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Foot and mouth disease economic impact assessment on production, export losses and eradication expenditure

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SUMMARY AND KEY WORDS

The second paper in this three paper session models the impact of a number of foot and mouth disease (FMD) incursion scenarios on production and export revenues of dairy, meat and other products. The guiding principle was big picture, plausible and estimable Key to this was how processors might respond during FMD eradication and how importing countries might respond once New Zealand becomes FMD free again. Government expenditure for FMD eradication and related livestock compensation was estimated for each scenario.

Foot and mouth disease, eradication, production, exports

INTRODUCTION

The first paper in this three paper session explains what FMD is and how the Ministry for Primary Industries (MPI) would respond if an incursion of this exotic disease to New Zealand occurred. A hypothetical incursion in northern Taranaki was assumed to have occurred on 30 September 2011 and its epidemiology or spread was simulated using the Interspread Plus software for a number of scenarios. The third paper models the macroeconomic impacts of FMD incursion scenarios based on shocks from exports, tourism and government expenditure.

At the start of the FMD Preparedness Programme a panel consisting of MPI experts or specialists in the fields of economics, epidemiology, disease control and trade was convened for the purposes of defining the scope and objectives of the FMD economic impact assessment. The panel concluded that for this review, three baseline outbreak scenarios would be produced by epidemiological modelling (a small, a medium and a large outbreak), along with vaccination options to limit the spread of the large scenario and disease free zoning for the South Island.

The size of an outbreak is defined both in terms of the numbers of properties infected (and their geographic distribution), as well as the duration of the outbreak i.e. the duration in days from the first detection to when the last infected animals are culled.

Table 1 presents data on the incursion scenarios. The depopulation refers only to animals on infected properties. Figure 1 shows the cumulative distributions of IP for the medium and large scenarios and Figure 2 shows the geographical distribution of surveillance zones which are areas within a 10 km radius of each IP.

Figure 1: Cumulative distributions of IPs for medium, large and large with vaccination scenarios

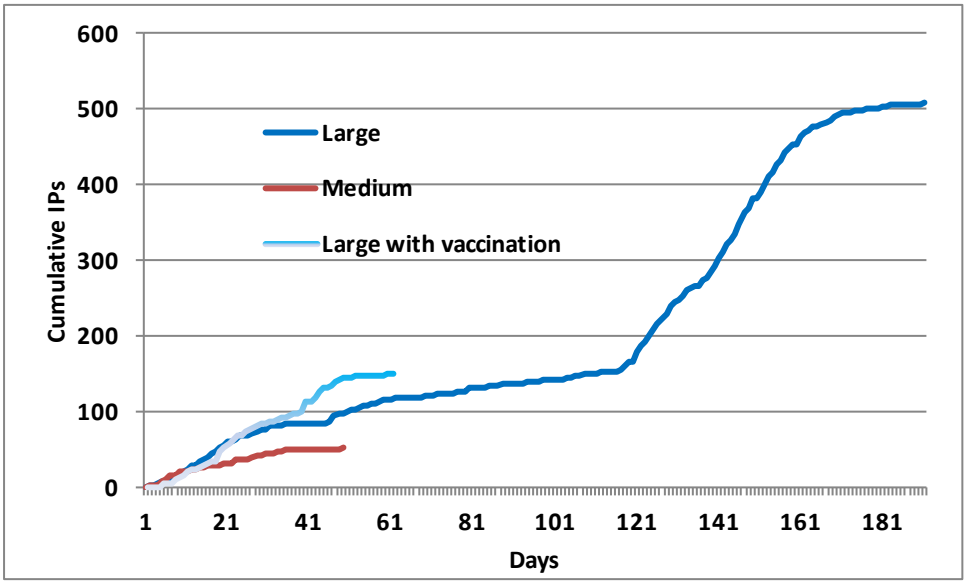
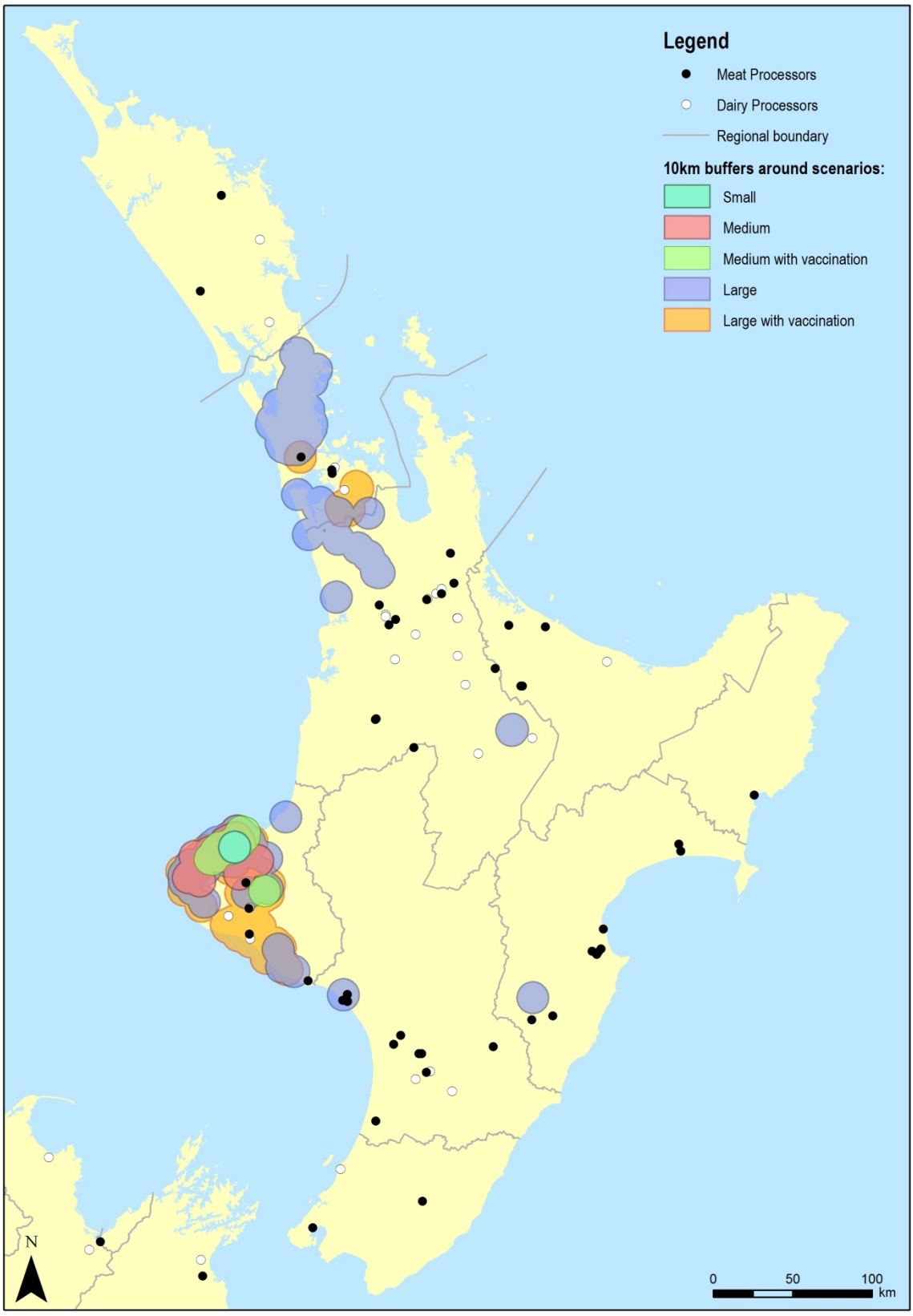


Table 1: Data on FMD incursion scenarios

Scenarios	Small	Medium	Large	Large with vaccination to live	Large with vaccination to die
No. of Infected Properties (IP)	1	52	508	153	153
Duration of incursion (days)	1	50	191	61	61
IP depopulation					
Beef	0	443	8,780	2,083	49,405
Dairy	0	5,048	10,881	15,938	205,228
Deer	0	0	331	121	121
Sheep	9	153	10,775	4,181	4,181
Pigs	2	34	93	801	801
Goats	0	7	407	578	578
Farms in Surveillance Zones (10km radius)	2,101	2,277	12,478	7,726	7,726
Coverage	Taranaki	Taranaki	North Island	Taranaki and Auckland	Taranaki and Auckland

Sources AsureQuality and MPI

Figure 4: Distribution of Infected premises within 10 km radius surveillance zones



MODELLING

From the beginning of the project, industry representatives have been involved in discussions and workshops around the analytical assumptions required to undertake economic modelling of FMD incursion scenarios. MPI's guiding principle is that the modelling required be big picture, plausible and estimable. All models are simplifications of complex biological, social and economic systems, and attempt to represent the key factors that will drive the effects of a shock. Models cannot capture all drivers otherwise they would become too unwieldy and less useful; however they are a useful way to represent and demonstrate some of the different linkages. Often the models can demonstrate effects that would not have been considered prior to the modelling.

For the purposes of this economic impact assessment, a hypothetical FMD incursion was assumed to have taken place on 30 September 2011 to enable a comparison with a baseline of actual exports after that date. Any economic analysis of a FMD incursion is fraught with uncertainty. New Zealand is unique as a global trader with over 90 percent of dairy, beef, lamb, mutton, and venison production exported, and there has been no experience of an actual FMD incursion. Assumptions must be made around how processing industries in New Zealand and how export partner countries might respond during a hypothetical FMD incursion.

With these assumptions in place, spreadsheet modelling of production and export losses and government expenditure on eradication and livestock compensation are carried out.

How processors might respond

In the event of an actual FMD outbreak in New Zealand, the dairy processing industry commented they would make decisions around continuation of processing based on a range of factors that will depend on the type of outbreak that unfolded. Depending on the location, time of year, strategic drying off may be considered, along with other interventions. In particular, FMD eradication activities would be disruptive to milk tanker movements.

For scenarios modelled, it was assumed that strategic drying off of herds would be applied to the geographic spread of the difference scenarios. For the small scenario of one IP in northern Taranaki, it was assumed that all dairy farms within a 10 km surveillance zone would be dried off. For the medium scenario with 52 IP, it was assumed that all dairy farms in Taranaki would be dried off. A large scenario with 508 IP closed down dairying in the whole North Island, while a large with vaccination scenario of 61 IP caused a drying off in Taranaki and Auckland regions.

A second assumption for the dairy industry related to the requirement for double pasteurisation of milk collected from remaining areas of New Zealand, to ensure that dairy products could be manufactured and eventually exported. Based on dairy processing industry advice, a double pasteurisation capacity of 65 percent of peak season milk production was assumed. Double pasteurisation is still an OIE and EU requirement for trade. Future amendments may allow first stage processing to be equivalent to a second pasteurisation.

Views of meat companies were canvassed on a number of questions provided by MPI, to inform assumptions for economic impact assessment. The general response from meat processors was that they would close down processing for exports until after the OIE granted New Zealand FMD freedom and premium overseas meat markets re-opened up again, with only some production for domestic

consumption. This was largely due to uncertainty around financial margins from processing and marketing, and the risk status to processing facilities being compromised.

How importing countries might respond

The pivotal factors relating to the assumptions made about trading partner responses are the rules established by the OIE and interpretations by MPI trade specialists (see Table 2). Key is the OIE ruling that a country previously free of FMD can regain disease free status a minimum of 3 months after the last infected animals have been killed (and provided appropriate evidence to substantiate the disease freedom request.) The allocation of countries into early start, middle and late start categories was based on assessments by MPI trade specialists.

Table 2: Dates from incursion to restoration of exports

Scenarios	Small	Medium	Large	Large with vaccination to live	Large with vaccination to die
First detection	30/9/2011	30/9/2011	30/9/2011	30/9/2011	30/9/2011
Last detection	30/9/2011	19/11/2011	9/4/2012	30/11/2011	30/11/2011
OIE FMD freedom	30/12/2011	19/2/2012	9/7/2012	31/05/2012	29/02/2012
Early trade start [1]	30/1/2012	19/3/2012	9/8/2012	30/06/2012	31/03/2012
Middle trade start [2]	29/2/2012	19/4/2012	9/9/2012	31/07/2012	30/4/2012
Late trade start[3]	30/6/2012	19/8/2012	9/1/2013	30/11/2012	31/08/2012

Source MPI

[1]Early trade start countries for meat exports to resume. Dairy exports start in the month following the last IP.

[2]Middle trade start countries for meat exports to resume. Dairy exports start when OIE declare FMD freedom.

[3]Late trade start countries for meat exports to resume. Dairy exports start six months after the last IP.

There are a number of key factors in New Zealand's favour when it might involve decisions by overseas countries to resume New Zealand imports after a successful eradication of FMD.

- New Zealand export industries and MPI have a good international reputation for biosecurity, animal health, animal welfare and food safety,
- New Zealand is a strong advocate for the reduction of international trade protection including for example global tariffs and non- tariff barriers,
- New Zealand leads by example, e.g. New Zealand was one of the first countries to recognise Japan's FMD free status,
- As New Zealand is the largest exporter of dairy, sheep meat and venison and the 5th largest for beef, the cessation of exports creates a large shortfall for global demand and prices would escalate rapidly and reverse once bans were lifted for New Zealand exports,

- With supply fixed in the short term (up to a year), remaining global supply can only be redirected to higher priced markets,
- New Zealand has large import quotas to the EU for sheep meat and to the US for beef and veal, which can't be filled by other country exporters,
- FMD does not pose a risk to human health, unlike Bovine Spongiform Encephalopathy (BSE).

Current health certificates of many trading partners for meat and dairy products have a clause that a number of diseases including FMD 'do not occur in New Zealand' and in a few cases that New Zealand has been free of FMD for the previous 12 months. In this study, it was assumed that the New Zealand government could negotiate access. For late start countries in the large scenario, a total of 9 months elapse after the last IP.

It was further assumed that New Zealand export sales would begin once overseas countries removed their import bans. Industry representatives raised the possibility of further delays by market participants to reactivate supply chains. There is also the possibility of variation in country recognition of FMD freedom due to the scale of FMD incursion and eradication. All these factors pose downside risks to the estimated economic impact.

Production and export modelling

Two spreadsheets were developed to model the impacts of FMD scenarios on monthly production and monthly exports, one for meat and other animal products, and the other for dairy. Historical monthly series from July 2011 to June 2013 were used as a counter-factual against what might have happened if a FMD incursion had occurred on 30 September 2011.

For meat, production comprised slaughter numbers, slaughter weights and average carcass weights for lambs, adult sheep, total cattle and deer. For dairy, production was milk solids collected for Taranaki, Auckland, the rest of the North Island and the South Island.

Export data derives from the Harmonised System (HS) codes[1] for meat, meat related and dairy products. However, input requirements for the NZTM required matching to Overseas Trade Index (OTI) groups 'Dairy – Treasury' and 'Meat – Treasury' with the remaining products included in 'Other Commodities – Treasury'. The remaining products are fats and oils, meal, guts etc, raw hides and skins, live animals, semen and embryos, and dairy products not included in 'Dairy –Treasury'. The CGEM uses the standard export statistics.

Export data involves volume, value and price and disaggregated by early start, middle start and late start country destinations. For ease of analysis, export availability out of production and export volumes are linked to the same month.

Meat production is split into export availability and apparent domestic consumption. The latter is estimated by converting export volumes to carcass weight equivalents and then subtracting from production. This allows for a variable assumption of increasing domestic consumption (assumed at 15 percent) due to lower prices during a FMD incursion. Note that FMD presents no food safety risks

[1] The Harmonised Commodity Description and Coding System (HS) is an internationally standardised system of names and numbers for classifying traded goods The HS codes are developed and maintained by the World Customs Organisation.

and does not pose a risk to human health. Standard meat inspection procedures will also ensure that no diseased animals enter the human food supply.

Export availability for both dairy and meat can also increase from the carryover of some livestock for subsequent slaughter and from manufactured dairy product stocks once the last IP is identified under any scenario and expectations of the timing for export resumption become known.

There are a number of other variable assumptions incorporated into the spreadsheet models. These are:

- September 2011 export rejection losses (75 percent for meat and 50 percent for dairy) due to products having been produced in the risk period before the disease was detected and confirmed,
- Dairy elasticity at consumer level in developing countries to derive the price decline required to clear end of season dairy stocks after meeting baseline dairy export volumes,
- Monthly exchange rates (in terms of the trade weighted index) during the period from FMD incursion to the restoration of exports.

With the FMD incursion on 30 September, three weeks of previously shipped products are not accepted by trading partners. The loss is assumed to be the value of that amount – representing a combination of destruction overseas, diversion to lower priced markets and shipped back to New Zealand.

The exchange rate was assumed to depreciate sharply with the FMD incursion and then appreciate as New Zealand exports recovered.

In the event of an FMD incursion, world prices would increase substantially due to the exclusion of New Zealand exports of dairy and meat products, and then fall back to baseline levels as exports are restored to early start, middle start and late start countries. No attempt was made to estimate these higher prices or any transition back to baseline price levels.

The possibility of New Zealand losing its premium status for dairy and meat exports has been raised in discussions. There are difficulties in estimating what the premiums might be. A scan of export statistics from New Zealand (FMD free) and a significant exporter, India (FMD endemic), indicates higher average prices of beef and skim milk powder for New Zealand in the same export destinations, but this might not be entirely due to FMD status.

The processes in the spreadsheet models were as follows:

1. Set up monthly production data for livestock slaughter and similarly for milk solids collections.
2. Set up monthly export data for meat and similarly for dairy.
3. Derive the livestock slaughter requirements to match the resumption in export trade in each FMD scenario.
4. For dairy, adjust down milk solids collections specific to each FMD scenario and estimate export availability from processing the milk solids.

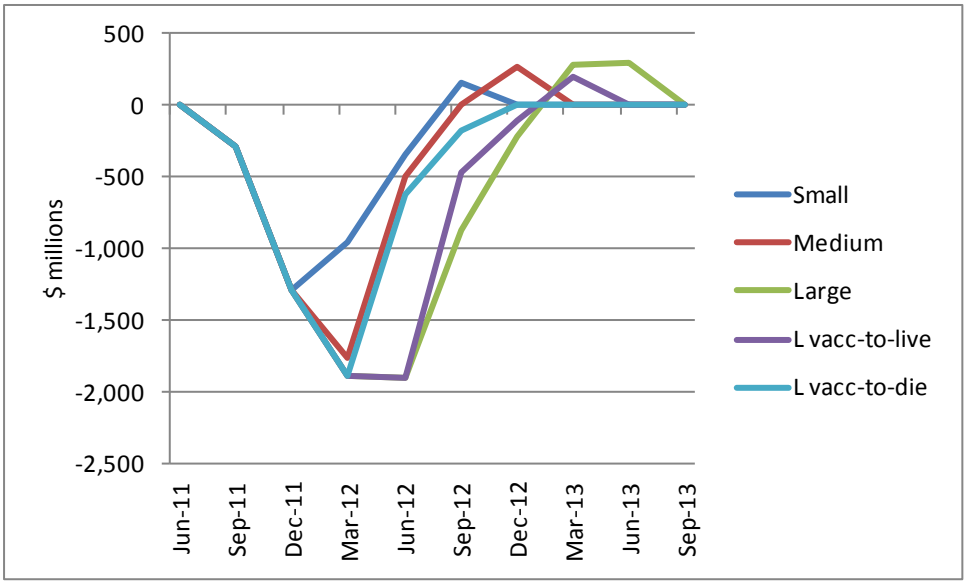
5. Dairy stocks build up when monthly export availability exceeds baseline export volumes. At the end of the season stocks are sold at a lower price to developing countries over a six month period.
6. Aggregate export data into quarterly format as inputs for macroeconomic modelling.

Results

Export value losses for meat and other products are illustrated in Figure 3 for the FMD scenarios, from June quarter 2011 to September quarter 2013. The total losses over the two years to June 2012 were $2.73 billion for the small scenario, $3.55 billion for the medium scenario, and $5.87 billion for the large scenario. Vaccination-to-die was the better option as it reduced the large scenario to $4.25 billion, while the large with South Island early freedom scenario reduced the large scenario to $4.94 billion. The increased export value once markets re-open in all scenarios reflects an anticipatory build up of livestock on farms for export slaughter.

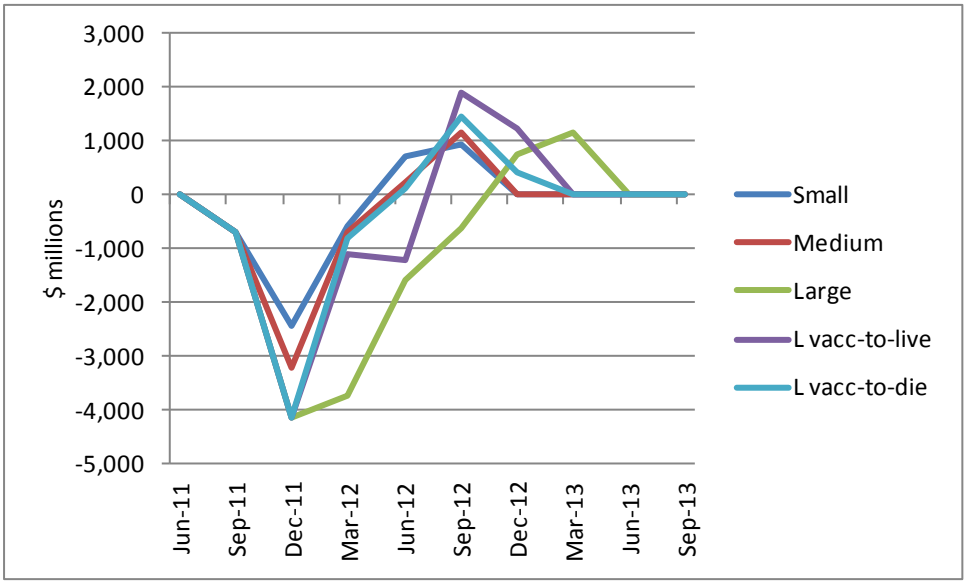
Export losses for dairy products are illustrated in Figure 4 for the FMD scenarios from June quarter 2011 to September quarter 2013. The total losses over two years to June 2012 were $2.00 billion for the small scenario, $3.20 billion for the medium scenario, and $8.84 billion for the large scenario. Vaccination to die was the better option as it reduced the large scenario to $3.96 billion, while there was no advantage for early freedom to the South Island. The increased export value once markets re-open in all scenarios reflects the sale of dairy product stocks built up during the FMD incursions.

Figure 3: Meat and other products export value losses for FMD scenarios



Sources: Statistics New Zealand and MPI

Figure 4: Dairy export values for FMD scenarios



Sources: Statistics New Zealand and MPI

The assumption that meat processors close down until markets open again results in the need for livestock to be destroyed on farms. The livestock numbers estimated are set out in Table 3. Pigs have not been included in this table as it was uncertain how the outbreak would impact on domestic pork consumption and on pork imports. A decline in pig slaughter figures would result in significant numbers of pigs requiring destruction for animal welfare reasons.

This destruction is not for disease control purposes but for welfare purposes only. Refer to table for livestock numbers to be destroyed for disease control purposes.

Table 3: Livestock to be destroyed for welfare purposes

	Small scenario	Medium scenario	Large scenario
Lambs	7,550,000	10,900,000	16,500,000
Adult sheep	1,750,000	2,270,000	3,080,000
Cattle and calves	1,090,000	1,790,000	3,070,000
Deer	115,000	239,000	356,000

Source MPI

FMD ERADICATION AND LIVESTOCK COMPENSATION EXPENDITURE

A response cost calculator spreadsheet has been developed for Government-Industry Agreement (GIA) applications. The template was adapted to meet the requirements for FMD eradication (net of baseline budgets) and compensation expenditures with estimates for each scenario summarised in Table 4.

The eradication costing was done in consultation with staff from AsureQuality and MPI. Compensation estimates were restricted to livestock depopulated on all IP as part of FMD eradication. These depopulated numbers were generated after the FMD scenario simulations using ISP. Compensation expenditure was then derived using the Inland Revenue Department's livestock values for March year 2012.

Table 4: Eradication and livestock compensation

	Eradication expenditure	Livestock compensation
Small scenario	$24.2 million	$1,710
Medium scenario	$122 million	$10.3 million
Large scenario	$1,169 million	$30.8 million
Large with vaccination to live	$172 million	$21.0 million
Large with vaccination to die	$249 million	$230 million

Sources: AsureQuality, Inland Revenue Department and MPI

This is a minimum estimate of compensation liability and only reflects compensation for destruction of animals for disease control purposes. Compensation claims would apply to cases of slaughter on suspicion of FMD infection and from imposed movement controls during FMD eradication, but there was inadequate and potentially variable information on which to base any estimates. These estimates therefore do not cover losses suffered as a result of slaughter on suspicion, movement restrictions, or damage to chattels or property caused by the exercise of powers under the Biosecurity Act 1993 (other than the slaughter of livestock). See Appendix for details around compensation under the Biosecurity Act 1993.

Any recovery package by the government of the day has also not been accounted for. Medium and large FMD scenarios would trigger an extreme adverse event, and enable financial assistance to farm families. Normal financial assistance would apply to people out of work.

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APPENDIX - COMPENSATION UNDER THE BIOSECURITY ACT 1993

The provisions for the payment of compensation are set out in Section 162A of the Biosecurity Act 1993, amended in 1998.

The compensation provisions provide for losses arising from actions of the exercise of powers under the Biosecurity Act. The key features of the compensation provisions are:

- losses must be caused by the exercise of powers under the Biosecurity Act for the purpose of managing or controlling any pest or disease and not from the effects of the pest or disease itself;
- losses must be verifiable;
- losses must result from damage to, or destruction of property, or from restrictions placed on the movement or disposal of goods;
- claimants receiving compensation must be placed in no better and no worse position than any person whose property or goods are not directly affected by the exercise of the powers;
- compensation must not be paid:
    - for a loss related to unauthorised or goods that have not been cleared for import;
    - for a loss suffered before the time the exercise of the powers commenced; or
    - to any person who has failed to comply with the Biosecurity Act or regulations made under the Act; where the failure is serious or significant; or contributed to the presence or spread of the pest or disease being managed or eradicated; and
    - in the event of dispute, the compensation claim must be submitted to arbitration.

Compensation under the Biosecurity Act is related only to the use of statutory powers under the Act and not to the presence of, or losses due to, pests and diseases.

All reasonable steps must be taken by affected parties to mitigate losses. Compensation is calculated so that those affected are no better or worse off than any person whose property or goods are not directly affected by the exercise of the powers. It is the responsibility of the individual or organisation incurring the loss to present a claim, which must be verified by evidence. MAF will consider all claims for compensation, and offer settlement where this is consistent with section 162A of the Biosecurity Act.