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Biosecurity attitudes and practices among NZ lifestyle block owners

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by Pike Stahlmann-Brown, Manaaki Whenua – Landcare Research

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Publications Logistics Officer
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PO Box 2526
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Reviewed by:	Approved for release by:
Pam Booth Associate Economist Manaaki Whenua – Landcare Research	Suzie Greenhalgh Portfolio Leader – Society, Culture & Policy Manaaki Whenua – Landcare Research
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1 Remit

On 28 May 2018, the New Zealand Government and its Government Industry Agreement (GIA) partners made the decision to attempt to be the first country in the world to eradicate *Mycoplasma bovis (M. bovis).* The Government announced an investment of up to $30M over 2 years for science to support the eradication effort. The *M. bovis* Strategic Science Advisory Group (SSAG) was established in July 2018 to support prioritisation of science to accelerate eradication. Science Priorities are outlined in the *M. bovis* Science Plan, which was drafted by the SSAG and informed by scientists, government, and industry. The *M. bovis* Science Programme is charged with delivery of the Plan and provides high-level recommendations to the *M. bovis* Governance Group on the requirements for strategic science as outlined in the Plan (https://www.mpi.govt.nz/dmsdocument/32713/direct). A collaborative, multidisciplinary approach is central to the Science Plan – social, biophysical, and technological expertise need to be harnessed to address the complexities of the eradication.

Manaaki Whenua – Landcare Research was commissioned to undertake a survey of lifestyle block owners' biosecurity attitudes and practices. This was to contribute to meeting the objectives under the Behaviour, Drivers and Incentives section of the *M. bovis* Science Plan.

Specifically, the survey sought to learn more about:

- animals held by lifestyle block owners
- animal movements among lifestyle block owners and other off-farm movement
- how and where lifestyle block owners acquire stock
- compliance with relevant provisions in the NAIT Act and the Biosecurity Act
- current biosecurity practices, and
- risk perceptions in relation to *M. bovis* and other incursions of animal disease.

In addition, the survey sought to better understand how the attitudes and practices of lifestyle block owners differs from those of commercial cattle farmers.

The desired outcomes were enhancement of MPI's understanding of current attitudes towards biosecurity in New Zealand by lifestyle block owners and a report that can be utilised by MPI the GIA partners and, potentially, OSPRI ltd to support decisions in relation to the *M. bovis* response in particular and the biosecurity system in general.

2 Key findings

Commercial and lifestyle farmers were asked about their biosecurity practices, providing an indicator of claimed compliance and prevalence of risk behaviours. The following findings summarise results that are described extensively in the Detailed Results section below.

2.1 Survey sample

- The survey included 286 commercial cattle farmers (including both dairy and beef), 568 lifestyle block owners with cattle (including both dairy and beef), and 152 lifestyle block owners without cattle.
- **The median lifestyle block owner who owns cattle owns two dairy cattle or seven beef cattle.**

2.2 Reasons for owning cattle

- **Meat production and paddock control are the main reasons lifestyle block owners keep cattle.**

2.3 Cattle management

- Moving livestock among farms and lifestyle blocks is a potential pathway for disease transmission. **Apart from buying in cattle, movement of cattle on and off farm is limited.** For example, 27% of commercial farmers and 12% of lifestyle block owners with cattle graze their cattle off-farm. Commercial farmers are more likely than lifestyle block owners to finish or trade cattle off farm, to slaughter cattle off farm, and to have cattle wander off the property.

- **Commercial farmers and lifestyle block owners largely comply with National Animal Identification and Tracing (NAIT) requirements**: 97%+ use ear tags that are registered with NAIT. In addition, most respondents report having a designated person in charge of animals (PICA) on the property.

2.4 Sourcing equipment, organic material, and germplasm

- Shared equipment is another potential biosecurity risk. Conditional on using such equipment, **lifestyle block owners with cattle are more likely than commercial farmers to borrow equipment** such as yards, tagging equipment, radio-frequency identification (RFID) readers, drench equipment, pour-on equipment, and calf-rearing equipment from friends, and neighbours.
- Bringing in organic material (e.g. soil, feed, see, and fertiliser) represents another biosecurity risk, particularly if they are not from commercial/retail sources. **Eleven percent of commercial farmers and 20% of lifestyle block owners with cattle bring in organic materials and source at least some of what they bring in from friends and neighbours.**
- **Lifestyle block owners are less likely to bring in bull semen for artificial insemination** relative to their commercial counterparts, with 97% of commercial farmers and 43% of lifestyle block owners bringing in semen.
- **Eight percent of lifestyle block owners who own both cattle and pigs and 14% of commercial cattle farmers with pigs report feeding their pigs uncooked meat products**, a recognised vector for many serious livestock diseases.

2.5 Biosecurity definitions and perceived threats

- **Respondents often interpreted 'biosecurity' in terms of national borders or farm borders, but rarely both.** Commercial farmers often focused on their own properties and animals, whereas lifestyle block owners were more likely to emphasise national borders.
- Cattle owners – whether commercial or lifestyle – also interpreted biosecurity in terms of trade, industry, and traceability.
- **Commercial farmers named *M. bovis* as a serious biosecurity threat** alongside TB, foot-and-mouth disease, and other livestock diseases, stock movement, and lax border controls. **Lifestyle block owners with cattle also emphasised *M. bovis*** and other livestock diseases.
- Weeds were also widely recognised as serious biosecurity threats by both commercial farmers and lifestyle block owners.

2.6 Perceptions regarding biosecurity

- Most respondents believe that biosecurity is a concern, that they are responsible for biosecurity on their own properties, that their biosecurity practices are good, and that biosecurity on their properties affects the rest of New Zealand. However, **a significant number of respondents are uncertain whether people who visit their properties follow biosecurity procedures**.
- Commercial farmers are less likely than lifestyle block owners to believe that New Zealand has strong biosecurity laws or that responses to recent biosecurity threats have been either efficient or effective.

2.7 Experience with *Mycoplasma bovis*

- Ten percent of commercial farmers report having been affected by *M. bovis* and 56% report knowing someone who has. Two percent of lifestyle block owners with cattle report having been affected by *M. bovis*, and 25% report knowing someone who has.
- *M. bovis* caused 61% of commercial farmers to change their biosecurity procedures. **Thirty-three percent of lifestyle block owners with cattle changed their biosecurity procedures as a result of *M. bovis***, as did 14% of lifestyle block owners without cattle.

2.8 Behaviour and attitudes of lifestyle block owners with cattle by demographic group

- **Lifestyle block owners in regions most affected by *M. bovis* are more likely to have changed their biosecurity practices as a result of the disease** than those in regions that were less impacted.

2.9 Relevance and trust in sources of information on biosecurity

- **Biosecurity information provided by veterinarians, industry bodies, MPI/Biosecurity NZ, and research institutes is considered relevant and trustworthy** by commercial farmers and lifestyle block owners alike.
- Commercial farmers are more likely than lifestyle block owners to value biosecurity information provided by industry businesses and industry bodies.

3 Methods

3.1 The Survey of Rural Decision Makers

Conducted biennially since 2013, the Survey of Rural Decision Makers (SRDM) collects detailed information on issues of topical interest to the primary sector in New Zealand. The sample was initially drawn from official databases of farmers, foresters, and growers, including the National Animal Identification and Tracing (NAIT) system. Subsequent waves have been widely promoted by industry bodies and central and regional government. Respondents represent the entirety of the primary sector in all 16 regions in New Zealand. Respondent demographics are representative of the primary sector as a whole, although the dairy and beef industries are overrepresented as an artefact of the sampling strategy (Stahlmann-Brown 2019). The most recent (2019) wave of the survey yielded 3,740 complete responses, approximately 2,000 of whom self-identify as being lifestyle block owners. More than 1,200 lifestyle block owners consented to participating in supplemental surveys related to the primary sector.

3.2 Supplemental survey on biosecurity practices on lifestyle blocks

The primary target for this survey was lifestyle block owners with cattle. However, to better understand how lifestyle block owners with cattle differ from commercial cattle farmers on the one hand and from lifestyle block owners without cattle on the other, we also surveyed respondents representing these two groups.

This short, targeted supplement to the Survey of Rural Decision Makers was developed and administered on the Qualtrics platform. Branching and logic were used to ensure that respondents only saw questions that were relevant. On average, the survey took approximately 10 minutes to complete.

To encourage respondent participation, Manaaki Whenua donated $10 to the Rural Support Trust for each complete response received, up to $10,000 in total. The Rural Support Trust provides free and confidential support for rural people and farming families facing challenges including drought and *M. bovis*. There were also four prize draws for $250 supermarket vouchers.

3.3 Survey sample

The survey invitation was sent to 1,514 individuals who had previously completed the Survey of Rural Decision Makers and who had agreed to participate in additional surveys related to the primary sector. Four individuals wrote to indicate that they have since sold the property, leaving 1,510 valid potential respondents. The mailer that was used does not monitor whether people actually opened the email. Thus, the response rate we report is based on the assumption that everyone opened the invitation and was still on their rural property, both of which are unlikely. As such, our response rate calculation is quite conservative.

In total, 1,029 people completed the survey, yielding a response rate of 68.15%. Pre-contact, invitation personalization, reminders, relevant subject matter, and incentives – all of which were used here – have been demonstrated to increase survey response rates (Cook et al. 2000). Even so, this response rate is high by research standards.

Of those 1,029 respondents, 23 were outside the target sample scope, e.g. commercial farmers who had cattle in the past but who no longer do so. Removing these respondents yielded 1,006 complete responses that may be categorized as being ‘commercial farmers’ (i.e. sheep and beef farmers, dairy farms, and graziers who operate on a commercial or largely commercial basis, n=286), ‘lifestyle block owners with cattle’ (i.e. lifestyle block owners who own cattle and/or who graze others’ cattle on their

properties, *n*=568), and 'lifestyle block owners without cattle' (i.e. lifestyle block owners who neither own nor graze cattle, *n*=152) (Fig. 1).

If our sampling was random, our figures would suggest that 78.9% of all lifestyle block owners own or graze cattle on their properties. However, the Survey of Rural Decision Makers intentionally oversamples cattle owners, so the share of lifestyle block owners with cattle is very likely lower. Even so, Kate Brennan from lifestyleblock.co.nz reports that their surveying puts the share of lifestyle blocks with cattle above 50% (Brennan, pers. comm.), underscoring the importance of understanding how lifestyle block owners with cattle differ from their peers.

Figure 1. Survey sample (n and percent).

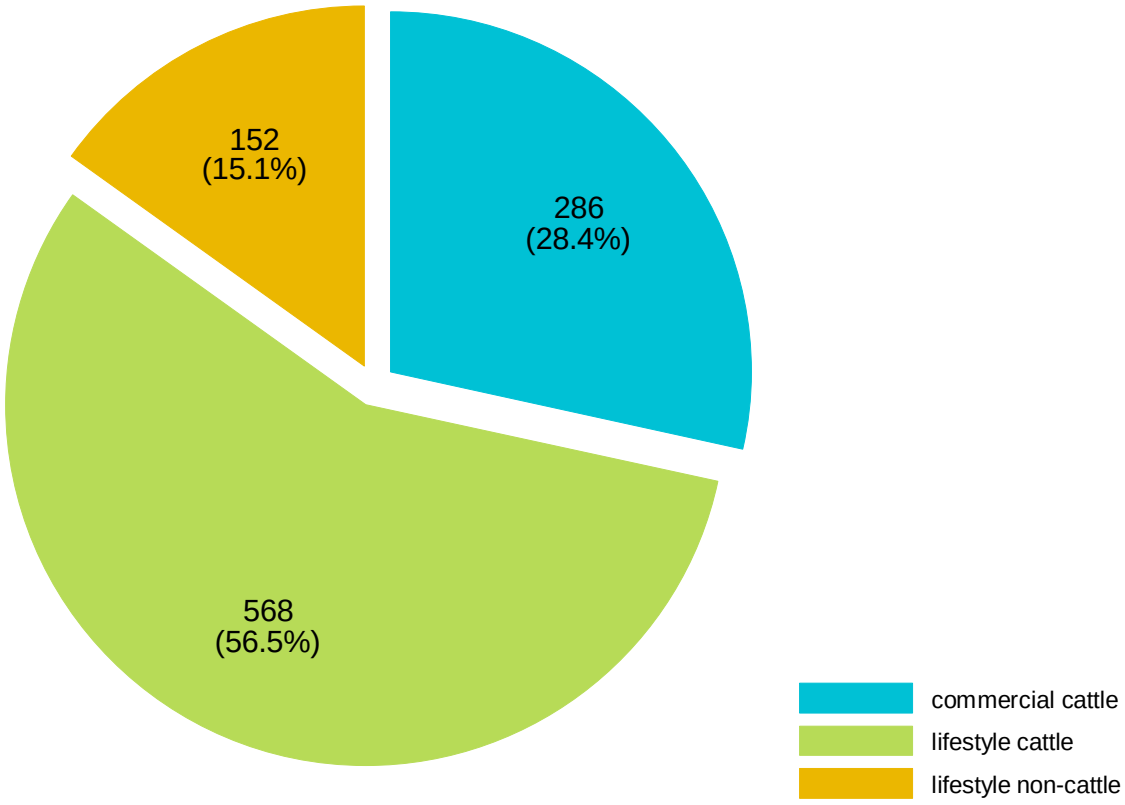


Table 1 presents summary statistics for the number of dairy and beef cattle owned and grazed among lifestyle block owners. Notably, this sample of self-identified lifestyle block owners includes one respondent who owns 60 dairy cattle, another who owns 150 beef cattle, a third who has grazed up to 400 dairy cattle on the block, and a fourth who has grazed up to 120 beef cattle on the block. Although the definition of 'lifestyle blocks' is subject to interpretation, our sample of self-identified lifestyle block owners includes farms that many would classify as being commercial in scale.

As such, it is useful to emphasise the median cattle holding of respondents rather than their average holdings. The median lifestyle block owner with dairy cattle owns two cattle beasts. The median lifestyle bock owner with beef cattle owns seven beasts. Overall, the median lifestyle block owner with dairy and/or beef cattle owns seven cattle beasts.

In terms of area, the median commercial farm in our sample is 181.5 hectares. The median lifestyle block with cattle is 5.8 hectares. The median lifestyle block without cattle is 6.0 hectares.

Lifestyle block owners who graze in dairy cattle graze 29 cattle beasts while those who graze in beef cattle graze eight cattle beasts. The median lifestyle block owner who grazes cattle grazes ten cattle beasts.

Table 1. Cattle on lifestyle blocks, by type and ownership

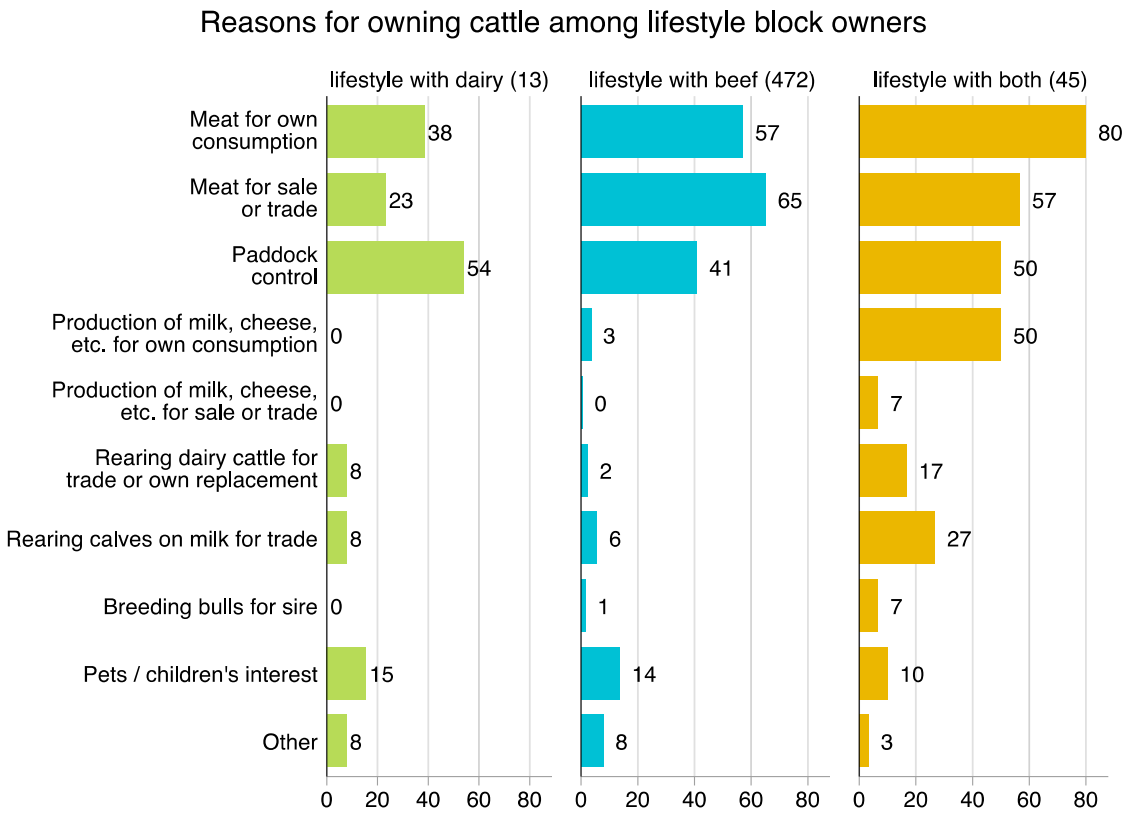
	obs	mean	median	Std dev	smallest	largest
Own dairy cattle	40	5.9	2	10.7	1	60
Own beef cattle	516	13.2	7	13.1	1	150
Other's dairy cattle	28	64.4	29	103.8	1	400
Other's beef cattle	76	14.0	7.5	19.8	1	120
All owned cattle	531	13.2	7	17.0	1	152
All grazing cattle	96	29.9	10	63.8	1	400

4 Detailed results

4.1 Reasons for owning cattle

Lifestyle block owners who own cattle were asked why they do so. Responses are shown in Figure 2, reporting separately for those who own dairy cattle only (green, *n*=13), beef cattle only (blue, *n*=472), and both (orange, *n*=45). For all three groups, meat production (whether for own consumption or for sale/trade) and paddock control are the main purposes for keeping cattle. Among lifestyle block owners with both dairy and beef cattle, milk production for personal consumption, rearing calves on milk for trade, and rearing dairy cattle for trade or own replacement are also common. Overall, 13% of lifestyle block owners with cattle reported keeping dairy and/or beef cattle as pets.

Figure 2. Reasons for owning cattle among lifestyle block owners (percent).

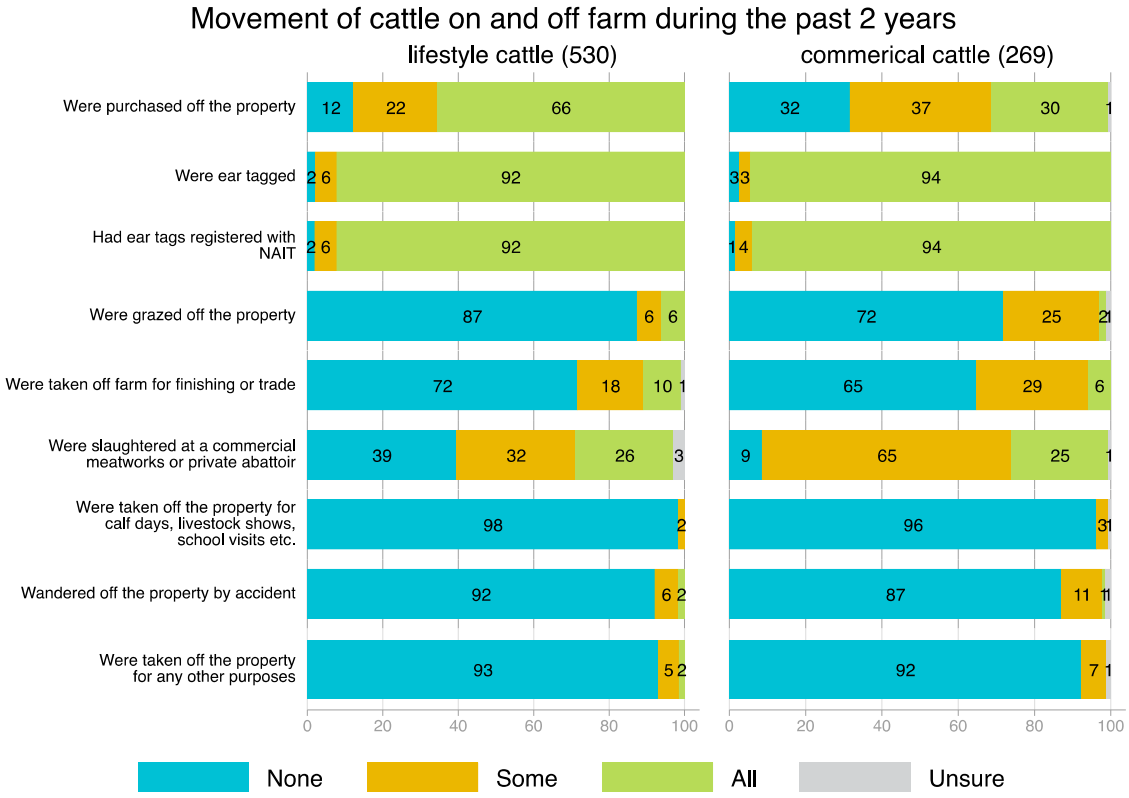


4.2 Cattle management

Because movement of stock and equipment between properties represents a potential disease pathway (Menzies & Neill 2000; Enticott 2008; Brennan et al. 2009; Biosecurity New Zealand 2019a), both commercial cattle farms (including both dairy farmers and sheep and beef farmers) and lifestyle block owners with cattle were asked about these topics as well as traceability of their animals. Stock movement and traceability for these two groups are shown in Figure 3.

Both lifestyle block owners with cattle (left panel) and commercial farmers with cattle (right panel) commonly bring in purchased cattle. Virtually all cattle are ear tagged and registered with NAIT, as required, whether they are located on commercial farms or lifestyle blocks. Ninety percent of commercial farmers and 57.6% of lifestyle farmers have taken cattle to a commercial meatworks or private abattoir in the previous two years. Few respondents from either group take their cattle off their properties for calf days, livestock shows, school visits, or other purposes. Similarly, few have had cattle wander off their properties.

Figure 3. Movement of cattle (percent).



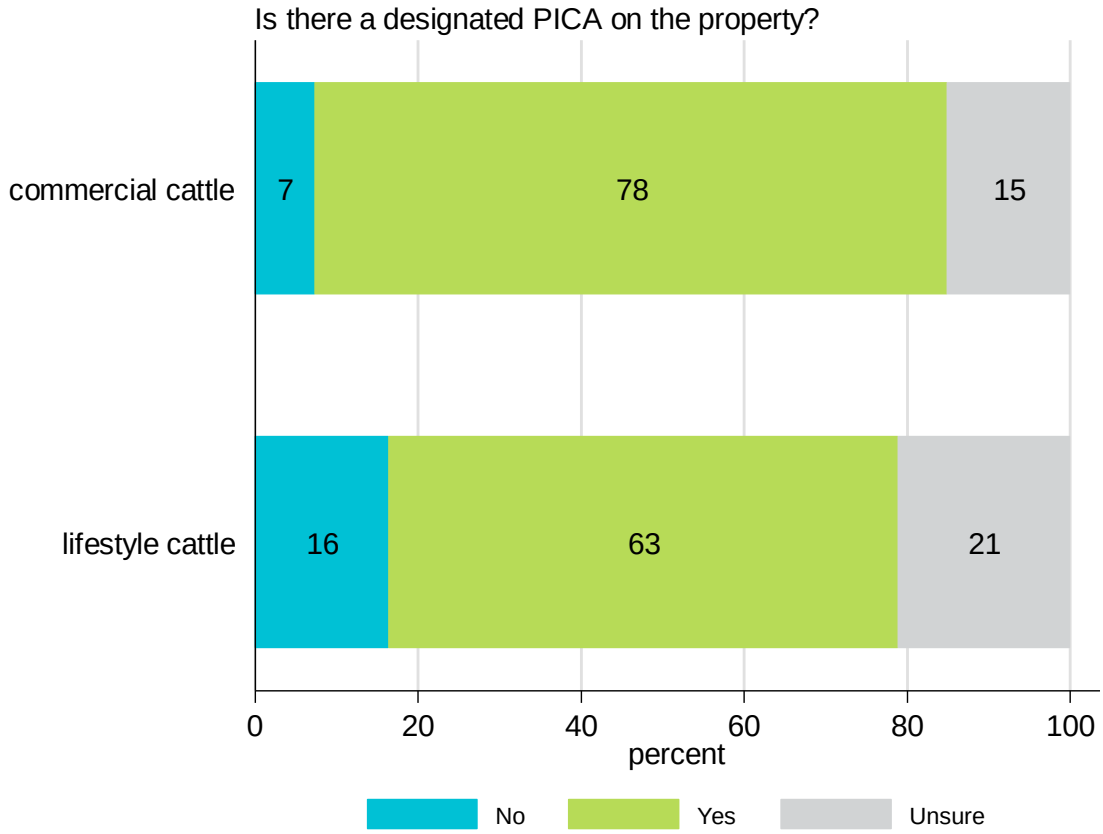
We use two-sided t-tests to statistically evaluate any differences in the share of respondents in each group who reported 'some' or 'all' within each category. Vis-à-vis commercial farmers, lifestyle block owners are:

- More likely to bring cattle purchased elsewhere onto the farm ($p < 0.01$)
- Less likely to graze cattle off the property ($p < 0.01$)
- Less likely to take cattle of the farm for finishing or trade ($p < 0.05$)
- Less likely to slaughter cattle at commercial meatworks or private abattoirs ($p < 0.01$), and
- Less likely to have had cattle wander off the property by accident ($p < 0.10$).

Any differences in traceability (e.g. whether cattle are ear tagged) are statistically indistinguishable.

Conditional on the respondent knowing whether there is a designated person in charge of animals (PICA) on the property, lifestyle blocks are statistically less likely to have one ($p < 0.01$) (Fig. 4).

Figure 4. Person in charge of animals (percent).



4.3 Sourcing equipment, organic material, and germplasm

Rearing cattle makes use of equipment ranging from yards for stock management to RFID readers to read ear tags. Table 2 indicates whether such equipment is owned, hired, or borrowed for both commercial cattle farmers and lifestyle block owners with cattle. For example, 97.6% of commercial farmers in our sample own yards. A further 2.4% borrow yards, and none hire them. Among lifestyle block owners, 77.3% own yards, 9.2% borrow yards, 0.5% hire yards, and the remaining 13.0% do not use yards.

While the vast majority of commercial farmers use yards, tagging equipment, drench equipment, and pour on equipment, 47.9% of commercial farmers in our sample do not use RFID readers and 38.5% do not use calf-rearing equipment. Usage rates are qualitatively lower for lifestyle block owners for all equipment except portable milking machines.

Shared equipment presents a potential biosecurity risk, particularly if equipment is borrowed from friends or neighbours who have less robust biosecurity procedures than commercial rental companies (Brennan & Christley 2012). However, hiring cattle-rearing equipment is uncommon among respondents, and conditional on using such equipment, commercial farmers are generally more likely to own and less likely to borrow such equipment. Using one-way analysis-of-variance models with the Bonferroni multiple-comparison test, we find that – conditional on using this equipment – lifestyle block owners with cattle are:

- Less likely to own ($p < 0.01$) and more likely ($p < 0.01$) to borrow yards
- Less likely to own ($p < 0.01$) and more likely ($p < 0.01$) to borrow tagging equipment
- Less likely to own ($p < 0.01$) and more likely to borrow ($p < 0.01$) RFID readers

- Less likely to own ($p < 0.05$) and more likely to borrow ($p < 0.05$) drench equipment
- Less likely to own ($p < 0.05$) and more likely to borrow ($p < 0.01$) pour-on equipment, and
- More likely to borrow calf-rearing equipment ($p < 0.10$).

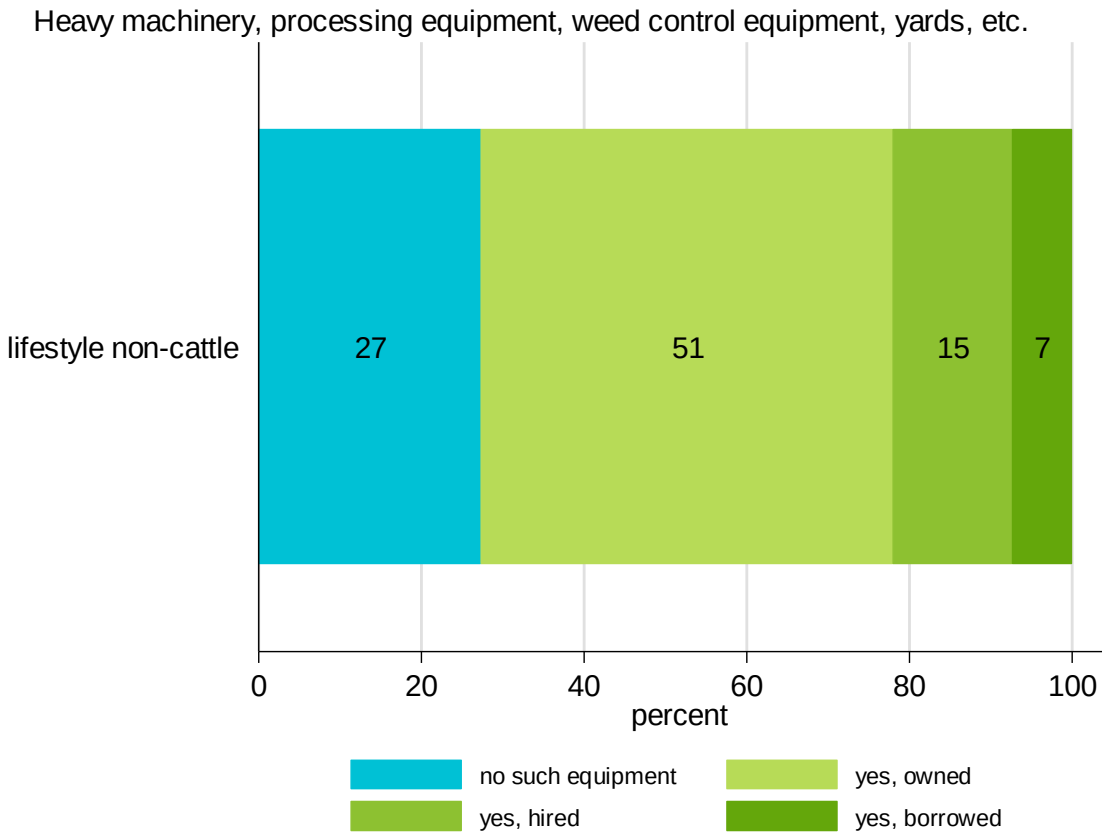
In addition, lifestyle block owners with dairy cattle are also more likely to own portable milking machines than commercial dairy farmers ($p < 0.10$).

Table 2. Equipment use and source

	Commercial farmers				Lifestyle block owners with cattle			
	Own	Hire	Borrow	Do not use	Own	Hire	Borrow	Do not use
Yards	97.6%	0.0%	2.4%	0.0%	77.3%	0.5%	9.2%	13.0%
Tagging equipment	91.6%	0.0%	1.4%	7.0%	50.2%	0.5%	4.9%	44.4%
RFID reader	47.2%	0.3%	4.5%	47.9%	5.1%	0.0%	4.0%	90.8%
Drench equipment	87.8%	0.7%	0.7%	10.8%	53.9%	0.2%	1.9%	44.0%
Pour-on equipment	92.3%	0.3%	1.0%	6.3%	73.9%	0.0%	3.9%	22.2%
Calf-rearing equipment	60.1%	1.0%	0.3%	38.5%	30.3%	0.0%	1.1%	68.7%
Portable milking machines (dairy only)	4.8%	0.0%	0.0%	95.2%	11.9%	0.0%	0.0%	88.1%

In contrast, lifestyle block owners without cattle are disproportionately likely to hire or borrow equipment from friends or neighbours. Specifically, 14.7% of lifestyle block owners without cattle hire equipment and 7.3% borrow equipment from friends or neighbours (Fig. 5).

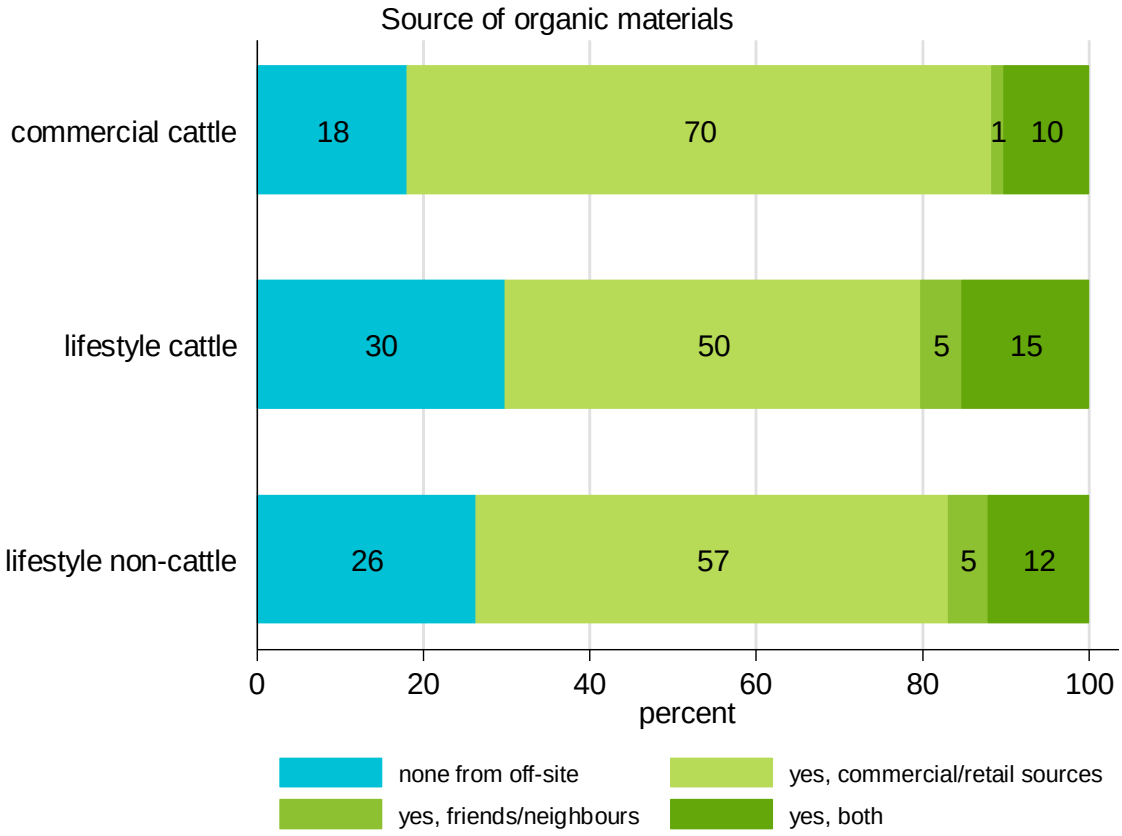
Figure 5. Equipment use and source among lifestyle block owners without cattle (percent).



Organic materials have been causally linked to the spread of livestock disease such as bovine tuberculosis (Hahesy et al. 1993) and *M. bovis* (Williams & Hoy 1930; Rudolfs & Ragotski 1950; Schellner 1956; Biosecurity New Zealand 2019b) as well as the spread of plant diseases and pathogens (e.g. Suckling et al. 2003; Lebas et al. 2009). Thus, survey respondents were also asked whether they bring organic material such as soil, feed, seed, and fertilizer onto their properties, and if so, the source thereof.

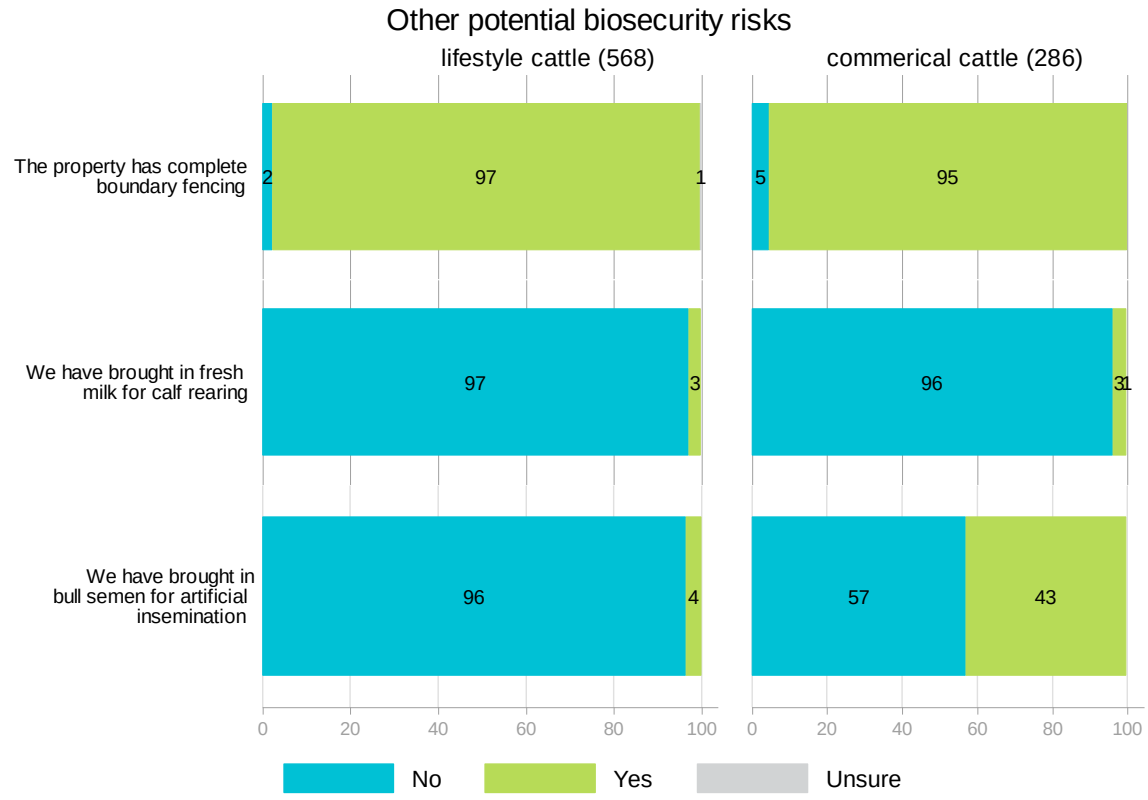
Some 28.9% of lifestyle block owners with cattle, 26.4% of lifestyle block owners without cattle, and 18.0% of commercial farmers report that they do not bring off-farm organic materials onto the farm. Among those who do bring organic materials onto the farm, the majority in all three groups source that material strictly from commercial/retail sources. However, 11.6% of all commercial respondents source at least some organic materials from friends/neighbours, as do 20.2% of lifestyle block owners with cattle and 16.9% of lifestyle block owners without cattle. Conditional on bringing in organic materials from off-site, lifestyle block owners with cattle are statistically more likely to obtain those materials from friends or neighbours than commercial operators (p <0.10).

Figure 6. Source of organic materials brought onto the farm, if any (percent).



Other potential biosecurity risks for cattle owners are depicted in Figure 7, including whether the property has complete boundary fencing (thereby preventing the respondent's cattle from wandering off the property and neighbours' cattle from wandering onto the property) (Kaneene et al. 2002; Barasana et al. 2013; Biosecurity New Zealand 2019a), whether the respondent has brought in fresh milk for calf rearing (McCLuskey et al. 2014; Parker et al. 2017; Biosecurity New Zealand 2019b), and whether the respondent has brought in bull semen for artificial insemination (Haapala et al. 2018). While 95.4% of commercial cattle farmers in the sample have complete boundary fencing, this figure is statistically lower than for lifestyle block owners with cattle ($p < 0.10$). Lifestyle block owners are also far less likely to have brought in bull semen for artificial insemination than commercial farmers ($p < 0.01$). Few respondents bring in fresh milk for calf rearing, and there is no statistical difference in the frequency of doing so between the two groups.

Figure 7. Other potential biosecurity risks (percent).

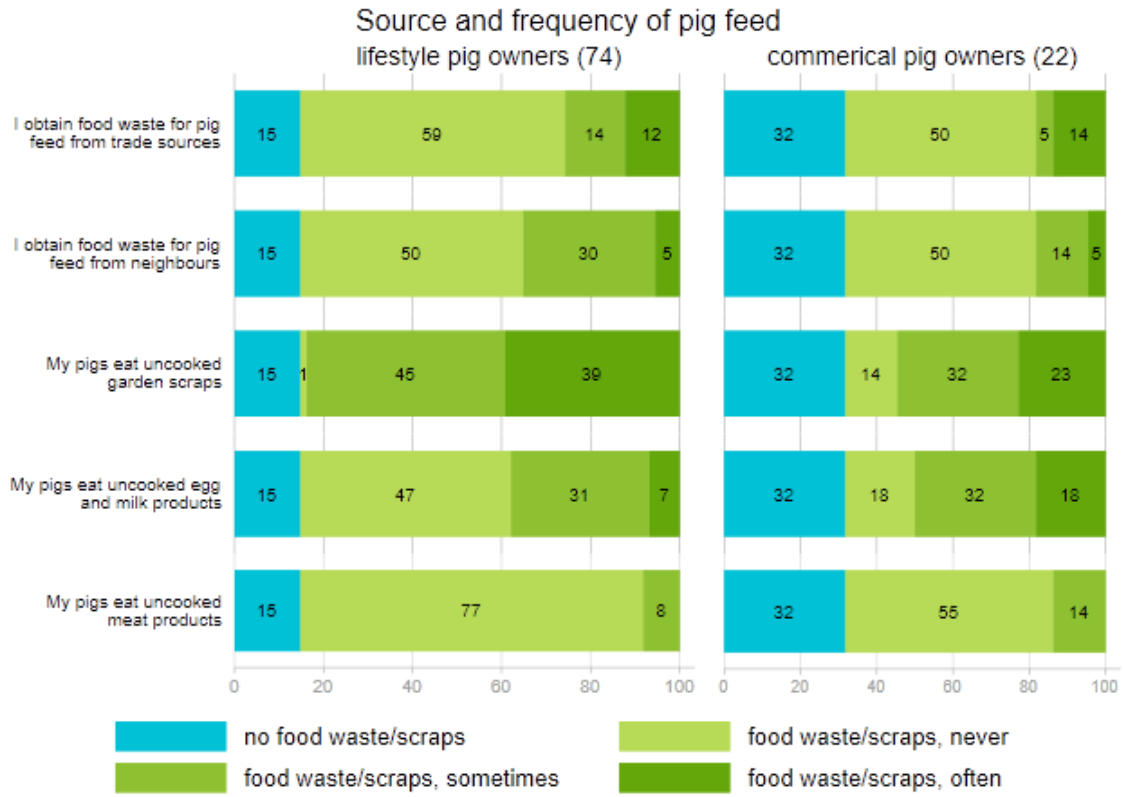


Finally, uncooked meat may contain animal pathogens, including the viruses causing foot-and-mouth disease, African swine fever, classical swine fever, and the prion protein that causes bovine spongiform encephalopathy or 'mad cow disease' (Gale 2004; Harnett et al. 2007). The consequences of any of these diseases establishing in New Zealand would be catastrophic: for example, it was estimated in 2016 that a large outbreak of foot-and-mouth disease would cost New Zealand $16 billion (MPI 2016). To prevent the establishment and spread of such disease in New Zealand, food waste fed to pigs must be cooked at 100 degrees Celsius for a minimum of 1 hour (Biosecurity New Zealand 2018, 2019a).

To evaluate compliance with these regulations, commercial farmers with pigs (n=22) and lifestyle block owners with pigs (n=74) were asked whether they fed food waste/scraps to their pigs and, if so, the source and composition of food waste/scraps. Results are shown in Figure 8.

Most notably, 13.6% of commercial farmers with pigs and 8.1% of lifestyle farmers with pigs report feeding them uncooked meat products 'sometimes' (these percentages are not statistically distinguishable due to the small sample sizes). This finding points to a serious lapse in biosecurity on a small number of the surveyed properties.

Figure 8. Food waste and scraps fed to pigs (percent).



4.4 Biosecurity definitions and perceived threats

The survey included two open-ended questions regarding biosecurity. The 2003 Biosecurity Strategy for New Zealand defines biosecurity as 'the exclusion, eradication or effective management of risks posed by pests and diseases to the economy, environment and human health' (Biosecurity Council 2003).

The first question read, 'In a few words of phrases, what does biosecurity mean to you?'. Respondents were neither provided with a definition nor primed to respond to the qualitative questions in any way. In total, 965 of the 1,006 respondents answered this question, and their responses were categorized into the following common themes: protecting their own property and animals; border controls and preventing new arrivals from establishing in New Zealand; supporting trade, industry, and traceability efforts; environmental protection, preventing the spread of biosecurity risks from one's own property to neighbouring properties; protecting the farming community and way of life; and general concerns about bureaucracy and 'red tape'.

Figure 9 indicates the share of qualitative comments by commercial farmers (green), lifestyle block owners with cattle (blue), and lifestyle block owners without cattle (orange) that may be described by each of the categories described above (some written comments fit into multiple categories, as discussed below). Approximately 33% of commercial farmers describe biosecurity in terms of protecting their own properties and animals, a share that is statistically higher than the 16.4% of lifestyle block owners with cattle who do so ($p < 0.01$) and the 11.7% of lifestyle block owners without cattle who do so ($p < 0.01$). Examples of such qualitative responses include the following: 'Protecting our farm from others'; 'The protection of my property and livestock against the introduction of infectious organisms or weeds'; and 'Taking all practical steps to minimize the risk of any weeds, pests or diseases from entering the farm'.

Many respondents describe biosecurity in terms of controls at the national border. Archetypal examples of such qualitative responses include 'Keeping any threats to our land away and keeping us

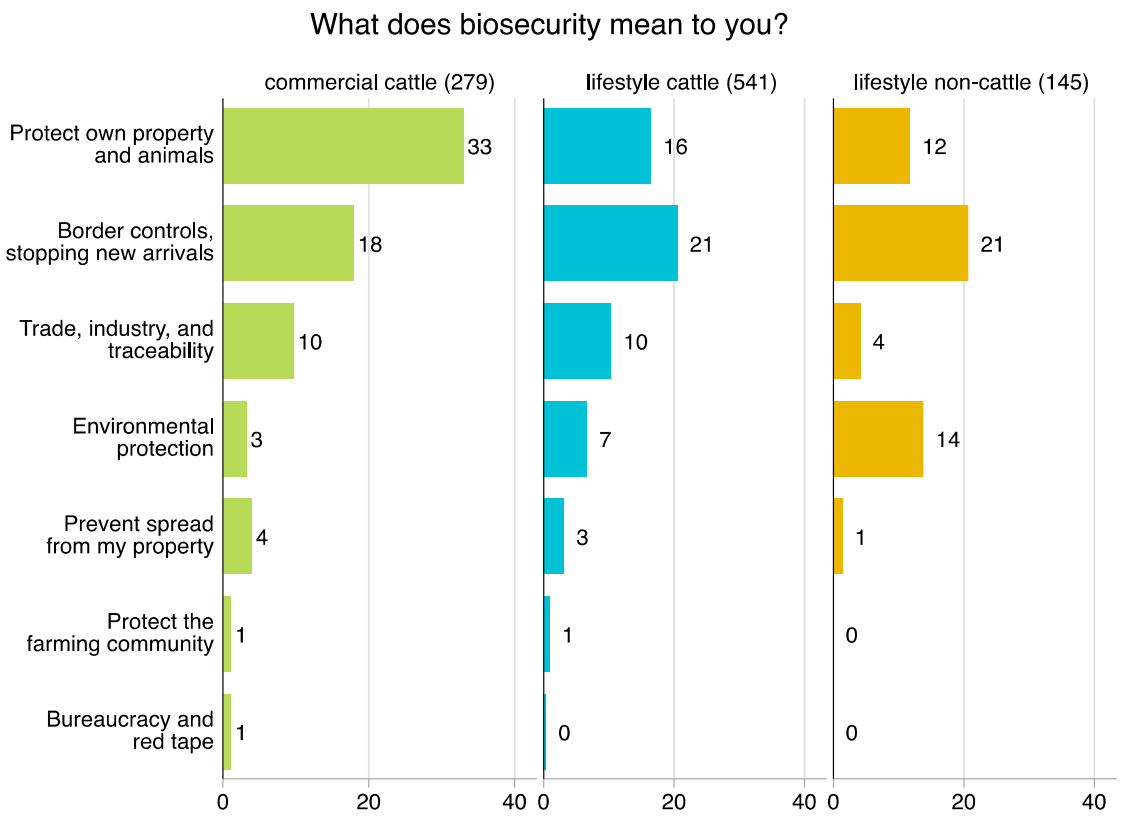
safe as a country. Good border controls by MPI'; 'Government responsibility to ensure nationwide practices to prevent disease and pest, quality controls, and thorough border control and import regulations followed'; and 'Keeping out unwanted pests and diseases that NZ doesn't have but other countries do'. Overall, 17.9% of commercial farmers, 20.5% of lifestyle block owners with cattle, and 20.7% of lifestyle block owners without cattle defined biosecurity in similar ways. These percentages are not statistically distinguishable from one another.

While 9.7% of commercial farmers and 10.4% of lifestyle block owners with cattle describe biosecurity in terms of trade, industry, and traceability (e.g. 'Following the NAIT/Ospri rules so that if any health issue arises from stock I have purchased/sold it can be followed up'), only 4.1% of lifestyle block owners without cattle do so. The difference between the two groups of lifestyle block owners is statistically significant ($p < 0.10$).

Conversely, at 13.8%, lifestyle block owners without cattle describe biosecurity in terms of the broader environment (e.g. 'Protecting our environment from disease, pests and invasive species') at significantly higher rates than either commercial farmers ($p < 0.01$) or lifestyle block owners with cattle ($p < 0.01$). In addition, 3.9% of commercial farmers, 3.1% of lifestyle block owners with cattle, and 1.4% of lifestyle block owners without cattle described biosecurity in terms of preventing spread from their properties onto neighbouring properties (e.g. 'Preventing pests and diseases coming onto my property, or being spread from my property').

Additional examples of qualitative responses and their categorisation are shown in the Appendix.

Figure 9. What does biosecurity mean to you? (percent).



Some comments span multiple categories. Examples include, 'bio security is about keeping pests and other diseases and viruses from entering our property and from entering NZ' (which focuses on both national and farm borders) and 'keeping my animals safe from diseases. Avoiding bringing diseases onto my property. Registering my animals in NAIT for tracing purposes' (which focuses on both farm borders and traceability). Thus, Figure 10 shows the number of qualitative responses assigned to each of the top three categories, including any overlap between categories. For example, 191

comments describe biosecurity in terms of border controls and stopping new arrivals from entering New Zealand. Among these, 27 described protection of one's own property and animals. The remaining 157 focused only on the border. Similarly, 158 responses focused only on protecting one's own property and animals. This finding points to a stark divide in how New Zealanders perceive biosecurity.

Figure 10. Overlap in how 'biosecurity' is defined (number).

Survey respondents were additionally asked 'In your view, what biosecurity threats pose the biggest challenge to your own farm/lifestyle block?' As with the previous question, this question was open-ended and without either definitions or prompts. In total, 960 respondents answered this question.

As above, responses were categorised to facilitate comparative analysis. For example, the category 'weeds' includes descriptions of 'grasses', 'gorse', 'introduced plants', 'invasive plants', and 'wildings'. The category 'TB' includes descriptions of 'hedgehogs', 'possums', and 'tuberculosis'.

Table 3 indicates the share of commercial farmers, lifestyle block owners with cattle, and lifestyle block owners without cattle whose responses fell into each of these categories.

Table 3. Biosecurity threats by respondent group

	Commercial farmers	Lifestyle block owners w/ cattle	Lifestyle block owners w/o cattle
Weeds	20.3%	20.2%	37.1%
TB (includes possums)	17.3%	20.0%	13.3%
M. bovis	**25.5%**	**17.8%**	**3.5%**
Other livestock diseases	13.7%	10.7%	9.8%
Border controls	12.9%	7.0%	7.0%
Foot-and-mouth disease	14.0%	7.2%	4.9%
Neighbours	10.7%	10.5%	4.2%
Stock movement (includes buying in)	13.7%	9.5%	2.1%
Insects (include brown marmorated stink bug)	4.4%	7.2%	12.6%
People other than contractors	8.5%	7.8%	4.9%
Plant diseases and pathogens	2.6%	3.1%	14.0%
Johne's disease (includes rabbits)	4.1%	5.2%	8.4%
No biosecurity threats	1.1%	6.4%	4.9%
Worms, parasites, and lice	2.6%	2.9%	6.3%
Government (including councils and MPI)	6.3%	2.9%	1.4%
Leptospirosis (including rats)	1.5%	3.1%	5.6%
Mustelids	1.1%	2.5%	5.6%
Contractors and shared equipment	5.9%	2.1%	0.7%
Chemical sprays	1.1%	1.6%	5.6%
Feral animals (including pigs, goats, deer, and wallabies)	2.2%	2.3%	2.8%
Bee diseases and pathogens	0.0%	2.9%	3.5%
Bovine viral diarrhoea	4.4%	1.2%	0.0%
Unsure	0.0%	3.3%	2.1%
Equine diseases	0.0%	1.0%	4.2%
Toxoplasmosis (including cats)	0.7%	0.4%	2.1%
Birds	0.7%	1.4%	0.7%
Footrot	0.7%	0.0%	1.4%
Facial eczema	0.0%	1.0%	0.7%

Responses that failed to garner at least 1% of responses for any individual group included sheep measles, airborne pathogens, mad cow disease, waterways, and scrapie.

Twenty-five percent of commercial farmers identified *M. bovis* as an important biosecurity threat, as did 17.8% of the lifestyle block owners with cattle and 2.5% of the lifestyle block owners without cattle. Commercial farmers also emphasized other stock disease, especially TB (17.3%), foot-and-mouth disease (14.0%), bovine viral diarrhoea (4.2%), Johne's disease (4.1%), and other diseases affecting livestock (13.6%). Alongside weeds (20.2%) and *M. bovis* (17.8%), Lifestyle block owners with cattle also identified TB (20.0%), foot-and-mouth disease (7.2%), Johne's disease (5.2%), and other stock diseases (10.7%) as being biosecurity threats.

Weeds are recognised as an important biosecurity threat by all three groups and were the most noted category by a wide margin among lifestyle block owners without cattle. Commercial farmers also identified lax border security (12.9%) and neighbours (10.7%) as biosecurity threats. Lifestyle block owners also noted neighbours (10.5%), stock movement (9.5%), people other than contractors (7.8%), pest insects (7.2%), and lax border security (7.0%) as threats. Lifestyle block owners without

cattle also noted plant diseases (14.0%), TB (13.3%), pest insects (12.6%), Johne's disease (8.4%), and lax border security (7.0%) as biosecurity threats.

Consistent with the 'bureaucracy and red tape' category of responses to the question 'What does biosecurity mean to you?', it is notable that 6.3% of commercial farmers identified government (including councils and MPI) as a biosecurity threat (analogous figures for lifestyle block owners with and without cattle are 2.9% and 1.4%, respectively). Also noteworthy, 6.4% of lifestyle block owners with cattle and 4.9% of lifestyle block owners without cattle responded that there are no biosecurity threats to their properties (cf. 1.1% of commercial farmers).

4.5 Perceptions regarding biosecurity

Survey respondents were presented with a series of eight statements pertaining to biosecurity and asked to evaluate the extent to which they agreed or disagreed with each of the statements, selecting from the following choices: strongly disagree, disagree, neither agree nor disagree, agree, strongly agree. Respondents also had the option of answering 'unsure'.

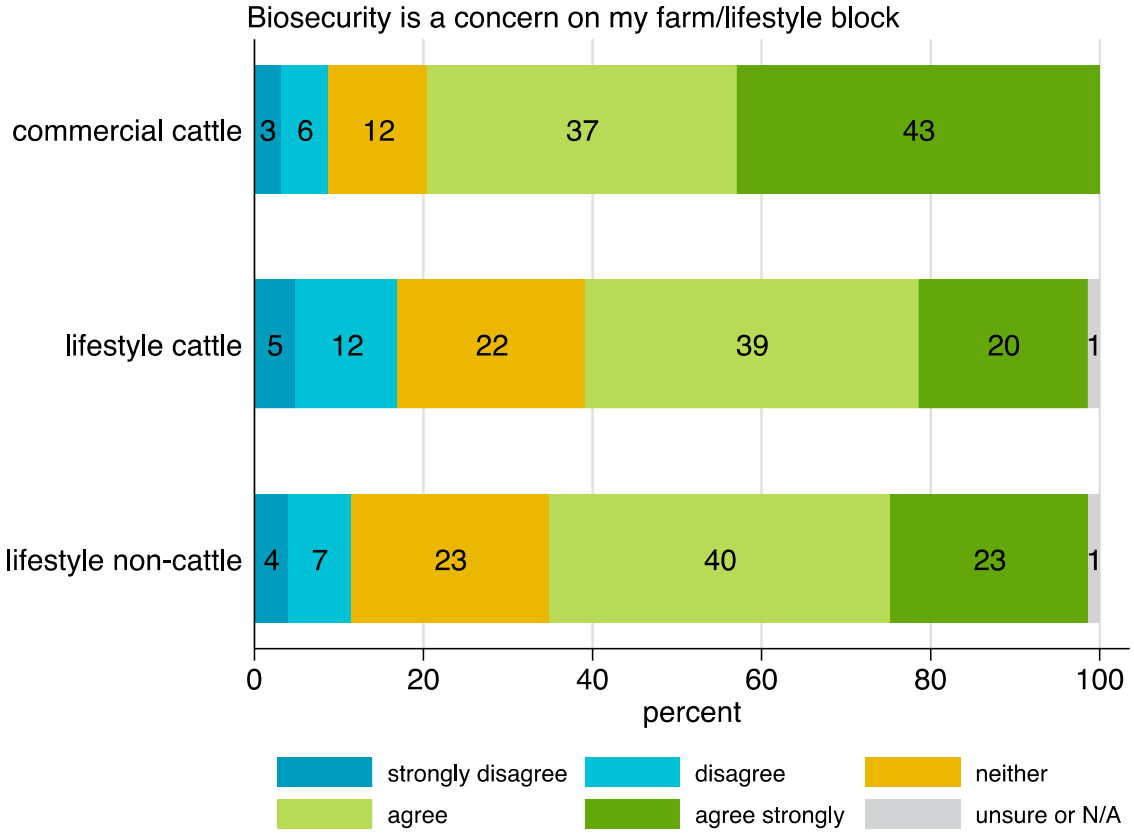
The eight statements are as follows:

- 'Biosecurity is a concern on my farm/lifestyle block' (Fig. 11)
- 'My family and I are primarily responsible for biosecurity on our farm/lifestyle block' (Fig. 12)
- 'People who come to work on my property follow biosecurity procedures' (Fig. 13)
- 'My on-property biosecurity practices are good' (Fig. 14)
- 'Biosecurity on my property does not affect the rest of New Zealand' (Fig. 15)
- 'New Zealand has strong biosecurity laws' (Fig. 16)
- 'New Zealand's response to recent biosecurity threats has been efficient' (Fig. 17)
- 'New Zealand's response to recent biosecurity threats has been effective' (Fig. 18).

To test for differences across groups in each statement, we evaluate the number of respondents who agree or strongly agree (which we refer to as 'agree') as a share of all respondents who selected an answer other than 'unsure' using one-way analysis-of-variance models with the Bonferroni multiple-comparison test. We then repeat the process for those who strongly agree (which we refer to as 'strongly agree').

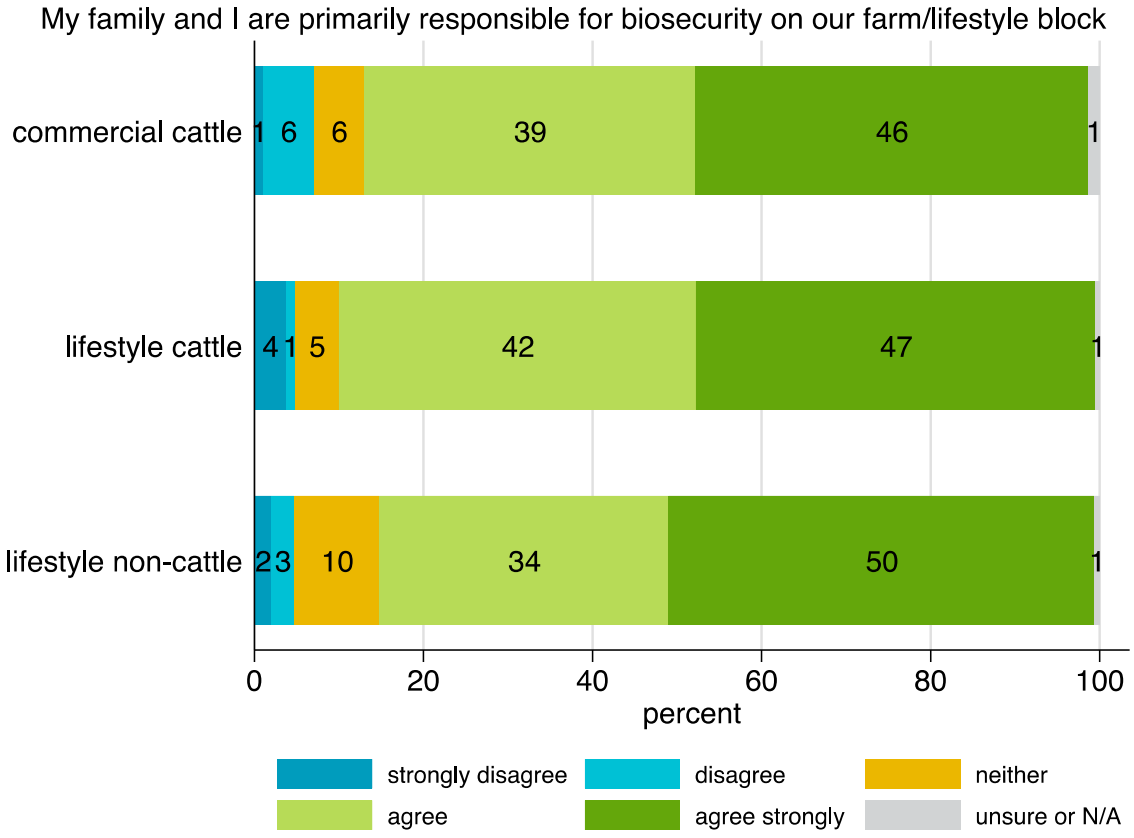
Most respondents believe that biosecurity is a concern on their property (Fig. 11). Commercial farmers are more likely to agree than lifestyle block owners with cattle ($p < 0.01$) and lifestyle block owners without cattle ($p < 0.01$). Commercial farmers are also more likely to strongly agree than either group of lifestyle block owners ($p < 0.01$).

Figure 11. Biosecurity is a concern on my farm/lifestyle block (percent).



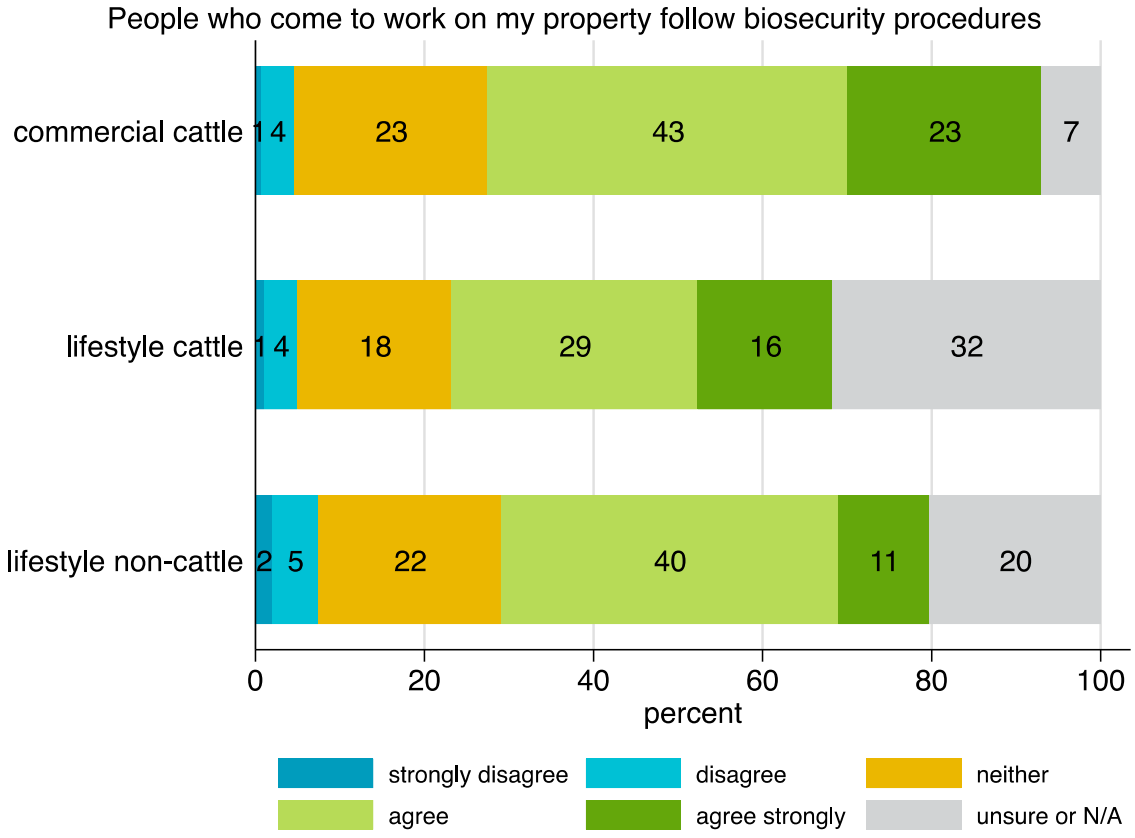
Whether commercial farmers or lifestyle block owners, survey respondents overwhelmingly believe that they are primarily responsible for biosecurity on their own properties (Fig. 12). Agreement does not differ statistically across groups.

Figure 12. My family and I are primarily responsible for biosecurity on our farm/lifestyle block (percent).



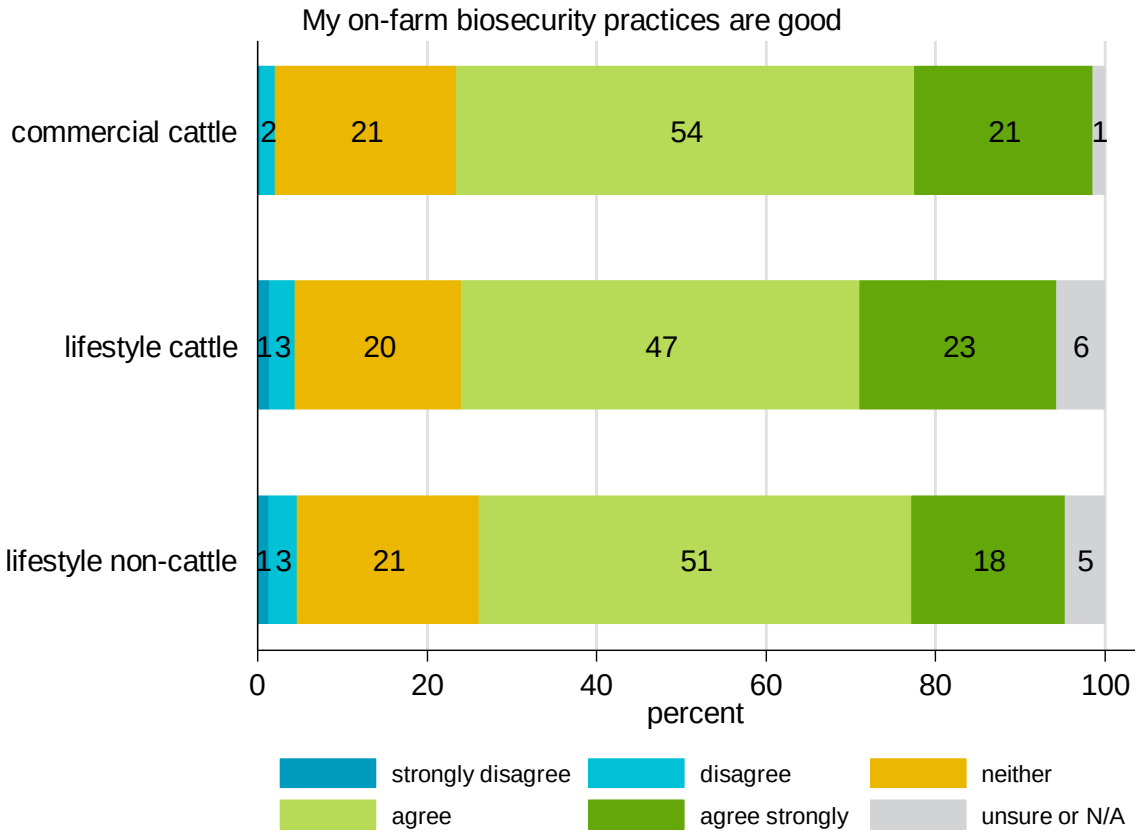
Approximately 67% of commercial farmers, 50% of lifestyle block owners without cattle, and 45% of lifestyle block owners with cattle agree that people who work on their properties follow biosecurity procedures (Fig. 13). However, 7.0% of commercial farmers, 31.8% of lifestyle block owners with cattle, and 20.3% of lifestyle block owners without cattle are uncertain, which suggests that those properties may leave biosecurity protocols to their visitors. Among respondents who selected an answer other than 'unsure', a higher share of commercial farmers strongly agreed than lifestyle block owners with cattle ($p < 0.05$) or lifestyle block owners without cattle ($p < 0.10$).

Figure 13. People who come to work on my property follow biosecurity procedures (percent).



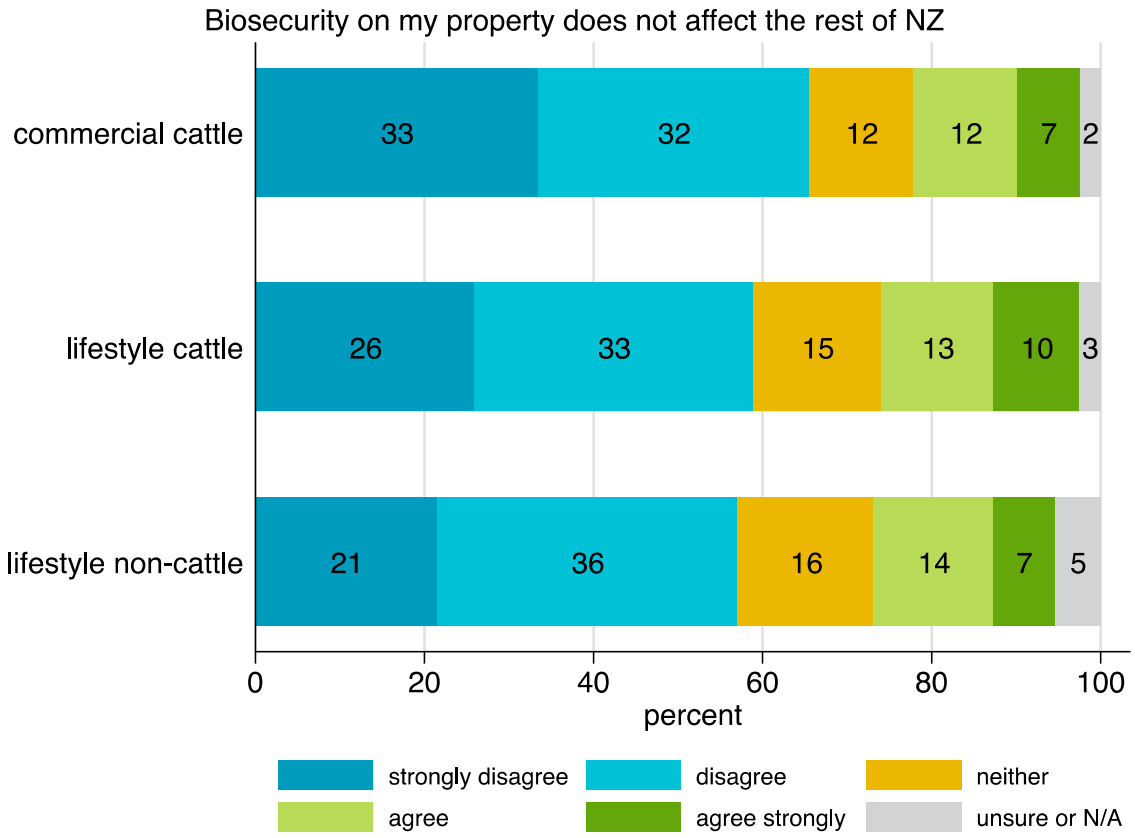
Seventy-five percent of commercial farmers, 70.2% of lifestyle block owners with cattle, and 69.1% of lifestyle block owners without cattle agree that their on-property biosecurity practices are good (Fig. 14). The level of agreement across groups is statistically indistinguishable.

Figure 14. My on-property biosecurity practices are good (percent).



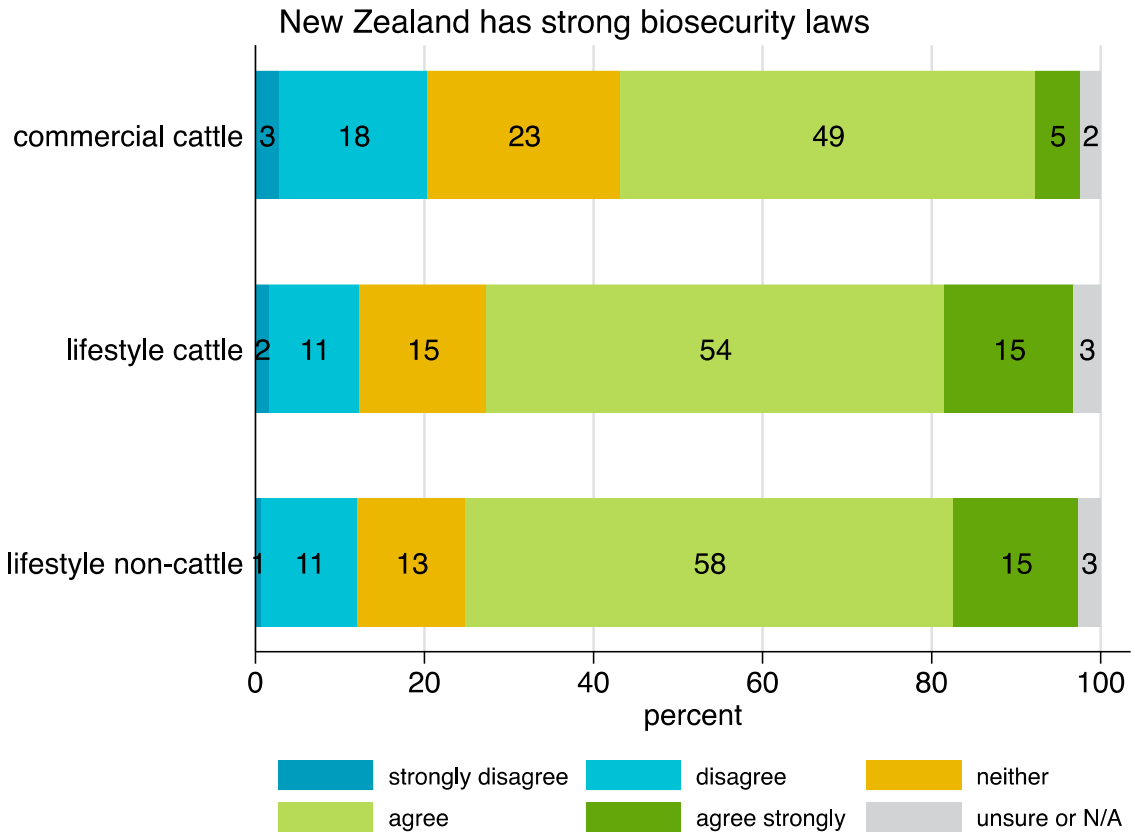
Responses to the statement ‘Biosecurity on my farm/lifestyle block does not affect the rest of New Zealand’ are shown in Figure 15. Some 65.5% of commercial farmers, 58.9% of lifestyle block owners with cattle, and 57.1% of lifestyle block owners without cattle disagree with this statement. The level of disagreement is not statistically distinguishable across the three groups.

Figure 15. Biosecurity on my farm/lifestyle block does not affect the rest of New Zealand (percent).



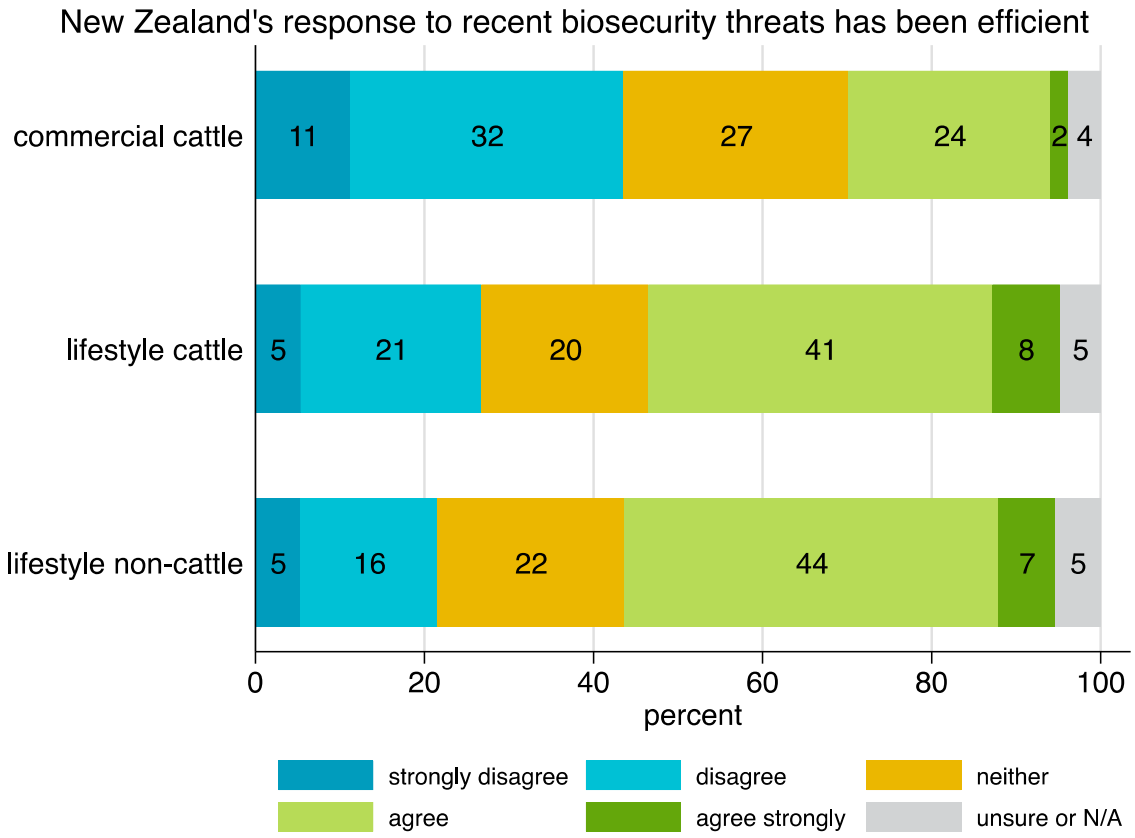
The remaining three statements in this section focus on perceptions of the strength of New Zealand's biosecurity laws and past responses to biosecurity threats. The extent to which survey respondents agree with the statement 'New Zealand has strong biosecurity laws' is reported in Figure 16. While 69.5% of lifestyle block owners with cattle and 72.4% of lifestyle block owners without cattle agree with the statement, only 54.4% of commercial farmers agree, a statistically significant difference ($p < 0.01$). In addition, commercial farmers are less likely to 'strongly' agree than lifestyle block owners with cattle ($p < 0.01$) and lifestyle block owners without cattle ($p < 0.05$).

Figure 16. New Zealand has strong biosecurity laws (percent).



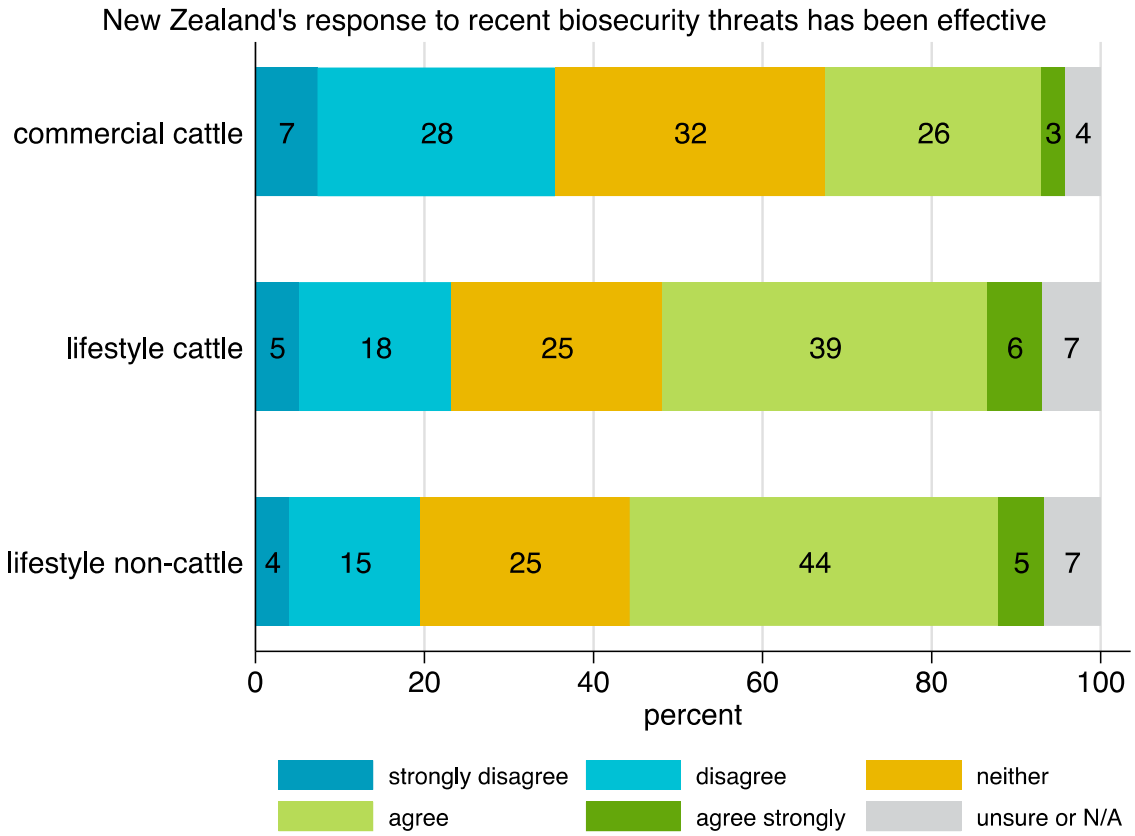
Just 26% of commercial farmers agree that New Zealand's response to recent biosecurity threats has been efficient (Fig. 17), fewer than the 48.6% of lifestyle block owners with cattle ($p < 0.01$) and the 51.0% of lifestyle block owners without cattle ($p < 0.01$) who believe so. Commercial farmers are also less likely to 'strongly' agree with the statement ($p < 0.01$).

Figure 17. New Zealand's response to recent biosecurity threats has been efficient (percent).



Similarly, 28.4% of commercial farmers believe New Zealand's response to recent biosecurity threats has been effective (Fig. 18), fewer than the 44.9% of lifestyle block owners with cattle ($p < 0.01$), and the 49.0% of lifestyle block owners without cattle who believe so ($p < 0.01$). Fewer commercial farmers than lifestyle block owners with cattle 'strongly' agree that recent responses have been effective ($p < 0.01$).

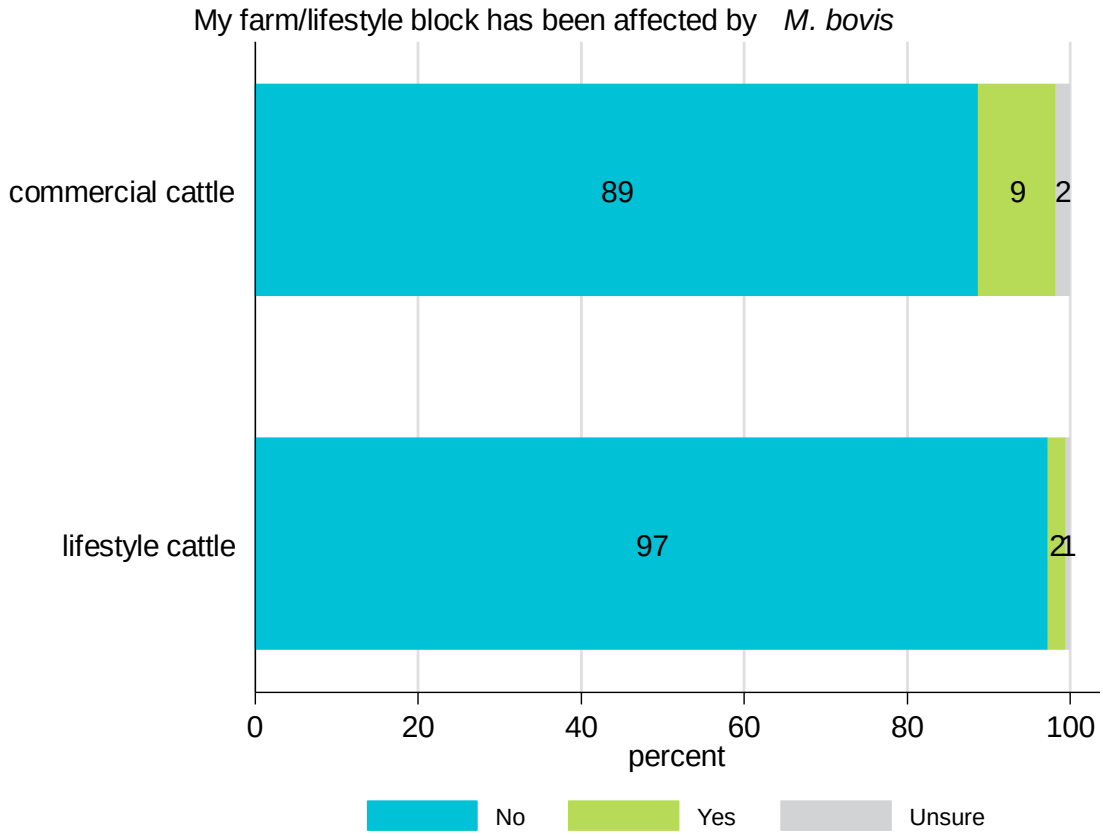
Figure 18.New Zealand's response to recent biosecurity threats has been effective (percent).



4.6 Experience with *Mycoplasma bovis*

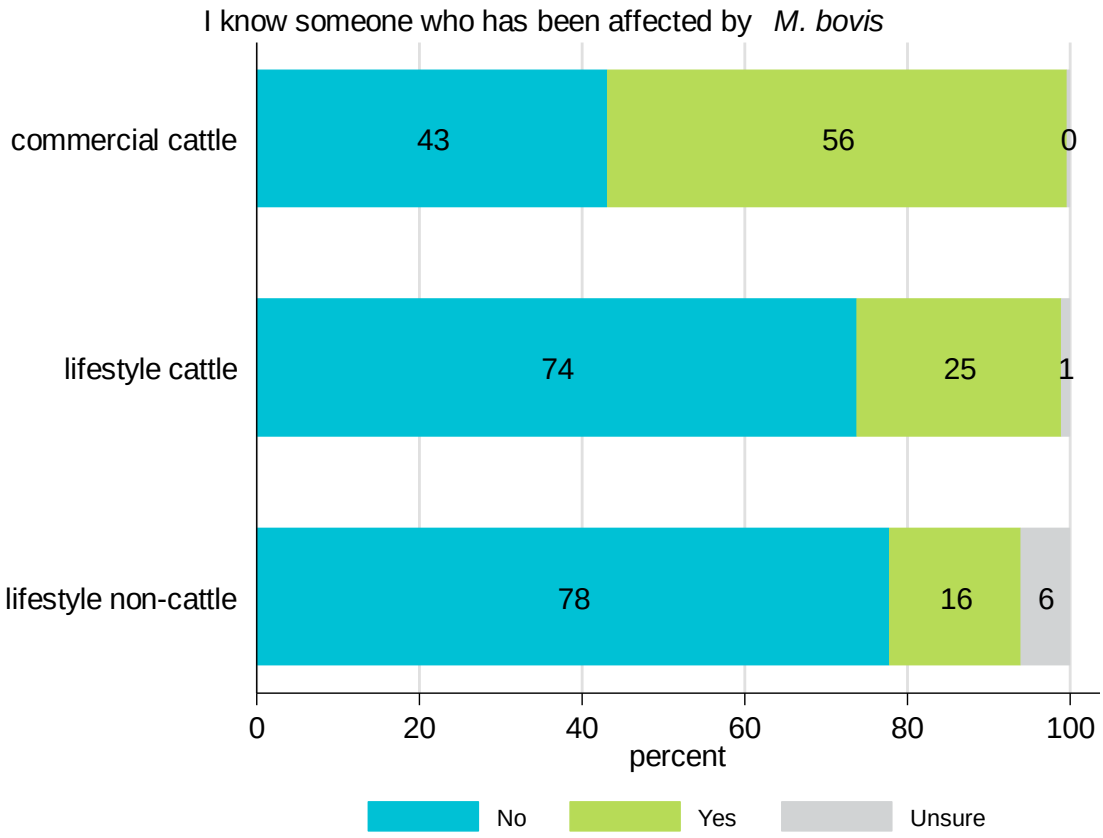
Commercial cattle farmers are more likely to have been affected by *M. bovis* than lifestyle block owners with cattle ($p < 0.01$) (Fig. 19). Specifically, 9.5% of commercial farmers responding to the survey report being affected by *M. bovis* compared with 2.1% of lifestyle block owners with cattle.

Figure 19. My farm/lifestyle block has been affected by *M. bovis* (percent).



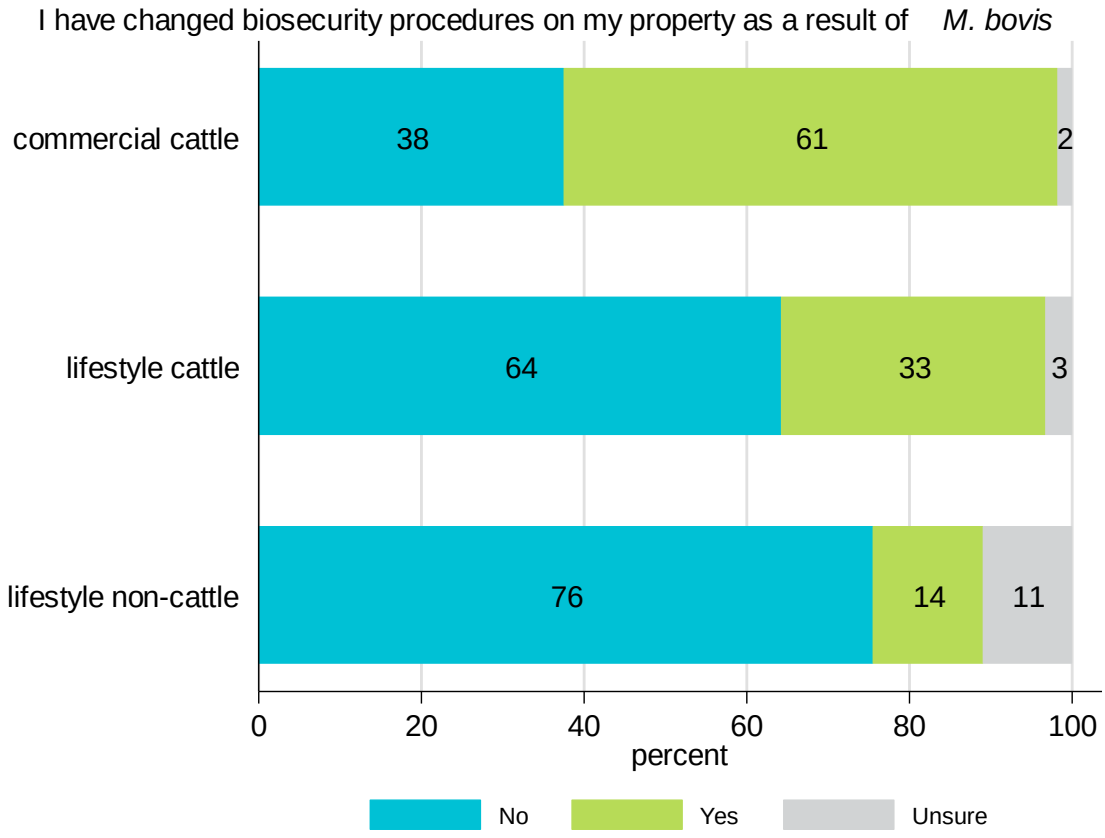
Commercial farmers are also more likely to report knowing someone who has been affected by *M. bovis* than lifestyle block owners with ($p < 0.01$) and without cattle ($p < 0.01$) (Fig. 20). Indeed, the reach of *M. bovis* has been extensive, with 56.4% of commercial farmers and 25.1% of lifestyle block owners with cattle reporting that they know someone who has been affected by *M. bovis*.

Figure 20. I know someone who has been affected by *M. bovis* (percent).



Finally, *M. bovis* has prompted 60.7% of commercial cattle farmers and 32.5% of lifestyle block owners with cattle to change their management practices (Fig. 21). It is notable that 13.6% of lifestyle block owners without cattle also report changing their management. From a statistical perspective, more commercial farmers have changed biosecurity practices as a result of *M. bovis* than have lifestyle block owners with cattle ($p < 0.01$), and more lifestyle block owners with cattle have changed biosecurity practices as a result of *M. bovis* than have lifestyle block owners without cattle ($p < 0.01$).

Figure 21. I have changed biosecurity procedures on my property as a result of *M. bovis* (percent).



4.7 Behaviours and attitudes of lifestyle block owners with cattle by demographic group

Ten of the questions analysed above are further investigated according to personal characteristics recorded in the 2019 Survey of Rural Decision Makers. Specifically, we consider correlations between demographic factors and the following outcomes:

- Whether there is a designated PICA on the property
- Organic materials sourced from friends/neighbours are brought onto the property
- Whether the respondent answers 'What does biosecurity mean to you?' in terms of national borders
- Whether the respondent answers 'What does biosecurity mean to you?' in terms of own property and animals
- The extent to which lifestyle block owners with cattle agree with the following statements:
  - 'People who come to work on my property follow biosecurity procedures'
  - 'Biosecurity on my lifestyle block does not affect the rest of New Zealand'
  - 'New Zealand has strong biosecurity laws'
  - 'New Zealand's response to recent biosecurity threats has been effective'
  - 'New Zealand's response to recent biosecurity threats has been efficient'

- Whether lifestyle block owners with cattle have changed their biosecurity procedures on their properties as a result of *M. bovis*.

For this analysis, we regress the outcomes of interest on age, region, gender, and education using logistic regression. Each explanatory variable enters as a dummy. Thus, age is measured as a dummy for whether the respondent is below the median age in the sample; region is measured as whether the respondent lives in one of the regions that had more than 20 confirmed cases of *M. bovis*, namely Northland, Canterbury, Otago, and Southland; gender is a dummy for whether the respondent is male; and education is a dummy for whether the respondent holds a tertiary degree. Results from these regressions (shown as odds ratios with heteroskedasticity-robust standard errors) are shown in Table 4.

The odds of a younger respondent having a designated PICA are 1.8 times those of an older respondent ($p < 0.05$) (column 1). However, these variables do not explain whether respondents bring in organic materials from friends and neighbours (column 2). The odds of a respondent living in Northland, Canterbury, Otago, or Southland referring to national borders when defining 'biosecurity' are twice those of a respondent living elsewhere ($p < 0.01$) (column 3). Men are half as likely as women to refer to national borders when defining 'biosecurity' ($p < 0.05$). These variables do not explain whether respondents define 'biosecurity' in terms of protecting their own property and animals (column 4). The odds of male respondents agreeing that people who come to work on the farm follow biosecurity procedures are roughly half those of female respondents ($p < 0.05$) (column 5). Similarly, the odds of highly educated people agreeing that people who come to work on the farm follow biosecurity procedures are roughly half those of respondents without tertiary degrees. The odds of younger respondents believing that biosecurity on their property does not affect the rest of NZ are roughly half those of older respondents ($p < 0.01$) (column 6). The odds of highly educated respondents believing this are lower than those of less educated respondents ($p < 0.05$). None of these variables predicts whether respondents agree that NZ has strong biosecurity laws (column 7). However, the odds that a younger respondent believes recent biosecurity responses to have been effective are 45% higher than those of older respondents ($p < 0.05$) (column 8). Similarly, male respondents ($p < 0.05$) and better educated respondents ($p < 0.05$) are more likely to consider recent responses to have been efficient (column 9). Finally, the odds of a respondent living in Northland, Canterbury, Otago, or Southland changing their biosecurity practices are 70% higher than the odds that respondents living elsewhere have done so ($p < 0.05$) (column 10).

These results are summarised in Box 1.

Box 1. Demographic characteristics and biosecurity behaviours and attitudes, lifestyle block owners with cattle (summary)

Younger lifestyle block owners:

- More likely to report having a designated PICA
- Less likely to believe that biosecurity on their property does not affect the rest of New Zealand
- More likely to believe that New Zealand's response to recent biosecurity threats has been effective

Lifestyle block owners in **Northland, Canterbury, Otago, and Southland:**

- More likely to define 'biosecurity' in terms of the border
- More likely to have changed biosecurity procedures as a result of *M. bovis*

Male lifestyle block owners:

- Less likely to define 'biosecurity' in terms of the border
- Less likely to believe that people who work on the property follow biosecurity procedures
- More likely to believe that New Zealand's response to recent biosecurity threats has been efficient

Highly educated lifestyle block owners:

- Less likely to believe that people who work on the property follow biosecurity procedures
- Less likely to believe that biosecurity on their property does not affect the rest of New Zealand
- More likely to believe that New Zealand's response to recent biosecurity threats has been efficient

Table 4. Demographic characteristics and biosecurity behaviours and attitudes, lifestyle block owners with cattle (logistic regression)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	**There is a designated PICA on the property**	**Obtain organic materials from friends/ neighbours**	**Define 'biosecurity' in terms of the border**	**Define 'biosecurity' in terms of own property, animals**	**People who work on property follow biosecurity procedures**	**Biosecurity on my property does not affect the rest of NZ**	**NZ has strong biosecurity laws**	**NZ's response to recent biosecurity threats has been effective**	**NZ's response to recent biosecurity threats has been efficient**	**I have changed biosecurity procedures on my property as a result of *M. bovis***
Age below median	1.826**	1.295	0.754	0.948	0.863	0.547***	1.020	1.454**	1.141	0.985
	(0.488)	(0.321)	(0.183)	(0.233)	(0.202)	(0.120)	(0.216)	(0.276)	(0.220)	(0.200)
In a region most affected by *M. bovis*	0.975	1.056	2.011***	0.767	0.889	1.454	1.027	1.003	0.820	1.713**
	(0.271)	(0.279)	(0.488)	(0.220)	(0.228)	(0.337)	(0.235)	(0.211)	(0.175)	(0.367)
Male	1.090	1.074	0.551**	0.817	0.585**	0.947	1.229	1.272	1.534**	1.037
	(0.297)	(0.273)	(0.136)	(0.207)	(0.154)	(0.218)	(0.271)	(0.252)	(0.312)	(0.217)
Tertiary degree or more	0.946	1.020	0.967	1.486	0.505***	0.613**	1.390	1.299	1.476**	1.170
	(0.241)	(0.245)	(0.228)	(0.370)	(0.120)	(0.136)	(0.290)	(0.245)	(0.282)	(0.231)
Constant	2.869***	0.328***	0.320***	0.211***	4.239***	0.493***	1.966***	0.698	0.624**	0.369***
	(0.864)	(0.0951)	(0.0879)	(0.0608)	(1.329)	(0.128)	(0.490)	(0.158)	(0.145)	(0.0866)
Observations	389	349	479	479	339	483	484	473	462	480

Robust standard errors in parentheses

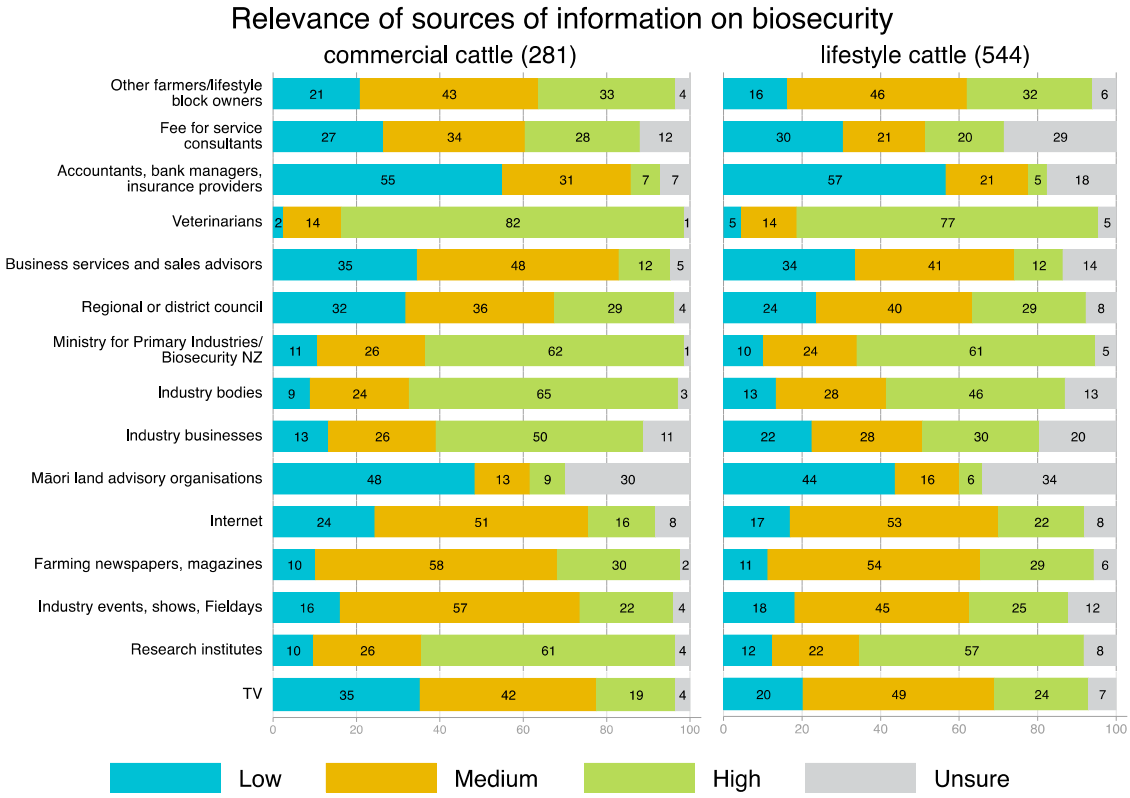
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

4.8 Relevance and trust in sources of information on biosecurity

The survey also asked respondents about the perceived relevance of information pertaining to biosecurity provided by 15 dispirit sources, namely: other farmers and lifestyle block owners; fee-for-service consultants (e.g. farm consultants); accountants, bank managers, and insurance providers; veterinarians; business service and sales advisors (e.g. fertilizer companies); regional and district councils; Ministry for Primary Industries/Biosecurity New Zealand; industry bodies (e.g. DairyNZ, Beef+Lamb NZ); industry businesses (e.g. Fonterra, Zespri); Māori land advisory organisations; the Internet; farming newspapers and magazines; industry events, shows, and Fieldays; research institutes (e.g. AgResearch, Plant and Food Research, and Manaaki Whenua – Landcare Research); and TV (e.g. Country Calendar). Respondents could evaluate the relevance of information provided by each source as being 'low', 'medium', or 'high'. Respondents could also choose 'unsure'.

Responses for 281 commercial farmers and 544 lifestyle block owners with cattle are shown in Figure 22. The information provided by veterinarians is considered to be most relevant, with 82.2% of commercial farmers and 76.8% of lifestyle block owners with cattle considering this information on biosecurity to be highly relevant. Among commercial farmers, 64.4% consider information provided by industry bodies to be highly relevant, 61.9% consider information provided by MPI/Biosecurity NZ to be highly relevant, and 60.9% consider information provided by research institutes to be highly relevant. Among lifestyle block owners with cattle, 60.8% consider information provided by MPI/Biosecurity NZ to be highly relevant and 57.2% consider information provided by research institutes to be highly relevant, but only 45.6% consider information provided by industry bodies to be highly relevant. Both groups considered accountants, bank managers, and insurance providers and Māori land advisory organisations to have the least relevant information on biosecurity.

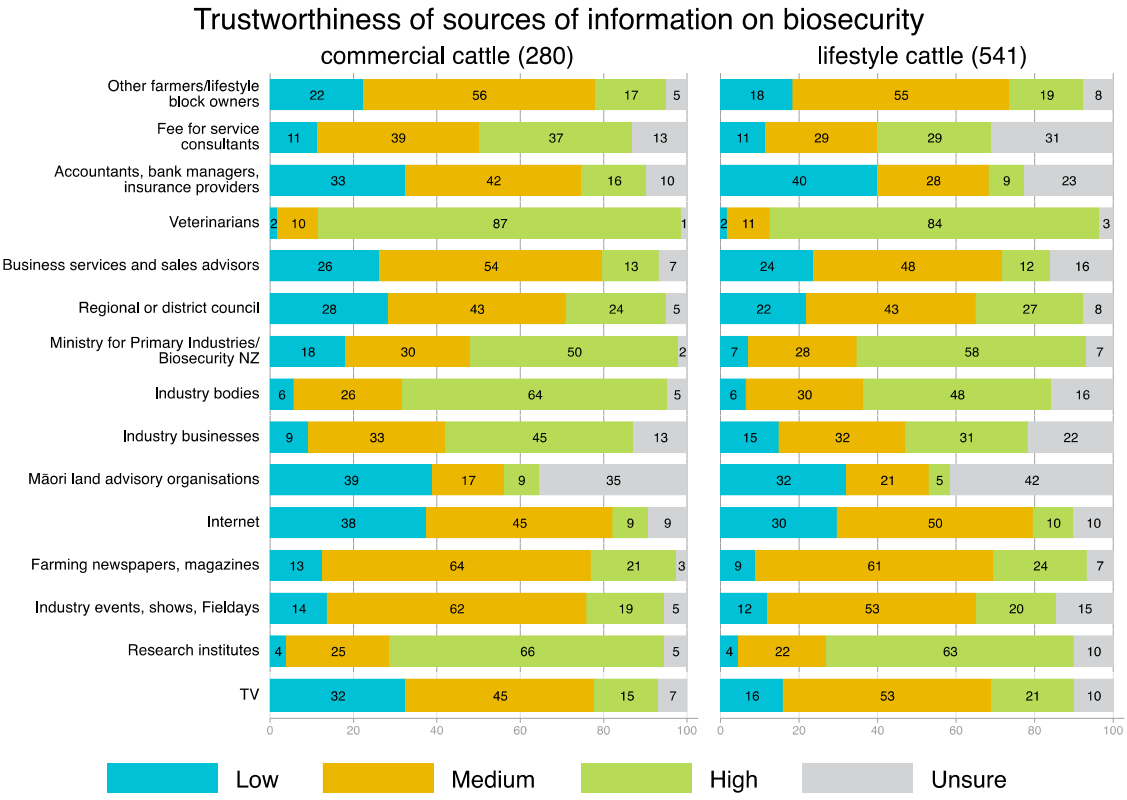
Figure 22. Relevance of sources of information about biosecurity (percent).



Comparing across groups, commercial farmers were more likely to consider the information provided by both industry bodies and industry businesses to be highly relevant (as opposed to having low or medium relevance) than lifestyle block owners with cattle ($p < 0.01$). Conversely, lifestyle block owners with cattle considered the relevance of information provided on the Internet and TV to be of higher relevance than did commercial farmers ($p < 0.05$).

The perceived trustworthiness of information on biosecurity provided by those same sources is shown in Figure 23, again separately for commercial farmers and lifestyle block owners with cattle. The sources who were perceived to have relevant information are generally also perceived to have trustworthy information. For example, 86.9% of commercial farmers and 84.1% of lifestyle block owners with cattle consider veterinarians to have highly trustworthy information on biosecurity. Some 66.0% and 63.7% of commercial farmers consider the information provided by research institutes and industry bodies to be highly trustworthy, respectively. The information provided by MPI/Biosecurity New Zealand is considered to be highly trustworthy by 49.8% of commercial farmers. Among LBOS with cattle, 63.1% consider the information provided by research institutes to be highly trustworthy, 58.5% consider the information provided by MPI/Biosecurity New Zealand to be highly trustworthy, and 58.0% consider the information provided by industry bodies to be highly trustworthy.

Figure 23. Trustworthiness of sources of information on biosecurity (percent).



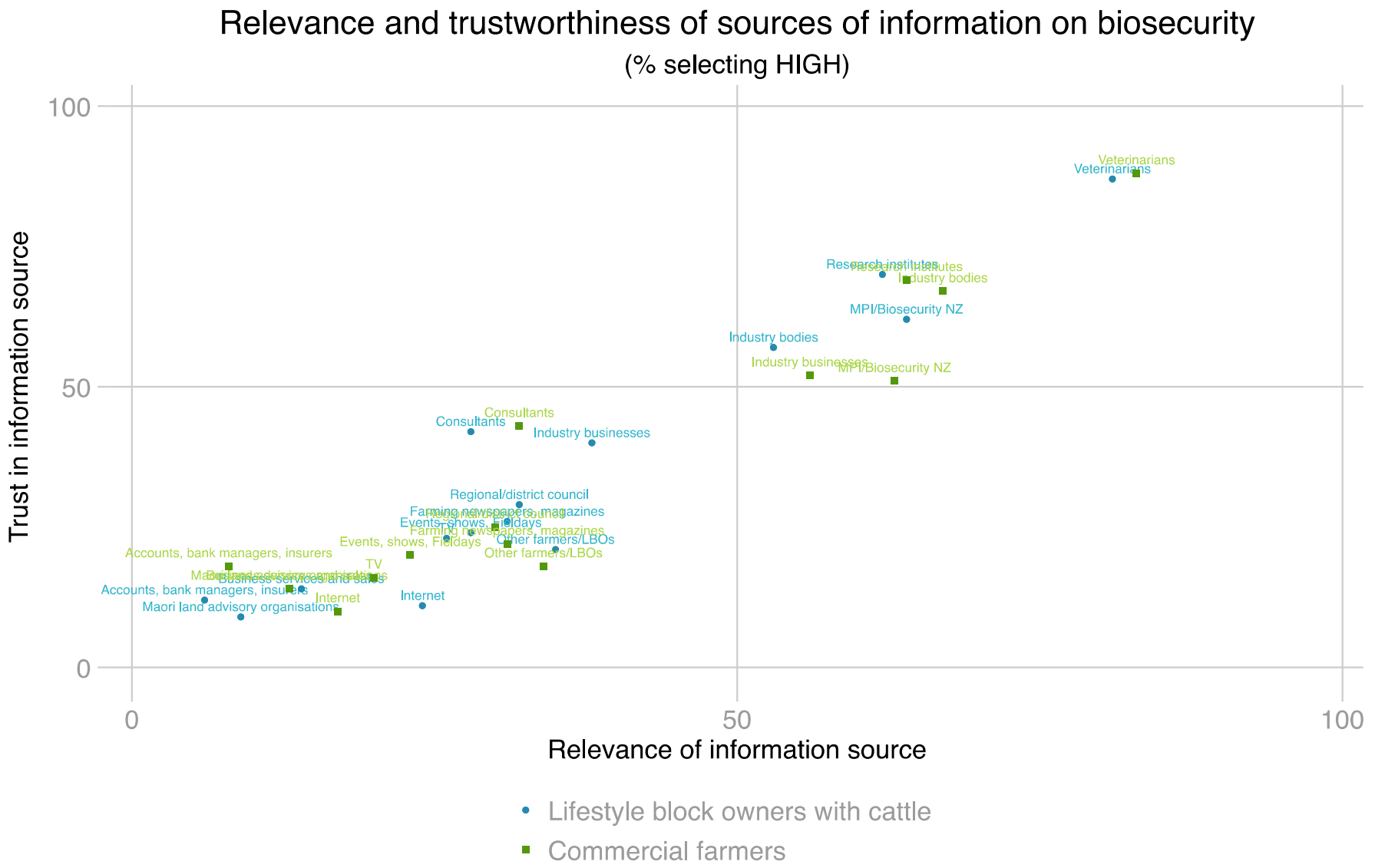
Among commercial farmers, Māori land advisory organisations and the Internet were considered the least trustworthy sources of information on biosecurity. Among lifestyle block owners with cattle, accountants, bank managers, insurance providers, and Māori land advisory organisations are considered to have the least trustworthy sources of information.

Comparing across groups, commercial farmers are more likely than lifestyle block owners with cattle to consider the information provided by the following sources to be highly trustworthy: accountants, bank managers, and insurance providers ($p < 0.05$); industry bodies ($p < 0.01$); and industry businesses ($p < 0.01$). Lifestyle block owners with cattle are more likely than commercial farmers to

consider the information provided by the following sources to be highly trustworthy: MPI/Biosecurity New Zealand ($p < 0.01$); TV ($p < 0.05$).

The sources who were perceived to have relevant information are generally perceived to have trustworthy information as well. For example, 86.9% of commercial farmers and 84.1% of lifestyle block owners with cattle consider veterinarians to have highly trustworthy information on biosecurity (Fig. 24). Some 66.0% and 63.7% of commercial farmers consider the information provided by research institutes and industry bodies to be highly trustworthy, respectively. The information provided by MPI/Biosecurity New Zealand is considered highly trustworthy by 49.8% of commercial farmers. Among Lifestyle block owners with cattle, 63.1% consider the information provided by research institutes to be highly trustworthy, 58.5% consider the information provided by MPI/Biosecurity New Zealand to be highly trustworthy, and 58.0% consider the information provided by industry bodies to be highly trustworthy.

Figure 24. Perceived relevance and trust of sources of information on biosecurity



5 Conclusion

This short report highlights results from a detailed survey on biosecurity undertaken in June–July 2020. The questionnaire emphasized attitudes toward biosecurity and biosecurity practices related to cattle management, particularly on lifestyle blocks. The data are to be used by Biosecurity New Zealand and its GIA partners in meeting the objectives under the Behaviour, Drivers and Incentives section of the *M. bovis* Science Plan.

Survey results confirm existing data showing that cattle ownership is common among lifestyle block owners. The median self-described lifestyle-block owners has a modest herd comprising two dairy cattle or seven beef cattle. Lifestyle block owners are motivated to keep cattle for meat production (whether for own consumption or sale) and paddock control.

While most lifestyle block owners with cattle source their animals from off the lifestyle block, movement of cattle off lifestyle blocks is uncommon. To wit, over 70% of lifestyle block owners report never taking cattle off the farm prior to taking them for finishing or slaughter. Lifestyle block owners also overwhelming reported that their cattle were ear tagged and registered with NAIT.

On the other hand, only 63% of lifestyle block owners reported having a PICA on the property compared with 78% of commercial farmers. Lifestyle block owners are more likely than commercial farmers to borrow equipment from friends and neighbours, a potential pathway for spreading disease. In addition, 20% of lifestyle block owners with cattle source organic material from friends and neighbours, and 8% of lifestyle block owners with pigs report feeding them uncooked meat products. Each of these represents a potentially serious biosecurity risk.

In contrast to commercial farmers, lifestyle block owners were more likely to reference national borders than farm borders when defining the term ‘biosecurity’. Lifestyle block owners with cattle often identified *M. bovis*, TB, and other cattle diseases as well as weeds as being potential biosecurity risks.

Lifestyle block owners with cattle generally believe that biosecurity is a concern, that they are responsible for biosecurity on their own properties, that their biosecurity practices are good, and that biosecurity practices on their properties affects the rest of New Zealand. However, 37% of lifestyle block owners with cattle reported either that people who came to work on the farm did not follow biosecurity procedures or being unsure whether they did. While few lifestyle block owners in the sample were personally affected by *M. bovis*, 33% reported that they had changed their biosecurity practices as a result of the disease. This figure is higher in regions that were most affected by the recent *M. bovis* outbreak.

Finally, lifestyle block owners reported that veterinarians, industry bodies, MPI/Biosecurity NZ, and research institutes provided the most relevant and trustworthy information on biosecurity. They are considerably more sceptical of information provided by the financial sector, Māori land advisory organisations, business services and sales providers, and the Internet.

Overall, these results show that lifestyle block owners with cattle are aware of biosecurity concepts and risks. At the same time, there are opportunities for improving biosecurity practices on lifestyle blocks, including the cessation of potentially high-risk activities such as bringing organic materials from friends and neighbours onto the property, feeding pigs uncooked meat, and allowing people to work on the property without ensuring that best biosecurity procedures are followed. Making owners aware of these risks and incentivizing best-practice biosecurity on lifestyle blocks may help keep all New Zealand protected from biosecurity incursions. Veterinarians, industry bodies, MPI/Biosecurity NZ, and research institutes are well placed to share such information, given findings about lifestyle block owners’ high levels of trust in these sources.

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7 Appendix

This appendix provides additional examples of how respondents described biosecurity. They are categorised as explained in the main text of this report.

Protecting their own property and animals

- External threats to the health of our animals on farm
- Protection against diseases that can devastate my crops, animals and plants/trees
- Being aware of the history of your animals and having confidence that no diseases are being bought in
- Keeping the farm secure from invasive threats (plants animals microbiological...)
- Being mindful of risk, reducing risk of introducing disease/pests to our property, taking action to reduce or eliminate disease/pests if they arrive
- Preventing invasive species getting onto our property or affecting our livestock
- Protecting my animals and property
- Security from introduced pests and diseases for the livestock or for the native habitats on the farm
- Safety on my property and knowing where anything brought onto the property comes from
- Any plant or animal pest or disease that will lessen good animal health and profit to me
- Keeping my animals safe from diseases. Avoiding bringing diseases onto my property. Registering my animals in NAIT for tracing purposes
- Ensuring the safety of our fauna and flora, our animals (and us and our staff) from any foreign organisms that can cause sickness, destruction, death

Border controls and preventing new arrivals from establishing in New Zealand

- Keeping our country free of exotic diseases
- Keeping NZ farm and horticultural industry free from foreign pests
- keeping biological problems out of the country and out of parts of the country
- That New Zealand border doesn't let disease/viruses, etc. into the country and control when it does get here
- Maintaining a border to prevent the incursion of undesirable pests whether they be insect, animals, viruses or other threats to our animals, plants or inhabitants
- Keeping bugs out of NZ and keeping our animals safe
- Keeping pests and diseases out of the country"
- Protecting NZ's crops and livestock from introduced disease coming through our borders
- Biosecurity is usually the check at the borders to check for pests and diseases to protect NZ from and new strains
- Biosecurity means keeping pest species out of NZ, closely associated with border control
- Preventing the incursion/inflation of biological threats to the health of the New Zealand environment and agriculture
- Keeping our borders secure from biological threats that could affect our ability export
- Dealing with threats that are already established here but being extremely vigilant at our borders to prevent new ones entering the country. Risks are increasing with climate change

Supporting trade, industry, and traceability efforts

- Tracking, isolation, protection
- Track and trace. Animal health
- Biosecurity is of the utmost importance to my farming business; a biosecurity breach is rated as one of my greatest business risks
- Making sure that MPI regulations are followed
- Biosecurity is crucial to the success of our business and our agricultural industry. It's crucial to our livelihoods
- Safety of our animals from disease. Protecting the export industry
- Keeping livestock healthy. Buying NAIT tagged cattle
- Traceability of stock from birth to slaughter
- Healthy animals, Protection for our industry
- Integrity of our livestock industry

- That we as a trading country can do so without restriction
- It means keeping property well for production of export grapes
- Complying with current animal law, regulation and by-laws
- Keeping NZ free of and stopping any unwanted viruses entering NZ. Track and trace

Environmental protection

- Protecting our natural environment from introduced threats, containing or eradicating active threats
- Caring for and managing a balanced ecological environmental
- Protecting our environment from unwanted pests/predators
- Protecting our environment
- Protect native species
- Protecting the environment from harm
- Keeping the biological component of the environment safe re pathogens, pests, invasive plants
- Control of unwanted organisms in the environment
- Good procedures to ensure no harmful bugs or chemicals are threatening to people and environment

Preventing the spread of biosecurity risks from one's own property to neighbouring properties

- Containing bugs/virus to my farm only if I have any and keeping outside bugs/virus out
- Keeping my stock and farm in its own bubble. to prevent the spread of infection
- Preventing diseases coming or going from the property
- Ensuring diseases and pests are not spread from one place to another

Protecting the farming community and way of life

- Keeping our farming community safe from diseases
- Protecting both ourselves and the wider community from unwanted pests and disease through managed processes both at country, district or farm borders
- Protection of the profit and sustainability of rural communities' weeds

Bureaucracy and 'red tape'

- Expensive difficult complication to my simple process of creating sausages and steak
- Money for people that suck off the farmers
- Government regulations and red tape

Other comments were more difficult to categories and thus not included in the above. Examples include:

- Not sure. Haven't thought about it
- Very important
- Security and safety
- Clean safe responsible
- Control of threats