loosely woven kete, which he places beside him. A silver plait slips down his neck. We have a cuppa before starting – our tea cups clink as we add sugar and long-life milk. Once he begins speaking, other priorities fall away.

“The rūnanga,” Danny tells us, “gave me some kaupapa to carry. I carry them out to the best of my ability. One thing for me is sustainability, through old technology, or new technology.” Danny’s first language is Māori, and it takes my Pākehā ears a while to settle into Danny’s rhythm, which ebbs and flows around his subject like the incoming tide.

“Trying to upkeep and uphold our unbroken chain, from our forefathers to us today. First the culture, the preservation of our culture, [then] the growing of our food

and the keeping of our technology.”

At first the strands of Danny’s kōrero seem disparate, but with time he weaves them together. He circles back again. “We’ve got an unbroken chain from our atua horihori, our atua Māori... We have an idea for them in the garden, Rongomatāne and Haumietiketike. They look after all the fern root crops, and ngā hua whenua, that’s the food on top of the ground.”

I ask Danny what he thinks about kiwifruit.

But he’s a master storyteller, and won’t be drawn by direct, mundane questions. Instead, he makes a fishing net out of his words.

He picks up one of the pears. “There were no apples and peaches and plums and grapes here, so our people ate a lot of kiekie, one was the fruit, and one was the flower they ate, the tāwhara. And the teure is the cone of the kiekie. They ate that as well.”

Danny tells the whakapapa of these pears, recalling who brought the trees to Omaio and when. And for the next hour or so, he takes us on a tour of his food cupboard, his pātaka kai, explaining which fruits and foods and fish and plants are harvested at which times of the month or year.

He shows us the abundance of his garden and his sea. He talks in detail about the timing for planting, and methods for harvesting, for building weirs, for setting traps, for netting, for fishing with bait. He talks about how to preserve hua whenua in dry storage, and how to preserve a fish like kahawai, by standing them upright and wrapping them with bracken fern – a preservative – then stacking them in a hāngī til they’re dark brown and hard.

“I make a lot of fermented food,” he says. “I’ve got some mussels that have been in the water for one week and the flies, ooh... they’re falling off the water! You just go like this,” Danny sweeps his hand in front of him, brushing the flies aside. “It takes about a week for the shell to open, you got a huruhuru on that, and when you

pull it out like this, it’s ready,” Danny laughs. “The young ones see the flies on the water and turn their nose up, like this.”

He talks about food as medicine, foods that complement each other, foods that support people as they grow older. “When you eat it, the smell is nothing at all to the sweetness of those fermented mussels... Your puku becomes adapted, as you get older. When you’re young, a child, the stomach is not ready to digest those foods. But as age comes on, you hunger for it. I hunger for it.”

He describes key ceremonies, and shares waiata that relate to specific foods, as well as to specific ancestors. It’s living practice.

“They say to me, ‘You kill a lot of sharks.’ I say, ‘there’s a time of the year when we hunger for the liver of the shark.’ There’s a

name for it, kōki...

No matter whether it’s the grey nurse shark or a blue fin shark or a thresher shark, what we want is the liver. Oh, my

family, they go berkas on it... The way to cook kōki is straight into the pot with water, boil it for 10 minutes or so, and it starts breaking up. Not too long cooking, once it starts breaking up, time to eat it. People say to me, ‘What do I do after that, when it starts breaking up?’ I say, ‘Oh, you ring me up.’”

THE SHARING OF food to build community is, or was, universal. But our modern, global food trade necessitates a different way of thinking about the relationship between food production, food consumption and community building.

Peter Insley says, “If we’re gonna grow food for the worldwide community, we need to take care of these hills. This is a place to teach the young ones. We need to invest in science, get our kids interested in science. We hope they’ll go from school and on to uni, access scholarships, and then we’ll get them back here.”

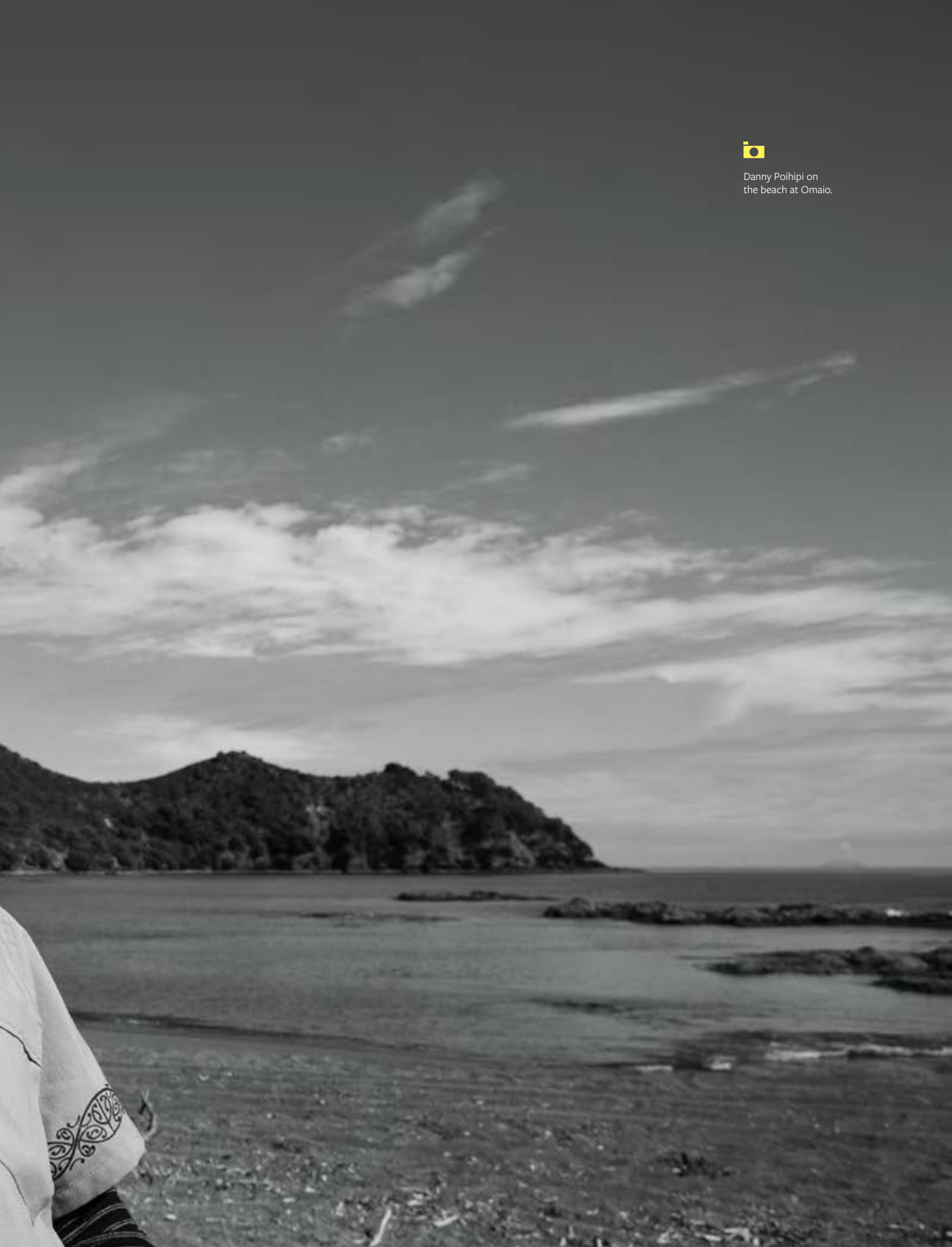
I meet Kimiora Webster, the near-new principal of Te Whānau a Apanui Area School in Omaio Bay, outside in the playground. Kimiora is working with Te Rau

“First the culture, the preservation of our culture, [then] the growing of our food and the keeping of our technology.”





Danny Poihipi on
the beach at Omaio.



DIMINISHING FOOTPRINTS



I consciously consume. I'm vegetarian, I don't drive and I volunteer for numerous green-related things (from the Sustainability Trust to replanting on Te Ahumairangi). It's not huge but it's something. I think it's a mix of guilt (feeling like homo sapiens have ruined the world for all other species), joy (even if it's a drop in the ocean of effort that's needed, knowing that I'm helping makes me feel happy and part of something), hope (if we all do a little, maybe all will be well) and maybe a touch of terror (in economics, we care about the margins, and what if my small action is part of the margin that tips us one way or another)!

SALLY OWEN, economist at Motu Economic and Public Policy Research, working on "Extreme weather, climate change & the EQC"



Others will do way more than me! But we have an electric car and charge from the roof via solar. Also, mainly due to my legendary wife, we have a pretty massive garden with chooks, etc., and we're involved a lot around better walking, cycling and urban planning in Tauranga. Ultimately, it's the right thing to do. We all have a relatively gigantic footprint and need to reduce this as much as possible. I think it's about fairness too, between us and our kids, us and the environment, us and our fellow humans and other species. As for emotions... I feel frustration and guilt, firstly, interspersed with joy when my wife brings in a harvest of kūmara!

JAMES HUGHES, infrastructure resilience specialist at Tonkin + Taylor, working on "Stormwater, wastewater and climate change"

Aroha Trust to investigate how to bring science into the curriculum, and to get his school kids out into the environment.

"We don't call it science," Kimiora says. "We call it living. We freak out about the word science. But we have no trouble going out to get us a feed. When I first started teaching," he continues, "my goal was to become a science teacher. That's because I hated science, and I wanted my kids to love science."

Kimiora gathers together some of the senior students, and we head to a local land-block which was leased some years ago and converted into kiwifruit. The manager of the block is happy to work with the Trust – he himself is benefiting from the science. NIWA has installed monitoring equipment here, specifically to gather data about rainfall and soil moisture at various depths.

The vines are laden with massive SunGold kiwifruit, the size of which I've never seen before. Horiana Anderson and Shonita Wikaire wander through the orchard. Shonita's family own the block, and she picks here in the school holidays. "This one's no good," she tells us. "Too long. Too flat. This one's not round enough. That one would never make it."

Kimiora's vision for place-based learning, for whānau-run orchards, and for the local economy, is that it all might operate like a marae, where everyone has a role and can play to their strengths. "The kids feel comfortable on the marae," he says. Everyone has a place and knows what to do. And there's so much to learn here – from environmental management, communications technology and climate science to the fully integrated mātauranga practiced by Danny and other gardeners and fisher people on the coast.

For now, the girls say they'll leave Omaio once they finish school. Shonita's thinking about dentistry; Horiana would like to become a physical trainer, and to keep up with waka ama. Neither are keen to work in the orchard. But with a local economy to support them, they could return to practise their professions on the coast – living and working on their ancestral land.

SUNGOLD IS NOT the variety that's always been grown on the coast, and it's not the

Kimiora Webster,
principal of Te
Whānau a Apanui
Area School, takes
a moment to sign a
student's homework.

variety New Zealand climate science knows most about.

The Deep South Challenge itself was established in the wake of the Climate Change Impacts and Implications (CCII) programme that ran from 2012 to 2016. The research programme undertook case studies to understand likely climate impacts on New Zealand's varied types of agricultural land. One case study area was the lowlands of Papamoa, in the Bay of Plenty. The project examined the climate impacts of flooding, inundation, rising seas and pests on the region, with one focus on how climate change would affect kiwifruit yield. The study was initiated by Zespri's





then-Head of Innovation Alistair Mowat.

Andrew Tait, who co-led CCII with Daniel Rutledge from Manaaki Whenua Landcare Research, and who is still involved in the Deep South Challenge, explains. “Alistair’s proposal was to assess the impact of seasonal temperature variability on kiwifruit production. We decided to use simple temperature indices, rather than taking the traditional approach of modelling plant physiology. We chose the Hayward variety, as there are many years of production data available, particularly for the Bay of Plenty region.”

But the project got going just as the Psa crisis was ramping up, the effect of

which was ultimately to see Hayward taken out of orchards and replaced with the Psa-resistant SunGold variety. Another key difference between these cultivars is the Hayward’s greater reliance on winter chilling, making it more vulnerable to a warming climate.

Orchardists had no choice but to adapt immediately, but the CCII project took longer to realise the extent of the transition underway in the industry. By the time its findings were presented in Papamoa, the Bay of Plenty had left Hayward behind.

Nevertheless, the science was exciting. Alistair Mowat says, “[That] modelling...

has helped make the future scenarios of climate change more tangible for growers. In combination with the introduction of new cultivars, as well as information on how leading growers are successfully developing and adopting new management practices to adapt to climate change, the kiwifruit industry is confident about its long-term future.”

As a climate scientist, Andrew says he’s learned a lot about “deep engagement” with stakeholders in the last nine years, from the start of the CCII work right through to joining the Challenge in a leadership role. “The way the Challenge is doing engagement is a completely



Shonita Wikaire and
Horiana Anderson under
the kiwifruit vines.

different model to CCII, which relied on methods of the past: localised case study approaches, investing a lot of effort to bring stakeholders together in the early stages, then reporting back at the end.

“As it is with a lot of science, [in CCII] that true engagement with decision makers in the industry didn’t come to pass. So, I like what the Challenge is trying to do now, with a dedicated engagement programme. A lot more effort and research has gone into building stronger relationships with stakeholders and asking how we can better integrate those key decision makers into our research design. It’s a massively difficult area to be working in. Nobody has got it right all the time, but globally this is becoming standard practice, where the research community talks about co-development, collaboration and co-creation of knowledge.”

“A lot more effort and research has gone into building stronger relationships with stakeholders and asking how we can better integrate those key decision makers into our research design.”

There are parallels in the Omaio project. Embedding community researchers like Peter and Danny into the project – par for the course in kaupapa Māori research – is one way of ensuring the knowledge chain remains unbroken.

A new incarnation of the CCII work is underway in another Challenge project, “Climate change & its effect on our agricultural land”. In partnership with the Our Land and Water National Science Challenge, Manaaki Whenua’s Anne-Gaelle Ausseil

is investigating how climate change will impact the suitability of particular regions for food production.

With case study areas in Nelson, Waikato and Tauranga, Anne-Gaelle’s research pulls together historical knowledge and climate modelling, with a little bit of educated guesswork, to mimic the effects of climate change on local soil

conditions and seasonal patterns.

Communities, industry and government should be able to take these modelling packages and use them to analyse their local or specific needs. A picture of more severe drought may require some communities to invest in water storage or redistribution systems. A picture with increased storm activity might trigger other communities to invest in fruit or crop protection mechanisms.

Anne-Gaelle looks at what we do know and interrogates issues we know less about. For example, how will the land itself absorb carbon, adapt and change? There’s evidence that with more carbon available, plants use water more efficiently. But both scientists and growers are yet to see how this plays out.

While the research is being applied locally there are national lessons to be learned. By identifying a range of likely scenarios and raising some tricky “what if” questions, food producers will be able to assess the risks and plan for those they can’t tolerate.

KIWIFACTS

30%

The global volume of kiwifruit trade managed by Zespri.

► SO GOOD

The humble kiwifruit beats bananas for potassium, oranges for vitamin C, cranberries for antioxidants, and one kiwifruit has more fibre than 4 sticks of celery.

SUNGOLD ◀

The variety of kiwifruit that's so large it looks more like a mango, is resistant to Psa, needs less winter chill, and is now grown in Otaipo and throughout the Eastern Bay of Plenty.

► 2,500

The number of kiwifruit growers in New Zealand.

PSA ◀

The notorious (in NZ) bacteria first identified in 2010, which threatened to derail the kiwifruit industry.

► 102 MILLION

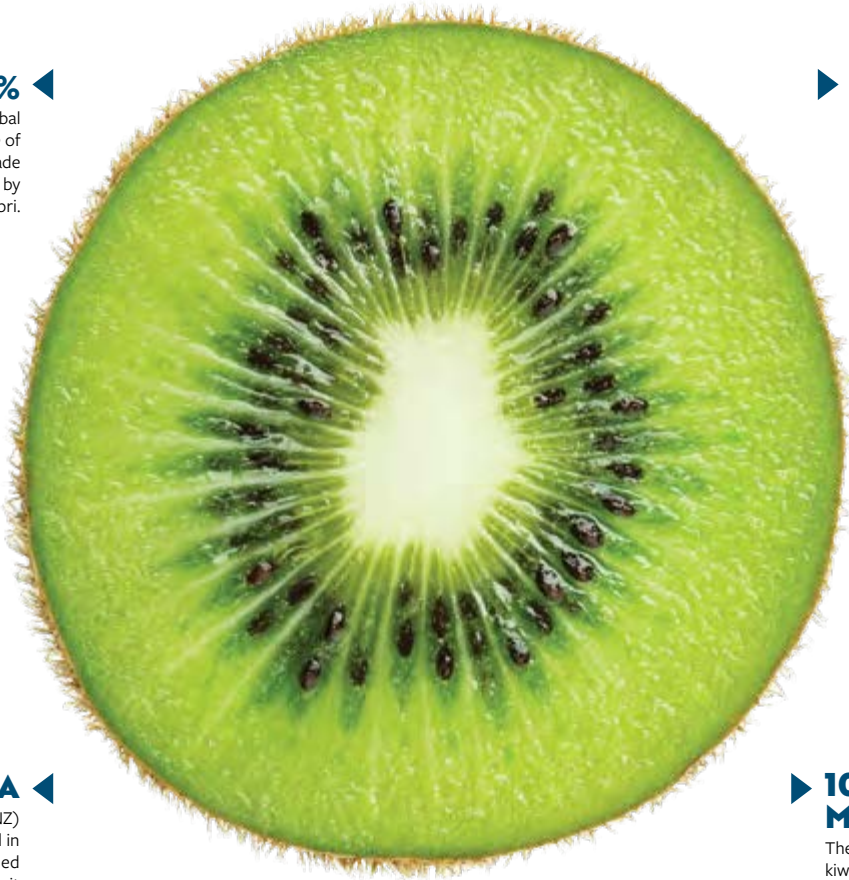
The number of trays of kiwifruit Zespri exported from the Bay of Plenty in 2017.

▼ SAXERBY

The name of the farmer who brought the first pear to Otaipo (called a "native" by Danny Hoihipi because it's been in Otaipo so long). Yes, you're right, this is not a kiwifruit.

▼ \$6 BILLION

The projected contribution of kiwifruit to the GDP by 2030.





Danny and Horiana
outside Otuwahare
Marae in Omaio.



It's an approach that builds resilience and is very much in play in the kiwifruit industry, as Alistair Mowat makes clear. It's also the approach Omaio is taking – analysing the whole landscape before putting everything into a single product.

"IN MY DREAM last night," Danny laughs, "I dreamed I was catching eels. The blimmin' eels, we were pulling them out, and they were already pāwhara, and some of them were in packets! We were pulling them out of the creek like that... These tunas, we were going to be cooking them. Na! They were coming out already prepared!"

I could keep listening to Danny and his hidden metaphors forever. But I'm not Danny's key audience. After school, we pick up Danny's moko Horiana and head to the rocky shoreline, so Danny can show us how the kit he's been explaining to us works in practice.

Horiana points out Motunui on the far coastline, and the adjoining beach where she and her mates launch every morning for waka ama training.

"The kaharoa," Danny says, "is one of the nets that's locally made. It's a long net. The longest net in our history is the Kupenga a Te Huki. It's a living net, it's the whakapapa net that goes from Whangarā mai Tawhiti to Pōrangahou. It's the marriages, the whakapapa links. That's the biggest kupenga. It's a human net, and in it you get all the tribes."

Communities like Omaio have experienced waves of cataclysmic change that may well echo what's coming with climate change. Settler colonialism, land wars, world wars, loss of taonga, including land and fishing grounds, economic

upheaval and cultural loss. I can't help but think that in order to adapt to our changing climate, we could look at the example set by those who've been through it already.

In the face of such fast and drastic change, Danny's toughness, his resilience, causes me to stop and think. He broadens the parameters for a national conversation about adaptation. Neither Danny, Peter or Horiana have expressed fear or anxiety about the future, even though much of Omaio is at sea level, including two marae. Perhaps, sometimes, the antidote for anxiety is connection and action. Danny and Peter

never stop working, and they never stop learning – mastering new technologies and transmitting the lessons of this whenua and their forebears.

For climate researchers and food producers alike, there

is so much to learn here.

The investment to get started in kiwifruit is large – it's not just the orchards, it's the supporting infrastructure like irrigation, water storage and ongoing environmental monitoring. It's about figuring out all the jigsaw pieces required to get land-development moving: finance (particularly difficult on multiply owned whānau land), governance, science, relationships with various intermediaries like packhouses, and enough certainty that whānau will return home to work. Not to mention communications technologies (like phone reception or broadband internet) to support efficient farming or an education system that empowers young people to engage in science.

Over our three days in Omaio, Karamea labours this point, "You got to get the economics working. Otherwise whānau won't come home."



I've been vegetarian since I was 14, and last year I started having three 'vegan' days a week to cut my dairy consumption. I haven't... ah... told my husband and kids about the vegan days and nobody has noticed! I figured that if I told everyone I was cooking vegan, I'd get a lot more whining than if I made delicious food that happens to be vegan. Totally worked. I've also made it to the age of 44 without ever getting a driver's license (though recently I got my learner's). Even after I get the license, I hope to keep my travel mostly to bus, carpool or walking. Honestly, what drives me is too corny for your magazine! It's love – of people, animals, wild spaces. Any time you're doing something out of love, it becomes somehow lighter than it would otherwise be.

SARA MIKALOFF-FLETCHER, atmosphere and ocean scientist at NIWA, working on "Carbon dioxide & the Southern Ocean"



I'm a trustee for Project Rameka, a 93-hectare carbon sink forest in Golden Bay. The land was formerly marginal pasture and is now regenerating native forest, featuring three walking-biking tracks open to the public. The project focusses on carbon sequestration, forest restoration, biodiversity and non-motorised recreation. I'm motivated by a sense of responsibility to future generations and a desire to act now, before we reach the point of irreversible damage.

LIZ KELLER, data scientist at GNS Science, working on "Climate change & its effect on our agricultural land"



Danny and Horiana
on the rocks at
Omaio.



Keeping so many pieces in hand requires a clear vision and a hell of a lot of energy. Luckily, Omaio is not lacking in energetic visionaries. Three generations, from Danny to the Insley brothers to Horiana, are expressing their dynamism in different ways.

Peter is now completing his Masters in Environmental Science at Te Whare Wānanga o Awanuiārangī. He reflects on a day spent up in the hills wrangling with the question of how to tie all this activity together – invasive weeds, water, the kōkako, food production, climate change – in a Māori way. “It sharpens your thinking,” he says. “You take responsibility for your environment. I do know about this stuff. I’m walking the talk. I’m not just sitting in a classroom or an office doing research, when I can’t actually implement it.”

And Danny provides a crucial depth to the national conversation about sustainability, resilience and risk management. He compels us to maintain an integrated vision that’s responsive to the climate and to the community, and that focusses on building connections – between disciplines, between generations, between science and the communities it serves.

I sometimes feel that a sense of the bigger economic, cultural and relational picture is overlooked in “mainstream” science. But in describing the breathtaking

technology of a massive, hand-made fishing net, and speaking both in practical language and in metaphor, Danny finds the relationships between food, technology, trade, sustainability and productive community. He holds an unbroken line from his tūpuna to his grandchildren –

a unifying theory and practice I feel we might all try to aspire to.

“That’s all in this pātaka kai,” he says. “It’s the living whakapapa. That’s a pātaka. The knowledge is a pātaka kai,

our knowledge. So we fill our pūkuro with the knowledge of this unbroken chain. It’s what’s keeping us together, from our forefathers to us today. It’s in our hangarau, our everyday use of taonga tuku iho. It’s fortunate that we’ve got books now, today, to help preserve it. And rorohiko, another form of preserving. And it may be that we are the last frontier, with all this ancient pātaka kōrero.”

Balancing on the rocks, Danny hands his kete to Horiana. “Here, hine,” he says to her. “You take it. You see,” he chuckles, “you’re the new net.” Ka pū te ruha, ka hao te rangatahi. ●

“That’s all in this pātaka kai. It’s the living whakapapa. That’s a pātaka. The knowledge is a pātaka kai, our knowledge. So we fill our pūkuro with the knowledge of this unbroken chain. It’s what’s keeping us together, from our forefathers to us today.”



OTHER CHALLENGE PROJECTS THAT TELL A NATIONAL, OR A VERY LOCAL, STORY ABOUT WATER IN OUR CHANGING CLIMATE

DRINKING WATER IN TE HIKU O TE IKA

Three isolated communities of the Far North – Te Kao, Pawarenga and Motukaraka – are preparing for the impact of climate change on household drinking water.

MAKING ROBUST DECISIONS ABOUT NEW ZEALAND’S WATER

Large-scale water storage facilities are expensive and when climate information is still uncertain, investment decisions need careful and staged planning.

DRINKING WATER, DROUGHT AND CLIMATE CHANGE

What risks might future droughts pose to our drinking water in New Zealand?

CLIMATE IMPACTS ON THE NATIONAL WATER CYCLE

Identifying where New Zealand’s water cycle is most vulnerable to change.

SIMULATING NEW ZEALAND’S CHANGING CLIMATE

A global climate model representing our southern hemisphere more accurately in turn provides better regional and local information, including about our changing water cycle.



nzgeo.com/climate

Stories, images, video pondering an uncertain future,
in association with the Deep South Challenge.



CONFRONTING THE WORLD'S BIGGEST PROBLEM

[STUFF.CO.NZ/CLIMATECHANGE](https://stuff.co.nz/climatechange)

stuff



ADAPTATION CHAMPIONS

Proactive, timely and well-planned adaptation to climate change depends, in part, on the quality of the relationships between researchers and decision makers. These “adaptation champions” are working to bridge the gap between science and society.



TIM NG

Deputy Secretary, Chief Economic Adviser,
Treasury New Zealand

Tim Ng works in the leadership team of Treasury New Zealand, making sure that Treasury's advice on raising living standards is underpinned by sound evidence. He's also been a treasured member of our Representative User Group since its inception.

"Being involved in the Deep South Challenge has definitely influenced my thinking," Tim says. "I'm a big believer in multi-disciplinarity, and the Challenge is a great example of its strengths. Understanding the science better, what it tells us and what it can't yet, and the interface with economic decision-making, has been fascinating."

Climate adaptation is very much a live issue in Treasury's thinking, and several Deep South Challenge projects have presented findings directly to Treasury. Tim explains, "We're charged with anticipating and advising on the long-term economic and fiscal outlook, so climate change and its impacts is one of the megatrends most relevant to our work."

Treasury has also recently introduced a new well-being framework. There's tangible common ground between the framework and the approaches being taking in some of the Challenge's social science and kaupapa Māori research. In his gently spoken way, Tim talks about how Treasury's work, as well as his own, is values-driven.

"My values centre around our common humanity, the power of evidence and science to improve human lives, and the desire to make the world a better place. They come from everything our wonderful country provides us and which we are moved to protect and build on for future generations."

In 2018, Tim addressed a young crowd of budding economists. He said, "The story [about economic growth] needs enrichment so that it better reflects the context and complexity of real life." Would Tim describe himself as a story teller, as well as an economist?

"Human beings," he says, "respond at a very basic level to stories. Many economic phenomena can be understood

in terms of a beginning and an end, tension and resolution, even heroes and villains. Even better if the story involves the audience in the action. Fortunately, economics is a social and behavioural science, so it isn't hard to bring human stories into the economics."

The Challenge also has several research projects that incorporate economic modelling and physical climate modelling. And this question – of dialogue and co-development on research – is key to the mission-led science underway in the National Science Challenges (NSCs). Tim agrees. "I think there should not only be more dialogue –

drawing on the excellent practices developed through the NSCs, for example – but also collaboration."

Tim continues, "Each of us brings a particular framing to the evidence, drawing on our expertise and experience, but that unavoidably implies that we each have blind

spots. The stories we tend to tell from the perspective of any particular discipline can be oversimplified and risk reaching only a narrow audience. Natural scientists, economists, sociologists, political scientists, legal theorists and others are all necessary to effect the kind of large-scale social and economic transformation we need to adapt to and limit climate change."

With the power of an omniscient narrator, would Tim see the Challenge do anything differently? "No, not necessarily. The Challenge is doing great stuff in reaching out to and involving key stakeholders. I would just urge us all to continue asking hard questions, pointing out inconvenient truths, and confronting the many elephants already in the room."

Tim suggests that people need to accept that climate change, and the way it will impact our economy, is going to be massive. "It's going to hurt, both in the pocket and in just about every aspect of life as we know it. But there are also possibilities and opportunities. People need to be curious about that, because curiosity leads to innovation, action and change." ●





TANIA HOPMANS

Deputy Chair, Maungaharuru-Tangitū Trust,
“Exploring coastal adaptation pathways for Tangoio Marae”

Tangoio marae sits on the frontline of climate change. As with the rest of the Hawkes Bay coastline, coastal erosion is an issue. But the main threat for the marae comes from flooding, and the potential for more severe flooding as the climate changes.

Tania Hopmans notes that her hapū has no choice but to adapt if they are to hold together. Fortunately, thinking on their feet is in their whakapapa: “Our tipuna survived by adapting whenever they needed to, and we will too. They had a whakatauakī – ko tō rātau pā kai ngā rekereke – their pā were in their heels. They moved with the seasons to collect kai, they moved from one pā to a safer one following an attack.”

Tangoio has a unique social and political history, as well as unique whenua, awa and moana whose voices must also be heard. Already, Tania explains, due to farming and plantation forestry, “most of the native bush is long gone. There’s no riparian planting along our awa, so we have erosion of our whenua, sedimentation of our waterways and coastal reefs, and the obvious impact on our taonga species – including pātiki, tuna and kuku.” The needs of the whenua and the hapū are now closely merged with the imperative to respond to climate change. “We need to return some balance to the environment,” Tania says.

Tangoio (through the Maungaharuru-Tangitū Trust) partnered with NIWA and the Deep South Challenge on a project looking at how a marae community might make decisions about their key taonga, such as their whareniui, at risk in a changing climate. The research partnership was able to bring independence and information into a hapū discussion that was “fraught with some misinformation, strongly held views and emotions.”

One highlight for Hopmans was a game the project developed called Marae-opoly. “We had teams of whānau with paper money making decisions about what to do with our marae. [We had] flood simulations over

a 100-year period – the catch being you didn’t know what the next 10 years would bring until the simulation played. The whānau really got into the game,” Tania tells us, “and learned a lot about how complex the problems are – the pressures, costs and benefits of choosing an option, and dealing with the consequences. It was a safe environment for whānau to give it a go.”

In terms of research challenges, Tania notes that “the modelling looked at flooding from the river, but didn’t take into account flooding from the hills, which we later learned had a significant impact on flood mitigation and what options would be viable.”

From Tangoio’s unique experience on the climate frontline, they have some advice for other marae communities facing similar decisions. “Have an agreed vision, values and guiding principles. You’ll want to refer back to these when the going

gets tough. Our vision was ‘building a proud, vibrant and modern marae’. Our values included unity and being progressive. Our guiding principles were disciplined people, thought and action.”

Crucial, Hopmans explains, is finding ways to include all voices. “Good decision making takes time and is hard work. It required us to invest in the best available information, to get help from a facilitator and other specialists, to test assumptions and engage in difficult conversations, and sometimes with difficult people.” Yet for Tania, the urgency is clear. “Be brave, future generations are counting on you.”

Tania is also skilled at stepping back and surveying the bigger picture for Māori communities and their respective local and regional councils, as we all adapt to climate change. “Marae are part of the communities you serve,” she says. “Look after them, too... Don’t focus your efforts only on protecting infrastructure or areas seen to be economically important. Nor on research for research’s sake.” ●

ADRIAN MCDONALD

Deep South Challenge Programme Lead,
Processes and Observations

The Director of Gateway Antarctica, recently promoted professor at the University of Canterbury, and the science lead of the Challenge's Processes and Observations programme, Adrian is also principal investigator on the research project, "Clouds and Aerosols over the Southern Ocean". He's a cloud watcher! But in his busy daily life, he keeps his feet firmly on the ground.

"My involvement in the Deep South Challenge has highlighted the urgency to make better climate projections for the future of Aotearoa New Zealand. Whenever I consider new research efforts or ongoing work, I now ask the fundamental question, 'How will this potentially improve climate model predictions?'"

Adrian and his team examine specific physical processes happening in the Southern Ocean, on the Antarctic ice, and in the overlying atmosphere. In comparison to the Northern Hemisphere, with its proximity to the research epicentres of Europe and North America, the Southern Ocean is not well understood by climate science. In turn, what's happening in Antarctica is not well-represented in global climate models.

The decision to focus on improving the models sounds obvious, but Adrian explains that often, observational work stops at model evaluation. That is, physical science is geared towards understanding how well our climate models simulate reality. The next step, of identifying flaws or strengths in the models themselves, is often missed. "This second step," Adrian explains, "is critical to help modellers make the simulations better and reduce uncertainties in climate models." This is the focus for the joint work between the "on-the-ground" scientists and the climate modellers in the Challenge.

"I might spend my life fixing small issues," says Adrian, "but a key piece of information I always tell people is that these models are good. They have real predictive power."

The constant barrage of climate research, from the mundane to the apocalyptic, must have an impact on

the way the general public receives the science. A recent Nature GeoScience article, for example, suggested that stratocumulous clouds might disappear from our lives by the end of the century.

Adrian responds, "There are many papers out there that detail the potentially disastrous effects of human-induced climate change." Adrian sees his job is to inform people about these potential futures and to translate detailed climate studies into information people can actually understand. "While I'm sometimes pessimistic about the way the world is going," he says, "I'm optimistic that the younger generation particularly are going to demand action. So my job is to keep them informed and

make sure they know that some research might be overblown by the media. Stratocumulus disappearing would be a very long way down the track."

Adrian was very involved in solving the problem of the ozone hole. Does he believe the planet can heal, the way the ozone hole has healed? "The science around the ozone hole and the corresponding global efforts to make policy (the

Montreal protocol) are definitely a success story. I think climate change can still follow the same path. There were doubters about CFCs affecting ozone at first. But, once the science was beyond dispute, things changed. We are at this point now. The science [about climate change] is unequivocal."

Adrian is flexible and generous in the way he works with the many other disciplines involved in the Challenge's research.

"All the time," he says, "it's important to understand that while climate science is well developed, it's only one set of evidence that stakeholders have to consider. There are some great articles by Sir Peter Gluckman on science advice to government that every scientist should read. When I talk to stakeholders and the general public, the kinds of questions they ask are nearly always a surprise." ●

"I'm optimistic that the younger generation particularly are going to demand action. So my job is to keep them informed and make sure they know that some research might be overblown by the media. Stratocumulus disappearing would be a very long way down the track."



ANITA WREFORD

Lincoln University researcher,
“Making robust decisions about New Zealand’s water”

Anita Wreford is an expert in the economics of climate adaptation, particularly in the natural environment, agriculture and forestry sectors. She’s been involved in many fields of climate research, from infrastructure to agriculture to trade.

“Agriculture is the sector I’m most familiar with,” Anita explains, “and most of my career has been in institutions with a primary-sector focus. But I’m always interested to learn about the issues in other sectors and contribute if I can.”

Given the primacy of the national economy in supporting timely and well-planned adaptation, it seems vital that our country has enough economists researching the climate. But Anita tells us that in New Zealand, “we definitely don’t have enough economists or social scientists in the climate change space! I’m trying to fill a knowledge gap that will make a real difference to real people.”

Anita’s project is introducing a tool – Real Options Analysis (ROA) – to decisions being made about water storage. At present, few large investments in New Zealand consider climate change in their decision-making process. ROA places explicit value on flexibility – making investment as efficient as possible and adaptable to a range of climate futures.

Anita has developed solid working relationships with people on the ground – from irrigators and engineers to farmers and policy experts. Have these relationships changed the way she works?

“Yes, I think so. These relationships definitely bring a sense of reality to some of the academically interesting but less practical work I might have thought was a good idea. I try to keep my research relevant and tailored... I hope [the particular audience] feels empowered to make decisions despite the uncertainty they face.”

Anita has worked around the world, with the IPCC, the EU Commission, the OECD, the UK’s Committee

on Climate Change and the Scottish Government’s ClimateXChange programme. She’s well-placed to assess how New Zealand is stacking up.

“Aotearoa has an opportunity to learn from what’s worked and what hasn’t in other countries’ experiences. We are quite late in starting to think about adapting to climate change, and will have to work very hard to make sure we can cope with the changes we’re already beginning to experience. I think some of our institutions and practices haven’t quite grasped the urgency and the need to radically rethink how we do things.”

Does Anita think what the Challenge is trying to do

is achievable? What would she do differently? “I think we need a much greater emphasis on supporting the implementation of adaptation. We have a reasonable knowledge of how the climate will change, now we need to focus on enabling good planning, decision-making and implementation. We see examples of the urgent need to support and empower

“We need to focus on enabling good planning, decision-making and implementation. We see examples of the urgent need to support and empower national and local government, the private sector and communities grappling with climate-related challenges.”

national and local government, the private sector and communities grappling with climate-related challenges. Look at the recent flooding on the West Coast! I think the Deep South Challenge has a responsibility to lead this work and make a difference.”

Working at the interface of climate science and decision-making could easily be frustrating, and yet the daily honing of key messages means researchers like Anita are well placed to consider what people need to understand, now.

“This is urgent!” Anita says. “Everything we value is at stake if we don’t reduce our emissions! But regardless of the level of global emissions reductions we achieve, we will experience some changes in climate. We need to start planning now, across all sectors, and all levels, and do things differently, to minimise the disruption this will have. And maybe in the process we can even make New Zealand a better place to live.” ●





SAM HUGGARD

Secretary, NZCTU | Te Kauae Kaimahi

Sam Huggard is a driving force for climate change mitigation in Aotearoa, as well as for a just transition to a low-carbon economy. He represents that fundamental engine of our economy – our workforce. What inspires him to keep driving for change?

“We have a saying in the union movement that there are no jobs on a dead planet,” Sam says. “Climate change is coming. It’s probably the most significant issue to affect working people. I have a sense of obligation to New Zealand workers, to make sure their voices are front and centre in our planning.”

Sam’s been a member of our Representative User Group for a while now, which has been useful, he says, “in part through hearing how other sectors are planning their work. The union movement is very much in the mitigation space, so it’s been advantageous to get on top of the issues around adaptation.”

While the union movement sees that mitigation is the most pressing issue, bearing the highest risk of rapid economic disruption for working people and their families, it acknowledges that workers have a wider interest around adaptation challenges. “The key learning,” says Sam, “is making sure that the people affected by change – be that mitigation efforts to reduce greenhouse gas emissions or adapting to sea level rise or adverse weather – need to be there helping to plan the response.” Sam believes there are lessons we can learn from communities who’ve gone through previous transitions, including those caused by natural disasters, such as in Christchurch.

Echoing the principles of the recent Climate Change Adaptation Technical Working Group (CCATWG) report

(including *We adapt together, in partnership – ara whakamua*), Sam emphasises the importance of involving everyday people in the decision-making process. “Climate change is a social issue that can be collectively decided,” he says.

“If there are particular communities who are heavily affected, like those in low-lying areas or regions especially exposed to extreme weather events, then I want us to gather round and support these people collectively, not just leave them to fend for themselves.”

In a recent blog post, Sam wrote, “big transitions in work can make people anxious. New Zealand hasn’t done them well before.” Facing and managing anxiety may well be key for effective climate adaptation. “Knowing there is a plan in place to help New Zealand

transition will be critical,” Sam agrees. “If workers can see a future for themselves in a decarbonised society – in which they can contribute, have good jobs, see a future for their kids – they’ll be up for the changes we need to make. If change comes too quickly or is poorly planned, this creates anxiety.”

Reflecting on what’s working well in the Challenge, Sam says, “I think what’s critical is that there is a two-way conversation. Sector bodies, like the one I represent, need to do the work with our communities to find out what they need.” He doesn’t expect the Challenge to do everything – handing workers, for example, a snappy digest of climate information on a plate. “It’s really up to us to work out what information and science we need, for our constituencies – and make this clear to the Challenge. In other words, we have to meet half way – and design the response collectively.” ●

“It’s really up to us to work out what information and science we need, for our constituencies – and make this clear to the Challenge. In other words, we have to meet half way – and design the response collectively.”



PRIYA KURIAN, DEBASHISH MUNSHI, SANDY MORRISON

University of Waikato researchers, “Culture and Climate Change”

Unique among the NSCs, the Deep South Challenge has a research programme dedicated to understanding the nature of engagement, as well its practice and evaluation. Its major research project looks at the way culture influences people’s decisions about adapting to climate change.

The energy bubbling through this research trio from the University of Waikato is infectious, and speaks volumes about the work culture they themselves foster. “Yes!” they respond, collectively. “We have a collaborative research culture with no hierarchies or centres of authority. We draw our inspiration from our research participants, students and inter-disciplinary collaborators. We don’t have a designated leader – we follow each other’s lead.”

It must be somewhat difficult to frame a project around culture, when people interpret the idea of culture so differently. “‘Culture’ means many things to many people,” they agree, “and we don’t think there is a common understanding of the word in New Zealand. To some, it’s synonymous with ethnicity; to others, it stands for certain customs, traditions or behavioural characteristics that bind particular groups of people together... We tend to align with the late cultural studies theorist Raymond Williams’ reading of culture as ‘lived experience’. In other words, we see culture as the way people make sense of their everyday lives.”

Their research focusses on the tourism industry, which is particularly vulnerable to our changing climate. Tourism is an excellent prism through which we can understand how culture influences the choices we might make about adapting to climate change. “Tourism is built on the cultural narratives of a place. What draws tourists to a land and what tourism providers offer to attract tourists tell us a lot about the importance of values, place and practices that underpin culture. The tourism industry demonstrates the critical need to start changing these narratives – by adopting key Māori values, for example – in adapting to climate change.”

“We see this also with many Māori narratives that offer insights into natural phenomena and spark so many enlightening ‘aha’ moments. They show us the possibilities for public engagement on climate change adaptation.”

And yet the media, the “general public” and researchers themselves sometimes assume there are values and even emotions that all Kiwis share. How much does the team think this is true or not true? “We hear a lot about ‘Kiwi values,’” they say, “as if there’s one definitive set of values that’s common to every New Zealander. We don’t believe that’s true. This is a diverse country, not just ethnically diverse but also in terms of socio-economic status, access to resources, geographical location, political, cultural and ideological leanings, and circumstances of life... People have

different approaches to what is ‘valuable’ in their lives.

“At the same time,” they continue, “values such as manaakitanga and kaitiakitanga and many other values from te ao Māori are woven into our cultural and social landscapes here, and shape our diverse ways of being New Zealanders.”

One key manifestation of culture is story-telling, whether through movies, novels, press releases or even in tweets. “Over the summer,” the team tells us, “we read a huge amount of climate fiction. Reading dozens of novels and short stories, we realised the power of stories to get the message of climate change across to communities. We see this also with many Māori narratives that offer insights into natural phenomena and spark so many enlightening ‘aha’ moments. They show us the possibilities for public engagement on climate change adaptation.”

Some Challenge researchers have talked about supporting their children to attend the recent high school students’ climate strike. The research trio takes this support one step further.

“The recent School Strike 4 Climate showed us that our young people ‘get it’. It’s time the adults came through too... Wouldn’t it be great to work with those who currently have no say in the electoral process to develop plans, policies and recommendations for action on climate change and climate adaptation?” ●

DAVID WRATT

Chair of our Independent Science Panel (the ISP)

David is a softly spoken person who seems to tread lightly on the earth. He's an emeritus researcher with NIWA – whose lifelong contribution transcends ordinary employment relationships. He's the chair of our Independent Science Panel, and so is one of the Challenge's wise minds. We suggest he might also be likened to one of the grandparents of climate science in New Zealand.

"Over the past three decades," David reflects, "I've drawn on and explained the research of many talented climate scientists – to stakeholders in New Zealand and internationally. I've also helped scientists plan, prioritise and resource their work, in consultation with end users and with funders. So I feel more like a farmer encouraging things to grow, than a grandparent."

The ISP provides the Governance Group with independent science advice, including about science strategy and priorities. "We also help with assessments of science quality and performance," David explains. "We have robust discussions which usually, but not always, reach consensus. If there are different views, we explain these to the Governance Group, to help them make decisions."

It must be exciting, but also perhaps surreal, to nurture the waves of young graduates as they set out to understand, describe or even pose solutions for our climate. If David could write his young scientist self a letter, we wondered, what might it say?

His advice is succinct. "Talking with people – stakeholders, research users, members of the public, scientists of many disciplines – is really important. Don't over-rely on emails!"

David also reflects on the range of voices he's encountered throughout his research career. "When I started work in the 1970s, I shared an office with Edith Farkas, a Hungarian refugee who carried out important early research on monitoring stratospheric ozone. I've been lucky to work with very talented Māori and Pasifika colleagues. While I was on the Bureau of the Intergovernmental Panel

on Climate Change, I worked closely with people from all parts of the world, whose disciplines ranged from climate modelling to economics. I've learned that diversity brings strength."

Fifty years since David began his research career, the public conversation on climate change is finally picking up speed. How does David feel about the speed of science – is it moving fast enough?

"I don't think 'science' is the primary constraint to the frustratingly slow speed with which the world is addressing climate change," David responds.

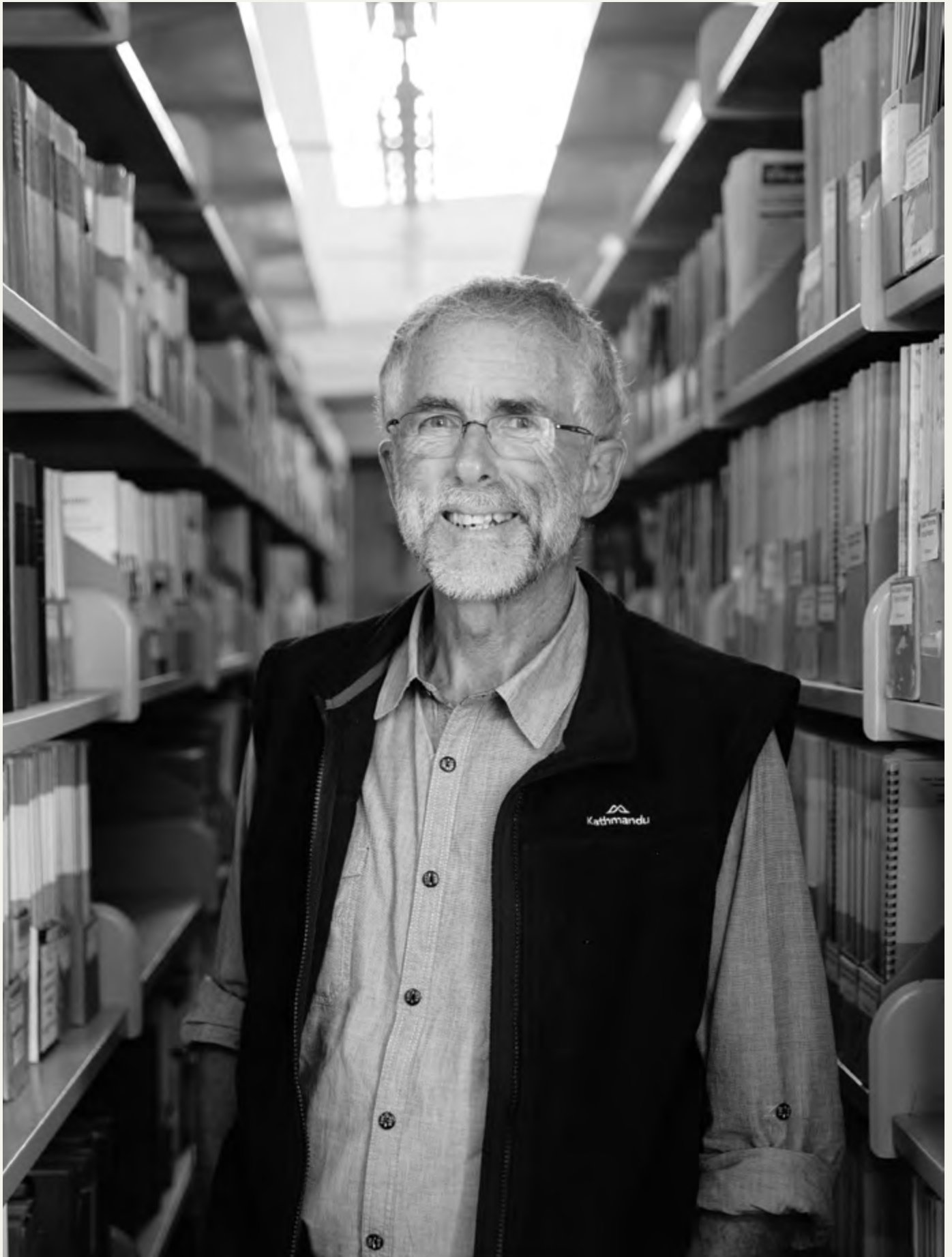
"It's complex, fraught international political processes. That said, robust scientific knowledge across a whole range of disciplines – social and biophysical science, engineering, economics – is very important for informing detailed decision-making"

He continues, "There are never enough resources... So the challenge

becomes understanding and addressing the most important gaps, to progress the science and to inform action. Earlier in my career, we went through a rather dark and difficult period of cut-throat competition for dollars between organisations and disciplines, and the Challenge is heading in the right direction. My biggest frustration is that, given the need to focus our limited resources, not all of the exciting ideas I have seen put forward can be funded."

As one of the people charged with navigating a path for the Challenge, does David believe the Challenge is on the right track? "Yes, I do... The stakeholder dialogues, the excellent work within the Vision Mātauranga programme, work like this has enabled the Challenge to engage with user communities, identify their needs, and co-develop research plans. Achieving the Challenge's mission depends on many players," David concludes. "So collaborations remain vital. The Challenge must continue to focus its research on selected topics where its efforts will make a major contribution, including building on its specialist modelling work, while continuing to engage with the broad effort to build New Zealand's resilience to climate change." ●

"Earlier in my career, we went through a rather dark and difficult period of cut-throat competition for dollars between organisations and disciplines, and the Challenge is heading in the right direction."



LESLEY SMITH

Principal Data Scientist, Water New Zealand

As the principal data scientist for Water New Zealand, Lesley's knowledge about water runs into the megalitres. Lesley represents Water New Zealand on our Representative User Group, which is the principal voice for the sector, encompassing the three waters. We think there's not much Lesley doesn't know about water, but she disagrees.

"There's so much I don't know! So many questions about our water environment remain unanswered. Even a question as simple as 'where do we use our water' is intractably hard to answer. It's great that the Deep South Challenge has an interest in helping connect our sector with the science that can plug some of the gaps. We have plenty of thorny problems scientists can help us find answers to. I'm talking in particular about our drinking water, wastewater and stormwater networks."

Lesley's been a champion of Challenge research to the water sector, and vice versa. Her work seems largely to be about translation – translating climate research into information that people on the ground, from planners to engineers, can use. But there are hurdles to successful translation, as well as opportunities. "Being present in the regions," Lesley continues, "and having time to share information face-to-face with our members, is really important. But it's a big challenge. I recently sat in on an online Challenge hui and see heaps of potential for this format to share knowledge in the future."

The Challenge has several projects in the water space, from the 'whole of life' water cycle, to more practical projects looking at water storage, drinking water, or issues for our storm and waste water infrastructure. Lesley takes her pick of the projects.

"I'm interested to see how the 'drinking water, drought and climate change' project pans out. In New Zealand, we're not always the best at planning for future drinking water

demands. That's understandable – it generally feels fairly wet here! I'm hopeful this project will not only improve our understanding of how climate change might alter things, but will also encourage a more forward-looking approach to water supply and demand management."

Is the Challenge on track when it comes to matching climate science with the needs of key stakeholders like Water New Zealand? "The Challenge has been great at matching science with stakeholders, in particular through the dialogue process. One issue I see with this is that most stakeholders seem to represent different sectors at a national level. As a result, most projects don't appear

to respond to the local challenges being faced at a community level. I think there is big potential for more projects that work with communities as case studies."

For obvious reasons, the National Science Challenges are restricted in scope. The Deep South Challenge does not look, for example, into the effects of climate

change on biological systems. Nevertheless, suggests Lesley, this work mustn't be forgotten. "Linked with the work above," she says, "we need to understand the adaptation challenges that will be faced by our aquatic ecosystems. It seems likely that human needs will get priority if, or when, we start moving into a more water-constrained world. What will this mean for our aquatic ecosystems?... Work to understand how we can assist our flora and fauna adapt is falling through the gaps – at our peril. We depend on the ecosystems that surround us."

Lesley carries herself carefully – her baby's due any day. As our interview closes, she reflects on the future world she's working to bring into being. "By the time my kids get to work, I hope we have stopped hiding behind the notion that 'nobody owns our water'. I hope we've come up with a fair way of allocating and valuing water, that addresses pointed questions around iwi rights and interests." ●

"I'm hopeful this project will not only improve our understanding of how climate change might alter things, but will also encourage a more forward-looking approach to water supply and demand management."





MOIRA POUTAMA AND AROHA SPINKS

Researchers with Taiao Raukawa,
“Risk management for Māori coastal assets”

We meet Moira and Aroha on their ancestral whenua in the Horowhenua, between the mountains and the coast. They reluctantly agree to be photographed, encouraging us to represent their whenua on film instead.

The wetlands they show us, including the restored coastal dune ecosystem of Lake Waikorangomai, were not long ago as barren as the adjacent paddocks, grazed by cows. Now the whenua is returning to life, and wetland birds alight among harakeke and tī kouka.

Where do the women feel happiest carrying out their research? Moira and Aroha respond together, “Whenua, moana, awa, roto.” On the land, by the sea, in the rivers and lakes.

The restoration work is extraordinary, but Moira is quick to point out that as community researchers, they are following in the footsteps of many others. The first phase of their research – a project also led by Huhana Smith of Massey University – combined data about soil, floods, topography, river sedimentation and sea level rise, to identify the most vulnerable areas of the hapū’s coastal farms. The research team used an interdisciplinary approach to identify indicators of change and staged strategies for adaptation.

In this, the second phase of the team’s research, they’re looking at additional physical processes, such as future change in groundwater levels, and identifying a wider range of options for managing wetlands and landscapes.

They see huge potential to re-plant the coast in harakeke, which was flourishing before the land was cleared for farming. The team are also investigating the

potential to establish a harakeke industry for the hapū.

Moira and Aroha are part of the community their research is about. “Tautoko rātou i tēnei kaupapa,” they tell us. “The landowners have led this research with their aspirations and are highly supportive of this kaupapa.”

Equally, their research changes to meet the aspirations of the community. Whanau- and landowner-led research is important to the team, as is a collaborative research approach that is able to respond to the aspirations of landowners.

The team is researching on specific whenua. Do they feel like the whenua itself is one of their end users?

“Āe,” they say. “Whenua i te ao, i te po. Ka taea te whenua te kōrero ki a mātou. Ancestral landscapes, steeped in tradition and tohu, speak to us.”

Towards the conclusion of the first research phase, the team presented a remarkable final exhibition in a cleaned-up series of disused dairy sheds. It was

made even more remarkable when an ephemeral rainbow rose from the ground nearby.

As researchers on a project about our changing climate, the imperative to adapt may well compete with the imperative to respond to what communities want and need. But neither Moira nor Aroha see it that way. “E rua, e rua,” they say. “They both have equal importance. Our collaborative team respond to both equally.”

Finally, we ask the duo whether Aotearoa has enough community-based researchers who are working on the question of climate adaptation. Their answer is simple. “Kāo.” It’s a good word to learn in te reo Māori. It simply means, “no.” ●

“Whenua i te ao, i te po. Ka taea te whenua te kōrero ki a mātou. Ancestral landscapes, steeped in tradition and tohu, speak to us.”

JACQUI HASTIE

Climate Adaptation Programme Manager,
Wellington City Council

When Cyclone Gita hit New Zealand at the beginning of 2018, Makara Beach had the greatest concentration of damage in the Wellington region. In the months afterwards, the Makara community, in partnership with the Wellington City Council, began the difficult process of deciding how it would adapt to the “new normal”. Jacqui Hastie led the project, which has been striking for its speed and success in reaching consensus decisions.

Jacqui took several lessons from the process. First, she says, “We don’t need to tell people what they think or need to do. Councils can lead this by empowering communities to make their own choices and supporting them through access to good information.”

Secondly, Jacqui believes that focussing too heavily on the risks and worst-case scenarios can reduce the potential to recognise opportunities. “We need to be ambidextrous,” she says. “Of course there is a need to identify the risks and uncertainties, but let’s not get stuck thinking there is no upside. We need to think creatively and stay open to new opportunities.”

Others have noted that Jacqui’s leadership, as well as her communication skills, were key in the success of the Makara Beach project. But is she up for doing it again? “Absolutely, I loved it. I loved the way we all learned from each other.” But while she feels closely connected to Makara now, Jacqui notes that, “Each community has to be looked at independently and each adaptation process has to be co-created with the people who live, work and play there.”

As someone working at the flaxroots of climate adaptation, Jacqui is well-placed to comment on the gaps between climate research and the needs of both councils and their communities. She sees a need to

work more closely together and to find ways to make science and community engagement more aligned.

“One way we can do this,” she says, “is through the language we use. Unfortunately, the jargon that comes with climate science can be really exclusive. Terms like ‘adaptation’ and ‘managed retreat’ are abstract and potentially unhelpful when talking with communities, if no one knows what they actually mean.” Jacqui lists some of the other acronyms and science jargon at play in climate adaptation research. “Don’t even get me started,” she sighs.

Jacqui sees the need to be mindful that people are looking for reasons to distance themselves from climate change issues. We can’t let our language be a barrier. “Climate science is most helpful when it’s focussed on people and it doesn’t sound

like science. One of the ways that I think the Deep South Challenge can support this is to continue to make the science accessible.”

Jacqui is grappling with the future of a coastal city that is highly exposed to climate change. But she is full of hope for Te Whanganui-a-Tara. “I see Wellington as a place that is learning to embrace its natural hazards and has found innovative ways to live with them. People choose to live and visit here because we have accepted that change is necessary and we’re making the most of that opportunity. We’ve been bold enough to re-imagine a CBD that works for the next 100 years and is designed to be redesigned over the next 500.

“People who live here understand that living with risk is just called living in Wellington.”

If you want to learn more about how the Makara community set about this difficult conversation, visit www.wgtn.cc/makara-project ●

“People who live here understand that living with risk is just called living in Wellington.”





PORT ROAD

Climate risks at our urban edges



LORRAINE TAYLOR

|



SYLVIE WHINRAY



MEET THE ROBINSONS

IT'S A CALM SUNDAY morning as I arrive at the home of Wellington property investor Paul Robinson, in the thriving beachside community of Plimmerton. Armed with muffins from the local café, I'm greeted by Paul's friendly border collie Harry, who herds me into a stunning, carefully designed house.

Natural materials enhance the beauty of the coastline. Paths are planted in native coastal grasses and integrate with, rather than seal, the ground underfoot. Cedar cladding is weathering gracefully. The high-spec insulation and double-glazing were revolutionary Northern Hemisphere concepts at the time of building. Concrete flooring retains heat in winter and keeps things cool in summer. In short, the house is efficient, reflecting the Robinson family's broader approach to property development.

Paul hands me a strong coffee, and we survey the concrete sea-wall separating the

property's edge from the sandy beach, a drop of little less than a metre. This glorious piece of paradise is regularly battered by westerly storms, and on a high tide there's no beach to speak of.

I first met Paul Robinson several years ago. His family business had grown beyond the work of one person, and his warm optimism belied his personal circumstances. He was grieving, after a significant loss and a transition to a life as a solo dad.

True to character, today Paul is relaxed and cheerful, though he really shouldn't be – he and his fiancé Julia have family arriving imminently for their wedding the coming weekend.

But he does love talking business. For Paul, property development and the environment are two entirely reconcilable concepts. Their business provides the Robinsons with an opportunity to create spaces people love to be in and that reduce the environmental impact of the buildings and the industries located within them.

CLIMATE CHANGE POSES a significant threat to low-lying and coastal urban infrastructure, including commercial and industrial property. These are the buildings in which we work, create, shop, eat out, live and play.

The Robinson siblings, property owners Sam, Paul, Cathy and Meredith, consider ethics and the environment in their decision-making matrix. They favour modern, eco-friendly builds and they retrofit character buildings to improve efficiencies in water, waste and energy. They see the risks of climate change on the horizon.

The family are flexing their adaptive muscles on a new purchase in Lower Hutt's Seaview, a landscape with multiple hazards. This part of the coastline faces the risks of liquefaction and tsunami in the event of an earthquake, flooding from Te Awa Kairangi (the Hutt River) in heavy rain, and will be among the first of Wellington's suburbs to feel the touch of our rising tides.

How the property, as well as the family business, plans for and responds to



Residential housing alongside the beach at Plimmerton, to the north of Wellington (photo by Rob Suisted). Opposite: Storm clouds gather behind the Robinson's property at Port Road in Seaview.





exceptional, climate-driven weather, will determine the impact these events have on the family's livelihood, as well as the lives and livelihoods of their tenants and surrounding communities.

And as once-exceptional events become more common, the way we as a nation build climate knowledge and climate resilience into our infrastructure planning, economy and political system will determine whether they are somewhat of an inconvenience, or utterly disastrous.

The Robinsons hope their experience and track record have prepared them for their latest challenge. But will triggers and forces beyond their control derail their plans and dreams?

PORT ROAD AND OTHER EXCEPTIONAL WEATHER EVENTS

THE FAMILY'S LATEST acquisition is a large industrial park on Port Road. The area was once at the centre of New Zealand's car manufacturing industry and is still chockfull

of heavy industry. Most of the park is leased to a steel tube manufacturer, and a serious array of equipment and products are spread across multiple factory floors.

The weather's dramatic when we arrive. Clouds rush through a metallic sky. Rain hits us in sharp bursts. It's weirdly warm.

Port Road is jostled between low-lying Petone and the narrow coastal strip of Eastbourne (which is periodically cut off from adjacent suburbs by slips). The whole coastline groans when storms and heavy rainfall coincide with spring or high tides.

The morning radio bulletin warns of a storm brewing on the West Coast of the South Island. By midday, it's been termed an "exceptional rain event" and a state of emergency has been declared in the Westland District Council area from Hokitika to Haast. The road between Franz Joseph and Fox Glaciers is closed, and as the day wears on, more slips cause further closures from Makarora to Hokitika, trapping several tourists.

According to reports from NIWA, rain gauges at Milford Sound recorded

357 mm of rainfall in 24 hours, a third of Wellington's *annual* rainfall, the sixth wettest day since records began, and the biggest weather event in 20 years. Rivers rose suddenly causing stop banks to burst, and a key bridge on State Highway 6 was washed away.

The extreme weather brought human tragedy, too.

THE CASCADING IMPACTS OF CLIMATE CHANGE

WEEKS LATER, the event feels eerily like "life imitating research." The floods took out bridges and roads, cutting off local communities and, for a short time, the main route between Canterbury and the West Coast. Both freight and passenger rail services were cancelled and tourism was hit heavily. Farmers lost precious crops. A disused landfill site was breached. Built on the banks of the Fox River, water sluiced tonnes of rubbish, including hazardous material, out into the river and across 300



I've been an e-bike commuter for more than 10 years and have seen the growth of e-cycling over that time. On the family side, central to our house build was amalgamating our housing across generations. We put two houses together into one and brought three generations of family to live together. It was an energy efficient build, with the idea that one energy efficient house has substantially reduced our footprint from two poorer performing homes. We're also evolving the way we automate our home energy use, on a miniature computer, where we can play with ideas and have fun monitoring the environment. Living together worked well for nearly five years, although since my father died recently the family has since scattered. So the next phase is work in progress... If I jump on to the wheels of emotion, I mainly feel optimistic. Trying out new things is always interesting and in finding things that work, I see there are practical actions I can take that make a tiny difference, but that can scale to something useful with collective action.

MIKE HARVEY, atmospheric physicist at NIWA, working on "Sulfate aerosols over the Southern Ocean"



I seem to give quite a few talks about climate action and try to live as low-emissions a life as possible (flights excepted, though I always offset personal flights). At home we've made a lot of energy innovations, so we barely use any electricity – mostly solar hot water and our home is heated with wood. My husband has been building an electric car for about 19 months. It's now certified for on-road use and he's just doing the final tinkering. Our other vehicle has been converted to gas, so it has less emissions. I'm vegetarian. Walk to work. Have a veggie garden. Buy from the farmers market.

JANET STEPHENSON, Director of the Centre for Sustainability at the University of Otago, working on "Climate adaptation, vulnerability and community well-being"

This page: 1976 flooding at the Waione Street bridge, which links Petone and Seaview.
Left: View from the Waione Street bridge to the Robinson's Port Road complex today.



kilometres of pristine coastline. Resource that would normally be focussed on such a massive clean-up was initially diverted to the disaster itself.

It will be months and years before the full range of climate impacts can be quantified (though the Westland District Council are already expecting a big clean-up bill). But while the West Coast is nothing if not resilient, as a society we're not very good at understanding how increasingly frequent weather events "cascade" to affect our wider social and economic activities. We need to get better at understanding the impact of cumulative weather events in the context of a changing climate.

Research led by the Victoria University of Wellington's Judy Lawrence, "Cascading impacts and implications for Aotearoa New Zealand," describes exactly the kind of scenario that unfolded on the West Coast. But Lawrence also asks us to imagine what might happen if people are more frequently dislocated from their homes, businesses or communities. She suggests

that with repeated flooding, frustration is likely to build, and the cost and disruption of repeated evacuations will cause some services (as well as businesses) to withdraw. She paints a picture of a slowly evolving "natural disaster," akin to the Christchurch earthquakes, where whole suburbs may well be abandoned, leaving behind vulnerable citizens with nowhere to go.

The research draws on the ClrCle tool (Critical Infrastructures: Relations and Consequences for Life and Environment), developed by Deltares, a research institute in the Netherlands. The tool helps users identify interdependencies between infrastructure systems. Lawrence hopes it will enable local and regional councils to understand and explore climate impacts that spill from the physical quickly into the social, economic and political spheres.

"Unless we do this properly," Lawrence says, "and if we keep responding only to single impacts and ignoring the cumulative stress and the costs of multiple impacts, our adaptation choices will simply be insufficient. Improving our literacy in how

climate change impacts compound and cascade will support more successful adaptation.”

The Robinsons are applying similar (though more contained) analyses to their own infrastructure. And – as for local and regional councils – tailored information is available that can help them understand the changing risk profile of their immediate environment.

NIWA’s Ryan Paulik, for example, is leading a Deep South Challenge project analysing flood risk across every river in New Zealand and mapping that risk against infrastructure. His research findings will be made available on the open source platform RiskScape (jointly developed by NIWA and GNS Science).

Patrick Walsh, of Manaaki Whenua Landcare Research, is looking more closely at the flood mitigation schemes operated by councils. His research notes that New Zealanders are increasingly moving *in* to urban, flood-prone areas, yet at the same time, our aging flood-mitigation schemes may be insufficient for future risk. This research is exploring both the costs and benefits of such schemes, in an effort to identify possible improvements in the system.

TOMORROW WHEN THE WAR BEGAN

BACK AT PORT ROAD, where the storm did not develop into the major event suffered by the West Coast, Paul Robinson and his siblings Cathy, Sam and Meredith, along with their business manager Edith, have donned their armour – hot pink hi-vis vests – to introduce us to their modern war in the built environment. “World War E” is the family’s war on water, waste and energy. It’s their overarching strategy to improve

the performance of their commercial properties.

Perhaps unsurprisingly, Paul’s thinking echoes some of the ideas being developed and implemented in the Netherlands, where there’s the strong understanding that we must work with, rather than against, water.

“There’s a lot of talk around retreating from the edge,” says Paul. But in the short-term, at least, the Robinsons plan to work on the border between property and water. “I think there is a lot we can do to embrace the coast,” he says.

For the family, 2019 is a year for reconnaissance and assessing baselines. “First,” Paul says, “we’re looking at the three waters – drinking water, stormwater and wastewater – then at what’s happening with energy, and finally what’s happening with waste for each property.” When the family took ownership of Port Road, they assessed the property’s storm and wastewater infrastructure.

“We think that’s where the immediate problems lie,” says Paul.

“We purchased these buildings knowing there was a risk of inundation from extreme weather events, and we know that risk is probably going to get worse. So, we need to understand the stormwater system really well, and to make sure it’s immaculate. Tenants have been concerned about water coming up through the manholes,” he notes wryly, “which is never ideal.”

Paul explains how engineers have already removed five tonnes of gravel from the underground pipes that discharge directly into the Hutt River, which has been eye-opening. “We quickly realised that these

stormwater drains have probably never been maintained. Probably, most [property owners] don’t maintain their drains. It’s only if something blocks that people have a look, but there’s a lot of preventative maintenance that can be done.”

Dealing with storm and wastewater is a priority for the family. “We’d like to avoid filling up the Wellington Harbour with brown flush after a wet day,” he laughs, not without irony.

Unfortunately, while graphic, such an image is not uncommon along our coastline, particularly in urban or

peri-urban coastal areas. Even in Paul’s affluent hometown of Plimmerton, the stormwater system can’t cope in heavy rain and the smell around the stormwater outlet pipes is unpleasant, to say the least.

The asset value of stormwater and wastewater assets in New Zealand is well over

“We purchased these buildings knowing there was a risk of inundation from extreme weather events, and we know that risk is probably going to get worse. So, we need to understand the stormwater system really well, and to make sure it’s immaculate.”

\$20 billion. This includes 24,000 kilometres of public wastewater networks, with more than 3,000 pumping stations and over 17,000 kilometres of stormwater networks. Much of it, however, was not designed for the trials of climate change, from sea level rise to changes in rainfall frequency and intensity.

A Deep South Dialogue, held in late 2017, brought together water sector representatives with relevant researchers, to explore how climate change will affect our storm and wastewater networks, and to identify critical gaps in our knowledge about them. The resulting dialogue report noted that sea level rise will affect *all*



Sam, Meredith, Cathy and Paul Robinson, and Edith Boettcher at their Port Road property.





coastal water infrastructure and will likely result in increasing sewage overflows, the infiltration of wastewater into saltwater, the corrosion of pipes by salt water, and exposure to liquefaction. As many of our water networks rely on gravity to discharge into rivers or the ocean, sea level rise may cause them to fail. Coastal storms may cause electrical failure at treatment plants. And drought will also affect networks, interfering with gravity systems by slowing flow, leading to blocked pipes. It's not a comforting picture. The challenges are immense and magnified by the reality that – like the pipes under Port Road – our water infrastructure is in places aging and poorly maintained.

The failure of water infrastructure has obvious and not-so-obvious implications for human health, ecological systems, cultural and recreational spaces, and for

our drinking water supply. To create a successful adaptation plan – to make good decisions about maintaining, replacing or upgrading our water infrastructure – we need to understand these direct and indirect risks. We need to be able to imagine the consequences of each decision or indecision.

By looking at this specific network of infrastructure, and working backwards from an “ideal” future, James Hughes of Tonkin+Taylor is trying to discover the performance we require of our storm and wastewater systems in a changed climate. His research project, “Stormwater, wastewater and climate change,” intends to show which types of economic, social, cultural and environmental impacts are likely to be the most serious, and where they might emerge. “We’re aiming to highlight likely hot spots over the short-,

medium- and long-term,” Hughes explains. The research will ultimately provide guidance for local government and water sector decision-makers, who are trying to build affordable resilience into our water infrastructure, in the face of future uncertainty.

Paul Robinson makes his feelings on the subject clear. “We’re sitting around in the towns, pointing at the dairy farmers and saying, ‘You bastards, you’re polluting the rivers’. Well, we’re doing exactly the same thing to the Porirua and Wellington Harbours... I think we need to take the plank out of our own eye, before we try and take the speck out of theirs. That might be a good starting point for taking action and moving forward.”

WATERWORLD

THE ROBINSONS ARE also looking at ways to detain and retain water onsite. “There are really, really good ideas for harbourside property,” Paul says. “At the moment, greenery is not really valued by owners or occupiers. Let’s make sure we green these sites as much as we can – let’s make them as porous as we can.”

Porous surfaces are key to managing excess water in storms and floods. Paul points to the pavement and curb bordering the Port Road property. “If we’re just parking cars,” he says, “let’s see if we can park them on porous surfaces. As the asphalt wears out and requires repair, my thinking is, instead of repairing it, let’s replace it with something better.”

These ideas take Paul somewhat out of the realm of current Deep South Challenge research, but hint towards future research that’s as relevant to the Deep South Challenge as it is to related National Science Challenges (NSCs), like Building Better Homes, Towns and Cities, or Resilience to Nature’s Hazards. The NSCs are keenly aware of the need to complement each other and collaborate on research. Given that climate change has implications for every area of life, from human health to the built environment,

from agriculture to technology, the NSCs know that working together is increasingly important. Challenge Director Mike Williams looks forward to a future when Deep South Challenge climate projections – both global and local – are easily accessible for researchers across all fields and areas of interest.

Paul's optimism, his willingness to try new things, reflects the thinking in another Deep South Challenge research project. Otago University's Janet Stephenson's "Climate adaptation, vulnerability and community well-being." Stephenson's research is exploring, and documenting, recent successful attempts to engage communities about how they might need to change with our changing climate.

Based mainly in Dunedin, the research surveys council, community and iwi strategies to build resilience into the very fabric of their rohe. The breadth of practical and creative responses to climate change, in the absence of a national adaptation framework, are exciting. Dunedin City Council, for example, are well into imagining what they can do differently to cope with more frequent coastal inundation.

Maria Ioannou, Dunedin City Council's Corporate Policy Manager, explains how the council is looking into engineering methods used overseas, bringing street gutters to the centre of the road, for example, thereby separating pedestrians and pavements from hazardous water. It's a small but concrete example of the kinds of strategies the council, and its many communities, are considering, to embed sustainability and adaptation into the city's regular work plan.

It's difficult to identify exactly which factor, or "trigger," is causing some climate-vulnerable communities to face up to climate change more quickly than others. While some communities might be motivated by the desire to take care of their most vulnerable members, others might be triggered to change by, for example, the likelihood they'll lose insurance at some point in the next few decades.

DEEP IMPACT: LOSING INSURANCE IN A CHANGING CLIMATE

A RECENT ANNOUNCEMENT by IAG, New Zealand's largest insurance group, that they will no longer be taking new business in the Wellington residential market, is the latest in a string of insurance shocks for the region. Long before the ocean laps at the front door, it may well be insurance and credit retreat that forces the hand of the Robinson's family business.

New Zealand is an unusually well-insured country, so increased hazard risk is putting pressure on insurers, who have already begun to make changes. Lloyds Bank, an international insurance player, includes New Zealand in the top 10 risky places for natural disaster, which – along with climate change – explains why IAG (which owns State, NZI and AMI and underwrites several banking insurance products) has put its investment in Wellington on ice. Late last year, the Insurance Council announced that 2018 had been the second most expensive year for weather-related insurance claims since 1969, second only to 2017. What will the 2019 bill look like?

For a commercial operation like the Robinson's, the issue of insurance retreat, while frustrating, has not been insurmountable. The family has been dealing with insurance woes in the commercial market since the Christchurch earthquakes, and have since abandoned local brokers and ventured offshore to deal directly with international providers.

But for homeowners or small-scale property investors, the prospect of losing insurance is a much more nerve-racking possibility. Tim Grafton, Insurance Council CEO and Chair of the Challenge's Representative User Group, notes that the risk of insurance retreat for Seaview and Petone is unusually high.

Challenge climate risk researcher Belinda Storey explains that the key risks

for coastal property owners are storminess and sea level rise. Her research project, "Climate change and the withdrawal of insurance," notes that although we have reliable data for sea level increases over the next few decades, we have very little reliable information about how stormy our coasts will become.

Sea level rise doesn't just threaten the coast, Belinda explains. Only a small increase in sea level rise enables storms to reach much farther inland.

"In the past," she says, "insurers have been able to look at the historical record and determine the likelihood of a specific event happening. The problem is that now we've got a significant change in the risk." Insurers are having to reassess their business models and rethink the level of risk they're willing to bear.

I ask Belinda to give me a sense of the potential timeframes for insurance withdrawal. I don't even finish my sentence. "Twenty years," she says. A recent Hutt City

Council report put the worst-case scenario at 30 years.

A lot of the discussion around likely climate change impacts pivots around the year 2100. We know, for example, that we're in for one to four degrees of temperature rise by then, and between one and three metres of sea level rise. But, Belinda

argues, it's very easy for people to ignore or at least delay this kind of discussion, because 2100 feels so far away. People have difficulty planning five years in advance, let alone 80. Belinda says the loss of insurance will bring decisions that we think are far off in the future forward by 50 to 70 years. That's 2030; 2050 if we're very lucky.

"A good place to start is with changes we're most confident about. We're confident that we're heading towards a 10cm sea level rise in the next 20 years. We can consider which locations in New Zealand are going to be hit earliest and

"A good place to start is with changes we're most confident about. We're confident that we're heading towards a 10cm sea level rise in the next 20 years. We can consider which locations in New Zealand are going to be hit earliest and hardest."





Paul Robinson at the
Port Road property.





I'm involved in reducing plastic in the environment. We're currently setting up a charity, NZAPPA: Aotearoa Plastic Pollution Alliance, to better connect colleagues and to reach out to the public with the goal of reducing plastic in New Zealand's environment. We recently had our official launch! I care about the well-being of oceans. I'm a passionate ocean swimmer, surfer and sea-kayaker and I simply like to sit on a beach and watch waves. It makes me sad when I see rubbish on beaches, because I know it's only a tiny fraction of the plastic that ends up in the ocean – there's way more we can't see. With a background in physical oceanography, I have a good understanding of how the ocean transports plastic around. I was looking for organisations I could support, and found there actually weren't any which ticked all my boxes. So I sent a few emails around and found some like-minded people, with the same vision, who were willing to spend some spare time to establish NZAPPA. www.nzappa.org

ERIK BEHRENS, ocean modeller at NIWA, working on "The Southern Ocean in a warming world"



We bought an electric car to replace my 18-year-old car, we get our electricity from Ecotricity, we use an electric lawn mower, I bike when I can, we eat almost no meat, we offset our carbon from any flights, we grow a lot of our own vegetables and get the rest from farmers markets. We installed a heat pump and double-glazing in our home, we try to be second-hand consumers and make things ourselves. We make climate-conscious purchase and investment decisions. Our daughter says she's motivated by sadness – losing nature feels sad, and she's moved to protect it. As a family want to change how we live so we cause less harm, and even improve things.

DANIEL COLLINS, hydrologist at NIWA, working on "Climate impacts on the national water cycle"

hardest... which brings us to Wellington. One problem for Wellington is that it also has a low tidal range, meaning that when storm surge comes, there's more chance it'll be bigger than a high tide."

There are already places in New Zealand where insurance has become unavailable, but it's difficult to access that information. Private insurers know who they're turning down, but researchers and society at large do not have access to this information. Owners may not realise until they go to sell the property that their buyer can't get insurance.

Belinda's research is using actuarial analysis to predict which locations are likely to lose insurance. "The thing about insurance is that if you lose it, you don't want to tell anyone, the insurer doesn't want to tell anyone, and the council sometimes doesn't want to tell anyone either... You've got all parties wanting to brush it under the carpet, then potential buyers won't really know either, which is not a good long-term outcome for anyone.

"There are places in the world that require insurers to notify the regulator when they decline insurance, but we don't have that here," says Belinda, who would like to see more information made publicly accessible. Belinda believes that applying this model in New Zealand could make a significant difference to public planning, and would enable society to consider how the risk is changing.

SO WHO BEARS responsibility for risk in all of this? Whether development is large-scale coastal or riverside property, or a beach side family bach, it's all forging changes in the infrastructure on our coastline. Decisions are being made within the frameworks set by local and central government.

And according to Deep South Challenge researcher Lisa Ellis, from the University of Otago, within our current framework, "individual members of our most vulnerable communities will bear the burden of risks they could not have foreseen."

"If we do not take action," Ellis argues,

"we can expect delayed, expensive and uneven responses to these new natural hazards; reactive responses to challenges that could have been mitigated or prevented; emergency measures imposed from above rather than community-led long-range planning; missed opportunities to enjoy the co-benefits accruing from long-term adaptation planning; and overall, a transfer of risk from the least to the most vulnerable."

Ellis's Challenge project, "How should the risks of sea-level rise be shared?" has found that for any new build in risky locations, "the government – that is, effectively, everyone – will be expected to cover losses for development that is already predictably risky."

Ellis and her research team concluded that, "The most important immediate step New Zealand can take toward an ethically robust sea-level rise policy is to bring certainty and consistency into the legislative framework." They also argued that there needs to be wider consideration given to the ethics and values we want to follow as we adapt, to ensure that the highest costs of climate change are not transferred to the most vulnerable.

"There's no current international best practice for climate adaptation," Ellis said, in a recent Deep South Challenge online seminar. "If we do this well," she continued, "there are substantial co-benefits society-wide, especially for achieving equitable outcomes. So, let's think of it as an opportunity."

THE DAY AFTER TOMORROW

AFTER THEIR WATER and waste audit, the Robinsons will turn their attention to the question of energy. The Port Road buildings consume \$240,000 worth of energy a year. An initial audit identified the potential to save over \$100,000 worth of electricity per year, by doing relatively simple things like replacing or modifying the site's transformers. "We'll also go through and replace over a hectare or so of high bay metal fluoride lighting with LED," Paul says.

Paul Robinson inside the Port Road premises.



But the final stage of the Robinson family's World War E will be a change in the way they organise themselves. In the future, instead of "property manager," Paul would like to shift into environmental management, communicating the priorities of their business. "All of a sudden, renewing leases and fixing leaking roofs [will become] ancillary to environmental and social management."

There may well be a metaphor in here for the way we need to change our collective thinking in relation to our stewardship of our built environment in a changing climate.

"My brother Sam and I started a company in the mid-1990s and bought the old Briscoes building in Porirua," now the site of the very popular Peppermill Café. "Our first goal, all those years ago, was based around one simple question. 'How do we get this business to a sustainable level... to ensure it's resilient against economic shock.'"

A building is inherently humans + infrastructure. Buildings provide for people and livelihoods, and should primarily consider the people who work, live and socialise within them. Protecting both

the past and the future is a challenge the Robinsons are willing to tackle. A few decades on, their business is thriving, with eight large commercial properties in their portfolio, including Porirua's first Greenstar building.

They also own the Woolstore Design Centre on Wellington's Thorndon Quay, which has been designed to bring people together, through great social spaces, excellent food and an impressive collection of New Zealand art. "It gives the place a spirit," Paul says.

There are many parallels between the kind of planning the Robinson family are considering and the questions that councils and central government must consider in their policy development. Adaptation must take not just hard infrastructure into account but must ensure that the future we plan for is built for human communities and enables us to thrive.

At the most basic level, however, Belinda's advice for homeowners and property developers alike, is clear, "Don't underestimate the risk... Make your decisions considering that the extremes could happen, because at some point they will." ●

OTHER CHALLENGE PROJECTS THAT EXPLORE RISKS TO OUR COMMUNITIES, OUR INFRASTRUCTURE AND OUR NATIONAL ECONOMY IN OUR CHANGING CLIMATE

NATIONAL FLOOD RISKS & CLIMATE CHANGE

How will flood risk evolve in your area, and which assets – buildings, roads, bridges and railway lines – are at risk?

FLOOD MITIGATION SCHEMES: ARE THEY WORKING IN FLOOD-PRONE AREAS?

Floods are the most frequent economically damaging natural hazard in New Zealand, and climate change and sea level rise are projected to increase their intensity and frequency.

STORMWATER, WASTEWATER AND CLIMATE CHANGE

What do we require of our storm and wastewater network in a changed climate?

EXTREME WEATHER, CLIMATE CHANGE AND THE EQC

What does climate change mean for our state-owned provider of natural hazard insurance – the Earthquake Commission (EQC) – and for those affected by extreme weather?

SEA LEVEL RISE, HOUSING AND INSURANCE: LIABILITY AND COMPENSATION

Can homeowners rely on the EQC, or on local or central government, for compensation, if their homes become uninsurable or uninhabitable?

EVENTS

The Deep South Challenge partners with key stakeholders and communities at events, conferences and workshops. Understanding the values and attitudes that shape society's engagement with climate change is core to our work. Plus, we enjoy getting out and meeting people!



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1. Rebecca Mills at the 2018 Climate and Business Conference.
2. The MFE national roadshow of the 2017 "Coastal Hazards and Climate Change" guidance for local government.
3. Wendy Saunders at the 2018 LGNZ Climate Change Symposium.
4. Janet Stephenson, Jacqui Hastie and Mike Williams at a briefing for Wellington City Council on our Dialogue report, "Communities and climate change."
5. Wendy Saunders at the 2019 NZPI Conference "Weaving the Strands".
6. Huhana Smith at a Deep South Challenge Seminar.
7. Sarah Meads and Dan Zwart at our 2018 Communicating Climate Colloquium.
8. League of Live Illustrators at the 2018 LGNZ Climate Change Symposium.
9. Stephen Daysh, Waverley Jones and Amy Kearse at the 2019 NZPI Conference "Weaving the Strands".
10. Tim Grafton and Belinda Storey at the 2018 SOLGM Climate Change and Local Government Forum.
11. Sally Owen, Belinda Storey, Ilan Noy and Farnaz Pourzand at the 2019 NZ Association of Economists Conference.
12. Angela Haliday, Mike Williams, Teanau Tuiono and Lucy Jacob at the cross- NSC workshop for the primary sector, "Feeding our Future".
13. Jo Fountain, David Hadfield, Alison Stewart and Caroline Saunders at the cross-NSC workshop "Feeding our Future".

Our aim is to make our research accessible, to listen to your needs and to make sure the right people have the opportunity to engage with the right researchers.

We also run our own events, from the Deep South Challenge seminar series to sector-specific workshops to targeted briefings with decision makers.

Let's talk!

Contact Waverley Jones,
our Partnerships Director
waverley.jones@cuttriss.co.nz
@WJ_DeepSouth
www.deepsouthchallenge.co.nz/events



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KEEP IN TOUCH WITH THE ADAPTATION CONVERSATION

#CHANGINGWITHOURCLIMATE
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**THE DEEP
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Te Kōmata o
Te Tonga



Te Kūwaha o Taihoro Nukurangi

National Centre for Māori Environmental Research

Working together

We deliver on Māori research aspirations in a way that reflects Māori values and respects both Māori and scientific knowledge systems.

www.niwa.co.nz/te-kuwaha



CLIMATE CHANGE & LOCAL GOVERNMENT FORUM

The Climate Change and Local Government Forum will feature New Zealand experts and is an opportunity to hear from people facing the same challenges as you.

27-28 JUNE 2019 / CHRISTCHURCH

REGISTER NOW: SOLGM.ORG.NZ/CLIMATECHANGE

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Taihoro Nukurangi

Understanding our changing climate

NIWA is New Zealand's leading provider of atmospheric and climate science and has the country's largest team of climate scientists.

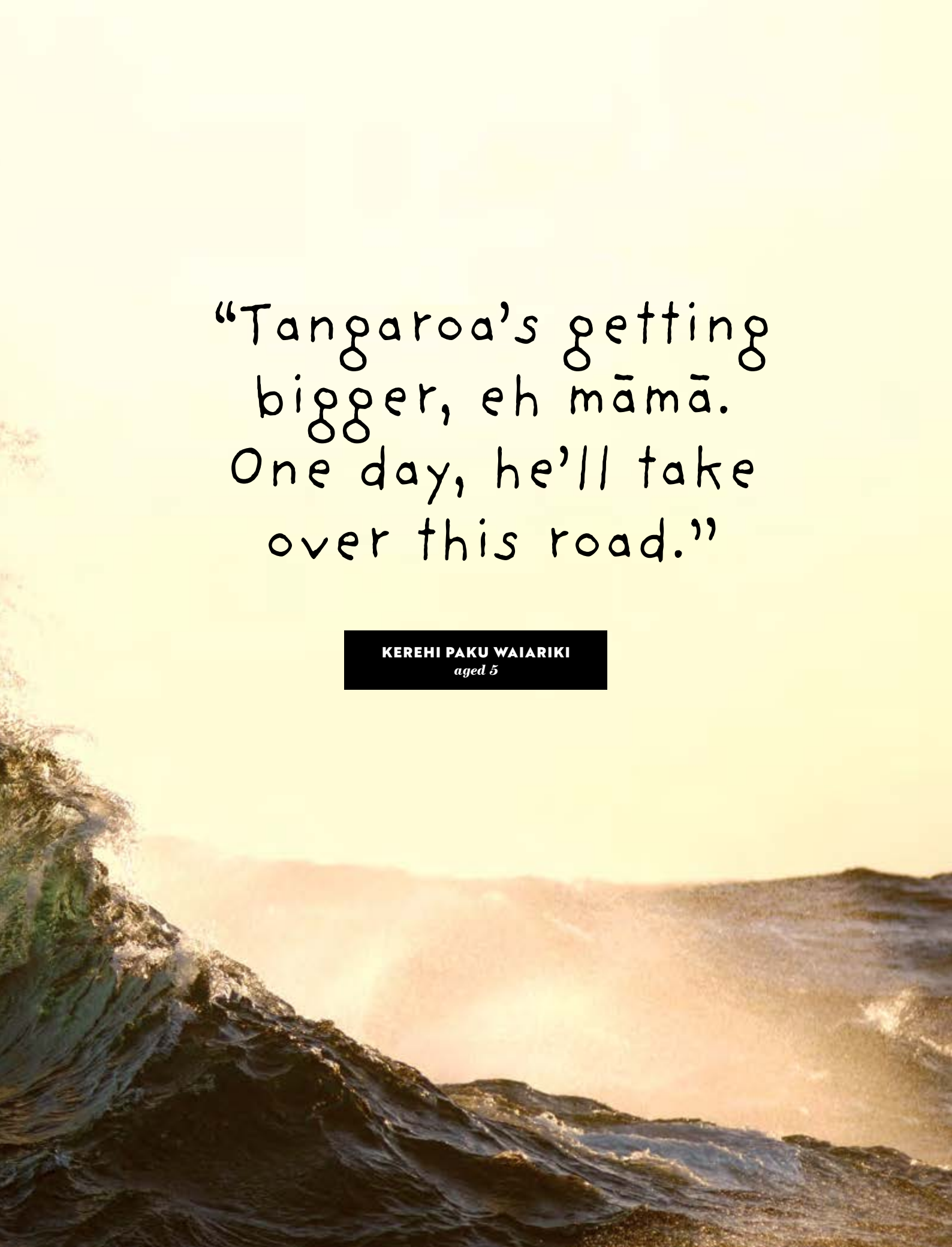
- We provide long-term climate change projections specific to your sector and needs.
- We carry out high-precision weather forecasting that can help your business thrive.
- Our products and services help to reduce the impacts of weather and climate-related hazards.
- We contribute to the global understanding of atmospheric physics and chemistry.

Our science is helping New Zealanders adapt to a changing and highly variable climate.

With 230 researchers, \$42 million annual investment in climate science, 7,500 climate stations and a new \$18 million supercomputer, NIWA is perfectly placed to provide the climate science needed by government, businesses and individuals.

NIWA – proud to host the Deep South National Science Challenge





“Tangaroa’s getting
bigger, eh māmā.
One day, he’ll take
over this road.”

KEREHI PAKU WAIARIKI
aged 5

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