NZASE scientist profile

Volcanologist Jonathan Procter

Maunga Taranaki from Stent Rd beach, by Anke Zernack. Jon Proctor, right, photo courtesy Massey University.

Born

Palmerston North, 1974.

Affiliations

Jon affiliates to Muaūpoko, Ngāti Apa, and Ngāi Tahu; his marae is Kohuturoa, on the shores of Lake Horowhenua near Levin.

Schools and subjects

"I took all the science subjects – Chemistry, Physics, Biology, Maths, and some other technology subjects."

How he got into science

"I enjoyed working with computers, and also exploring our environment and understanding how our whenua was created."

Training and jobs

Bachelor of Education, 1998; **Diploma** in Teaching, 1998; **Bachelor** of Science, 2000; **Master's** in Science, 2003; and **PhD**, 2010, all at Massey University.

Jon worked as a primary school teacher, at a geographic information system (GIS) company; at Terralink; as Te Taiao manager for Tanenuiarangi Manawatū Inc.; and is now Professor of Natural Hazards at Massey University.

Fields of science

Earth sciences, natural hazards, GIS/remote sensing, volcanology.

Research examples

Jon leads the volcano research programme of the National Science Challenge: Resilience to Nature's Challenges.

Large flows from volcanoes

"I analyse and interpret how volcanic flows will probably move, as well as potential future hazards" from volcanic events.

Jon's PhD study focused on predicting lahars and their paths around ngā Maunga Taranaki and Ruapehu. He used Titan2D modelling to forecast where they would flow down the Whangaehu River, which runs from the Ruapehu crater lake to the sea just south of Whanganui.

"Taranaki has had at least 14 debris avalanches in the last 210,000 years," he says. "We analyse past events, the geology of the terrain, the physics that generate those flows, and match the flow types in computer simulations.

"We found that simulations accurately predict the area covered by lahar, where they divided, where they deposited, their speed and travel times.

"Computer modelling is now reaching the stage when it can be combined with geological mapping to forecast future hazard zones for debris flows. Anytime there's unrest or potential for an eruption, we use those simulations to indicate where things might be destroyed."

Predicting volcanic events

"New Zealand is is a world leader for forecasting what might happen with volcanoes, and the probabilities of different scenarios," he

says. His team's research predicts the likelihood and scale of eruptions, their impacts, and combines mātauranga Māori with volcanology to build our resilience.

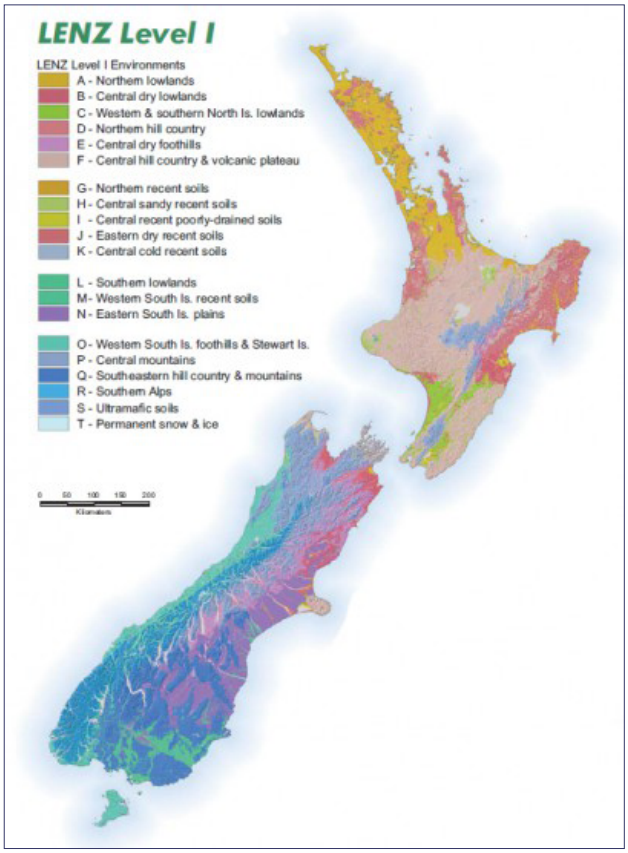
A Te Ao Maori landscape classification

Jon led a research team that produced the first Māori Landscape Classification (MLC-GIS) in Aotearoa, of the Manawatū catchment.

"Mātauranga used to be treated as personal accounts, and was rarely used in environmental management or decisions," he says. Those decisions depend on advanced GIS databases, such as Qmap for geology; SMap for soils; the Land Cover and Land Environments of NZ databases for bio-diversity; and the NZ Land Resource Inventory for land use.

"Standard databases and council measurements don't include the detailed local knowledge of traditional Māori practices," he says. "Councils monitor one or two sites per catchment, once a month. But around Lake Horowhenua near Levin, which has been heavily occupied over time, Māori used to visit 20 pā tuna (eel weirs) every few days, and had generations of knowledge about the size of their catches and the quality of eels and fish."

The living MLC-GIS database, based at Massey University, is already supporting Māori input into managing the Manawatū catchment, and will continue to have data added. "Every iwi cultural landscape is different," says Jon; "we're providing a template for regional councils to show them how they can gather that detailed data with hapū and iwi around the country."



An advanced GIS map of environments around Aotearoa.

Jon at Rangipō hut on Ruapehu.

How he finds things out

Jon combines methods from geological field work and the lab – studying different types of rocks, how they were created and moved, using observations on the ground as well as from satellites, remote instruments, drone cameras for photos as well as temperature and infrared wavelengths, and existing GIS.

He also uses computer modelling and simulations, and mātauranga Māori about volcanoes, landscape evolution and environmental management.

Most valuable results

Jon values creating new knowledge, and being able to provide solutions to communities that they can use: "Monitoring stations for volcanic warning systems, models to help communities make themselves safer, GIS and satellite data and systems to help iwi make environmental decisions."

"I also value training PhD students about the research process, and having them publish their own papers – building the next generation and sharing the knowledge."

Jon investigating springs near Ruapehu.

Mātauranga Māori

"Mātauranga Māori is a different way of observing the environment; it should be respected for the knowledge it adds, and be part of everyday decision-making.

"It's not science, it's a different knowledge system – the information we gather from both systems needs to be treated equally, but we're miles away from that. I draw upon both to find solutions; if we're trying to solve a problem, we need to use as many sources of information as possible."

One of Jon's projects is working with mātauranga Māori for assessing volcanic hazards. He says that the role of Māori as custodians of our active volcanic areas for centuries is key to our volcanic resilience – "it sits at the foundation of volcanic science.

Māori have a long history of volcanic eruptions, they accept that they have to adapt, and have moved some settlements due to volcanic events. Typically, Europeans are very unhappy when our environment changes, but these are regular events."

"We're exploring traditional volcanic monitoring sites with iwi, what they observed to indicate eruptions, and what they did when they saw those signs. Volcanologists rely on seismology, while Māori look at environmental changes more holistically.

"Iwi look at changes in the colour of lakes, the behaviour of springs, and changes in the acidity of waterways, which indicate unrest earlier than seismology. Our goal is ensuring that iwi are part of decisions about volcanic regions."

What he likes about science

"Exploring new knowledge and coming up with new solutions to problems that communities are facing."

Ngā Kupu

From Paekupu and Te Aka Maori Dictionary

Aroturuki – To monitor
Hūnga puia – Volcanic eruption
Manawaroa – Resilience, stamina
Mātai puia – Volcanology
Mātai rū whenua – Seismology
Matepā – Hazard
Puia – Volcano, geyser, hot spring
Puia koeko - Cone-shaped volcano
Puia korehāhā – Extinct volcano
Puia pākai - Shield volcano
Rahā - Lahar
Te ahi tupua – Taupō Volcanic Zone.

Looking up the Whangaehu River to Ruapehu: Photo by Jon Procter.