



## **Agricultural Production Survey Frames: Changes over time, issues, and challenges**

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## Introduction

New Zealand has a long history of producing official statistics on agricultural, horticultural, and forestry production (for example, livestock counts and crop areas). It is important that these statistics be of high quality as they are widely used for monitoring, research, planning, forecasting, and international reporting.

In this paper, agriculture includes livestock and arable farming, and horticulture and forestry production.

A population frame is the total number of observations of interest. This includes people, businesses, farms and forests, or sub-groups such as dairy farms or vineyards. A census or survey is designed to produce statistical information that represents the subject population. A census is defined as a full-coverage survey, where all units in the subject population are surveyed. The term survey is used when sampling of the subject population is carried out.

Several different population frames have been used over time for agricultural production censuses and surveys in New Zealand. These include land-based registers, administrative (tax-based) registers, farmers and growers lists, and combinations of these. The current agricultural statistics programme of censuses and surveys uses the Statistics NZ Business Frame (BF). This is an administrative (tax-based) frame that Statistics NZ uses for all business and economic statistics.

This paper will discuss the current frame together with earlier frames, and the associated challenges. These challenges include:

- the transition from land-based to administrative frames
- coverage issues that may lead to double counting or undercounting of production activity
- frame updating and issues that arise when statistics based on different frames are compared.

Initiatives to check and improve frame quality will be discussed, together with a brief look at the frames used for the production of other official agricultural and forestry statistics.

## The New Zealand Agricultural Sector

The agricultural sector is very important to the New Zealand economy with products from the primary sector making up about two-thirds of merchandise exports. The temperate climate and physical environment have made it suitable for raising several types of livestock and growing a wide range of arable and horticultural crops.

The primary sector directly contributes 7 percent to GDP with upstream and downstream manufacturing and service activity making further contributions. The agricultural sector is well developed with the majority of activity being undertaken on a commercial basis by farming and forestry businesses (the formal sector), not households (the informal sector). There are 60,000 farming and forestry production businesses.

New Zealand's population of 4.3 million is highly urbanised, with only 14 percent of the population living in rural areas. The highly mechanised nature of New Zealand agriculture means 7 percent of the labour force work directly in the primary sector. New Zealand has a number of lifestyle or hobby farms – these tend to be relatively small in size, with the owners and occupants choosing to live on them for the rural lifestyle, rather than to carry out agricultural activity to provide income or food supplies – most work in other businesses, usually in urban areas.

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With a small population, the majority (over 80 percent) of New Zealand's agricultural and forestry outputs are exported. For the year ended 30 June 2010, these sectors combined generated 63 percent of New Zealand's merchandise export receipts.

## **The New Zealand Official Statistics System**

New Zealand has a well-developed official statistics system (OSS) with many government agencies producing a wide range of official statistics. Statistics New Zealand is responsible for co-ordination across the OSS, as well as being a producer of many official statistics.

A range of agricultural and rural sector information is available from a variety of sources within the OSS. As well as the agricultural production censuses and surveys Statistics NZ conducts, there are a number of sector-specific surveys and statistics. Information relating to the agricultural and rural sector is available from many other sources, including the population census, import and export data, and collections of business, labour market, financial, and economic statistics.

## **The Current Agricultural Statistics Programme**

The current agricultural production census and survey programme began in 2002 with a census of agriculture, horticulture, and forestry. Statistics NZ carries out this programme in partnership with the Ministry of Agriculture and Forestry (MAF). This programme is made up of a five-yearly census, involving all agricultural, horticultural, and forestry businesses, with sample surveys being held in each of the inter-censal years. Information is collected through postal questionnaires, which contain questions on:

- farm details – including, farm ownership and location; and information to determine if the farm has been sold or leased, or if additional land has been acquired
- land area and land use
- livestock numbers
- arable (grain and seed) crops
- horticulture crops – fruit, vegetable, flower, and nursery crops
- farm practices – including fertiliser application, irrigation, and cultivation.

## **The Statistics NZ Business Frame**

The BF provides the population frame for the current agricultural production statistics programme as well as some of the surveys carried out during the 1990s. The BF is a statistical business register maintained by Statistics NZ. It is a tax-based frame and made up of a list of businesses based on their registration for goods and services tax (a form of VAT) with the Inland Revenue Department. It covers all business sectors including agriculture, horticulture, and forestry, other primary industries, and the manufacturing and services sector. The BF is continuously updated from a range of sources including administrative data (primarily from the tax system), feedback from Statistics NZ surveys, and other publicly available information. The BF is used for all Statistics NZ business surveys.

## **Frames Used for Agricultural Production Statistics Before 2002**

An annual agricultural production census, using a land-based frame, was carried out between 1956 and 1987. The census included all livestock and arable farmers, horticulturists, and forestry growers. The land-based frame used a list of farms specifically developed for these annual censuses. It was maintained (updated) each year from the information collected in the census. This land-based frame was costly to maintain, relied totally on the annual census for maintenance, and was only used by Statistics NZ.

In the late 1980s, financial constraints started to affect the annual agricultural statistics programme. The annual census, using a land-based frame, became unsustainable. Without an annual census, it was impractical to maintain the land-based frame. From 1988 to 2001, a mixture of sample surveys and censuses were used. In some years, there was no survey or census.

In the early 1990s, the land-based frame was merged with the Statistics NZ Business Frame. The BF provided the frame for the 1994 Agricultural Production Census, the first conducted using a frame totally dependent on GST registrations. It was subsequently used for the 1995 and 1996 sample surveys.

In 1997 and 1998, no agricultural census or surveys were carried out. In 1999, a survey of livestock farmers was carried out using a frame sourced from Agri-Base, an administrative database used for bio-security purposes. Agri-Base is land based. This was followed in 2000 by a survey of horticulturists using a frame based on the BF, supplemented with grower lists. These frame solutions proved to be unsatisfactory, as each had their own coverage, maintenance issues, and challenges. Agricultural production statistics that used a variety of frames resulted in a lower quality statistical series, and issues when comparing data over time. During this time, the agriculture sector of the BF was maintained using administrative tax data updates.

## **Frame Used for the Current Agriculture Production Statistics Programme**

From 2002, Statistics NZ, in partnership with MAF, began the current agricultural statistics programme. The programme is based on a five-yearly census (2002, 2007, and 2012) with sample surveys in the other years. The frame is sourced from the Statistics NZ Business Frame. The agriculture, horticulture, and forestry sectors of the BF are maintained to the same high standard as the other industry sectors on the BF. Considerable investment has gone into processes to update the frame with feedback from every agricultural census and survey. Although complex automation routines have been introduced, there is still considerable manual work needed for this updating. This investment is needed to ensure quality 'fit-for-purpose' statistics are produced from the agricultural production statistics programme.

The current frame selects all businesses that may be undertaking agriculture, horticulture, or forestry production activity. This includes businesses classified to these industries and businesses where these are carried out as a secondary activity. On dairy farms there are many instances of sharefarming arrangements where some, or all, of the farming operation is carried out by the sharefarmer (known as the sharemilker). Sharemilkers are identified on the BF to ensure that both the farm owner and the sharemilker are not included in the population, as this would lead to duplication. Also, in many cases farmland is leased out by the owner and farmed by other farmers. The farms that are leased out by the owner are identified and excluded from the population to prevent duplication.

When the current agricultural statistics programme was introduced in 2002, careful consideration was given to deciding on the most suitable frame. The following key factors were considered:

- The benefits that could be achieved in coherence and consistency with other statistical outputs.
- The lack of a viable alternative frame with an established and consistent level of quality, and an ongoing maintenance programme.
- Experience of the frames used for agricultural production surveys before 2002. These frames produced their own challenges. For example, land-based frames: one farm can consist of many legal land parcels, the owner may not be the farm operator, or the land may not be used for agricultural production. When frames based on grower lists or administrative animal

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registration systems for disease control were used, there were issues to do with the lack of complete coverage across all the sectors, as well as maintenance issues.

- The prohibitive cost of constructing and maintaining a frame specifically for the agricultural production statistics programme.

The use of the tax-based BF for agricultural production statistics since 2002 has provided significant benefits, as well as challenges, which have been progressively resolved.

## **Benefits of Using the Business Frame**

As noted above, the BF is used for all Statistics NZ business and economic surveys. This allows coherence and consistency across all statistics, as they use the same statistical units and classification. For example, this allows the publication of comparable data on agricultural production statistics, employment statistics based on administrative tax data, and annual financial statistics (income, expenditure, profit, assets, and liabilities) based largely on administrative tax data. If the agricultural production statistics programme used a frame independent of the BF, any integrated use of statistics would be less robust, and would need to account for differences between frames.

Using the BF for agricultural statistics is a cost-effective option. The wide use of the BF across Statistics NZ means most of the frame's operational costs are already covered. The BF makes extensive use of comprehensive administrative tax data sources. This includes the monthly use of GST and employment tax data to add and cease units, and update size measures. The BF has robust coverage of business entities in New Zealand and is continually maintained from feedback collected through Statistics NZ's range of surveys (including agricultural production censuses and surveys).

The BF's quality is improved through ongoing quality checks and data analysis. The updating of agricultural survey feedback to the BF means that other statistics benefit from these updates. One example is Business Demographic statistics, which show changes in business numbers, employment, and business births and deaths.

## **Challenges Associated with Using the Business Frame**

### **Multiple Reporting Units**

On the BF, an enterprise unit has a one-to-one match with an administrative legal data unit.

A single farming operation can involve several enterprise units. For example, one unit may carry out the farming activity, while another unit may own the land. Sharefarming arrangements are common in the dairy industry, with the farming operation split between two enterprise units, the owning enterprise, and the sharemilking enterprise. Potentially a third unit may own the land. These types of arrangements present a number of challenges when using BF units for agricultural production survey reporting units. If all the enterprises involved in a single farming operation are surveyed, they are likely to report the same farming or forestry production activity. This will overstate the statistics.

These challenges have been addressed by:

- Ensuring enterprise units that own agricultural land and lease the land to other farmers are correctly coded to property ownership, not agriculture, horticulture, or forestry. This is addressed by including questions in the agricultural production survey questionnaire to identify units that require an update to their industry classification on the BF. Annual administrative tax data is used to identify units with only rental income.

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- Identifying sharemilking units by including a question in agricultural production survey questionnaires, and then identifying these units on the BF. About 5,000 of these units are identified on the BF, which is significant as there are around 11,500 dairy farms in total.

Implementing these solutions (to cleanse the frame) was a process that took several agricultural production surveys. It is ongoing, with extensive updating taking place each year. For example, between 2002 and 2010, approximately 5,500 enterprises had an industry reclassification from agriculture to property owning. Over the same timeframe, approximately 1,500 enterprises were reclassified from property ownership to agriculture. Agricultural survey feedback over this period has provided over 30,000 updates to the industry classification of businesses. Every year, survey respondents report changes to the ownership, leasing, or sharemilking status of farming businesses. They also report if a farming business has ceased trading. These reported changes are updated to the BF, which is also updated via the tax system, including details of business start-ups and ceases.

## **Business Frame Coverage**

New businesses usually come onto the BF via GST registration. The BF covers all economically significant enterprises – for most sectors the threshold is \$60,000, including goods and services tax (GST), in annual turnover. No minimum threshold applies for agriculture, horticulture, and forestry business units. Note that there are many smaller lifestyle or hobby farms, which may be outside the tax system, or a secondary activity of another business. This non-coverage is a limitation of the BF, and can't be quantified. Biosecurity initiatives currently under development include the National Animal Identification and Tracing (NAIT) initiative and the Farms-On-Line database. These initiatives may enable this gap to be quantified in the future.

Comparing land area statistics produced from the agricultural production programme and the Ministry for the Environment's (MfE) Land Cover Database gives a reasonable match, despite the different sources and concepts used to collect data. This provides a level of confidence in agricultural production statistics based on the BF.

## **Future Frame Developments for Agricultural Production Statistics**

Current and future developments offer opportunities to enhance the BF for agricultural production statistics, or may offer suitable alternative frames or methods for producing statistics.

Biosecurity developments such as the NAIT initiative and Farms-On-Line database have the potential to support agricultural production statistics. This could be through:

- providing alternative statistics
- helping quantify and improve BF coverage and industry classification for the agriculture, horticulture, and forestry sectors
- frame extension or alternatives.

Integration of current agricultural production statistics based on the BF with a land-based frame has been considered for several years. Linking statistics based on the BF with information such as land ownership, vegetation cover, topography etc, would extend the usefulness of the statistics. This integration could be carried out by geographic area, or at the BF unit level at each location. Unit record integration supports a greater depth of analysis than integration at a more aggregated level.

To date, land-based information on large plantation forests has been successfully matched to BF agricultural production statistics. Achieving this was time-consuming and challenging,

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especially when sorting out the connections between land ownership, forest ownership, and in some cases, forest management companies.

Ideally, the efficient production of quality agricultural statistics that maximise the use of administrative data would be achieved by making links between:

- administrative units on the BF
- land parcel information that gives the location and characteristics, for example, vegetation cover and topography
- administrative systems used for biosecurity and livestock tracing purposes.

As initiatives are progressed, the opportunities they offer will be investigated further.

## **Frames Used in Other Official Agricultural, Horticultural, and Forestry Statistics**

MAF produces official statistics on forestry plantations, production, and trade. Several surveys are run to collect the information. These surveys use purpose-built frames developed and maintained from sector information and feedback from survey respondents. In 2010, MAF and Statistics NZ worked together to improve these population frames. This work involved matching the population frames of the MAF surveys with the Statistics NZ BF to identify areas where improvements could be made. This work was challenging and relatively resource intensive due to the complex and changing nature of forestry ownership and management.

Geospatial technology, including satellite imaging and remote sensing, are relatively new areas being exploited to produce official statistics. MfE's Land Cover Database is one such example. Another is the Land Use and Carbon Analysis System (LUCAS), which tracks and quantifies changes in land use over time. This is a cross- government initiative led by MfE to help New Zealand meet its international reporting requirements under the Kyoto Protocol.

Beef & Lamb NZ has been carrying out a Sheep and Beef Farm Survey of the whole farm business for the past 60 years and samples 4.5 percent of the sheep and beef farm population. This provides a sound base to produce estimates of livestock numbers that are a key component in forecasting farm production, profitability, and export volumes. Beef & Lamb NZ aims to carry out a statistically robust survey that produces quality statistical information. Agricultural Production Survey statistics are used during sample design and for post-stratification. Statistics NZ also helps ensure the survey frame is supplemented in a robust way by contacting a sample of farmers who meet specific criteria, asking for consent to pass their contact details to Beef & Lamb NZ to take part in their survey.