AI FOR THE ENVIRONMENT
HACKATHON SERIES 2022 REPORT

30 November, 2022

ABOUT THIS REPORT

The purpose of this report is to help create a shared understanding of how the hackathon series held across Aotearoa in September 2022 was organised and what outcomes it achieved. Not least that it brought together a range of people who would not normally work together, to give life to a range of environmental issues in Aotearoa. These participants (team members and mentors) provided us with practical examples of how our AI solutions can have the concepts of te taiao (the environment, the natural world) and its mauri (life force and vital essence) at their core.

THANK YOU TO OUR KEY SPONSORS

ABOUT THE AI FORUM OF NEW ZEALAND

The AI Forum brings together New Zealand's artificial intelligence community, working together to harness the power of AI technologies to enable a **a prosperous, inclusive and equitable future Aotearoa**

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FORWARD

We launched the AI Forum's AI for the Environment Report on Techweek TV in May 2022, with the Ministry for the Environment and NZ Stats as principal sponsors.

The report's purpose is to help create a shared understanding of how artificial intelligence (AI) can be applied to a range of environmental issues across Aotearoa New Zealand.

At its centre is ensuring that te taiao (the environment, the natural world) is nourished and its mauri (life force and vital essence) is kept in balance.

In providing an overview of the current state of AI for the environment in Aotearoa New Zealand, and what a thriving future could look like, the report also outlines the challenges to increasing uptake and proposes areas for future focus.

The report talks about how AI can be used to effectively identify data gaps and build models and tools that can better direct and augment our very limited resources. It includes an assessment of what activity has been done and is currently underway in Aotearoa. It also provides thoughts about what the challenges to using AI and associated toolsets more widely and effectively are.

The report raises ten recommendations that also chime with some of the current preoccupations of business, government and academia involved in data and AI.

At the same time, we are faced with the common problem of having little funding available to investigate these recommendations and provide activations that would allow the Ministry for the Environment and others to drive the next steps.

Most crucially, how do we bring data together in a way that supports the concerns of data subjects while delivering positive, purposeful environmental outcomes?

The subject matter lent itself to a hackathon series format, bringing together teams from across the AI ecosystem who wouldn't normally use their skills for environmental purposes.

OUTCOMES

We also agreed that this type of activation would allow us to bring the AI for Environment Report to life by building practical examples of how these recommendations might be addressed providing us with the following outcomes:

Community building

- Bring together government, academia, NGOs, business and citizen scientists around a common problem to solve
- Engage a wider audience in the Environmental challenge by providing a 'no cost' event – effectively increasing the AI for Environment ecosystem to include businesses.

Raising the profile

- Each event generated its own chatter both locally and nationally
- The series attracted new players to the table

Activation and problem solving:

- Build practical examples of how the report's recommendations can be solved for the betterment of the environment, and for many other problems
- Solve problems identified by subject matter experts and ones that mattered to the teams
- Provide a non-controversial way to investigate different solutions that can inform some of the most contentious issues we currently face around data – in business, government and academia.

Generating demand:

- By putting the best solutions in front of our Summit audience to vote for the overall winner, we extended our engagement to an audience that is not necessarily involved in environmental matters, some of whom have the potential to pick up and develop the ideas further.
- Have solutions that are then used in the real world.
- Broaden the audience and participants' view of AI and the use of this type of event

RESULTS

The results exceeded our expectations.

The participants and mentors were passionate and engaged – for many this was their first time using their professional skills for a good cause and the feel-good factor at the venues was palpable, with new friendships and networks forged.

As each event ran, the chatter on social media was amplified. We unexpectedly picked up international attention, with a team from Pakistan and a mentor in San Francisco.

The stretch result for a 48-hour event like this is creating something that is used in the real world. At least one solution being is used in the real world (and picked up by local media) with several more showing good promise of further development.

With results like these our intention is to use this kind of exercise again in 2023 to expand the community involved in AI for good and the AI ecosystem as a whole.

HACKATHON BACKGROUND & LOGISTICS

HACKATHONS

Hackathons are not new tools. They have been used effectively to foster innovation through collaboration, increasing participants' (and observers) skill sets and knowledge at the same time.

They are well recognised tools for building teams and communities, bringing people together around a common problem to solve.

Traditionally, a Hackathon is a technology focused design sprint, bringing together computer programmers, interface designers, domain experts and others to collaborate intensively over a short period of time on a software project.

The teams then 'pitch' their ideas to a judging panel who select the winners.

For the AI Enviro Hack Series, we strived to create environments where we challenged our ecosystem to raise the bar higher, focusing on outcomes that will produce a fundamental shift in our environmental capabilities.

The series was made up of 6 Hackathons across New Zealand run over two dates: the first two events at AUT's Auckland campus and University of Otago in Dunedin 3rd & 4th September, and the remaining four on 8th and 9th September.

SPONSORSHIP

Each event was hosted by an organisation and this meant that, with the exception of the Female-led She Sharp event, no cash sponsorship was required.

In the end more than 14 organisations donated venues, technology, time and effort with many more contributing through encouraging their staff to participate:

TIMELINE

Registrations went live in late July giving potential participants and mentors 5-6 weeks to register. The events were priced to attract participants who were committed (skin in the game) with registration going towards the regional prize pool.

There were web pages for the events that provided a good amount of easy-to-understand information about the Hackathon Series.

BootCamp:

A bootcamp video was pre-recorded to provide more specific information about the data sets and technology being made available and any pre-requisite registration, training and other information for technologists and data scientists.

This was followed a week later with a live Q&A session where we also provided outlines of the example problems to solve and answered more general questions about the events.

Date	Event
27th July	Registrations Live (online) / Promotional Comms start
18 August	BOOTCAMP - Recorded
25 August	BOOTCAMP - LIVE Q&A
2 September	Dress Rehearsal - Data & Tech
3 September	HACKATHON DAY 1
4 September	HACKATHON DAY 2
7 September	Dress Rehearsal - Data & Tech
8 September	HACKATHON DAY 1
9 September	HACKATHON DAY 2
12 September	AI SUMMIT
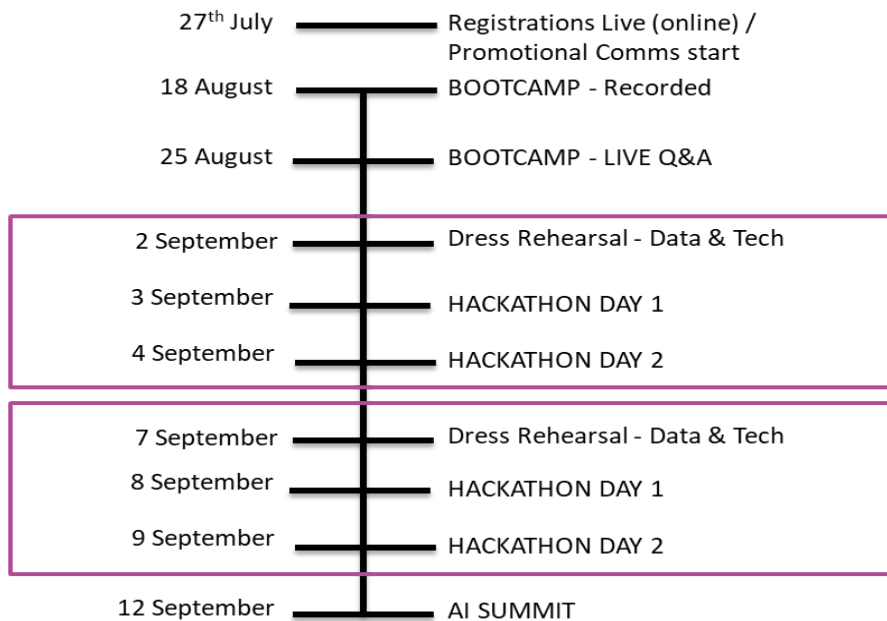
Diagram: Schedule of events for the AI Enviro Hack series 2022

Female-led She Sharp AI Hackathon, 3 & 4th September

The Female-led Hackathon was NZ's first Female-led AI Hackathon, run in partnership with the She Sharp organisation and AUT. This sold-out event attracted more than 100 people over a weekend including participants and supporters alongside some very high calibre mentors and judges.

Judging for his event took place on the afternoon of the second day, with two teams selected to progress to the finals, pitching to the audience at the AI Summit 2022 on 12th September.

Participants and Mentors from the Female-led She# hack at AUT

NZ-WIDE SERIES

Aotearoa's first NZ-wide AI Hackathon started in Dunedin on 3rd & 4th September, with the other centres running theirs together on the 8 & 9th September in Christchurch, Wellington, Waikato and Auckland.

Regional judging took place on the afternoon of Day 2, with the top teams from each region then pitching to a national judging panel immediately afterwards for a spot at the AI Summit.

TAIAO PRIZE

The top teams from the series had the opportunity to pitch to the audience at the AI Summit 2022 who decided on the overall winner of the TAIAO Prize (sponsored by the University of Waikato's AI Institute and the TAIAO Project).

This was potentially career-making for some participants and was well received by the Summit audience. Feedback from the audience confirmed it was one of the top three segments of the day. It also helped us to reach a much more diverse audience, making for richer discussions and networking opportunities.

PARTICIPANTS

We had a diverse range of participants who generally fell into four categories, but all had a passion for environmental issues in common:

- University students and researchers
- Those interested in exploring new skill sets and expanding their network
- Employees of organisations for whom this was a paid workday
- Environmental scientists, ecologists and citizen scientists

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RULES OF ENGAGEMENT

Participants were reminded that we are all inclusive organisations, welcoming people from all genders, ethnicities and backgrounds. We ask that the participants:

- Be welcoming to each other and treat everyone with respect

- Be open to learning new things and form new friendships

- Be fair. You can pre-plan with your team, but keep to the spirit of the event by collaborating and developing your ideas at the event itself

- Be respectful. Our hosts are welcoming you into their environments, please follow their guidance and rules

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INTELLECTUAL PROPERTY

Neither the AI Forum nor any of the sponsors have any interest in IP created at the event – while they must have regard for pre-existing IP, whatever participants created is their own.

MENTORS

Our mentors were volunteers who came with a range of skill sets, including:

- Identification and proofing of problem, solution and outcomes
- Technical advice on technology and data sets
- Planning and execution
- Marketing, commercial strategy and successful pitching
- Subject matter experts in environmental science and the problems being solved

They came from all over NZ contributing as they were able, with some onsite at venues and others available remotely.

The Female-led She Sharp Hack was run as an in-person only event, while the NZ-wide series was a hybrid mix of in-person and remote events, meaning the mentors were a combined resource collectively available to support teams across the country.

There was a trade off between the warmth and in-depth relationship building of an in-person event and the ability to provide more coverage via remote access. In both cases there were experienced support teams at most venues able to advise teams and help polish pitches.

PROBLEMS TO SOLVE

Using recommendations in the recently published a report on **AI for the Environment**, Hackathon participants were asked to concentrate on delivering real life examples of how we could deliver the first of those sections, **Build a Coherent Environmental Data Ecosystem,** for **a purpose.**

1. | Build a Coherent Environmental Data Ecosystem

- Deploy AI alongside other new technologies to enhance environmental data collection.
- Develop a national environmental open data framework.
- Consider where and how mātauranga Māori may be incorporated within Government AI systems.
- Coordinate the development of standards and best practices for environmental data management.

2. | Build Capabilities and Relationships

- Invest in increasing the institutional understanding of AI in businesses and Government.
- Increase the exposure of AI specialists to environmental challenges and environmental scientists to AI.
- Increase collaboration within the AI for the environment ecosystem.

3. | Increase and Align Funding to Support Impactful Projects

- Target funding to accelerate AI for the environment uptake.
- Align funding with measurable environmental impacts.
- Target funding to outcomes of national importance.

It was important that the purpose be compelling. With the AI Summit audience as the final judges, the solutions needed to appeal to a diverse crowd (not all technologists or data scientists) who would want to see the purpose in what was being created.

Examples

Initially we gave the following examples as guides and asked participants to create their own ideas:

1. Bring together disparate data sources to produce something new, for example:

- Demonstrate bringing together different forms of citizen science with academic and government research to uncover previously hidden insights – e.g. pest control; water; erosion; native and non-native flora, fauna and sea life; emissions; waste; etc.

- Demonstrate bringing together data from different sources for an environmental purpose without impacting data sovereignty, e.g. using federated data via data mesh.

2. Consider how we might deploy AI alongside other new technologies to enhance environmental data collection, enabling the incorporation of mātauranga Māori and principles of accessibility and openness into a Climate Change solution

We then contacted a couple of small NGOs to bring these examples to life while others heard about it and got in touch:

- **Te Korowai o Waiheke**: Rat eradication programme set up as part of the predator free Waiheke Island by 2050. They provided 1Tb of unstructured photos taken from rat lures and traps in the Rocky Bay area.
- **Seascape**: Use of advanced telemetry to map the seafloor has created a new problem: How to deal with the large amounts of really valuable data being produced.
- **The Big Wild**: Using new technology and data sources (ship tracking and satellite imagery) to identify and eradicate Illegal oil dumping at sea.
- **NZ Moths and Butterflies Trust**: Provided a detailed data set of butterfly sightings collected over 15 years by volunteer citizen scientists.
- **Sustainable Power:** A project on Aotea (Great Barrier Island) to provide efficient switching for a localised solar installation providing a secure localised power supply.

James Fuller of Seascape explains their problem to solve to the participants at Datacom, Auckland.

The key to the Hackathon was inspiring and engaging problems to solve. Many, including the eventual TAIAO Prize winners, came with their own ideas that they were passionate about, while others were happy to have some direction from the suggested problems.

It was interesting to see that four teams from across NZ picked up the Te Korowai rat eradication problem and the Butterflies data was also very popular with two teams directly using the data and a third used it as inspiration for their noise pollution app.

Conversely the Aotea and Seascape problems were not picked up at all. Both of these have had appeal to investors and researchers in our follow up conversations.

Categorisation

In order to be consistent and focused on Aotearoa and to incorporate matauranga Māori, ideas were categorised using the latest report from the Ministry for the Environment, "Environment Aotearoa 2022"

- Freshwater - Waitī
- Land and soil - Tupuānuku
- Biodiversity and land-based ecosystems - Tupuārangi
- Marine environment - Waitā
- Weather - Waipunarangi & Ururangi

DATA & TECHNOLOGY

Managed by the **University of Waikato's AI Institute**, participants registering with the **TAIAO Project** were provided with free access to share datasets and notebooks, tutorials and software (including free licences), and support.

The new data sets like the NZ Moths and Butterfly Trust data were added to the **TAIAO Project**, making them available to all the participants – and beyond the hackathon for future studies.

Fujitsu provided free computing power and support on the day to anyone using **TAIAO Project** assets,

The **AI Institute** also organised a day of **NVIDIA** Deep Learning training for participants, free to students and at a discounted rate to companies.

Amazon Web Services (AWS) called out its free online access to relevant datasets, tutorials and software; with support via FAQs and email and in person (in Wellington) on the day.

Google and **Microsoft** were involved in the Female-led hack and provided support to the series through their online resources via free-mium models:

Other NZ Data sets were identified and highlighted including: **Data.Govt.NZ**; **Stats New Zealand**; **National Library;** and **LINZ**

Participants were also free to bring their own data sets or to search more widely and we invited them to let us know if they couldn't find what they were looking for, so that we could help with them locate the right data.

SOLUTIONS

There were a wide variety of solutions developed with, as is the nature of hackathons, the majority only existing for the duration of the event. This does not detract at all from achieving the desired outcomes at all, with the most important being to bring people together building new connections, skills and interests.

CASE STUDIES

The following nine case studies are a collection of the solutions from the Hackathon series.

Some are included because they made the finals, some because they provide good examples of the kinds of things people were trying to achieve; and some because their teams are carrying on development.

1. COUNTDOWN | AUCKLAND

Countdown has a large diverse data and technology team and the Hackathon provided them with the perfect opportunity to come together around a topic that aligned to their corporate sustainability goals.

They built a cross functional team of people who would not normally work together, building bridges across their own organisation while expanding the team member's skills and knowledge around a topic they were passionate about.

It also gave the team members a much-valued opportunity to work outside the narrow confines of their day-to-day working environment. These are people with highly valuable skill sets including data analytics, AI technologists, UX designers, Storytellers and Project managers who would not normally use them in an environmental context.

The team held preliminary brainstorming sessions ahead of the hackathon to consider which problem to solve they would choose, gaining value from the different perspectives in the room.

Te Korowai o Waiheke was chosen because:

- Their goal for a Predator Free NZ by 2050 aligns directly with Countdown's sustainability goals
- Any solution they developed could be used by an existing not-for-profit organisation – adding real value.
- Having direct access to Markus Gronwald (an ecologist and rat eradication expert working with Te Korowai) as a subject matter expert allowed them to practise their skills of focusing their solution around a real problem for a real customer.

The team really enjoyed the whole experience, and having Markus there allowed them to see and understand the wider problem.

WHAT'S NEXT?

Te Korowai o Waiheke:

Given the time available, the team developed a basic model prototype, completing the core work and framework required to demonstrate what is possible – which they have donated to Te Korowai o Waiheke and are happy to make available to other NGOs for free.

It will still take a sizeable project several months to deliver the fully working toolkit they envisaged, however, it has provided Te Korowai (and Markus) with the basic capability to process images and that vision and something they can now work towards.

Markus Gronwald from Te Korowai o Waiheke bringing their problem to life for the participants

This was such a successful exercise for CountDown that Hackathons have now been adopted as a part of their internal toolkit to build bridges between teams; expand the skills sets and knowledge base of participants; and to ferment new ideas from across their organisation.

Te Korowai blogged about the event and the story was picked up by the Gulf News running in mid-October 2022 providing Te Korowai o Waiheke, Countdown and the AI Forum with a good news story.

<table>
<tr><td>2.</td><td>Leaf | Female led AI Enviro Hack</td></tr>
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Team Leaf were an all-woman team who came together at the She Sharp Female-led hack and were the overall TAIAO Prize winners.
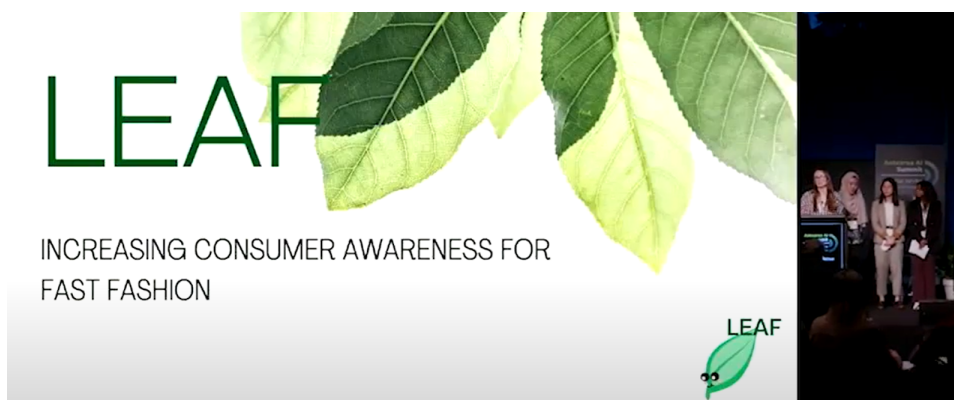
Leaf presenting their winning idea at the AI Summit 2022

They addressed the issue of increasing consumer awareness for Fast Fashion with an overall goal to increase transparency of fast fashion, presenting a solution that was a well-formed and complete vision that the audience could see themselves using.

They identified a gap in the market: A lack of information helping consumers to make informed decisions about each item as they are shopping. At the moment consumers have to do that research

themselves, making sustainability considerations far less likely to feature in purchasing decisions in both virtual and in-person shopping environments.

Leaf's solution was a web-browser overlay with a simple eco-friendliness indicator that considers Material (sustainability: Made-by Fibre Benchmark), Transport (CO_2 emissions) and Quality score (combining issues identified by customers using a sentiment analyser and Classifier).

Providing a simple 'happy face' green leaf symbol overlaid on any store website indicates a good score for a garment, while a grey 'sad face' leaf indicates a poor score, providing an instant, accessible and easy to understand marker.

As brands and stores buy into the idea, it has the potential to extend across brands on the web and to an in store experience reusing existing labels.

3.	BLOOM SQUAD	CHRISTCHURCH

Bloom Squad was a collaboration between **Environment Canterbury** and **Ministry for the Environment** to develop an early warning system for cynobacteria blooms in lakes.

Lakes are important recreationally but also as a source of food (e.g. a rich source of Eels / Tuna) and cynobacteria are a naturally occurring part of their ecosystem which, under the right conditions, create potentially toxic blooms.

Current lab testing is only undertaken monthly or on receiving a report from the public and takes 7 days to produce results, adding to the public health risk.

Bloom Squad used existing data to train AI models to predict blooms and allow targeted sampling, with the aim of reducing the public health risk and unnecessary closures. They identified that supplementing that data with Sentinel 2 satellite imagery would further enhance the ability to accurately identify and react to blooms of this nature.

In the process of analysing the data they also discovered that the most important factors in determining a bloom were the total nitrogen and pH levels in the water, which could eventually lead to forecasting of blooms remotely.


The Bloom Squad team, hard at work at Callaghan Innovation's facilities in Christchurch.

Emily Gray from Environment Canterbury is taking this work forward as part of her Master's Thesis and we wish her well in her studies.

| 4. | ILLEGAL OIL DUMPING | WAIKATO |

Oil dumped accidentally or intentionally at sea causes much largely unseen damage. The Big Wild had identified that there are now data sources available that can be repurposed to provide early warnings of spills and to track and trace the perpetrators.

The team from the University of Waikato took The Big Wild's challenge as a base using satellite imagery, deep learning object identification, and developed a Machine Learning classification system that could identify where and when oil spills happen, what type of oil they are and tie that into real time location of marine vessels.
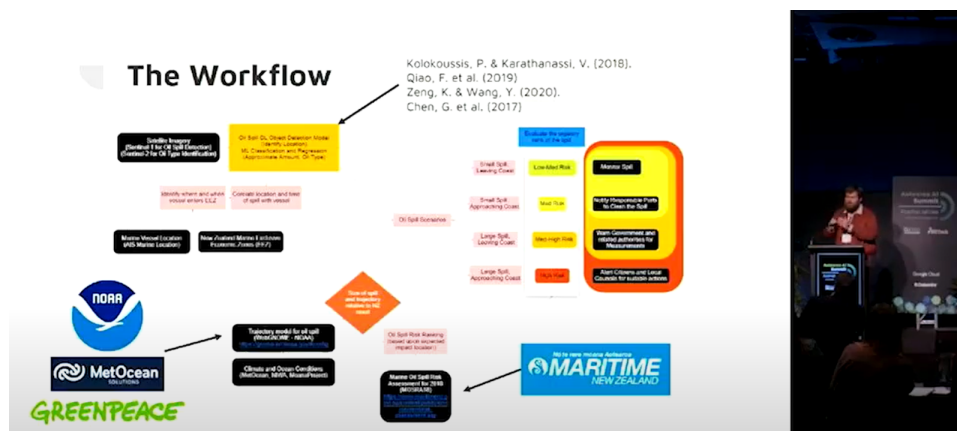
Joshua Sargent, Earth Science PHD student presenting for The Big Wild and the Illegal Oil Dumping team at AI Summit 2022.

Using data that was already proven, they plan to be able to identify who caused the problem and model the trajectory of where that oil is going and what the impacts might be. Their solution would also notify organisations and relevant regulatory bodies to monitor and react, while adding to existing apps would enable citizen scientists to improve enforcement related to spills.

| 5. | WETLANDS | WAIKATO |

This team was a collaboration between participants from the Waikato Regional Council and the AI Institute.

This team worked out a way to use mātauranga Māori informed models with local and satellite data to map wetlands remotely and effectively, a regulatory requirement aimed at avoiding extended loss of wetlands, promoting their restoration and protecting threatened species.

| 6. | ENVIROX (ELEMENTX / SPARK64) | AUCKLAND |

This team used the butterfly data as an inspiration to look at noise pollution and its impact on people and the environment, providing a strong link back to mātauranga Māori: How we are part of our environment and the detrimental impact noise pollution has on animals, plants, the land and people.
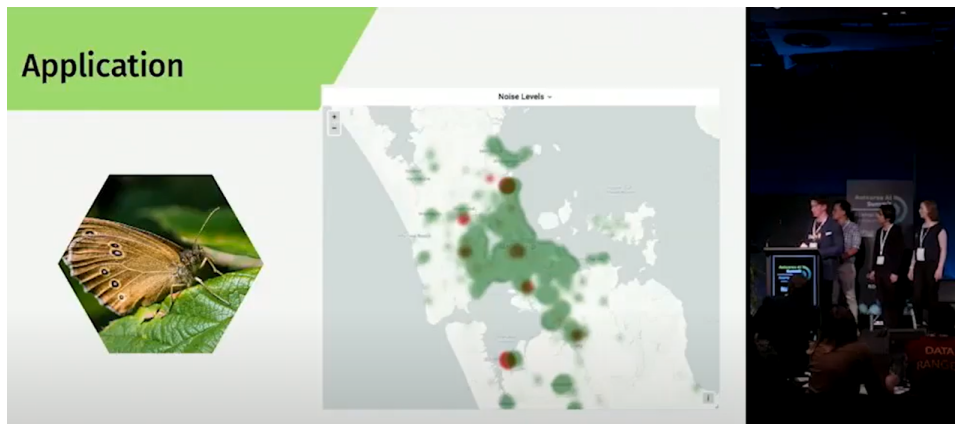
EnviroX presenting the matching of Forest Ringlet butterfly data with noise pollution data at the AI Summit 2022

They developed a working app at the event, made it available to their friends and family, and used it to collect and categorise noise pollution data overnight.
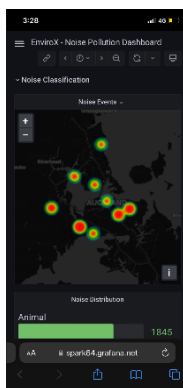
Screen grab from the audience of the working noise pollution app populated with data collected overnight by the EnviroX team.

7. ATIYA MASOOD AND TEAM | PAKISTAN AND WAIKATO

This team of Pakistan-based students was led by Dr Atiya Masood who is part of the ecology group at Wellington's University of Victoria led by Prof Mengjie Zhang.

Being based in Pakistan, this team personally felt the impact of global warming earlier this year when over 5 times the 30-year average rainfall swept across the country resulting in devastating floods that impacted over 33 million people, forcing 8 million from their homes. These numbers are so large they are almost incomprehensible to us in New Zealand – but are very real for this team.

Every year around the world, 26 billion trees are cut down but only 11 billion are planted, leaving an annual deficit of 15 billion trees. After centuries of deforestation, Pakistan has been left with less than

6% of their land mass forested (as compared to 31% average), with much of the land now arid and semi-arid. Our team wanted to explore ways to plant trees faster.

Their solution uses imaging captured by a drone to identify features and types of soil, e.g. pH levels. This information is used to identify the right trees to plant in that location. The drones then drop seeding kits in the optimum places.

Their solution is a unique use of three relatively low-cost technologies: the drone technology, already in use in Australia and Japan for crop spraying, is controlled via a website; object and image classification is used to determine soil type; and seed balls that have been developed in the lab for high rates of accelerated germination. Testing shows a 70% to 90% success rate for germination in 2 to 3 weeks, with accelerated growth over time.

Concept image of the farming and monitoring application

The team are very keen to continue to develop their prototype and are actively seeking funding.

The next development steps identified to improve performance are: a better version flight controller which could provide integrated processing, removing the additional processor from the payload improving range and capacity; reducing the amount of data required to be sent to the server; and decision speed which would allow the right seed balls to be fired more quickly.

The team also identified other use cases for this technology that could prove relevant to New Zealand including the monitoring of farmland using the web application and drone with RIFD sensors to collect imagery and chemical properties for analysis of the health of crops and fields; and soil analysis paired with seed firing capability to help speed up the regeneration of native plants in hard-to-reach places.

8.   RIPPLE | THE BUTTERFLY EFFECT | FEMALE LED AI ENVIRO HACK

The Butterfly (Monarch) population has decreased worldwide by 80%, to the point where it is now considered an endangered species.

Pollinators play a key role in our ecosystem and economy supporting $60 million export earnings annually from insect pollinated crops. They are a key part of our biodiversity, support our environmental ecosystem.

The all-female Ripple team presenting at the AI Summit 2022

With a goal of increasing awareness and action to promote butterfly creation and diversity, **Ripple** is designed to get people involved by educating them about the different species using an AI classifier to identify the species of moths and butterflies from images captured by users of the app, with the data collected stored for further processing.

Aimed at tourists, young families and schools initially with a promotion for participation in "You can have butterflies in your Garden", users can scan a QR code which goes to a map of NZ and then filter by location, month, plants and date to get a prediction of when they can see butterflies. Users can also capture image, date and location data of their own butterfly sightings, tracking for rewards.

Built using Cat-boost and using opensource tools, with data from 80,000 butterfly sightings collected in NZ over the last 20 years, its more than just a image capture and classification tool. It uses AI to forecast what butterfly distribution could look like across NZ depending on the conditions, and with the next steps in development to integrate weather and climate change forecasts to help fine turn predictions and inform actions.

9. DE-WEED - TANGOHIA NGA TARUTARU │ WELLINGTON

NZ is the weediest country in the world. De-Weed, a team from ANZ Bank, answered this problem by developing an identification and education tool for people to use in their own backyard.

De-Weed's vision was to develop an app that helps to protect our native flora by educating everyday people, giving them a tool to identify, document and deal with weeds in their own environment - and to provide a method to collect data for a centralised track and alert system for invasive weeds.

The solution was built using proven technology (AWS Sagemaker and opensource tools) to provide 90% plus accuracy from the outset, with machine learning able to improve accuracy over time.

How does it work?

● Snap (Take snapshot and the AI identifies the Weed)

● Treat (The App provides a treatment method: when to treat the weed and if products are needed the app links through to suppliers)

● Collect – Collect reward badges

● Connect – Users their build own knowledge, improve their own environments and collect data

All the data collected goes into a centralised database to support comms and simplify data collection and reporting.

Working towards a sustainable Aotearoa using proven technology that has the potential to provide the start of a new data ecosystem for the future while improving weed detection and treatment while reducing public spending on invasive weeds.