Factsheet 2: Projected Climate-related Impacts on Food Safety/Systems in the Meat Sector

RISK MATRIX

The risk matrix represents a sector specific overview of the climate change impacts to food safety and systems, their risk now, in the future under a high emission scenario, and following suggested adaptation options. The risks are defined as low = green, medium = yellow, high = orange, high = red. Information used to develop the risk matrices was sourced from scientific publications and industry feedback from Workshop 1 and based on the high emission scenario. The purpose of the risk matrix is to provide a summary of potential impacts for discussion with representatives from the NZ food sectors, research providers and government agencies.

Issues have been categorised as follows:

Category 1: Existing hazards affected by climate change

- Those arising from infectious agents
- Those arising from naturally occurring chemicals and biotoxins

Category 2: From risk management to address climate change issues

- Chemical interventions (pesticides, antibiotics etc.)
- Other changes in production processes

We have based our indications of climate change expected over the next 100 years on the highest representative concentration pathway (RCP) 8.5, because this enables us to more clearly assess future change.

Additional commentary is provided below the table.

CLIMATE CHANGE AND FUTURE IMPACTS

Extreme events are likely to increase and include:

- Frequency, duration and intensity of hot spells,
- Frequency of heavy precipitation events and the potential for associated flooding,
- Incidence of extremely high sea levels during storm surges,
- Longer dry spells in some areas (especially in the north of the North Island and east of both islands), and the area affected by drought each year, are likely to increase.
- Cold spells and frosts will decrease in frequency, duration and intensity (Solomon et al 2007).

Changes to the average climate will include:

- Most areas of New Zealand will experience increased average crop and pasture yields associated with anticipated mean temperature rises of 1–3°C,
- Average annual rainfall in New Zealand will generally increase in the south and west and generally decrease in the north and east of the country, with seasonal variations.
- The winter season is projected to have the greatest rainfall changes (an exacerbation of the annual changes), as westerly winds (particularly across the South Island) are likely to strengthen. Together with warmer temperatures, this is likely to have a significant effect on winter cropping and pasture production.
- Average relative humidity is likely to increase for most areas of New Zealand.
- By the end of the 21st century, mean growing season temperatures are highly likely to equal current extremes in temperate areas (including New Zealand) and to exceed them in the tropics and subtropics, resulting in major impacts on global food production (Battisti and Naylor 2009).

FOOD SAFETY SYSTEM ISSUES

The impacts of global climate change on food systems will be widespread and complex

- Scientific consensus says that individual pathogens will differ widely in epidemiological responses, the net impact of climate change will lead to a large increase in the burden of infectious diseases (Costello et al 2009).
- For plant-derived foods including stock feed, mycotoxins are considered the key issue for food safety under climate change (Tirado et al 2010).
- Rising incidence of disease will lead to overuse or misuse of pesticides and veterinary medicines, particularly in fisheries (Miraglia et al 2009; Solomon et al 2007; Tirado et al 2010).

Specifically for NZ's Meat Sector:

Increase in hot days (maximum temperature of 25°C or higher)

- Changes to mitigate heat stress such as housing for shelter may increase food safety risks e.g. hide contamination, crowding conditions, hygienic dressing more difficult.
- Heat stress may result in more shedding of STEC (see case study).
- Increased demand for water and declining water quality could all lead to increases in the levels of pathogens and chemicals in food.
- Extreme drought can lead to boreholes contaminated with nitrates.

Increased rainfall and humidity

- Increased rainfall and humidity will also lead to more animal stress that increased shedding of pathogenic bacteria. This will also result in higher pathogen loads transferred to waterways.

Increased winter rainfall coupled with milder winter temperatures

- Contamination of pasture, drinking water and silage by emission, soil, manure and water leading to increased contamination of livestock
- Increased pesticide and veterinary drug residues in the environment, leading to new or higher residues in food, some from new approvals.
- Changes in pesticide activity of some pesticides.
- Control responses may generate food safety problems due to the novelty of the pests in question as well as the unfamiliarity of farmers using the controls
- Increase spread of facial eczema resulting in increased use of zinc treatments.
- Muddy conditions can be created where cows are more likely to feel tired and lay down, such that their udder will become coated with mud, increasing contact with environmental pathogens.
- Reduced grazing, can also occur resulting in a lowered immune system
- Rainfall and muddy conditions are stressful and also may result in more hide contamination.

Emergence of new exotic pests, weeds and diseases resulting in outbreaks:

- Increased microbial burden on carcasses and meat leading to foodborne illness.
- Animals carrying more enteric pathogens in their guts or body surfaces e.g. research has indicated that retail products are more likely to carry higher total viable bacteria counts in summer.
- Increased risk of antibiotic-resistant pathogens developing.
- Mycotoxins, including aflatoxins will increase in range, type and amount. When cows consume aflatoxin-contaminated feeds and milk products can also serve as an indirect source of aflatoxins.

Local efforts to reduce greenhouse gas emissions

- Refrigerant management ranked as the No. 1 global solution in terms of estimated atmospheric CO_2-equivalent reductions between 2020 and 2050. About 20% of the global-warming impact of refrigeration plants is due to refrigerant leakage.
- Reduced meat and dairy consumption – ethical food choices
- Land use changes

ADAPTATION OPTIONS

At the farm level

- Better use of seasonal climate forecasting (Jarvis et al 2011).
- Greater deployment of water conservation technologies
- Diversification of on-farm activities (Hansen et al 2007).
- Improved farm design, provide shelter through trees or housing systems
- Development and adoption of different varieties and species more suited to emerging climatic conditions,
- Improved management of pests and diseases,
- Promotion of integrated pest management and non-synthetic methods of pest control
- Adjustments in cropping and management practices (Easterling et al 2007; Jarvis et al 2011).
- Shift in production to areas more suitable e.g. further south to avoid new pests and diseases or to areas with more reliable rainfall/water supply
- Reduction of mingling during transport and lairage of calves.
- Changes in management of calf shed – e.g. number of animals, bedding turn-over.
- Decontamination of hides at lairage.
- Post dressing interventions: hot water acidified sodium chloride wash.

At post-harvest/off-farm level

- Improving energy efficiency,
- Promotion of alternative refrigeration technologies and refrigerants such as fluorinated gases (MfE, 2017; EECA business 2017)
- Switching to cleaner and renewable fuels,
- Improved processing and food safety technologies,
- Strengthening food safety systems, including hazard intervention and control
- Improving non energy resource efficiency, such as through recycling and reuse.
- CH_4 from wastewater treatment could potentially be recaptured for energy generation, minimize food waste
- Enhanced transport truck hygiene measures.

CASE-STUDY: STEC (Shiga toxin-producing Escherichia coli)

STEC are bacteria primarily transmitted via the faecal-oral route. Ruminants, predominantly cattle, are important reservoirs. STEC has no known animal health or production effects and is considered normal gut flora. Due to the public health risk, STEC are a red meat trade concern and declared adulterants of beef and bobby veal in the USA. STEC are also a domestic public health risk, causing haemorrhagic diarrhoea and kidney failure, particularly in children. New Zealand has a high and increasing incidence of human cases of STEC compared to other countries, with 9.6 cases per 100,000 people reported in 2016. A 2011/2012 New Zealand case-control study of 113 cases and 506 controls identified the presence of cattle in the local area, contact with animal manure and contact with recreational waters, as significant risk factors for human STEC infection.

A nationwide 2014 cross-sectional study of 1508 young calves on 102 randomly selected dairy farms reported 20% of calves and 75% of farms had infection detected of STEC. Risk factors included region, with Northland most affected, and increased shed humidity and number of calves per shed.

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