

Living in harmony with New Zealand's volcanoes: Balancing tourism, social values, land use, and hazards around caldera and cone volcanoes

Graham Leonard¹, Sally Potter¹, David Johnston², Wendy Saunders¹

¹ GNS Science, 1 Fairway Drive, Lower Hutt 5010, New Zealand

² Joint Centre for Disaster Research – Massey University – GNS Science, Wellington, New Zealand

E-mail: g.leonard(at)gns.cri.nz

Tourism, both domestic and international, is a substantial part of New Zealand's economy, with a strong link to volcanoes. Volcanoes are also widely valued in terms of landscape, access and resources by New Zealanders. Risk management in New Zealand is underpinned by New Zealand's signatory to the post-Sendai 2015 framework for improved community resilience to all natural hazards.

The most challenging hazards around both calderas and cone volcanoes lie at the two ends of the eruption size spectrum. The smallest eruptions, which are often phreatic or phreato-magmatic can occur with little or no warning due to a sudden perturbation in the hydrothermal system. Because these hydrothermal areas are also accessed daily by abundant tourists (Tongariro, Ruapehu, central Taupo Volcanic Zone (cTVZ) calderas, and White Island) even in small eruptions the consequences can be severe. Figure 1 shows the large number of hydrothermal systems across cTVZ and White Island.

At the other end of the spectrum when possible magmatic unrest is detected through monitoring at these volcanoes, the challenge is in interpreting the signals to provide eruption forecasts, and in interpreting and communicating uncertainty. This applies also at less-recently active volcanoes including Auckland, Taranaki and other parts of cTVZ. Cooperation between scientists, emergency managers and communities is complex because response actions such as evacuation can require substantial lead times. This means decisions need to be planned and executed while there is potentially high uncertainty as to whether or how big an eruption may occur.

Research into our most recent large eruption, at Ruapehu 1995-96 shows two paths to tourism impacts. The single largest economic cost was from disruption of flights, however the largest local disruption was the loss 1/3 to 2/3 of eruptive period tourism revenue across those two years.

Living in harmony with New Zealand's volcanoes means balancing a desire and need for access to places at risk across this eruption size spectrum. Risk elimination would only be possible through abandonment of large parts of the North Island, and all of New Zealand (like
