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**Economic Risk Assessment of Mount Egmont**  
**The Potential Economic Implications of a Volcanic Eruption in**  
**Taranaki**



Coral Aldridge

2006

Economic Risk Assessment of Mount Egmont  
The Potential Economic Implications of a Volcanic Eruption in Taranaki

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Massey University  
Palmerston North  
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Coral Louise Aldridge  
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# ***Abstract***

New Zealand is home to a large number of volcanoes, many of which threaten the North Island, with damaging ground hugging hazards or disruptive ash deposits. As little as 2mm of ash will put grazing animals off their feed, completely disrupting the agricultural environment, transport is affected and equipment is vulnerable. The most likely damaging event from an eruption is ash, the potentially unknown area of which is determined by wind direction and strength. The 1995/1996 Ruapehu eruption was geologically considered minor with no more than 10mm of ash deposited, yet the economic consequences and disruption were significant, estimates put the minimum cost of the eruption at \$130million made up almost singularly of tourism revenue losses and damage to the hydro-electric turbines.

There has been little work completed in assessing economic impact of a natural disaster in an economy prior to the event. While the expected scale of any disaster is frequently assessed on historical evidence for planning purposes, social or economic studies tend to consider vulnerable sectors during evacuation and recovery as opposed to a monetary figure or the economic impact.

The most recognised volcanic event (and standard example) in recent history was the Mt St Helens eruption in 1980; this eruption killed 57 people and caused damage in excess of US\$1billion. Mt Egmont is the visible headstone of Taranaki's volcanic history but is only the youngest location in a series of destructive volcanoes in the area. There have been no known eruptions within the region since 1755, with eight recorded eruptions in the 300 years prior.

It is generally accepted that any future events from Mt Egmont will follow the same path as historic eruptions, explosive ash emissions with gentle lava extrusions. Three eruption scenarios, all skewed towards a more likely smaller eruption, are considered in the overall analysis of the region; future studies may concentrate on rare catastrophic eruptions or the evacuation of New Plymouth. The first scenario is limited largely to the national park with ash fall only within the region, the third scenario pushes ash over much of the North Island and has damaging hazards throughout Taranaki. A final consideration is made to investigate how an economy responds to increased volcanic threat without an eruption. If precursors to volcanic activity extend for a long period of time the threat of economic stagnation, reduced investment, emotional stress and permanent relocation from the region will increase. Early warning systems and increased disaster planning has greatly reduced the number of deaths caused by volcanic eruptions, in many ways it has also increased economic vulnerability as danger zones become populated.

Taranaki has a low population density with rich natural resources and an economy largely geared towards dairy farming and the extraction of oil and gas. The five largest sectors in Taranaki create \$8,910.18million in total output or 57.83% of regional output; these are oil and gas extraction, dairy manufacturing, dairy farming, meat processing and wholesale trade. Oil and gas exploration adds an additional \$331.72million to economic output.

There is a lot of high level energy infrastructure in Taranaki from gas pipelines connecting fields, production stations and delivery systems to the multitude of high voltage power lines connecting two power generation stations with the national grid. All oil and gas production and much of the gas transmission system is based within Taranaki, this industry alone is estimated to contribute more than \$1billion a year to the national economy. One factor of Taranaki's gas monopoly is the significant downstream impact any regional disruption in supply could have on the national economy and social well being. Oil and gas is vital to many aspects of New Zealand business not just within Taranaki but day to day business operations, manufacturing processes and power generation capacity.

Iconic industries are those businesses that may have an impact on the local community above that of direct economic loss, that are socially as well as economically significant. These firms are predominantly the largest employers and contributors to the local and national economy, and are the most likely to consider permanent relocation outside the region in the case of a large ongoing event. Research was completed on significant industries to gain a more detailed impression of the largest contributors to the local and national economies and potential disruption. These enterprises include electricity generators and gas production, Fonterra, Ballance, Yarrows and Westgate Port. The National Park, tourism and the airline industry were also considered separately due to their individual importance and likelihood to be affected by an eruption.

The results of the input-output scenario analyses show an immediate value added decline in the regional economy ranging between \$519.09million and \$2,505.21million due to volcanic eruption. Input-output captures the overall regional impact of an eruption, the immediate reduction in output as a result of evacuation and physical influences. However an eruption of any magnitude will also have a national impact on the economy which should not be forgotten. Iconic industries were considered separately to take into account some of the largest regional contributors to the national economy.

Risk assessment of the iconic industries enabled the assessment of more long term, wide reaching and national effects of an eruption which are not captured in input-output assessments. The gas industry will have the most detrimental economic effect, literally closing the entire gas dependent manufacturing sector throughout the North Island for a number of weeks. Although the Whareroa dairy factory contributes considerable value to national exports with 100% of production being

exported milk volumes normally processed could, with the exception of approximately two weeks during the peak season, be absorbed by other factories in the North Island limiting national impact. It is impossible to determine the degree of flow on effects from all of the businesses affected; many interdependencies wouldn't openly be recognised until they occurred.

New Zealand has been lucky in that recent volcanic activity has been minor and sporadic in nature; consequently the public perception of risk has been skewed towards events which in geologic records would not even register. An eruption would overwhelm local civil defence resources almost immediately, the surrounding communities would be flooded with evacuees and the economic ripples would be widely felt. This is particularly the case with Taranaki and the critical high level infrastructure. Mitigating economic risk can only be done by locationally spreading risk, with adequate protection measures (financial or physical) and by increasing public awareness.

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## ***Abbreviations***

accom.	Accommodation
AMF	Anhydrous Milk Fat
ANZSIC	Australia New Zealand Standard Industrial Classification
CAE	Centre for Advanced Engineering (Canterbury University)
CDEM	Civil Defence and Emergency Management
CPI	Consumers Price Index
DOC	Department of Conservation
ECLAC	Economic Commission for Latin America and the Caribbean
EMO	Emergency Management Office
FTE	Full Time Equivalent employees
GDP	Gross Domestic Product
GIS	Geographic Information System
GJ	Gigajoule
GRP	Gross Regional Product
Gw	Gigawatt
ha	Hectare
IGNS	Institute of Geological and Nuclear Sciences
ISDR	International Strategy for Disaster Reduction
kg/ms	kilograms of milk solid
kg/su	kilograms per stock unit
KGTP	Kapuni Gas Treatment Plant
km	Kilometre
kV	Kilovolt (measure of electricity)
LCDB2	Land Cover Database 2
LIC	Livestock Improvement Corporation
LPG	Liquefied Petroleum Gas
m	metres
(\$)m	million
MAF	Ministry of Agriculture and Forestry
MCDEM	Ministry of Civil Defence and Emergency Management
MED	Ministry of Economic Development
mm	millimetres
Mt	Mount (mountain)
Mw	Megawatt
n/a	Not Applicable

NEFD	National Exotic Forestry Description
NGC	National Gas Corporation
NNE	North North East
NNW	North North West
NOAA	National Oceanic and Atmospheric Administration
NP	New Plymouth
NZ	New Zealand
NZDG	New Zealand Dairy Group
NZIER	New Zealand Institute of Economic Research
OECD	Organisation for Economic Co-operation and Development
PJ	Petajoule
PJe	Petajoule equivalent
ppm	Parts per million
PV	Present Value
SBPT	Shell BP Todd
SH	State Highway
SME	Small and Medium Enterprise
SSE	South South East
STOS	Shell Todd Oil Services
su	Stock Unit
TAWN	The Tariaki, Ahuroa, Waihapa and Ngaere grouping of gas fields
TCC	Taranaki Combined Cycle (Power Station)
TJ	Terajoule
TRC	Taranaki Regional Council
TSB	Taranaki Savings Bank
TV-SN	Taranaki Volcanic Seismic Network
24-7	Twenty four hours a day, seven days a week
US	United States of America
WINZ	Work and Income New Zealand

# ***1. Introduction***

New Zealand is one of the most volcanically active areas on earth with several active volcanoes throughout the heavily populated North Island. Eruptions can have enormous impacts on both the economy and society in terms of physical damage, loss of life and economic disruption. For planning purposes it is important to gain an understanding of where these physical consequences will occur and potentially how important these damages will be to the national and local economy.

This thesis is part of a larger project assessing the risk posed by North Island volcanoes, led by geologist Dr Shane Cronin at Massey University. The volcanic risk project aims to extend and document knowledge of volcanic hazard processes, volcanic risk, risk management strategies and community vulnerability for the Ruapehu and Egmont volcanoes.

The area chosen for analysis is Mt Taranaki/Egmont and Taranaki. The mountain is known by two official names, as the Maori Taranaki or European Egmont. For the purpose of this report Mt Egmont will be used in reference to the mountain whilst Taranaki will refer to the region as a whole. With any disaster, the impact on an individual basis is significant for all businesses and farmers directly affected. What is interesting about Taranaki is that any long term eruption, or even a short term but significant eruption, will be extremely detrimental to New Zealand as a whole given that the economic activity in the entire Central North Island will be disrupted. Many industries originating in Taranaki provide critical facilities well beyond the borders of the region, an interruption to manufacturing and agricultural sectors or to the gas and power supply will be influential over a wide area. This will potentially have a huge adverse impact on national GDP and in particular the trade balance if agricultural exports from Fonterra are damaged. The Fonterra Whareroa dairy factory alone contributes 5% to New Zealand's GDP.

Interruption to the gas supply will impact on all facets of business in the North Island if an alternative immediate gas source can not be found (most likely via import). Interruption will occur even in the event that an eruption does not take place but if alert levels reach a critical level. Many different industries throughout the North Island rely on this gas for day to day production; even the temporary ceasing of gas supply to the Hawkes Bay during the 2004 Manawatu floods had enormous economic consequences. These widespread detrimental effects that are unique to resources within Taranaki will not be offset in GDP by the recovery and replacement costs that traditionally follow a disaster, particularly if the eruption continues for an extended period.

The main objectives of this research are to:

- Develop an analytical framework to support the estimation of economic impacts
- Determine an overall economic impact from a volcanic eruption from Mt Egmont
- Complete a risk assessment of large industries that will experience the greatest impact both regionally and at a national level
- Determine the independent impact of behaviour change as a result of volcanic activity.

The overall aim of this research is to assess the structural vulnerability of Taranaki, to investigate the level of risk to Taranaki's economy of volcanic specific hazards. This is achieved by developing an analytical framework to estimate economic impacts, the direct damage costs of an eruption scenario, business disruption and ongoing economic loss. The thesis also considers the impact of a change in volcanic alert levels which ultimately do not result in an eruption. Economic losses due to eruptive episodes<sup>1</sup> can greatly exceed the losses caused by physical damage. This incorporates the risk assessment of large industries in the region in terms of economic contribution and vulnerability, determining the direct extent of volcanic hazards and the economic consequence for the predominantly agricultural communities. While determination of the financial consequence is one focus of this research also aims to highlight the economic weakness of New Zealand's economic base to volcanic hazards.

Although hazard zones are identified and outlined it is important to note that boundaries are not discrete and specific, volcanic hazards in particular are uncertain and "safe" zones can not be completely assured. Similarly varying degrees of damage exists in each zone. Hazards decrease by increment as topography and distance from the mountain alter; all analysis in this report takes the identified hazard boundaries as absolute and certain. The analysis does not include secondary disasters that could potentially result from an eruption. This includes events such as secondary flooding, tsunami or increased fire risk, threat of starvation or disease to animals and humans. Neither does this analysis assess the potential impact of an event where New Plymouth, the population and business hub of Taranaki, is deemed to be unsafe and requires evacuation. If water supplies become contaminated or the town otherwise becomes uninhabitable, mass evacuation will need to be considered with even greater economic consequences. In addition this analysis only considers the potential gross economic cost to the region as a result of an eruption, the net effects once recovery packages and insurance claims have been received may, particularly in small eruptions, be positive. Gross figures are important as they provide the major impact of damages that result from an eruption (or any event)

The thesis initially discusses the current nature of the Taranaki economy, followed by a contextual overview of the volcanic hazards that will be referred to throughout the analysis and a history of Mt

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<sup>1</sup> An eruptive episode refers to all volcanic activity which results in changes to behaviour, whether that is physical eruption or just indicators of activity.

Egmont. A brief literature review is included regarding projects of a similar nature and the civil defence framework that is integral for recovery of the region and consequently the economy. The expected hazards from Mt Egmont and eruption scenarios are discussed as the basis for all analysis. The importance, vulnerability and influence of certain industries in the region are discussed on an individual basis to establish specific impacts on the drivers of the economy, this risk assessment will be representative of the wider, broader and long lasting effects of an eruption which are not incorporated within the input-output analysis. Small and medium enterprises are discussed with regard to volcanic hazards they will face and the potential flow-on effects. Input-output modelling allows the modelling of the entire economy capturing the immediate reductions in output that result from an eruption.

New Zealand is fortunate that modern volcanic eruptions have been relatively minor in geological terms. An eruption of any magnitude has the potential to stall the entire economy to a degree that is immeasurable; all of the flow on effects simply can not be considered. Identifying an economy's economic exposure is critical in protecting against and preparing for disaster recovery.