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Growing the Productive Base of Māori Freehold Land – further evidence and analysis

Ministry for Primary Industries

December 2014

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Executive Summary

The Ministry for Primary Industries has engaged PwC to further develop a framework for analysing the potential economic impact of increasing the productivity of Māori freehold land (MFL). Our report:

- builds upon earlier work on the sector – in particular, a February 2013 report by PwC that developed a preliminary analysis of the potential gains on MFL
- presents results from an economic model of four core industries that comprise the primary sector, at a national and regional level
- is intended to assist MPI in understanding the potential value from MFL and identifying opportunities to targeting their resources to achieving this value.

In this report, we describe the development of an economic model for analysing the potential economic gains from improving Māori freehold land at a regional and national level. This model extends earlier work undertaken by PwC. We have developed a model that:

- is based on the national accounting framework used by Statistics New Zealand and which uses a variety of historical and forward-looking data from MPI and industry sources to model expected future outcomes
- allows for the analysis of different scenarios for bringing Māori freehold land into production, and which incorporates MPI assumptions and data on the sector
- produces outputs for four agricultural industries (dairy; sheep and beef; forestry; and horticulture) at a national and a detailed regional level.

Note that in this report as in the last, assumptions still needed to be made around the area of Māori freehold land that is available for development. These assumptions have been incorporated into the economic model. However, they are subject to caveats around the achievability of some conversions and therefore represent an "upper bound" estimate of the potential for change on MFL. Nonetheless, these assumptions are an improvement over the previous report, being more detailed and inclusive of data on the freehold land resource held by the Māori Land Court, as well as updated estimates from MPI.

However, critical assumptions around current land uses still had to be made, as the Māori Land Court does not collect data on current uses. This is important as these assumptions influence the potential economic impact of a programme of improving the productivity of Māori freehold land and contain important caveats to the results reported below. A critical assumption is that land that is currently under-performing has a productivity equal to 70% of the regional (or national) average farm productivity. It is assumed that this land has the potential to improve to 100% of average farm productivity while remaining in current use.

National level outputs

Outputs from our national level economic model have been used to provide an indication of the "size of the prize" associated with raising the productivity of Māori freehold land across the board. This section provides an overview of the results for individual sectors. The table below summarises the real (2013 NZ$) undiscounted value added potential from improving the Māori freehold land resource over the 2013-2025 period (2013-2055 for forestry).

Table 1: Increase in value added under a rapid development scenario

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$1,511	$805.9
Sheep and beef	2013-2025	$506	$271.6
Horticulture	2013-2025	$268	$142.6
Agriculture subtotal	*2013-2025*	*$2,285*	*$1,220*
Forestry	2013-2055	$1,170	$106.3

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

** Discounted to present value using Treasury's discount rate of 8%.

Key findings include:

- Results differ from indicative analysis conducted in PwC's February report as a result of more detailed information about current land uses and land quality; the overall increase in gross output is comparable in scale but the inclusion of forestry has pushed some outcomes further out in time.
- The largest immediate opportunities are in dairy farming, but forestry offers long-term value in some regions.
- Obtaining these gains would require improving productivity on approximately 460,000 hectares and converting land use on approximately 150,000 hectares[1], which would require an estimated $825 million in additional fixed capital formation.

Because of the long-term nature of forestry, our model for the forestry industry stretches out to 2055 so it is important in our view to also provide a value added table showing the discounted future value added in as a present value (i.e. in today's terms). The table below shows the discounted future value added from improving the Māori freehold land resource. In order to provide an idea of the on-going impact of the programme after its completion, it also reports annual impacts on gross output (total farm revenue), value added (GDP creation), and employment (in terms of full-time equivalent employees) over the 2021-2025 period.

[1] The total amount of land converted between uses is greater than the figures for net conversions presented in the table on this page, as there are conversions in both directions that will "net out". For example, we have identified 49,720 ha that could potentially be converted to plantation forestry from other uses. However, offsetting we have also identified 15,082 ha of existing plantation forestry that could potentially be converted to dairy farming or sheep and beef grazing. As a result, the net amount of land converted to forestry is equal to 49,720 ha new plantings – 15,082 ha conversions of existing forests = 34,638 ha.

Table 2: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	61,905	26,554	$485.5	$390.1	$191.5	1,055
Sheep and beef	396,190	55,684	$250.1	$156.6	$62.9	607
Horticulture	4,459	1,277	$89.9	$101.1	$34.5	571
Agriculture subtotal	**462,554**	**102,713**	**$825.4**	**$647.8**	**$288.9**	**2,234**

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 3: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	34,638	$79.9	$373.7	$125.3	350

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

This reporting is consistent with Treasury guidance on forecasting impacts in future years, which emphasises the need to discount future impacts to take into account the time value of money. It reflects a more accurate and meaningful picture of the true value of this programme as it accounts for the different time horizon in different sectors – particularly in forestry, where there is a 25 to 30 year lag between plantings and harvest.

Regional level outputs

We developed a regional-level model of three main agricultural industries (dairy; sheep and beef; and forestry) to support a more in-depth analysis of the potential impacts of raising the productivity of Māori freehold land. Horticulture was not modelled on a regional level due to the relatively small amount of horticulture land identified as having potential for productivity improvements and the lack of sufficient information on regional productivity variations. Our main findings include:

- The impacts of upgrades to MFL are concentrated in six regions – Northland, Waikato, Bay of Plenty, Gisborne, Hawke's Bay, and Manawatu-Wanganui – that account for 92% of total MFL.
- Raising productivity of MFL is likely to result in net increases in employment and value added in these regions – which are often modest in percentage terms but significant in absolute terms.
- These impacts are greatest in certain regions and industries, such as Northland and East Coast pastoral farming, where the MFL potential is large compared with existing underdeveloped industries.

These regions are relatively deprived on main socioeconomic measures such as unemployment and low average income, which are disproportionately likely to affect Māori communities. They are also subject to central government welfare expenditures per capita that are at or above the national average. The gains from developing the MFL resource could partially offset some of these issues.

Developing the MFL resource in this context could provide a fillip to generating regional activity through higher wages and retained profits (operating surplus) for distribution, as well as through the additional intermediate consumption expended in the local business community.

Northland

Table 4: Northland region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	8,144	3,970	$63.9	$53.5	$26.3	175
Sheep and beef	48,866	7,859	$42.9	$14.9	$5.8	17
Agriculture subtotal	**57,010**	**11,828**	**$106.8**	**$68.4**	**$32.1**	**192**

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 5: Northland region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	1,599	$0.2	$17.9	$6.0	8

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 6: Northland region: Increase in value added under rapid development scenario

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$205	$109.3
Sheep and beef	2013-2025	$47	$25.2
Agriculture subtotal	*2013-2025*	*$252*	*$135*
Forestry	2013-2055	$56	$5.0

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

** Discounted to present value using Treasury's discount rate of 8%.

Waikato

Table 7: Waikato region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	15,373	7,920	$144.0	$131.7	$64.7	382
Sheep and beef	83,686	13,812	$73.8	$25.8	$10.1	116
Agriculture subtotal	**99,059**	**21,732**	**$217.8**	**$157.5**	**$74.7**	**498**

Notes: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 8: Waikato region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	1,339	$0.2	$16.4	$5.5	33

Notes: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 9: Waikato region: Increase in value added under rapid development scenario

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$515	$275.7
Sheep and beef	2013-2025	$81	$43.6
Agriculture subtotal	*2013-2025*	*$596*	*$319*
Forestry	2013-2055	$51	$4.5

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

** Discounted to present value using Treasury's discount rate of 8%.

Bay of Plenty

Table 10: Bay of Plenty region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	9,386	4,038	$84.1	$74.8	$36.7	186
Sheep and beef	63,322	7,819	$55.0	$17.8	$6.9	63
Agriculture subtotal	**72,708**	**11,858**	**$139.1**	**$92.6**	**$43.7**	**249**

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 11: Bay of Plenty region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	8,190	$1.2	$100.2	$33.6	55

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 12: Bay of Plenty region: Increase in value added under rapid development scenario

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$294	$157.3
Sheep and beef	2013-2025	$56	$30.0
Agriculture subtotal	*2013-2025*	*$349*	*$187*
Forestry	2013-2055	$312	$27.7

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

** Discounted to present value using Treasury's discount rate of 8%.

Gisborne

Table 13: Gisborne region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	6,921	2,019	$46.6	$33.0	$16.2	216
Sheep and beef	58,846	6,697	$50.0	$15.7	$6.1	138
Agriculture subtotal	**65,768**	**8,716**	**$96.6**	**$48.6**	**$22.3**	**354**

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 14: Gisborne region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	9,838	$1.5	$94.9	$31.8	135

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 15: Gisborne Region: Increase in value added under rapid development scenario

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$132	$71.3
Sheep and beef	2013-2025	$49	$26.2
Agriculture subtotal	*2013-2025*	*$181*	*$98*
Forestry	2013-2055	$298	$27.6

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

** Discounted to present value using Treasury's discount rate of 8%.

Hawke's Bay

Table 16: Hawke's Bay region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	5,925	1,918	$49.6	$41.9	$20.6	83
Sheep and beef	44,990	5,494	$38.4	$12.2	$4.8	66
Agriculture subtotal	**50,915**	**7,413**	**$88.0**	**$54.2**	**$25.4**	**149**

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052**.**

Table 17: Hawke's Bay region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	6,413	$1.0	$78.4	$26.3	39

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052**.**

Table 18: Hawke's Bay region: Increase in value added under rapid development scenario

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$166	$89.4
Sheep and beef	2013-2025	$38	$20.5
Agriculture subtotal	*2013-2025*	*$204*	*$110*
Forestry	2013-2055	$244	$21.7

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

** Discounted to present value using Treasury's discount rate of 8%.

Manawatu-Wanganui

Table 19: Manawatu-Wanganui region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	9,953	4,225	$84.5	$72.8	$35.7	233
Sheep and beef	63,005	8,897	$53.5	$16.8	$6.6	39
Agriculture subtotal	**72,958**	**13,122**	**$138.0**	**$89.6**	**$42.3**	**272**

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 20: Manawatu-Wanganui region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	5,440	$0.8	$48.0	$16.1	12

Notes: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 21: Manawatu-Wanganui region: Increase in value added under rapid development scenario

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$286	$153.1
Sheep and beef	2013-2025	$53	$28.2
Agriculture subtotal	*2013-2025*	*$338*	*$181*
Forestry	2013-2055	$151	$14.2

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

** Discounted to present value using Treasury's discount rate of 8%.

Introduction and context

The Ministry for Primary Industries has engaged PwC to further develop a framework for analysing the potential economic impact of increasing the productivity of Māori freehold land. This report:

- **builds upon earlier work on the sector – in particular, a February 2013 report by PwC that developed a preliminary analysis of the potential gains on MFL**
- **presents results from an economic model of four core industries that comprise the primary sectors**
- **is intended to assist MPI in understanding the potential value from MFL and identifying opportunities to targeting their resources to achieving this value.**

Purpose

PwC has been engaged by the Ministry for Primary Industries (MPI) to assist its Māori Primary Sector Partnerships Branch to develop a framework for analysing the potential economic impact of increasing the performance of Māori freehold land (MFL). This work is designed to complement MPI's own work developing a framework for improving the governance and management of MFL and enabling land owners to improve the productivity of under-performing land and bring new land into production.

This report follows on earlier work that PwC conducted on behalf of MPI in February 2013. The aim of PwC's February report was to answer two questions:

- First, is it possible to develop an economic framework that can used to analyse the potential future benefits of raising the productivity of Māori freehold land?
- Second, what is the potential size of this economic benefit if the productivity of all potentially viable MFL could be raised to a national or regional average?

The aim of this report is to extend this framework and develop the analysis of MFL potential further. It includes three main elements:

- First, the February report focused on two agriculture sectors – dairy; and sheep and beef. This report extends the analysis into the forestry and horticulture sectors.
- Second, the February report reported outcomes at a national level and provided some indicative regional results. This report extends the analysis and reporting down to a regional level for three sectors – dairy; sheep and beef; and forestry – for which there is sufficient data to support a detailed regional analysis.
- Third, this report can be used to support additional analysis on opportunities for Māori freehold land.

MPI is exploring new ways in which it can work proactively in partnership with Māori land owners and other strategic partners to assist owners to overcome challenges to improving the productivity of their land. MPI has established a number of projects to test approaches to increasing productivity on Maori land. This report investigates the potential accumulative regional and national value of increased productivity on Maori freehold land should work to raise productivity be successfully implemented nation-wide.

Scope of analysis

The key task of this project is to assist MPI with the further development of estimates of the productive potential of MFL by extending and updating the high-level economic model developed for PwC's February report to MPI.

What is in scope

The Primary Sector Economic Model developed by PwC is an economic model that covers the agriculture sector and its major constituent industries. It is intended to facilitate an economic analysis of the potential impact of bringing under productive- or under-utilised Māori freehold land into agricultural production. The model forecasts outcomes to 2025 to ensure consistency with the Government's Business Growth Agenda targets.

The model focuses on four main primary sectors:

- dairy cattle farming
- sheep and beef cattle farming
- horticulture (focusing on four main crops: wine grapes, kiwifruit, apples, and potatoes)
- plantation forestry.

This model has been developed to enable analysis of individual industries at both a national and a regional level.

What is not in scope

This report presents the results from an economic analysis of the potential impact of raising productivity of MFL across the board. There are three important elements of this analysis that are not in scope for this work:

- First, we only address the economic potential of Māori freehold land. This analysis excludes Treaty settlement land and Māori-owned land held in customary title.
- Second, we have not developed financial models that would enable an analysis of the financial viability of the programme as a whole or of individual projects (see below for discussion).
- Third, we do not comment on MPI's work in developing a framework for upgrading Māori agribusiness's governance and management capabilities.

Differences between economic and financial analysis

When using this report, it is important to be aware of and consider the differences between economic and financial analysis. Economic models and financial models measure different things and treat aspects of commercial undertakings differently. According to the World Bank[2], financial models answer the question 'is the project viable with an acceptable rate of return?', while economic models answer the question 'is it worth the effort and resources to intervene?'

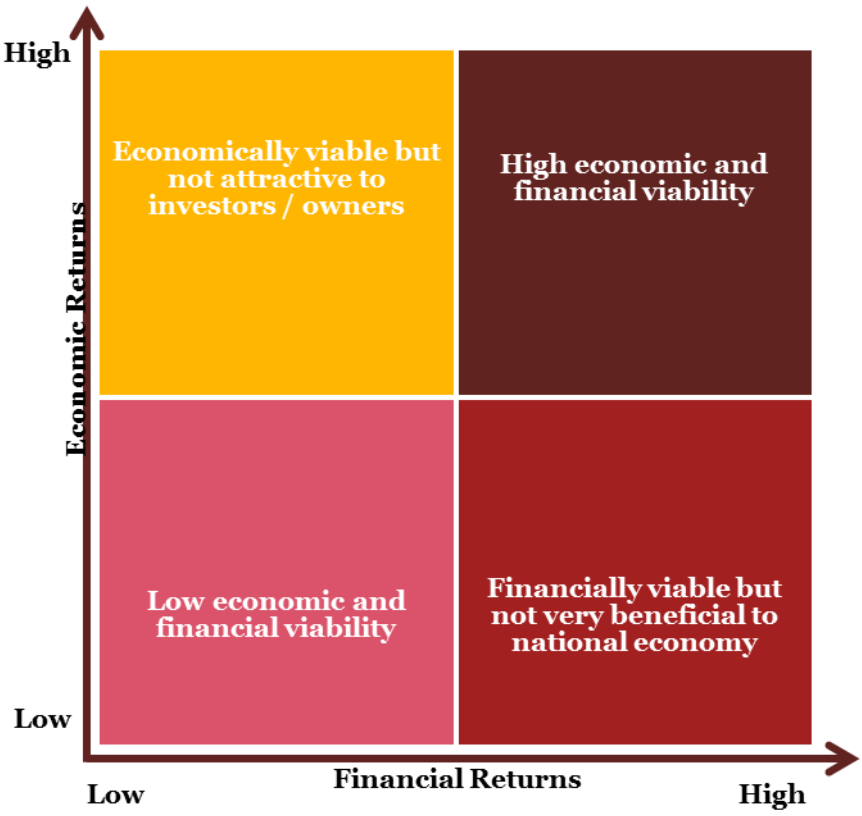
[2] http://rru.worldbank.org/documents/toolkits/highways/3_public/33/3333.htm

Economic analysis is typically concerned with net costs and net benefits to the national economy, regardless of who bears the costs and gains the benefits. It often measures benefits in terms of the net impact on gross domestic product (GDP), and costs in terms of overall costs to society, including those borne by individuals and by government. The results of economic analysis are typically reported in the form of benefit-cost ratios (BCRs) or in terms of net value added created across the economy.

Financial analysis is concerned with net costs and net benefits to an individual business or organisation. It often measures benefits in terms of the financial return to the business/organisation – for example, its impact on operating surplus (profitability). The results of financial analysis are typically reported in the form of a return on investment (ROI) or in terms of the impact on a business's returns to its shareholders.

There is often, although not always, a positive relationship between economic viability and financial viability. In most cases, decisions made by businesses or other organisations on the basis of financial analysis – for example, to expand a farm in one area, or not to invest in a marginal farming activity in another area – are also economically beneficial. In the longer term, financial decision-making supports the efficient use of resources, including land, capital, and labour.

Figure 1: Relationship between economic and financial viability



However, as Figure 1 suggests, some investments may be:

- Economically viable but not financially viable, due to the presence of market failures such as positive social externalities that cannot be captured by the investor or business, or a lack of sufficient information or capability in the market to take up potentially beneficial options. These investments represent attractive targets for intervention to overcome the market failures that prevent their development.
- Financially viable but not economically viable, due to the presence of market failures such as negative environmental externalities that are not paid for by the investor. These types of projects do not

represent appropriate targets for intervention as they will have a marginal or even negative impact on overall wellbeing.

In addition, there may be other factors, such as information failures and knowledge gaps, which prevent some opportunities that are both economically and financially viable from being realised. For example, landowners may not be aware of their options to benefit from specialised farm advising. It may be possible for MPI to overcome some of these knowledge gaps by promoting demonstration projects as examples for the other Māori landowners.

As discussed in the "Māori Freehold Land available for development" section, ownership of Māori freehold land is fragmented. Land parcels tend to be small, often with unclear governance and ownership structures. This creates barriers to developing commercially viable farming operations on Māori freehold land by making it more difficult to recognise opportunities that may exist. Overcoming the information and coordination failures caused by fragmented land ownership is a key challenge for MPI and landowners.

The analysis undertaken in this report is intended to assist MPI in shaping its views on the overall economic benefits of a programme to upgrade the productivity of Māori freehold land across the board. However, **this analysis must be supplemented with financial analysis of individual projects**.

Specific inclusions and exclusions in economic analysis

Our economic model of the primary sectors extends only as far as the farm gate – the point at which farmers get paid for the milk, meat, wool, logs, fruit, and vegetables they produce. It accounts for the economic impact of investments (defined as gross fixed capital formation) made by farms, employment on farms, and farms' contribution to value added (or national GDP). The model does not consider outcomes downstream in the farm value chains and markets for products. It does not, for example, account for the impact of processing activity or export receipts.

In addition, the economic model assumes that all additional output produced from introducing further land can be absorbed by domestic and international markets for minimal price changes. This is a reasonable assumption as productivity gains on MFL will result in a relatively small change in overall production volumes.

As this is an economic model rather than a financial model, the impact of financial transfers has not been included. This is because financial transfers – such as the purchase of an asset such as shares or Emissions Trading Scheme (ETS) units from another party – result in no net increase in the total value of economic activity. They are simply a transfer of income from one part to another.

This is important because a significant cost of doing business in the dairy industry is the requirement to purchase shares from Fonterra before milk supply will be accepted by the company. Since Fonterra accounts for around 90% of the milk market, this is a critical factor when assessing dairy projects because of the additional capital requirements. While the share purchase is a significant component of the capital required to establish a dairy farming agribusiness, they are classed as a transfer under economic analysis and do not figure in the estimates for investment used in this report.

In addition, the owners of some Māori freehold land blocks identified as having the potential for productivity improvements may be required to purchase ETS units in order to clear an existing forest for, say, use in dairy farming. Depending upon the price of ETS units, this may represent a significant added cost to landowners. However, while it should be considered in the financial analysis of individual projects, it does not figure in the estimates for investment used in this report.

Finally, the economic model does not explicitly account for any environmental costs of new farming activities. It is assumed that any new farming venture will be managed in an efficient and sustainable way. In theory, the costs of environmental harm-mitigation should be included in the farm establishment costs; in practice, some farms may face additional costs due to their position in vulnerable ecosystems or in regions where the environmental costs of farming are already higher.

Model Development

This section describes the development of an economic model for analysing the potential economic gains from improving Māori freehold land at a regional and national level. This model extends earlier work undertaken by PwC. We have developed a model that:

- **Is based on the National Accounting framework used by Statistics New Zealand and which uses a variety of historical and forward-looking data from MPI and industry sources to model expected future outcomes.**
- **Allows for the analysis of different scenarios for bringing Māori freehold land into production, and which incorporates MPI assumptions and data on the sector.**
- **Produces outputs for four agricultural industries (dairy, sheep and beef, forestry, and horticulture) at a national and a detailed regional level.**

Overview

This section provides an overview of the model development, including:

- Important caveats to consider when using the analysis in this report
- A description of the high-level model process used for the national and regional analysis
- An overview of the main data sources and key assumptions used in the model.

Important caveats to the economic model

The economic model makes the assumption that all land that is available for upgrading or conversion can in fact be upgraded or converted. The results of the analysis therefore represent an "upper bound" estimate of the economic impacts of raising the productivity of MFL.

However, there may be regulatory, environmental, or market restrictions on the ability of land owners to make improvements. These caveats are difficult to fully model but should be considered when assessing these results.

There are four main factors that may limit the ability of land owners to realise all potential gains:

- Limits to the ability of MPI or other groups to successfully target all MFL with an intervention. As discussed in the following section, roughly 16% of total MFL is contained within over 150,000 blocks of less than 10 hectares apiece. This may represent a "long tail" of land that may be difficult to upgrade.
- Limits to water allocation and the capacity to store water for irrigation. While the Government is making significant investments in water storage and irrigation, investment may not be available (or possible) to meet all expected future demands for water.
- Regulatory restrictions may exist in some areas. For example, regional councils may implement regulations on nutrient outflows from farms, or impose limits on conversion of regenerating manuka/kanuka scrubland to farming uses. At a national level, changes to legislation such as the Emissions Trading Scheme may impose costs on some types of farm conversions, or encourage different uses.

- Constraints in labour and product markets may limit growth in some areas. For example, some regions are reporting shortages of dairy farm labourers. Newly established farms may not be able to obtain workers or other inputs, such as dairy cattle. While there are ways to manage around these constraints – for example, by purchasing dairy cattle that would have otherwise been culled – they may add costs or lower the productivity of new farms.

High-level model process

The model transforms inputs (including national accounts data, regional farm production data, and agricultural land area) into four main economic outputs at a national and regional level using an approach developed in PwC's February report to MPI.

The model incorporates three elements:

- **Historical data** on each primary sector, which is used to benchmark the sector's performance over the past one to two decades
- **Forward projections** of each primary sector under a "business as usual" scenario in which no additional Māori freehold land is brought into production
- **Māori land projections** for each primary sector under a "change" scenario in which Māori freehold land is newly brought into production. The modelling assumes that under the change scenario productivity of under-performing increases from 70% of the regional (or national) average farm productivity to 100% of average farm productivity.

Model outputs are provided in charts and tables at a **national level** and a **regional level**. These outputs are based on historical performance and future scenarios for production and price growth.

The main economic outputs from the model are:

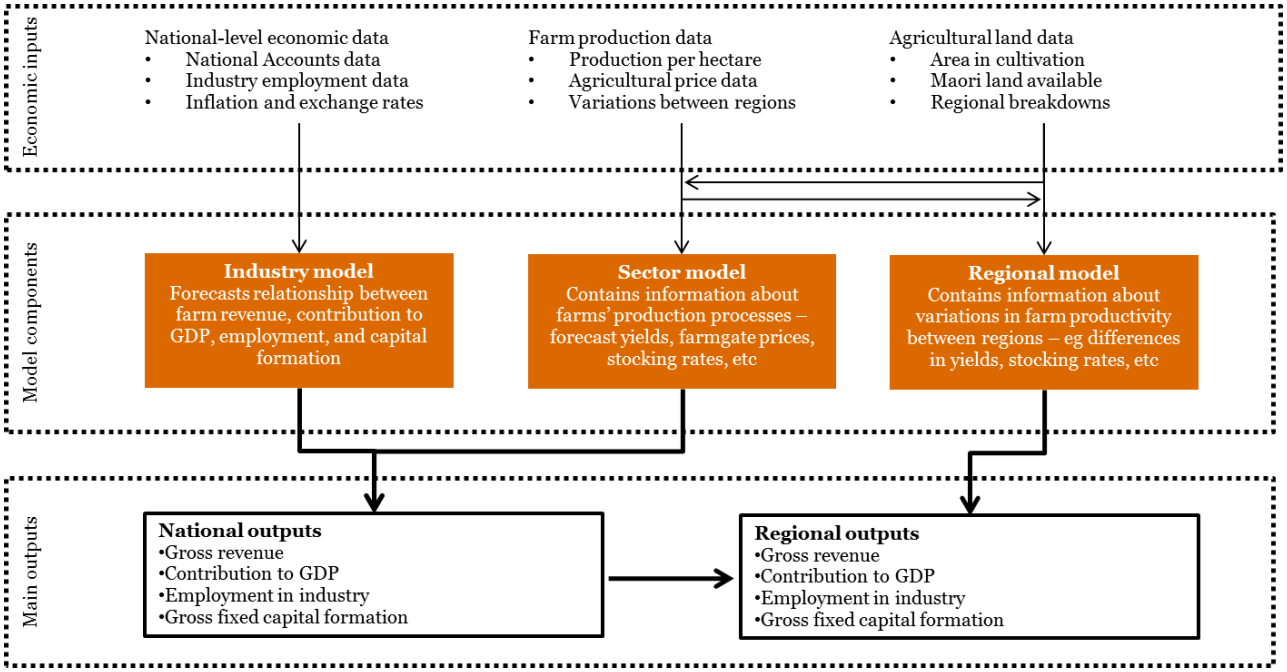
- Gross farm revenue, a measure of the total income earned by farm businesses
- Value added, or contribution to GDP, which measures the net effect of the primary sectors on the national economy
- Employment (in full-time equivalent employees)
- Gross fixed capital formation, or investment by the primary sectors.

Figure 2 summarises the model process, showing how it combines inputs (national level economic data on industries, farm production and price data, and information on the land available for upgrading) into outputs. The core elements of the model consist of:

- An **industry model** that forecasts, on the basis of historical data from Statistics New Zealand's National Accounts, the relationship between changes in farm revenue, value added, employment, and farm investment in each agriculture sector.

- Four **sector models** that use historical and forward-looking budgeted information about farms' productivity and prices for farm products to forecast future changes in farm revenue at a national level.[3]
- **Regional models** that use data on known differences between farm productivity and labour inputs between Statistics New Zealand's regional council areas to break down the national level estimates to a regional level.

Figure 2: High level model process diagram



Industries included in the model

We have based our analysis and reporting on the Australia-New Zealand Standard Industry Classification, 2006 revision, as it is consistent with Statistics New Zealand's framework and comprehensive in its coverage of the primary sector.

Our analysis focuses on four individual components of the overall primary industry:

- dairy cattle farming
- sheep and beef cattle farming [including wool production, but excluding grain farming]
- forestry and logging [including logging activities directly related to the establishment or harvesting of forests]
- horticulture and fruit growing.

At this point in time, we have excluded fishing, aquaculture, and poultry, deer and other livestock farming due to their small scale and/or difficulty in robustly identifying and measuring these industries.

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3 As MFL makes up a small percentage of overall agricultural land, we have assumed that a programme to raise productivity on this land will have no major impacts on prices for farm products.

Analysis period

We have chosen an analysis period that is consistent with the Government's Business Growth Agenda targets, which aim to achieve outcomes for export and productivity growth by 2025.

The economic model uses historical data to account for outcomes over the 2001-2012 period, and projects future outcomes over the 2013 to 2025 period.

The one exception to this is in the forestry sector. Our research indicated that a typical forestry development took place over a 25-30 year cycle, with on-going investment needed in that time, and that forest growth (and hence harvestable volumes) can be forecast over a long time horizon. Consequently, we have extended our analysis period to 2055 for the forestry sector only, while reporting some intermediate measures for forestry outcomes in the period to 2025.

Real versus nominal analysis

We have reported all results in real terms. This represents a change from PwC's February report, which reported values in nominal terms. Economic analysis usually distinguishes between real and nominal variables. Real variables are those that exclude the effects of inflation, whereas nominal variables are expressed in prices that include an inflation component. Values reported in real terms therefore provide a more accurate indication of changes in value within a sector.

Much of the data used in this analysis has been provided in nominal terms, including the Statistics New Zealand data on national accounts down to a more detailed industry level, as well as MPI forecasts and historical price data for agricultural commodities. We have converted historical figures to real terms using Statistics New Zealand's Consumer Price Index, the most widely-used measure of inflation (and one utilised by MPI). Future estimates of consumer price inflation have been established using NZIER's consensus forecasts of inflation for the period to 2018, followed by the assumption that inflation averages 2% (ie the midpoint of the Reserve Bank's target range). Consequently, our analysis captures the effect of price changes within the primary sectors relative to within the economy as a whole.

Full documentation of assumptions and underlying data

Further information on the model process and underlying data and assumptions is available in 'Appendix A – Detailed model documentation'.

Māori Freehold Land available for development

This section discusses the assumptions around the area of Māori freehold land that is available for development that have been incorporated into the economic model. This is important as these assumptions influence the potential economic impact of a programme of improving the productivity of Māori freehold land. It covers:

- **the caveats to this analysis – this is <u>not</u> a model for making decisions on land use or for making policy recommendations**
- **the data and assumptions underlying the land use assumptions, including (a) the use of Māori Land Court data to quantify the size and distribution of the resource, (b) use of previous MPI analysis, and (c) the assumptions that MPI has applied to land use for this work**
- **the assumptions about land use change potential at a regional and national level.**

Overview

The scale of the projected economic impact of a programme of upgrading productivity on Māori freehold land depends, in large part, on the assumptions about the size of the resource that is potentially available for upgrading. This section summarises the assumptions that have been made in order to estimate the area of MFL that could potentially be upgraded. Depending upon the block of land, a productivity upgrade could mean:

- remaining in current use and raising farm productivity through better management –based on previous work, we have estimated that this could mean raising production from 70% of the industry average production per hectare to 100% of the industry average
- converting the land from its existing use, if any, to a higher productivity use, which we have estimated to be equivalent to the industry average production.

The assumptions about land inputs summarised in this section represent an update to the high level analysis that was previously undertaken for PwC's February 2013 report. This report incorporates new and more detailed information on the regional allocation of MFL and current land uses.

In some cases, this has resulted in a reduction in the estimated size of the resource that could potentially be brought into production. However, it has also resulted in a more nuanced view of the mix of farming activities that could be supported on MFL.

Important caveats to analysis of MFL inputs

First and foremost, the analysis in this section **is not a model for making decisions on land use, nor does it make policy recommendations**.

This section simply reports on the assumptions that have been made in order to obtain an "order of magnitude" estimate of the potential from partnerships to improve the productivity of Māori freehold land. The aim is to improve the information available to MPI to support policy analysis and explain the impact of its framework for improving governance and management of Māori agribusinesses. This analysis may also assist MPI in targeting its programmes to the regions where they could potentially be the most effective.

The analysis in this section is assumption-based due to the lack of resource to develop a more granular view of current and potential land use on MFL. It draws upon the best information available at this time, including:

- Data from the Māori Land Court (MLC) on regional holdings of Māori freehold land, by land class.
- Previous analysis by MPI and its predecessor agencies on the size and potential of MFL at a national level.
- Contextual information and supplementary analysis available to MPI.

There are a number of caveats to this analysis. For example, the model assumes that in some cases that natural forest will be converted to grazing or forestry. Natural forest includes regenerating manuka and kanuka, which is more likely to be subject to conversion than mature native forest.

The restrictions include those imposed by regional councils under the RMA, which will vary from region to region. There are also restrictions around the commercial harvesting of indigenous forest imposed by MPI (such as the need for an indigenous forest plan or permit). In practice, any such conversions will be subject to restrictions, and as a result this model takes a relatively conservative view on the potential for change on this type of land.

Methodology used to estimate potential on MFL

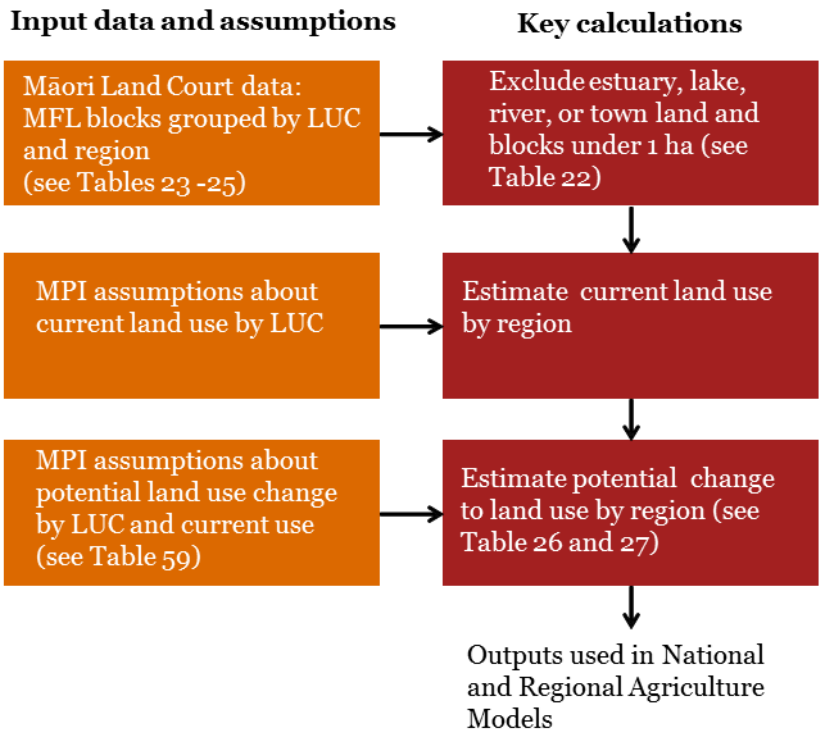
Figure 3 summarises, at a high level, the approach that we used to estimate the potential for change on MFL. While it does not summarise the quantity of MFL that is identified as having the potential to change, it refers to the tables in this report that provide this information. It should be possible to use Figure 3 in conjunction with these tables in order to follow the calculation process.

Broadly speaking, our approach was to:

- Use MLC data to identify the total amount of MFL and to break it down by region and land use capability class (LUC) (as shown in Table23, 24 and 25)
- Exclude MFL blocks that were not available for farming (eg estuary, lake, river or town land) or too small to be viable (ie blocks less than 1 ha in size)
- Estimate current land use on MFL using MPI's estimates of current land use by LUC (these estimates are summarised in "Appendix B – Assumptions about Māori Freehold Land")
- Estimate the potential future change to land use or farm productivity on MFL using MPI's assumptions about the potential for change, based on LUC and estimated current use (these assumptions, which were developed by MPI, are summarised in 'Appendix B – Assumptions about Māori Freehold Land').

The outputs from this model, which are summarised in Table 226 and Table 27, were then input into the National and Regional Agriculture Models.

Figure 3: Approach to estimating potential for change on MFL



Comparison of land use inputs with previous work

Table22 summarises, at a national level, the land use inputs used in this report and compares them with the previous (February 2013) report, which developed a "proof of concept" model for the dairy and sheep and beef sectors at a national level.

We note that there are considerable differences between the land use inputs used in the two reports, and the assumptions about the potential for change on that land. Broadly speaking:

- This report uses a lower figure for the overall area of Māori freehold land – 1.28 million hectares compared with 1.52 million hectares – that reflects the availability of more accurate and detailed data from the Māori Land Court (as opposed to the earlier report's reliance on estimates developed in work done by the Ministry of Agriculture and Forestry (MAF) – see below).
- It also excludes land blocks that are unlikely to be available for farming activities, bringing the total amount of land input into the model down to 1.18 million hectares.
- This report makes a considerably smaller estimate of the potential for change on MFL. In particular, it assumes that only 0.19 million hectares could potentially be converted to a more productive use, compared with 0.42 million hectares in the previous report. This is due to the use of more accurate and detailed information from the MLC, which suggests that MFL is concentrated in LUCs that are less available for high-productivity farming activities.

For purposes of comparison, we describe the process that was used to estimate the potential for change on MFL below. We note that it relies upon broad-brush assumptions than the approach used in this report.

Table 22: Comparison of land use inputs used in current report and previous (February 2013) report

Description	Land area (ha)	Figure used in Feb 2013 report (ha)
Total area in Māori Land Court dataset (1)	1,275,309 ha	
…excluding land classified as estuary, lake, river, or town LUCs	1,205,450 ha	
…excluding very small blocks (less than 1 ha)	1,182,542 ha	
Total MFL input into model	**1,182,542 ha**	**1,515,071 ha (2)**
Future land use forecasts		
…retain in existing use (if any)	531,944 ha	545,426 ha
…retain in existing use and upgrade productivity	462,554 ha	545,422 ha (3)
…convert to more productive use	188,044 ha	424,223 ha (4)

Notes:

*Māori Land Court data included an individual record for each land block, grouped by land use class and regional council area. For the sake of simplicity, this table reports data at a national level.

**Source: MAF (2011), "Māori Agribusiness in New Zealand: A Study of the Māori Freehold Land Resource". This data was less detailed and up-to-date than the Māori Land Court data.

***The Feb 2013 report only accounts for productivity upgrades on land currently used for sheep and beef.

****The Feb 2013 report only accounts for includes conversions to dairy (60,603 ha) and sheep and beef (363,620 ha).

Overview of approach used in February 2013 report

The analysis in the February 2013 PwC report was based on a national level study of the size of the Māori freehold land resource that is potentially available undertaken by the former Ministry of Agriculture and Forestry (MAF)[4]. The MAF report identified 1.5 million hectares of rural land as the potentially productive resource base, classified in the following way:

- Tier 1 lands – those that are currently in production and are designated as being well managed and is assessed as being about 20% of the freehold resource.
- Tier 2 lands – those that are currently used in production but are under-performing relative to industry benchmarks and is assessed as comprising around 40% of the freehold resource.
- Tier 3 lands – those that are currently under-utilised and could be brought into the productive sector and constitutes the balance of the resource (40%).

The MAF report identified a substantial opportunity associated with improving the economic performance of the 1.2 million hectares of Tier 2 and Tier 3 lands.

The February 2013 PwC report applied this high-level assumption about the potential on Tier 2 and Tier 3 lands to individual land classes to estimate a split between:

- Tier 2 land that could potentially be converted to dairy farming
- Tier 2 land used for sheep and beef farming that could be targeted for productivity increases

4 "Māori Agribusiness in New Zealand: a study of the Māori freehold land resource". Ministry of Agriculture and Forestry, March 2011.

- Tier 3 land that could potentially be converted to sheep and beef farming.

However, this analysis excluded other agricultural uses (eg forestry, horticulture) and did not incorporate any detailed information on current land uses.

Overview of data on Māori Freehold Land

This report relies upon data from the MLC to quantify the total size of the Māori freehold land resource and to break it out by regional council area and by Land Use Capability (LUC) class.[5] The MLC data covers 173,278 farm holdings that range from less than one hectare to over 1,000 hectares and cover a total of 1.27 million hectares, 1.21 million hectares of which is classified as agricultural land.[6]

Analysis of MFL by block size

Table3 and 24 presents this data at a national level, breaking it down by land use class and size of the block. The MLC data indicates that:

- Most MFL is held in relatively small blocks – 60% is in blocks of less than 100 ha.
- Some land is more concentrated – there are 27 blocks of land with over 1000 hectares, and 2,061 blocks with 100 to 999 hectares.
- There are a large number of extremely small holdings – over 100,000 blocks of less than 1 ha, and an additional 52,000 blocks with 1 to 9 hectares – but they represent a minority of overall MFL land.

5 LUC classes categorise land according to its geography, climate, and land cover. The eight classes used run from high productive/versatile land – land class 1 is "Very good multiple-use land", while class 7 is "Unsuitable for arable use and has severe limitations/hazards under perennial vegetation." For a description of these categories, see "Appendix B – Assumptions about Māori Freehold Land". Lynn, I., Manderson, A., Page, M., Harmsworth, G., Eyles, G., Douglas, G., Mackay, A., Newsome, P. (2009). Land Use Capability Survey Handbook (3rd ed.). Hamilton: AgResearch; Lincoln: Landcare Research; Lower Hutt: GNS Science.

6 As opposed to LUC categories e, l, r, t – estuary, lake, river, and town land. We have excluded these blocks in all subsequent analysis.

Table 23: Summary of MFL by land use class and size of farm block

LUC	Number of blocks, by block size					
	1000+ ha	100-999 ha	10-99 ha	1-9 ha	<1 ha	Total
1		1	167	847	1,928	**2,943**
2		2	716	4,123	10,250	**15,091**
3		37	1,570	6,713	16,777	**25,097**
4	1	165	2,164	7,590	15,286	**25,206**
5		4	141	405	682	**1,232**
6	2	779	7,386	18,204	31,249	**57,620**
7	11	820	4,692	10,493	13,986	**30,002**
8	13	263	1,407	4,142	6,331	**12,156**
Total	**27**	**2,071**	**18,243**	**52,517**	**96,489**	**169,347**

Source: Maori Land Court Data.

Table 24: Summary of MFL by land use class and size of farm block

LUC	Total area of blocks, by block size					
	1000+ ha	100-999 ha	10-99 ha	1-9 ha	<1 ha	Total
1		107	3,968	2,797	440	**7,312**
2		263	14,219	13,701	2,427	**30,609**
3		5,482	39,059	22,066	3,781	**70,389**
4	1,035	29,068	57,355	25,430	3,524	**116,413**
5		830	3,618	1,505	154	**6,107**
6	2,787	137,515	220,314	62,967	7,349	**430,932**
7	17,450	184,061	149,161	36,402	3,619	**390,693**
8	28,175	64,891	44,680	13,636	1,613	**152,995**
Total	**49,447**	**422,217**	**532,374**	**178,504**	**22,908**	**1,205,450**

Source: Maori Land Court Data.

Analysis of MFL by region and land use capability class

Table 25 summarises the MLC data by region and LUC class. Note that LUCs with lower numbers are more productive and have a wider range of uses than LUCs with higher numbers. This analysis of the MLC data shows that:

- 68% of Māori freehold land is in land classes 6 and 7, meaning that it is fairly marginal for all uses except forestry and some grazing.
- MFL is concentrated in six regions that together account for nine-tenths of the total MFL area:
  - Bay of Plenty (19% of national total)
  - Gisborne (16%)
  - Hawke's Bay (14%)
  - Manawatu-Wanganui (15%)

- Northland (10%)
- Waikato (19%).

This suggests that most interventions to raise the productivity of MFL will need to be targeted at these six regions, as other regions offer relatively limited scope for economic gains.

Table 25: Māori freehold land by region and land class

Region	Land use class								Share of total MFL in region
	1	2	3	4	5	6	7	8	
Auckland	8	515	635	820	0	3,054	1,414	102	0.6%
Bay of Plenty	298	7,329	11,339	17,336	85	53,850	89,702	41,326	19%
Canterbury	24	420	964	326	102	1,526	568	8	0.3%
Gisborne	379	6,875	8,878	5,274	0	57,905	91,002	14,707	16%
Hawke's Bay	656	1,188	7,230	5,942	1,459	45,026	60,865	39,953	14%
Manawatu-Wanganui	858	2,412	11,912	17,444	24	67,937	60,837	22,451	16%
Marlborough	0	127	37	0	26	2,034	4,202	452	0.6%
Nelson	0	0	0	0	0	4	0	0	0.0%
Northland	0	1,762	5,784	19,037	568	62,385	24,553	4,995	10%
Otago	0	0	165	1,052	57	2,846	98	57	0.4%
Southland	0	0	334	2,528	7	17,518	4,719	101	2.1%
Taranaki	4,206	3,233	5,011	1,849	2,454	5,739	4,443	1,052	2.4%
Tasman	1	0	6	0	0	15	7	1	0.0%
Waikato	415	3,838	12,816	38,786	1,059	100,388	37,603	24,984	19%
Wellington	25	485	1,343	302	11	2,619	5,980	1,083	1.0%
West Coast	0	0	154	2,193	102	738	1,083	110	0.4%
National total	**6,871**	**28,182**	**66,607**	**112,889**	**5,953**	**423,583**	**387,074**	**151,382**	**1,182,542**

Notes: * Excludes blocks smaller than 1 ha and land classified as estuary, lake, rive, or town LUCs
Source: Maori Land Court.

Potential for change

Here, we summarise our analysis of the potential for change on MFL at a national and regional level that are based on the assumptions described in this section and defined in detail in "Appendix B – Assumptions about Māori Freehold Land". Once again, we emphasise that this is an analysis of the theoretical potential of MFL rather than a model for making decisions on land use or making policy recommendations.

Table 226 presents a high-level summary of these changes for the six main regions, showing the amount of land in each region that is expected to (a) remain in current use with no change, (b) remain in current use with the potential for raised productivity, and (c) have the potential for changing to a higher value land use. Estimates for all regional council areas are presented in Table 59 in "Appendix B – Assumptions about Māori Freehold Land".

Table 226 is intended to provide a quick, at-a-glance overview of the potential degree of change on MFL, while Table 27 provides a more in-depth picture of the potential for change.

The estimates reported in Table 226 have been calculated using the approach described in Figure 3, which applies national level assumptions about current uses and potential for change in each LUC to the MLC data on MFL by region and LUC. As a result, differences in estimated potential between regions are driven by variations in the size and composition of Māori landholdings in each region.

This analysis suggests that on a national level, roughly 55% of MFL has been identified as having some potential for upgrading. Up to 42% of MFL has the potential to remain in existing use while improving productivity, and up to 13% has the potential to switch to a higher-value land use.

These proportions vary considerably among regions. Outcomes vary among the six regions that account for 92% of overall MFL:

- Most change: Northland and Waikato have the largest potential for change, with 14%-15% of land potentially changing uses and 47-50% upgrading productivity
- Least change: Bay of Plenty and Hawke's Bay have the least potential for change, with 51% and 54%, respectively, of land staying in current uses. This is due to the relative large area of natural and planted forest, land uses which offer few potential for change, in these regions.

Table 26: High-level summary of potential change on MFL, for main regions and NZ in total

Region	No change - retain existing land use	Improve productivity of existing land use	Change land use
Bay of Plenty	112,499	81,701	27,065
Gisborne	86,257	74,637	24,126
Hawke's Bay	87,485	56,935	17,896
Manawatu-Wanganui	80,359	79,325	24,190
Northland	42,209	59,748	17,126
Waikato	86,301	103,547	30,041
Other regions	36,833	42,272	11,989
National total	**531,944**	**498,165**	**152,433**

Source: MLC, MPI, PwC Calculations.

Table 27 provides a more detailed breakdown of the potential changes to Māori freehold land use at a national level and for the six main regions, summarising the amount of land that is likely to be retained in its existing uses, converted between uses, or targeted for productivity improvements. A full breakdown of potential changes for all regional council areas is presented in

Table 59 in 'Appendix B – Assumptions about Māori Freehold Land'.

A large proportion of overall MFL is expected to have little or no potential for change. Forty-five percent of land will be retained in its current use with no changes, including 28% of MFL which is currently in native bush and 8.3% which is planted in commercial forests. No changes are expected to occur on land which is either likely to be productive and in its highest value use (including LUC 1 and 2 land, forestry on LUC 5-7) or which is unsuitable for any primary industries (LUC 8).

This table reflects the expectation, based on an analysis of the LUC and current uses of MFL, that only a minority of overall MFL could potentially be changed from one land use to another. At a national level:

- 531,724 hectares (45% of MFL input into model) would be retained in their current use with no change to productivity. In addition, apiculture could be introduced on 35,433 ha of native forest (equating to 3% of MFL) with no required change in land cover.
- 152,433 ha (13% of MFL) could potentially be changed to a higher productivity use. This area is broken down as follows:
  - 26,554 ha (or 2.2% of MFL) could potentially be converted to dairying
  - 74,883 ha (or 6.3% of MFL) could potentially be converted to sheep and beef production, while 19,199 ha could potentially be converted to plantation forest. This would result in a net increase of 55,684 ha of sheep and beef farms (equivalent to 4.7% of MFL)

  - 49,720 ha could potentially be newly converted to plantation forest, while 15,802 ha of existing plantation forest could potentially be converted to other uses. This would result in a net increase of 34,638 ha of plantation forests (equivalent to 2.9% of MFL)
  - 1,277 ha (or 0.1% of MFL) could potentially be converted to horticulture.
- 462,554 ha (39% of MFL) could potentially be retained in its existing use with raised productivity. This area is broken down as follows:
  - 61,905 ha (or 5.2% of MFL) of existing dairy farming area that is potentially under-performing
  - 396,190 ha (or 33.5% of MFL) of existing sheep and beef farms that is potentially under-performing
  - 4,459 ha (or 0.4% of MFL) of existing horticulture operations that is potentially under-performing.

We note that these assumptions imply that a small share of all native forest could potentially be converted to other uses. According to discussions with MPI, this is possible due to the fact that the "native forest" category includes regenerating manuka/kanuka scrubland in addition to mature forest. While there may be some restrictions placed by regional councils on clearing this land, we have therefore assumed that it will be possible to convert some regenerating scrubland back into farming uses.

Table 27: Detailed summary of potential change to land uses, for main regions and NZ in total

Land use change	Bay of Plenty	Gisborne	Hawke's Bay	Manawatu-Wanganui	North-land	Waikato	Other regions	National Total
Retain as Natural forest	72,373	55,953	57,834	53,074	27,717	55,340	19,433	341,724
Retain as Planted forest	16,947	17,607	12,662	15,550	10,868	17,299	7,409	98,342
Retain as Dairy	2,902	2,760	707	1,251	669	1,620	3,479	13,389
Retain as Grazing animals	5,497	3,254	3,685	2,684	911	3,203	2,561	21,795
Retain as High-producing grassland with no known use	1,599	1,520	381	678	370	889	1,856	7,293
Retain as Low-producing grassland with no known use	9,505	3,383	9,189	5,164	1,149	5,746	682	34,818
Retain as Unused grassland with woody biomass	2,893	1,030	2,797	1,572	350	1,749	208	10,597
Retain as Horticulture	784	752	230	387	176	454	1,203	3,986
Total land retained in present use	*112,499*	*86,257*	*87,485*	*80,359*	*42,209*	*86,301*	*36,833*	*531,944*
Upgrade productivity of Dairy	9,386	6,921	5,925	9,953	8,144	15,373	6,203	61,905
Upgrade productivity of Grazing animals	63,322	58,846	44,990	63,005	48,866	83,686	33,475	396,190
Upgrade productivity of Horticulture	740	497	421	770	480	1,029	523	4,459
Total land with upgraded productivity	*73,448*	*66,264*	*51,336*	*73,728*	*57,489*	*100,088*	*40,201*	*462,554*
Convert Natural forest to Dairy	236	159	140	265	257	474	149	1,680
Convert Planted forest to Dairy	1,381	524	537	1,400	1,390	2,851	774	8,857
Convert unused grassland to Dairy	2,420	1,336	1,241	2,561	2,323	4,594	1,540	16,016
Convert Natural forest to Grazing	1,036	1,051	836	1,284	1,187	1,952	704	8,050

Land use change	Bay of Plenty	Gisborne	Hawke's Bay	Manawatu-Wanganui	North-land	Waikato	Other regions	National Total
Convert Planted forest to Grazing	979	412	406	996	936	1,928	569	6,225
Convert unused grassland to Grazing	10,253	9,748	7,272	9,635	6,953	11,797	4,950	60,608
Convert Natural forest to Planted Forest	246	264	206	310	285	459	167	1,936
Convert Grazing animals to Planted Forest	4,449	4,514	3,019	3,017	1,218	1,865	1,117	19,199
Convert unused grassland to Planted Forest	5,855	5,995	4,130	4,508	2,422	3,794	1,880	28,585
Convert unused grassland to Horticulture	208	124	109	215	155	327	139	1,277
Total land converted between uses	*27,065*	*24,126*	*17,896*	*24,190*	*17,126*	*30,041*	*11,989*	*152,433*
Introduce apiculture on Natural forest	8,253	8,372	5,600	5,597	2,259	3,459	2,071	35,611
TOTAL	**221,265**	**185,020**	**162,317**	**183,874**	**119,083**	**219,889**	**91,094**	**1,182,542**

Finally, Table 28 provides a regional summary of the potential future state of MFL after a comprehensive programme of upgrades. It breaks down the potential final land uses, including current agricultural and forestry activities and land that is converted between uses or brought into production. This suggests that even after a substantial programme of upgrading productivity and introducing new farming activities, almost one-third of MFL would still be covered by natural forest.

Table 28: Potential final land uses on MFL, for main regions and NZ in total

	Potential final land use							
Region	Natural forest (no apiculture)	Planted forest	Dairy	Grazing animals	Unused grassland	Horticulture	Apiculture on natural forest	Total
Bay of Plenty	72,373	27,497	16,325	81,088	13,997	1,732	8,253	221,265
Gisborne	55,953	28,380	11,701	73,310	5,932	1,372	8,372	185,020
Hawke's Bay	57,834	20,018	8,551	57,188	12,366	760	5,600	162,317
Manawatu-Wanganui	53,074	23,385	15,429	77,604	7,413	1,372	5,597	183,874
Northland	27,717	14,793	12,783	58,853	1,868	811	2,259	119,083
Waikato	55,340	23,417	24,913	102,566	8,384	1,810	3,459	219,889
Other regions	19,433	10,573	12,145	42,260	2,746	1,865	2,071	91,094
National total	**341,724**	**148,062**	**101,848**	**492,868**	**52,707**	**9,722**	**35,611**	**1,182,542**

Source: MLC, MPI PwC calculations.

National Analysis

Outputs from our national-level economic model provide an indication of the "size of the prize" associated with raising the productivity of Māori freehold land across the board. This section provides an overview of the results for individual sectors. Key findings include:

- **results that are largely consistent with indicative analysis conducted in PwC's February report; the overall increase in gross output is comparable in scale but the inclusion of forestry has pushed some outcomes further out in time**
- **"headline impacts" under a rapid development scenario of an estimated annual increase in value added from agriculture (dairy, sheep and beef, and horticulture) of approximately $289 million during stabilised production years (2021-2025) and an estimated annual increase in value added from forestry of $125 million during the harvest window (2044-2052)**
- **these impacts equate to a present value impact of $1.2bn in agriculture and $0.1bn in forestry**
- **the largest immediate opportunities are in dairy farming, but forestry offers long-term value in some regions**
- **obtaining these gains would require upgrades to productivity on approximately 460,000 hectares and converting land use on approximately 150,000 hectares, which would require an estimated $825 million in additional fixed capital formation over the period.**

Overview of results

In this section, we provide a national overview of the potential economic gains that could result from an across the board increase in the productivity of MFL. The estimates reported here are based on the analysis of the potential for change on MFL reported in the previous section. Note, again, that figures for net conversions account for the fact that some new land will be converted into each use and some land will be converted out of its existing use into another use.

These results are based on two scenarios for upgrades to under-utilised and under-performing land. In the "Rapid Development" scenario, conversions and productivity upgrades would peak in 2016 and 2017. Around 90% of MFL would be converted or upgraded by 2019. In the "Slow Development" scenario, conversions and upgrades would ramp up more slowly and peak in 2020 and 2021. Around 90% of MFL would be converted or upgraded by 2024.

The impacts of each scenario on value added within each agricultural sector are reported in the following tables.

Table 29: Economic impacts of productivity increases on MFL

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	61,905	26,554	$485.5	$390.1	$191.5	1,055
Sheep and beef	396,190	55,684	$250.1	$156.6	$62.9	607
Horticulture	4,459	1,277	$89.9	$101.1	$34.5	571
Agriculture subtotal	**462,554**	**102,713**	**$825.4**	**$647.8**	**$288.9**	**2,234**
Forestry	0	34,638	$79.9	$373.7	$125.3	350

Notes: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 29 reports the overall impacts of the programme in terms of:

- The investment required to raise the productivity of identified land and to make the conversions of other land to more productive use. This is estimated under a rapid development scenario to cost approximately $825 million in undiscounted terms.
- Annual impacts on gross output, value added, and employment during the stabilised year (2021-2025 for agriculture sectors) or the harvest window (2044-2052 for forestry). Our analysis of the rapid development scenario suggests that this programme could potentially result in the following additional annual impacts:
  - For stabilised years in agriculture (dairy, sheep and beef, and horticulture), a net increase in GDP of approximately $289 million and net additional employment of approximately 2,200 FTEs.
  - For harvest years in forestry, a net increase in GDP of approximately $125 million and net additional employment of approximately 350 FTEs.

Table 30 compares cumulative outcomes over the study period under a rapid development scenario, using both discounted and undiscounted values. (Undiscounted accumulated increases in GDP are provided for consistency with PwC's February 2013 report scoping out the potential for a national agricultural sector analysis.) We estimate that the interventions will be associated with an undiscounted increase in GDP of approximately $3.4 billion during the study period (albeit at very different times for agriculture sectors and forestry).

The model results suggest that:

- A large share of the impact – approximately $1.5bn – will occur in the dairy sector.
- Sheep and beef will account for a significant share of the remaining impact – approximately $0.5bn.
- The additional value added in the horticulture industry is expected to be relatively modest (on the order of ($0.2-0.3bn).
- Forestry will also account for a large share of the absolute increase – approximately $1.2bn. However, this impact will mostly occur between 2044 and 2055, rather than in the period ending 2025, due to the lengthy production cycle in the forestry industry. The forecast gains will not be realised before 2025, although assuming that land is planted by 2025, land owners will be able to plan around future harvests.

Table 30: Accumulated and present value of increase in value added over study period from Māori land upgrades (in real terms)

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$1,511	$805.9
Sheep and beef	2013-2025	$506	$271.6
Horticulture	2013-2025	$268	$142.6
Agriculture subtotal	*2013-2025*	*$2,285*	*$1,220*
Forestry	2013-2055	$1,170	$106.3

Notes

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

** Discounted to present value using Treasury's discount rate of 8%.

Table 30 also reports the present value of these impacts, in which future increases have been discounted to present value at a rate of 8%. This reporting is consistent with Treasury guidance on forecasting impacts in future years, which emphasises the need to discount future impacts to take into account the time value of money. It reflects a more accurate and meaningful picture of the true value of this programme as it accounts for the different time horizon in different sectors – particularly in forestry, where there is a 25 to 30 year lag between plantings and harvest.

Comparing the results in 30 shows a far more modest assumption regarding the increase to GDP of approximately 1.3 million in a rapid development scenario. This is driven largely the discounting of impacts on the forestry sector during the 2044-2055 harvest period.

The present value analysis suggests that dairy farming offers the best short-term gains, although a mix of farming activities will generate economic benefits in the longer term.

Detailed outcomes under a rapid development scenario

Here, we provide a more detailed, year-by-year breakdown of the impacts on land requirements, investment requirements, value added and employment under a rapid development scenario. The detailed analysis has been conducted on the rapid development scenario due to the fact that, under this scenario, most MFL is expected to be upgraded by 2019. As a result, outcomes in the 2021-2025 period will reflect a reasonable expectation for the on-going annual impacts of the programme. The slow development scenario will deliver similar long-term outcomes.

The tables on the following pages report annual impacts in each sector in the 2013-2025 period.

Table 31 summarises the requirements for investment and new land. This scenario would entail raising productivity on a total of approximately 460,000 ha and converting approximately 150,000 ha to different uses. Upgrading productivity on this land would require total investment in fixed capital formation over the 2013-2025 period of $900 million. Roughly half of this investment would be directed towards the dairy sector, and most of the rest would be required in the sheep and beef sector.

The definition of "investment" used here is derived from Statistics New Zealand's system of national accounts, which includes gross fixed capital formation – ie investment in plant, machinery, and physical upgrades – but excludes purchases of livestock, which is counted as intermediate consumption, and, in the case of forestry, tree-planting and silviculture/pruning activities. As noted in the section on the differences between economic and financial analysis, this is not therefore a guide to the return on investment that land owners could expect from these upgrades.

Table 32 presents the annual impact of this investment programme on value added, or contribution to GDP, and employment within each primary sector. To understand the on-going economic impacts, we have summarised the average annual impacts in the 2021-2025 period as most upgrades are expected to be complete by that point under the rapid development scenario.

This scenario is expected to result in average annual economic impacts of:

- In the three agricultural sectors, an increase of approximately $289 million in value added and an additional 2,234 FTEs during an average stabilised year (2021-2025)
- In the forestry sector, an increase of approximately $125 million in value added and an additional 350 FTEs during an average harvest year (2044-2052).

Dairy farming is expected to account for roughly 70% of the impact on value added, and 55% of the impact on employment. Dairy farming is expected to have a greater impact on value added than on employment due to the fact that it is both more capital intensive (and therefore requires fewer workers per unit of output) and more profitable (and therefore results in greater returns for farm-owners). Sheep and beef accounts for the majority of the remaining impacts – one-quarter of the impact on value added, and one-third of the impact on employment.

While forestry is expected to bring significant benefits in the longer term, activity in the next decade is confined to a small increase in forest establishment activity, which will result in a relatively small amount of additional activity and employment in the forestry and logging sector.

Table 31: Requirements for new land and investment under a rapid development scenario: Input of new land and investment after rapid development scenario

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Dairy farming													
Raise farm productivity (ha)	0	3,095	9,224	13,867	13,867	10,400	6,252	3,095	1,362	495	186	62	0
Dairy conversions (ha)	0	1,328	3,956	5,948	5,948	4,461	2,682	1,328	584	212	80	27	0
Investment required (real $m)	$0.0	$24.3	$72.3	$108.7	$108.7	$81.6	$49.0	$24.3	$10.7	$3.9	$1.5	$0.5	$0.0
Sheep, beef, and wool farming													
Raise farm productivity (ha)	0	19,810	59,032	88,747	88,747	66,560	40,015	19,810	8,716	3,170	1,189	396	0
Pastoral conversions (ha)	0	3,744	11,158	16,774	16,774	12,580	7,563	3,744	1,647	599	225	75	0
Pastoral converted to other use (ha)	0	-960	-2,861	-4,301	-4,301	-3,225	-1,939	-960	-422	-154	-58	-19	0
Investment required (real $m)	$0.0	$12.5	$37.3	$56.0	$56.0	$42.0	$25.3	$12.5	$5.5	$2.0	$0.8	$0.3	$0.0
Forestry													
Net new forest plantations (ha)	0	1,732	5,161	7,759	7,759	5,819	3,498	1,732	762	277	104	35	0
Investment required (real $m)	$0.0	$2.7	$8.4	$13.9	$16.0	$14.4	$10.8	$6.9	$3.8	$1.8	$0.8	$0.3	$0.1
Horticulture													
Raise farm productivity (ha)	0	223	664	999	999	749	450	223	98	36	13	4	0
Horticulture conversions (ha)	0	64	190	286	286	214	129	64	28	10	4	1	0
Investment required (real $m)	$0.0	$4.5	$13.4	$20.1	$20.1	$15.1	$9.1	$4.5	$2.0	$0.7	$0.3	$0.1	$0.0
Total													
Land with raised productivity (ha)	0	23,128	68,921	103,612	103,612	77,709	46,718	23,128	10,176	3,700	1,388	463	0
Land brought into production (ha)	0	5,844	17,414	26,180	26,180	19,635	11,804	5,844	2,571	935	351	117	0
Total investment required (real $m)	$0.0	$43.9	$131.4	$198.8	$200.9	$153.1	$94.2	$48.2	$22.0	$8.4	$3.3	$1.1	$0.1

Source: PwC calculations.

Table 32: Outcomes for value added and employment under a rapid development scenario: Additional value added and employment under a rapid development scenario

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Dairy farming														
Additional gross output (real $m)	$0.0	$0.0	$14.1	$65.1	$153.0	$241.4	$302.6	$350.6	$368.0	$387.1	$394.1	$398.9	$402.6	
Additional value added (real $m)	$0.0	$0.0	$6.9	$31.9	$75.1	$118.5	$148.6	$172.1	$180.7	$190.0	$193.5	$195.8	$197.6	
Additional employment (FTEs)	0	0	51	214	442	692	857	982	1,019	1,059	1,066	1,067	1,065	
Sheep, beef, and wool farming														
Additional gross output (real $m)	$0.0	$0.0	$6.3	$27.8	$67.2	$102.1	$129.0	$144.5	$153.4	$156.3	$157.6	$158.0	$158.0	
Additional value added (real $m)	$0.0	$0.0	$2.5	$11.2	$27.0	$41.1	$51.8	$57.9	$61.4	$62.7	$63.2	$63.5	$63.5	
Additional employment (FTEs)	0	0	31	126	268	406	511	569	601	609	611	609	607	
Forestry (including planting and pruning activities)														
Additional gross output (real $m)	$0.0	$2.7	$8.4	$13.9	$16.0	$14.4	$10.8	$6.9	$3.8	$1.8	$0.8	$2.0	$5.0	
Additional value added (real $m)	$0.0	$0.9	$2.8	$4.7	$5.4	$4.8	$3.6	$2.3	$1.3	$0.6	$0.3	$0.7	$1.7	
Additional employment (FTEs)	0	3	10	17	18	16	12	7	4	2	1	15	45	
Horticulture														
Additional gross output (real $m)	$0.0	$0.0	$4.0	$17.2	$37.5	$58.7	$75.7	$87.1	$94.1	$98.5	$101.6	$104.3	$106.8	
Additional value added (real $m)	$0.0	$0.0	$1.4	$5.9	$12.8	$20.0	$25.9	$29.8	$32.1	$33.6	$34.7	$35.6	$36.5	
Additional employment (FTEs)	0	0	41	153	315	466	566	611	617	602	576	547	515	
Total														
Additional gross output (real $m)	$0.0	$2.7	$32.8	$124.0	$273.7	$416.6	$518.2	$589.2	$619.3	$643.8	$654.1	$663.1	$672.4	
Additional value added (real $m)	$0.0	$0.9	$13.6	$53.6	$120.3	$184.5	$229.8	$262.1	$275.5	$287.0	$291.7	$295.5	$299.3	
Additional employment (FTEs)	0	3	133	510	1,044	1,580	1,946	2,169	2,240	2,272	2,254	2,238	2,231	

Source: PwC calculations.

Dairy industry

Figure 4 summarises the national level outputs from the economic model of the dairy industry. It compares economic outcomes for the Rapid Development and Slow Development scenarios with a baseline scenario in which no additional MFL is upgraded or converted. Full tables showing impacts in the dairy sector are presented in 'Appendix C – Full model outputs'.

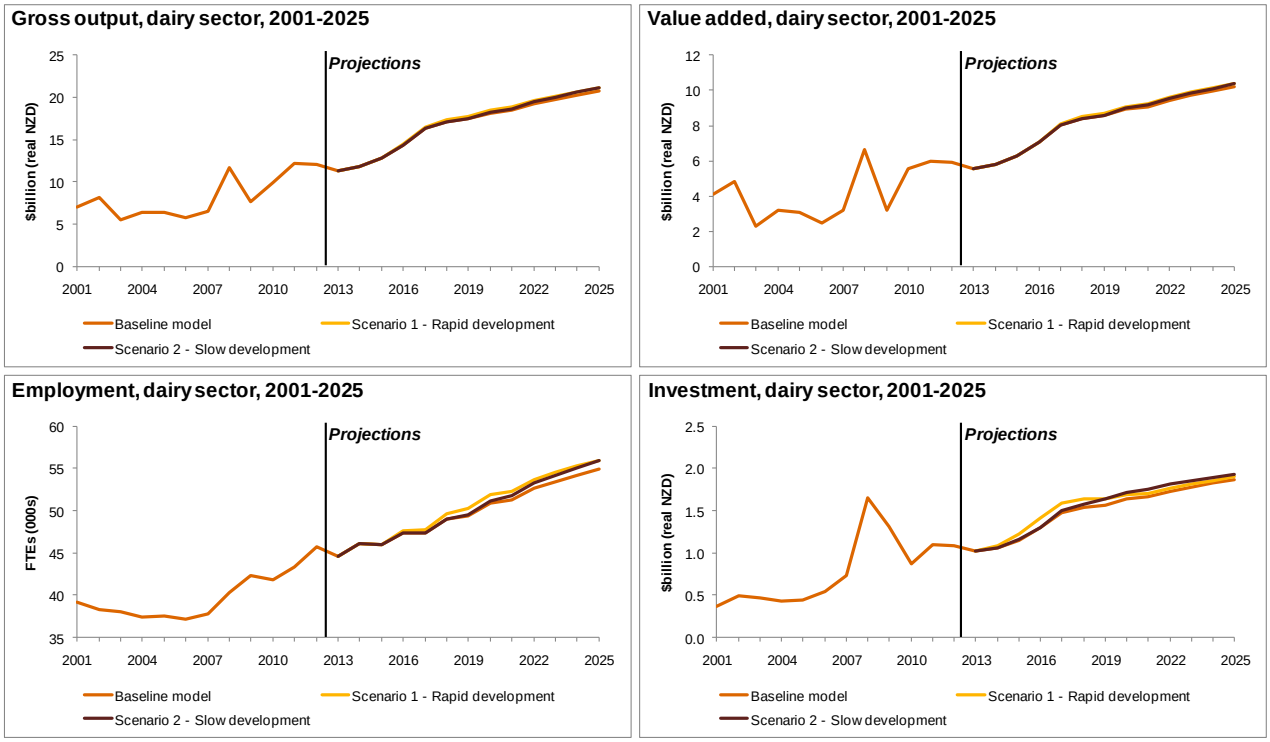
The model suggests that the following impacts can be expected:

- on-going annual impact of $158m to $191m in additional value added in the 2021-2025 period
- on-going annual increase in employment of 850 to 1,000 FTEs in the 2021-2025 period
- increase value added and FTEs by 1.7%-1.9% relative to baseline over the longer term
- approximately $0.5bn of additional investment required
- as Figure 4 shows, these impacts are large in an absolute sense but modest relative to the large size of the existing industry.

We note that these impacts, and requirements for investment and dairy workers, are taking place within the context of an industry that has grown robustly over the last decade and which is forecast to continue growing throughout the analysis period. However, this raises issues with capacity and resource constraints within the dairy sector and the broader environment. These constraints may apply in several areas:

- Availability of stock for new dairy herds may be limited, leading to some downgrades in the quality of the genetic stock used by new farms.
- Skilled dairy workers may be in increasingly short supply, creating the need for additional training and skill development.
- Environmental constraints such as nutrient loading in water bodies following intensification of or conversion to dairying will also be limiting factors in Bay of Plenty, Waikato, and Manawatu-Wanganui.
- Processing capacity may be limited – anecdotally, Fonterra has been having trouble processing all its milk during peak periods – but it is likely that firms will upgrade capacity in response to expected demand growth.

Figure 4: Impacts on dairy industry gross output, value added, employment, and investment



Sheep and beef industry

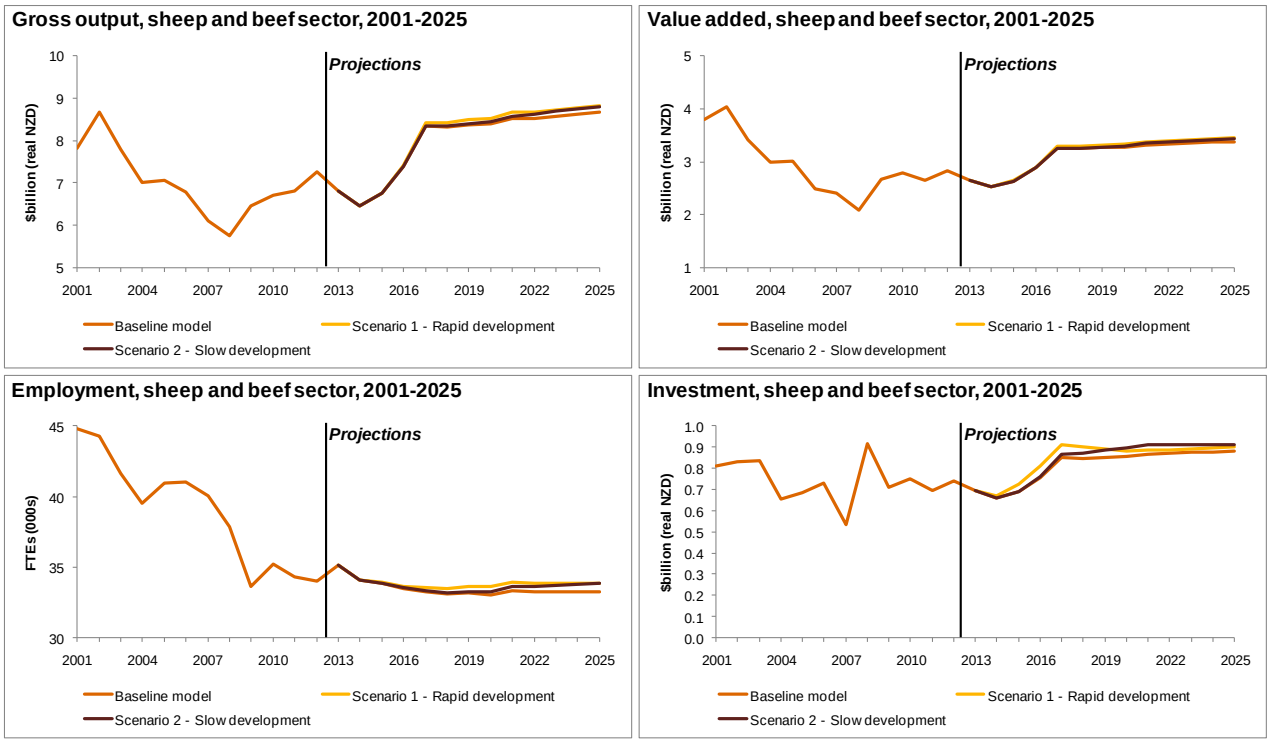
Figure 5 summarises the national level outputs from the economic model of the sheep and beef industry. It compares economic outcomes for the Rapid Development and Slow Development scenarios with a baseline scenario in which no additional MFL is upgraded or converted. Full tables showing impacts in this sector are presented in 'Appendix C – Full model outputs'.

The model suggests that the following impacts can be expected:

- on-going annual impact of $52m to $63m in additional value added in the 2021-2025 period
- on-going annual increase in employment of 500 to 600 FTEs in the 2021-2025 period
- increase value added and FTEs by 1.7%-1.9% relative to baseline over the longer term
- approximately $250 million of additional investment required
- as Figure 5 shows these impacts are large in an absolute sense but small compared with the overall size of the industry.

Unlike for the dairy industry, dry stock productivity upgrades and conversions would take place within the context of an industry that has contracted in recent decades and which is forecast to bounce back somewhat in upcoming years as a result of strong prices. Improvements to the management and governance of MFL could therefore have a more significant impact on this sector.

Figure 5: Impacts on sheep and beef industry gross output, value added, employment, and investment



Forestry industry

Figure 6 summarises the national level outputs from the economic model of the forestry and logging industry. It compares economic outcomes for the Rapid Development and Slow Development scenarios with a baseline scenario in which no additional MFL is upgraded or converted. Full tables showing impacts in this sector are presented in 'Appendix C – Full model outputs'.

The model suggests that the following impacts can be expected:

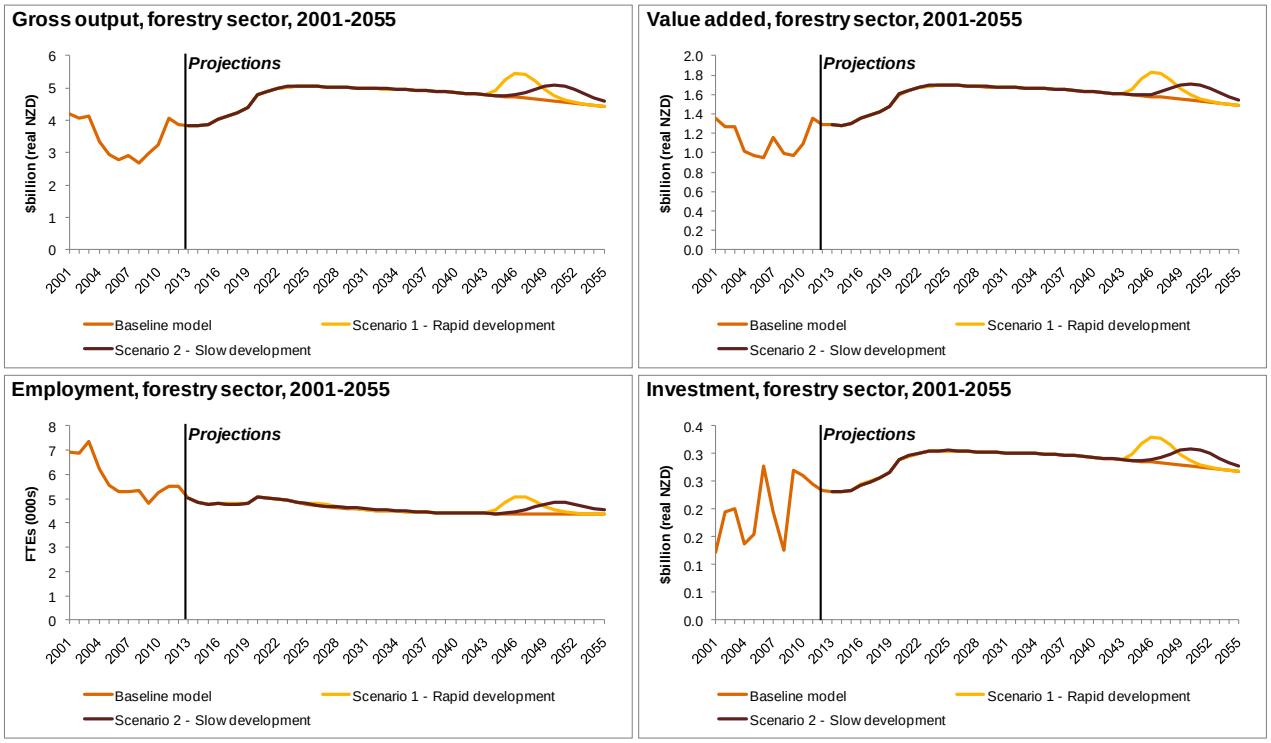
- annual impact of $105m to $125m in additional value added during the harvest period in 2044-2052
- on-going annual increase in employment of 300 to 350 FTEs during the harvest period in 2044-2052
- approximately $100-110 million required in planting and forest formation expenditure over the 2013-2035 period, associated with a peak requirement of 45-65 additional FTEs during the pruning period
- as Figure 6 shows, the introduction of significant new forest estates will result in few economic impacts in the short-term, but potentially large ones during the harvest period.

However, we note that there is significantly greater uncertainty about outcomes for forestry gross output and value added during the harvest period than for other sectors, as the price path for logs may deviate significantly during this period.

In addition, this model is based on historical data at a regional level which may not fully capture factors affecting forest yield, such as the fact that trees planted today have genetics that are considerably improved compared with those currently being harvested. As better formed trees result in greater timber yields, this may result in a moderate underestimate of future yields. Conversely, it is possible that a programme to upgrade MFL will see high-producing forestry land converted to grazing and replaced by hillier or less

productive country. This may mean that yields on newly planted forests are somewhat lower than yields from existing forests. As it has not been possible to robustly quantify the impact of these factors, we note them here.

Figure 6: Impacts on forestry industry gross output, value added, employment, and investment



Potential value of carbon sequestration on newly established forests

While forests are not harvested until 25-30 years after planting, newly planted forests may have some additional financial value to their owners due to the carbon sequestration services they provide. We have modelled outcomes under two carbon prices; however, note that there is considerable regulatory uncertainty in this area.

Forest owners' earnings from an ETS or a similar regulatory mechanism are **not** accounted for as a net increase in value added in the forestry sector. Under the SNA, purchases or sales of ETS units are considered to be a transfer rather than a net increase in production and they do not therefore result in an increase in the size of GDP. However, they will have a financial value to landowners.

Table33 summarises the expected annual impact of new forest plantings on carbon sequestration. This table incorporates the net effect of both new forest planting and conversion of existing forests to other uses – potentially resulting in negative impacts, as in the West Coast region, where more forests are expected to be removed than planted. The amount of carbon expected to be sequestered in each region has been estimated on the basis of regional estimates of the net amount of MFL expected to be converted to forestry and regional look-up tables for forestry in the ETS published by MAF[7].

The value of the carbon sequestration services provided by new forests has been estimated on the basis of two potential scenarios for carbon pricing:

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7 MAF (2011), "Look-up Tables for Forestry in the ETS", Schedule 6: Tables of Carbon Stock per Hectare for Post-1989 Forest Land. See data online at http://www.mpi.govt.nz/portals/0/documents/forestry/forestry-ets/2011-ETS-look-up-tables-guide.pdf.

- A "current policy scenario" reflecting the impact of recent changes to the ETS and the collapse of the European carbon market[8]. Under this scenario, the value of an ETS unit is estimated to remain at a low level of approximately $6/tonne. Under this scenario, the development of forestry potential on MFL would result in an additional $38 million in income for Māori landowners over the 2013-2025 period. This income would peak in the 2020s.
- An "alternative policy scenario" that envisages a return to the pre-2009 value of ETS units of approximately $25/tonne following policy changes to strengthen the ETS. Under this scenario, the development of forestry potential on MFL would result in an additional $136 million in income for Māori landowners over the 2013-2025 period.

This income is expected to ramp up gradually over the evaluation period to 2055. However, we note that forest owners would have to purchase ETS units to offset the carbon released from harvested forests in the 2040s and 2050s. Once again, these purchases would be considered to be financial transfers rather than a net increase (or decrease) in value added, and as a result we have not quantified them in our analysis of the economic value of the forestry sector.

8 Data published by the Ministry for the Environment suggests that the price of one NZ Emissions Unit fell from $19.10 in June 2011 to $0.29 in December 2012. It has remained under $1 since that date. We have assumed, however, that the price of carbon emissions will bounce back slightly from this low level. See data online at https://www.mfe.govt.nz/issues/climate/greenhouse-gas-emissions/net-position/history.html.

Table 33: Forecast value of carbon sequestered in newly planted forests

Forestry region	Carbon sequestered in selected year (tonnes)													
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022				
Northland	0.0	0.0	0.0	0.3	1.2	4.0	10.2	20.2	31.8	40.6	43.6	41.4	38.4	231.7
Auckland	0.0	0.0	0.0	0.0	0.0	0.3	0.7	1.3	1.7	2.7	2.6	2.5	2.6	14.4
Central North Island	0.0	0.0	0.2	1.6	6.0	19.9	52.7	105.2	166.9	217.5	238.1	228.9	208.8	1,245.8
East Coast	0.0	0.0	0.3	2.6	9.2	30.9	80.8	158.3	243.9	309.0	327.8	302.1	259.6	1,724.5
Hawkes Bay	0.0	0.0	0.2	1.3	5.0	18.0	48.4	95.9	149.7	193.5	209.8	195.7	167.4	1,084.9
Southern North Island	0.0	0.0	0.2	1.2	4.7	17.0	45.5	90.2	140.9	182.0	197.4	184.4	157.3	1,020.8
Nelson	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marlborough	0.0	0.0	0.0	0.0	0.2	0.4	1.4	2.9	4.9	7.1	8.9	9.8	9.6	45.2
Canterbury	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.1	0.4	0.5	1.5
West Coast	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-0.4	-0.6	-1.3	-1.9	-2.2	-2.5	-9.2
Otago	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-0.2	-0.5	-0.6	-0.9	-1.1	-1.2	-4.8
Southland	0.0	0.0	0.0	0.0	0.2	0.6	1.9	4.6	8.0	11.6	14.9	15.9	15.2	72.9
TOTAL	**0.0**	**0.0**	**0.9**	**7.0**	**26.5**	**91.1**	**241.0**	**478.0**	**747.0**	**962.3**	**1,040.4**	**977.8**	**855.7**	**5,427.7**
Value of carbon sequestered														
Carbon price $6/tonne	$0.0m	$0.0m	$0.0m	$0.0m	$0.2m	$0.5m	$1.4m	$2.9m	$4.5m	$5.8m	$6.2m	$5.9m	$5.1m	$32.6m
Carbon price $25/tonne	$0.0m	$0.0m	$0.0m	$0.2m	$0.7m	$2.3m	$6.0m	$12.0m	$18.7m	$24.1m	$26.0m	$24.4m	$21.4m	$135.7m

Source: PwC calculations.

Horticulture industries

Figure 7 summarises the national level outputs from the economic model of the horticulture industry. It compares economic outcomes for the Rapid Development and Slow Development scenarios with a baseline scenario in which no additional MFL is upgraded or converted. Full tables showing impacts in this sector are contained within the Appendix.

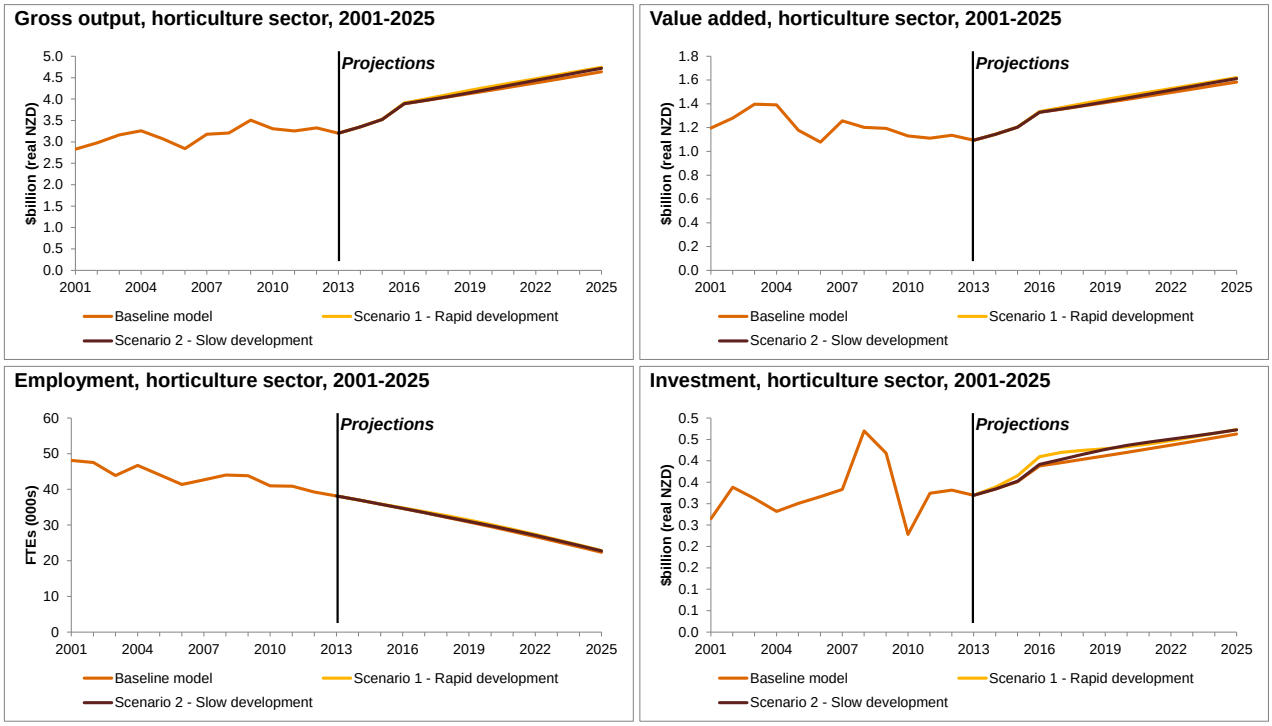
We note that the modelled gains in the horticulture sector reflect the impact of raising productivity on some existing horticultural land and converting small amounts of additional land.

The model suggests that the following impacts can be expected:

- On-going annual impact of $23m to $35m in additional value added in the sector in 2021-2025 period.
- On-going annual increase in employment of 370 to 570 FTEs in the 2021-2025 period.
- Increase value added and FTEs by 1.8%-2.3% relative to baseline over the longer term.
- Additional $30m to $50m required in investment over the period.
- As Figure 7 shows, these impacts are significant in an absolute sense but modest relative to the size of the existing industry.

While we have not built a full regionalised model of the horticulture sector due to a lack of information on regional differences between farm productivity, we have captured some regional differences through the allocation of land in different regions to different crops types. For example, we have assumed that Bay of Plenty land is mostly used for kiwifruit and that land in Nelson and Tasman is mainly used for apples or pip fruit. These assumptions are derived from information reported in Statistics New Zealand's Agricultural Production Censuses of 2007 and 2012.

Figure 7: Impacts on horticulture industry gross output, value added, employment, and investment



Regionalising the Model

We have developed a regional-level model of three main agricultural sectors (dairy; sheep and beef; and forestry) to support a more in-depth analysis of the potential impacts of raising the productivity of Māori freehold land. Our main findings include:

- **the impacts of upgrades to MFL are concentrated in six regions – Northland, Waikato, Bay of Plenty, Gisborne, Hawke's Bay, and Manawatu-Wanganui – that account for 92% of total MFL**
- **these regions are relatively deprived on the main socioeconomic measures such as unemployment and low average income, which are disproportionately likely to affect Māori communities**
- **raising productivity of MFL is likely to result in incremental increases in employment and value added in these regions**
- **these impacts are greatest in certain regions and industries, such as Northland and East Coast pastoral farming, where the MFL potential is large compared with existing underdeveloped industries.**

Overview of regional analysis

Breaking the model down into regional areas has enabled a more detailed, localised analysis of the economic development impacts of raising productivity on under-performing and under-utilised Māori freehold land into the productive sector. While the potential contribution of MFL may be small in comparison to the national agriculture sector, the contribution may be more significant at a local level. This is likely to be particularly true in regions of New Zealand with fewer economic and employment opportunities.

Strengths

The regional models have two main strengths:

- First, they are **consistent with the national level models**, in terms of model structure and output format, and draw upon data from those models where appropriate.
- Second, they are based on **known differences** in agricultural productivity between regions. For example, data from MPI's farm monitoring reports, regional forestry stock tables, and from industry sources enables us to quantify the differences in productivity between regions, while regional employment data from PwC's Regional Industry Database enables us to understand differences in labour inputs between regions.

Furthermore, the model structure has enough flexibility built in to accommodate further information on regional variations should additional data become available to make such issues meaningful.

Limitations

There may be some additional variations between regions that we could not capture with the available data. These **'unobserved variations'** potentially fall into two different categories.

First, we used national industry models based on Statistics New Zealand's National Accounts data to model the relationship between changes to farm gate revenue (gross output) and changes in value added and employment. We applied these national industry models to individual regions under the assumption that farms' production processes and required inputs were generally similar between regions. This is a generally reasonable assumption as there are national markets in most inputs and outputs from farms.

However, it is possible that there may be some modest variations between regions. For example, farms in one region may face higher costs for some inputs, resulting in higher intermediate consumption and lower operating surpluses. Alternatively, differences in labour availability and costs between regions may lead some farms to choose a different mix of capital and labour inputs than others.

Second, there may be some factors that may affect the production and revenues of some farms during the study period. The data on differences in volume of outputs produced per stock unit or per hectare that we have used may not capture the effect of some factors, such as:

- Natural events such as severe weather events distorting production, in specific areas are not factored in the model.
- Future variations in climate in different regions – some regions may become drier while others may receive more rainfall as a result of climate change. These factors affect important variables in agricultural production such as pasture growth and stocking rates that can be supported by the land.
- Differential pricing between regions – different sheep and beef schedules across regions can create small differences in prices between regions, particularly where transport costs between competing works are likely to be a factor.

These issues emphasise the impact local environmental conditions play in determining overall levels of agricultural output that can be achieved. To a certain extent, their impacts have been picked up in the regional model through the inclusion of regional data on production volumes per hectare or per stock unit. However, factors such as changes to local environmental conditions are not possible to robustly identify and quantify on the basis of the existing data.

Focus on six main regions

Here, we provide a more in-depth view of specific regions and sectors.

While results for all regions are presented in 'Appendix C – Full model outputs', the analysis will focus on the areas where results are most material.

We have identified six regions as being of interest:

- Northland - 123,000 hectares of total MFL, 93,000 hectares of which has been identified as having some potential for productivity improvements.
- Waikato – 223,000 hectares of total MFL, 158,000 hectares of which has been identified as having some potential for productivity improvements.
- Bay of Plenty – 225,000 hectares of total MFL, 116,000 hectares of which has been identified as having some potential for productivity improvements.
- Gisborne – 190,000 hectares of total MFL, 106,000 hectares of which has been identified as having some potential for productivity improvements.

- Hawke's Bay – 164,000 hectares of total MFL, 81,000 hectares of which has been identified as having some potential for productivity improvements.
- Manawatu – 187,000 hectares of total MFL, 116,000 hectares of which has been identified as having some potential for productivity improvements.

Note again that these figures will be greater than the figures for net conversions reported in the tables in this section, as they include some cases where some land blocks could be converted into a particular use while other blocks are converted out of that use.

As shown in Table , these regions contain 92% of the total Māori freehold land resource registered by the Māori Land Court. They also account for a proportionate share of total MFL that has been identified as having some potential for productivity improvements.

An opportunity to lift performance in deprived regions

In addition to having significant under-utilised Māori freehold land resources, a number of these regions face challenging economic issues. People in these regions are:

- more likely to be unemployed than the national average (except in the Waikato region)
- likely to have lower incomes than those in other regions
- more likely to receive assistance from social welfare.

These problems are especially acute for Māori communities in these regions, especially in rural areas that have undergone retrenchment in key industries in recent decades.

A programme of raising the productivity of Māori freehold land could have long-term positive effects on these regions. While our economic modelling focuses on the outcomes related to farming activities alone, we note that there are likely to be additional economic linkages into local communities, as farms purchase inputs from local suppliers, pay wages to local employees, and return profits to local owners.

Upgrading the governance and management of farms on MFL could help to bring down economic and social deprivation in some of New Zealand's poorest regions. An intervention in this sector could assist in reducing high unemployment in a number of these regions, raising incomes, and reducing expenditures on social welfare.

Figure 8 displays regional unemployment rates in the six regions studied in-depth in this section. With the exception of Waikato, all regions have unemployment rates above the national average. The regions that are most affected by high unemployment are Northland, with an unemployment rate of 9.6%, and the Gisborne/Hawke's Bay regions, which together have an unemployment rate of 8.5%.

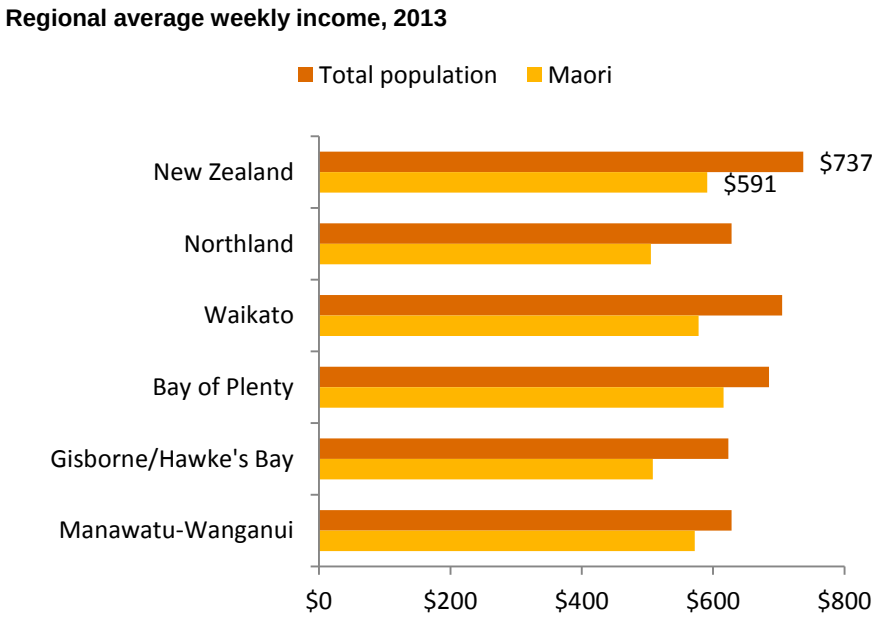
Figure 8: Regional unemployment rates

Source: Stats NZ Household Labour Force Survey

Figure 9 compares average weekly incomes for Māori and total population in the six regions examined in this section. Average incomes for the total population are lower than the national average in all regions, with Waikato and Bay of Plenty most closely approaching the national average.

Incomes are lowest among Māori in Northland (average weekly income of $505) and Gisborne/Hawke's Bay ($508). The gap between Māori and total incomes was smallest in the Bay of Plenty and Manawatu-Wanganui. However, there were no regions where Māori incomes were comparable to average incomes for the overall population.

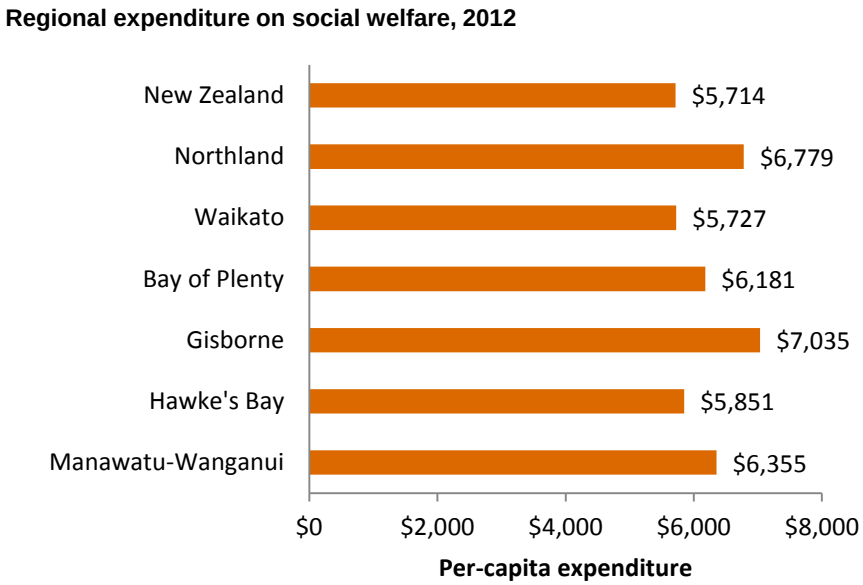
Figure 9: Average weekly income, by region, for Māori and total population



Source: Stats NZ Income Tables.

Figure 10 suggests that low incomes and high unemployment rates in these regions are matched by disproportionately high government spending on social welfare. Northland and Gisborne, two regions with the highest unemployment rates and lowest per-capita incomes, had the highest per-capita spending. Other regions – in particular, Waikato and Hawke's Bay had expenditure patterns closer to the national average.

Figure 10: Regional per-capita expenditure on social welfare



Source: NZIER (2013), Regional Expenditure Report.

Northland region

Northland is recognised as a region that contains areas with high unemployment, low incomes and reasonably high levels of deprivation, with educational attainment below national averages. A relatively small industry base also limits opportunities. In this context, bringing more Māori land into the productive sector could provide a catalyst to creating further economic and social development opportunities.

Based upon the data about the size of the Māori freehold land resource in the region, combined with our assumptions at the national level around the potential for change in each land class, we estimate that there is the potential for upgrading productivity in approximately 57,000 hectares and conversion to more productive usage of approximately 13,000 hectares. The potential changes are summarised in Table 34 and 35. The largest changes will occur in sheep and beef.

Table 34summarises the total investment and stabilised year outcomes from the land productivity and conversion programs. These results suggest that this intervention will be associated with the following annual additional annual impacts on employment and value added, after accounting for conversions away from some existing uses:

- For stabilised years in agriculture (dairy, sheep and beef, and horticulture), a net increase in GDP of approximately $32 million and net additional employment of approximately 190 FTEs
- For harvest years in forestry, a net increase in GDP of approximately $6 million and net additional employment of approximately 10 FTEs.

Table 34: Economic impacts of productivity increases on Northland MFL

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	8,144	3,970	$63.9	$53.5	$26.3	175
Sheep and beef	48,866	7,859	$42.9	$14.9	$5.8	17
Agriculture subtotal	**57,010**	**11,828**	**$106.8**	**$68.4**	**$32.1**	**192**

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 35: Northland region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	1,599	$0.2	$17.9	$6.0	8

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 36 summarises the total undiscounted and discounted increases in value added over the study period under a rapid development scenario. The unadjusted accumulated increase provides an indication of the potential total value of the programme to the Northland region; however, it does not adjust for the fact that some impacts – e.g. those in the forestry sector – will occur much later.

Table 36: Cumulative increase in value added over study period from Māori land upgrades (in real terms, undiscounted and discounted)

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$205	$109.3
Sheep and beef	2013-2025	$47	$25.2
Agriculture subtotal	*2013-2025*	*$252*	*$135*
Forestry	2013-2055	$56	$5.0

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

** Discounted to present value using Treasury's discount rate of 8%.

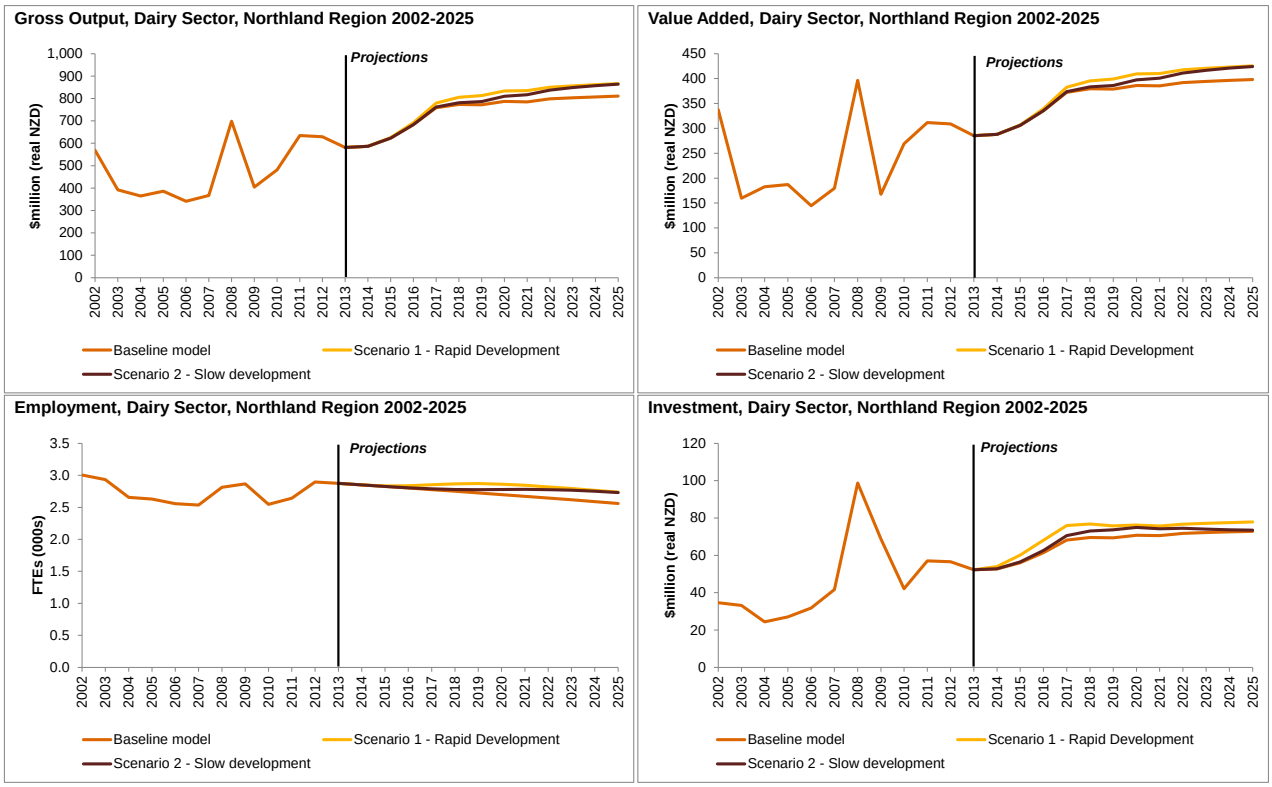
Table 36 demonstrates that our economic modelling suggests that an intervention that succeeded in raising the productivity of MFL in Northland would result in an accumulated total increase of approximately $252 million in value added in agriculture and $56 million in forestry in the region. This total impact would be spread throughout the study period (2013-2025 for dairy and dry stock farming, 2013-2055 for forestry).

In present value terms, the value of the long-term increase in production is worth approximately $135 million in agriculture and $5 million in forestry, depending upon the speed of development. (The low

present value of economic outcomes in forestry is a result of the fact that forests will not be harvested and sold for several decades.)

The largest contribution to this increase is expected to come from the dairy industry. Figure 11 displays the impacts in this sector. It shows that the development of MFL is likely to have a significant long-term impact on the Northland dairy industry – raising employment and value added by 6.5% to 7.2% over the longer term.

Figure 11: Increase in Northland dairy gross output, value added, employment, and investment



Waikato region

Based upon the data about the size of the Māori freehold land resource in the Waikato region, combined with our assumptions at the national level around the potential for change in each land class, we estimate that there is the potential for upgrading productivity in approximately 99,000 hectares and conversion to more productive use of approximately 23,000 hectares. The potential changes are summarised in

Table 37 and 38. The largest changes will occur in sheep and beef.

Tables 37 and 38 summarise the stabilised year impact of the programme on gross output (total farm revenue), value added (contribution to Waikato's regional GDP) and employment. These results suggest that this intervention will be associated with the following annual additional annual impacts on employment and value added, after accounting for conversions away from some existing uses:

- For stabilised years in agriculture (dairy, sheep and beef, and horticulture), a net increase in GDP of approximately $75 million and net additional employment of approximately 500 FTEs.
- For harvest years in forestry, a net increase in GDP of approximately $6 million and net additional employment of approximately 30 FTEs.

Table 37: Economic impacts of productivity increases on Waikato MFL

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	15,373	7,920	$144.0	$131.7	$64.7	382
Sheep and beef	83,686	13,812	$73.8	$25.8	$10.1	116
Agriculture subtotal	**99,059**	**21,732**	**$217.8**	**$157.5**	**$74.7**	**498**

Notes: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 38: Waikato Region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	1,339	$0.2	$16.4	$5.5	33

Notes: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 39 summarises the total undiscounted and discounted increases in value added over the study period under a rapid development scenario. The unadjusted accumulated increase provides an indication of the potential total value of the programme to the Waikato region; however, it does not adjust for the fact that some impacts – eg those in the forestry sector – will occur much later.

Table 39: Cumulative increase in value added over study period from Māori land upgrades (in real terms, undiscounted and discounted)

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$515	$275.7
Sheep and beef	2013-2025	$81	$43.6
Agriculture subtotal	*2013-2025*	*$596*	*$319*
Forestry	2013-2055	$51	$4.5

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

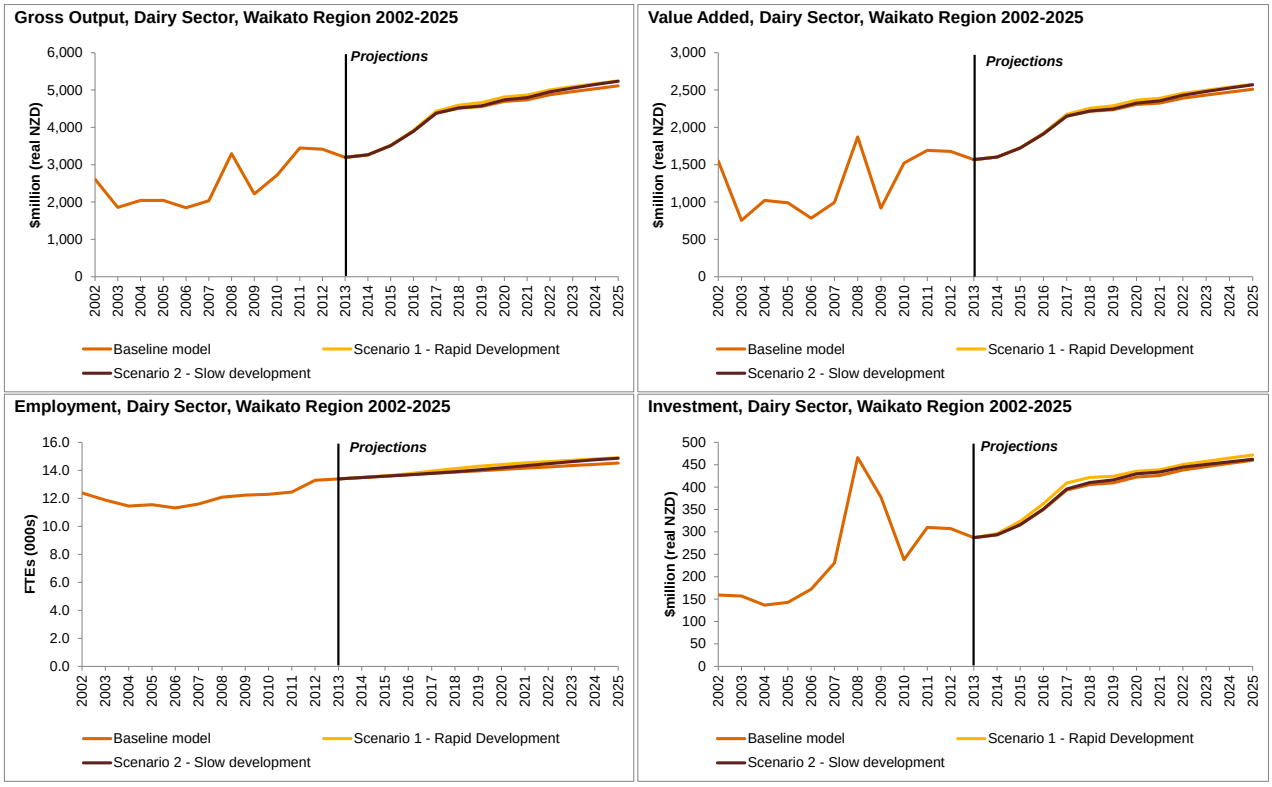
** Discounted to present value using Treasury's discount rate of 8%.

Table 39 demonstrates that our economic modelling suggests that an intervention that succeeded in raising the productivity of MFL in Waikato would result in an accumulated total increase of approximately $596 million in value added in agriculture and $51 million in forestry in the region. This total impact would be spread throughout the study period (2013-2025 for dairy and dry stock farming, 2013-2055 for forestry).

In present value terms, the value of the long-term increase in production is worth approximately $319 million in agriculture and $5 million in forestry, depending upon the speed of development. (The low present value of economic outcomes in forestry is a result of the fact that forests will not be harvested and sold for several decades.)

The largest contribution to this increase is expected to come from the dairy industry. Figure 12 displays the impacts in this sector. It shows that the development of MFL is likely to have a significant long-term impact on the Waikato dairy industry – raising employment and value added by 2.4% to 2.7% over the longer term.

Figure 12: Increase in Waikato dairy gross output, value added, employment, and investment



Bay of Plenty region

Based upon the data about the size of the Māori freehold land resource in the Bay of Plenty region, combined with our assumptions at the national level around the potential for change in each land class, we estimate that there is the potential for upgrading productivity in approximately 72,000 hectares and conversion to more productive use of approximately 20,000 hectares. The potential changes are summarised in Tables 40 and 41. The largest changes will occur in sheep and beef, with some significant changes in forestry as well.

Tables 40 and 41 summarise the stabilised year impact of the programme on gross output (total farm revenue), value added (contribution to Bay of Plenty's regional GDP) and employment. These results suggest that this intervention will be associated with the following annual additional annual impacts on employment and value added, after accounting for conversions away from some existing uses:

- For stabilised years in agriculture (dairy, sheep and beef, and horticulture), a net increase in GDP of approximately $44 million and net additional employment of approximately 250 FTEs.
- For harvest years in forestry, a net increase in GDP of approximately $34 million and net additional employment of approximately 50-60 FTEs.

Table 40: Economic impacts of productivity increases on Bay of Plenty MFL

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	9,386	4,038	$84.1	$74.8	$36.7	186
Sheep and beef	63,322	7,819	$55.0	$17.8	$6.9	63
Agriculture subtotal	**72,708**	**11,858**	**$139.1**	**$92.6**	**$43.7**	**249**

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 41: Bay of Plenty Region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	8,190	$1.2	$100.2	$33.6	55

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Tables 40 and 41 summarise the total undiscounted and discounted increases in value added over the study period under a rapid development scenarios. The unadjusted accumulated increase provides an indication of the potential total value of the programme to the Bay of Plenty region; however, it does not adjust for the fact that some impacts – e.g. those in the forestry sector – will occur much later.

Table 42: Cumulative increase in value added over study period from Māori land upgrades (in real terms, undiscounted and discounted)

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$294	$157.3
Sheep and beef	2013-2025	$56	$30.0
Agriculture subtotal	*2013-2025*	*$349*	*$187*
Forestry	2013-2055	$312	$27.7

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

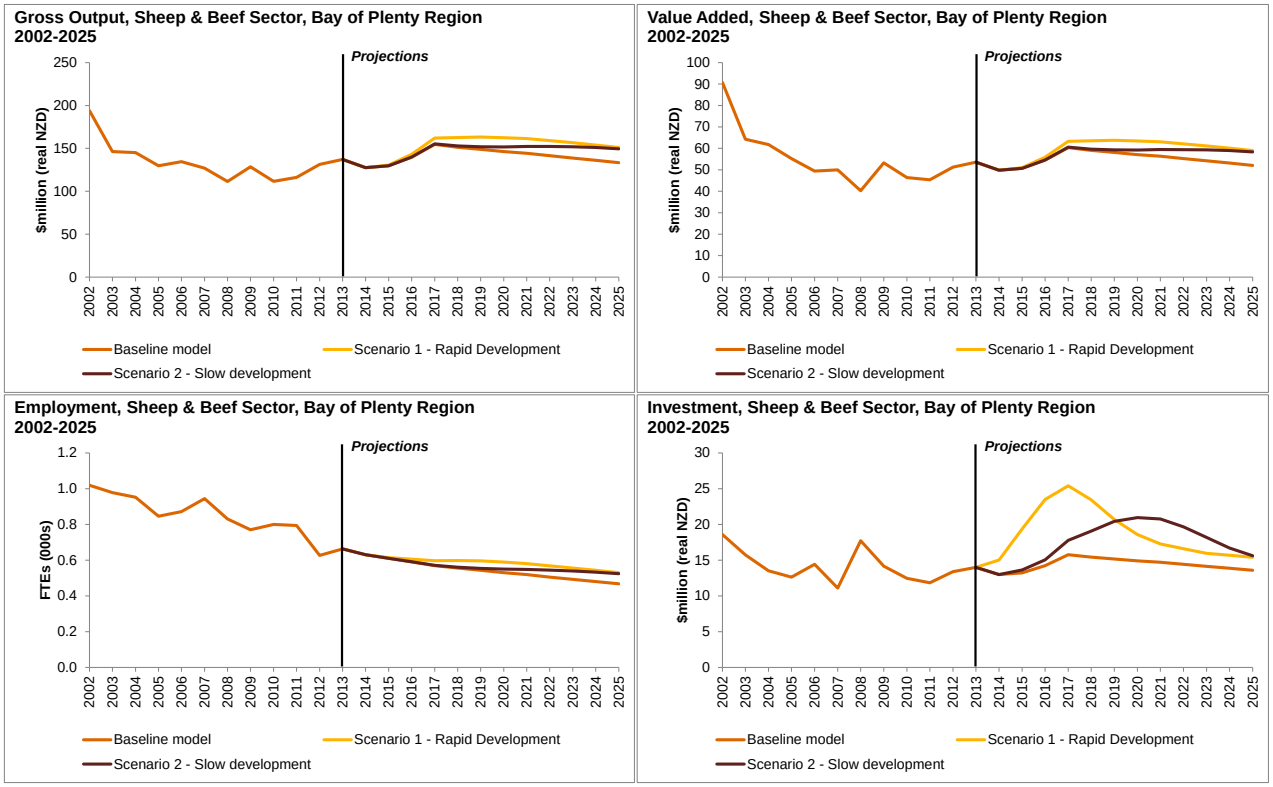
** Discounted to present value using Treasury's discount rate of 8%.

Table 42 demonstrates that our economic modelling suggests that an intervention that succeeded in raising the productivity of MFL in Bay of Plenty would result in an accumulated total increase of approximately $349 million in value added in agriculture and $312 million in forestry in the region. This total impact would be spread throughout the study period (2013-2025 for dairy and dry stock farming, 2013-2055 for forestry).

In present value terms, the value of the long-term increase in production is worth approximately $187 million in agriculture and $28 million in forestry, depending upon the speed of development. (The low present value of economic outcomes in forestry is a result of the fact that forests will not be harvested and sold for several decades.)

The largest relative impact on any sector in the region is expected to occur in the sheep and beef industry. Figure 13 displays the impacts in this sector. It shows that the development of MFL is likely to have a significant long-term impact on Bay of Plenty dry stock farming – raising employment and value added by 17% to 18% over the longer term. While this increase is occurring from a relatively low base, it would require a significant commitment of investment and resources in the near term.

Figure 13: Increase in Bay of Plenty sheep and beef gross output, value added, employment, and investment



Gisborne region

Gisborne is recognised as a region that contains areas with high unemployment, low incomes and reasonably high levels of deprivation, with educational attainment below national averages. A relatively small industry base also limits opportunities. In this context, bringing more Māori land into the productive sector could provide a catalyst to creating further economic and social development opportunities.

Based upon the data about the size of the Māori freehold land resource in Gisborne region, combined with our assumptions at the national level around the potential for change in each land class, we estimate that there is the potential for upgrading productivity in approximately 66,000 hectares and conversion to more productive land usage of 18,000 hectares. The potential changes are summarised in Table43 and 44. The largest changes will occur in sheep and beef and forestry, albeit in very different time periods.

Table 43 and 44 summarise the stabilised impact of the programme on gross output (total farm revenue), value added (contribution to Gisborne's regional GDP) and employment. These results suggest that this intervention will be associated with the following annual additional annual impacts on employment and value added, after accounting for conversions away from some existing uses:

- For stabilised years in agriculture (dairy, sheep and beef, and horticulture), a net increase in GDP of approximately $22 million and net additional employment of approximately 350 FTEs
- For harvest years in forestry, a net increase in GDP of approximately $32 million and net additional employment of approximately 130 FTEs.

Table 43: Economic impacts of productivity increases on Gisborne MFL

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	6,921	2,019	$46.6	$33.0	$16.2	216
Sheep and beef	58,846	6,697	$50.0	$15.7	$6.1	138
Agriculture subtotal	**65,768**	**8,716**	**$96.6**	**$48.6**	**$22.3**	**354**

Note:

* Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 44: Gisborne region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	9,838	$1.5	$94.9	$31.8	135

Note:

* Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 44 summarises the total undiscounted and discounted increase in value added over the study period under a rapid development scenario. The unadjusted accumulated increase provides an indication of the

potential total value of the programme to the Gisborne region; however, it does not adjust for the fact that some impacts – eg those in the forestry sector – will occur much later.

Table45: Cumulative increase in value added over study period from Māori land upgrades (in real terms, undiscounted and discounted)

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$132	$71.3
Sheep and beef	2013-2025	$49	$26.2
Agriculture subtotal	*2013-2025*	*$181*	*$98*
Forestry	2013-2055	$298	$27.6

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

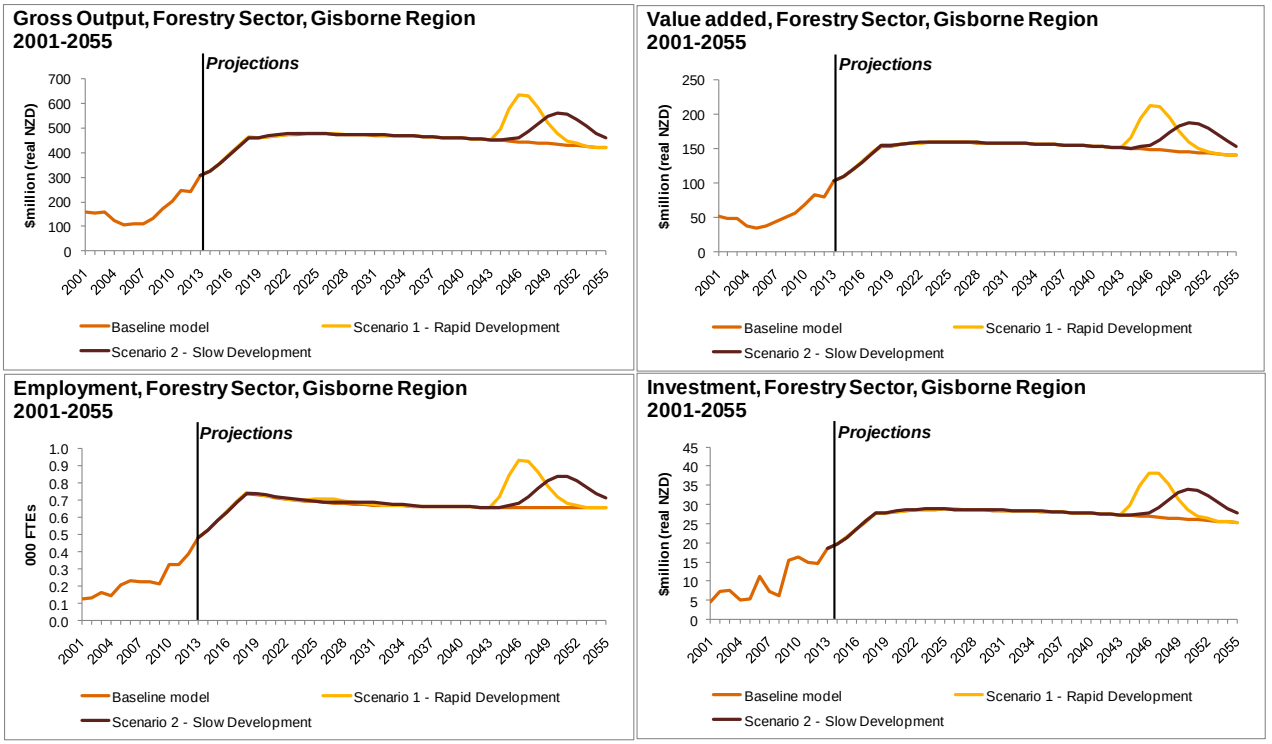
** Discounted to present value using Treasury's discount rate of 8%.

Table 45 demonstrates that our economic modelling suggests that an intervention that succeeded in raising the productivity of MFL in Gisborne would result in an accumulated total increase of approximately $181 million in value added in agriculture and $298 million in forestry in the region. This total impact would be spread throughout the study period (2013-2025 for dairy and dry stock farming, 2013-2055 for forestry).

In present value terms, the value of the long-term increase in production is worth approximately $98 million in agriculture and $28 million in forestry, depending upon the speed of development. (The low present value of economic outcomes in forestry is a result of the fact that forests will not be harvested and sold for several decades.)

The largest contribution to this long-term increase is expected to come from the forestry industry. Figure 14 displays the impacts in this sector. It shows that the development of MFL is likely to have a significant long-term impact on the Gisborne forestry industry – raising employment and value added by 15% to 16% during the harvest window in 2041-2055.

Figure 14: Increase in Gisborne forestry and logging gross output, value added, employment, and investment



Hawke's Bay region

Based upon the data about the size of the Māori freehold land resource in the Hawke's Bay region, combined with our assumptions at the national level around the potential for change in each land class, we estimate that there is the potential for upgrading productivity in approximately 50,000 hectares and conversion into more productive usage of approximately 14,000 hectares. The potential changes are summarised in Tables 46 and 47. The largest changes, in percentage terms, are expected to occur in sheep and beef.

Tables 46 and 47 summarise stabilised year impact of the programme on gross output (total farm revenue), value added (contribution to Hawke's Bay's regional GDP) and employment. These results suggest that this intervention will be associated with the following annual additional annual impacts on employment and value added, after accounting for conversions away from some existing uses:

- For stabilised years in agriculture (dairy, sheep and beef, and horticulture), a net increase in GDP of approximately $25 million and net additional employment of approximately 150 FTEs.
- For harvest years in forestry, a net increase in GDP of approximately $26 million and net additional employment of approximately 40 FTEs.

Table 46: Economic impacts of productivity increases on Hawke's Bay MFL

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	5,925	1,918	$49.6	$41.9	$20.6	83
Sheep and beef	44,990	5,494	$38.4	$12.2	$4.8	66
Agriculture subtotal	**50,915**	**7,413**	**$88.0**	**$54.2**	**$25.4**	**149**

Note:

* Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 47: Hawke's Bay region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Harvest year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	6,413	$1.0	$78.4	$26.3	39

Note:

* Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 48 summarises the total undiscounted and discounted increases in value added over the study period under a rapid development scenarios. The unadjusted accumulated increase provides an indication of the potential total value of the programme to the Hawke's Bay region; however, it does not adjust for the fact that some impacts – e.g. those in the forestry sector – will occur much later.

Table 48: Cumulative increase in value added over study period from Māori land upgrades (in real terms, undiscounted and discounted)

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$166	$89.4
Sheep and beef	2013-2025	$38	$20.5
Agriculture subtotal	*2013-2025*	*$204*	*$110*
Forestry	2013-2055	$244	$21.7

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

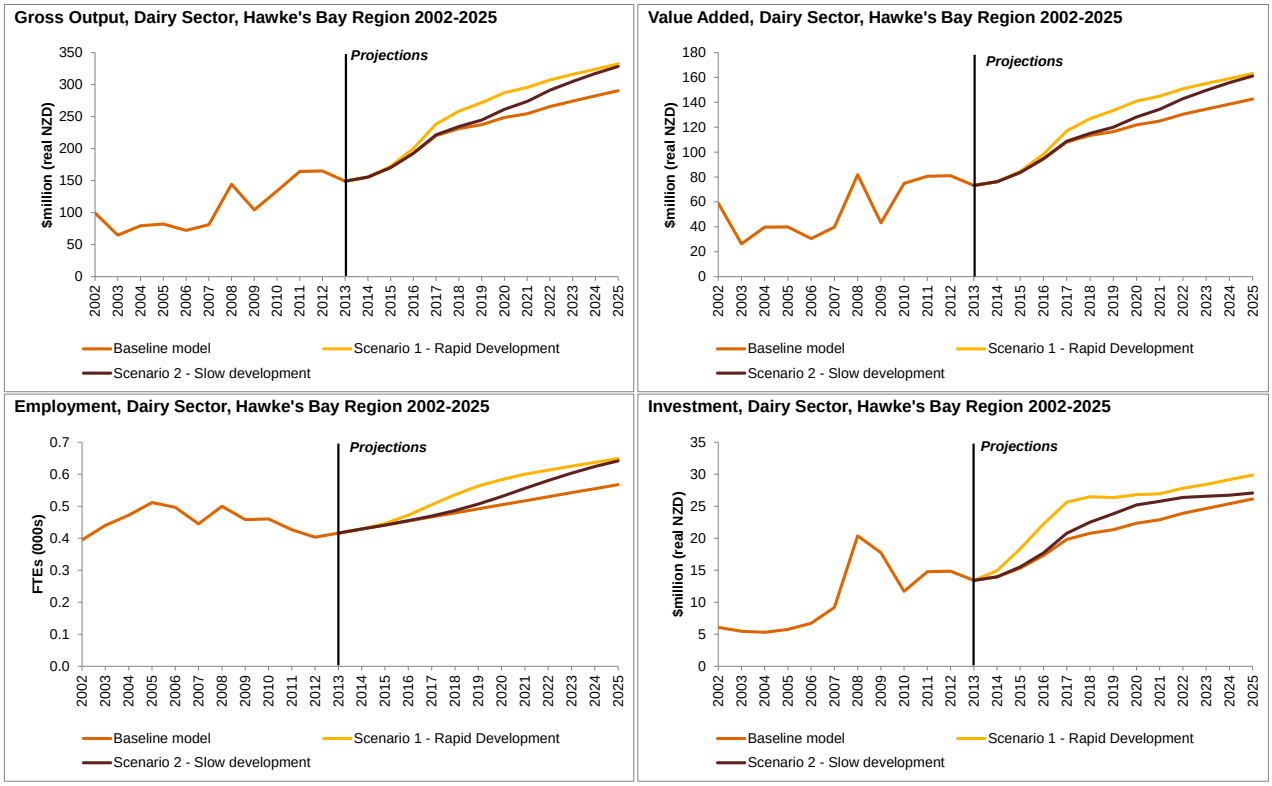
** Discounted to present value using Treasury's discount rate of 8%.

Table demonstrates that our economic modelling suggests that an intervention that succeeded in raising the productivity of MFL in Hawke's Bay would result in an accumulated total increase of approximately $204 million in value added in agriculture and $244 million in forestry in the region. This total impact would be spread throughout the study period (2013-2025 for dairy and dry stock farming, 2013-2055 for forestry).

In present value terms, the value of the long-term increase in production is worth approximately $110 million in agriculture and $22 million in forestry, depending upon the speed of development. (The low present value of economic outcomes in forestry is a result of the fact that forests will not be harvested and sold for several decades.)

The largest contribution to this increase is expected to come from the dairy industry. Figure 15 displays the impacts in this sector. It shows that the development of MFL is likely to have a significant long-term impact on the Hawke's Bay dairy industry – raising employment and value added by 13% to 15% over the longer term.

Figure 15: Increase in Hawke's Bay dairy gross output, value added, employment, and investment



Manawatu-Wanganui region

Based upon the data about the size of the Māori freehold land resource in the Manawatu-Wanganui region, combined with our assumptions at the national level around the potential for change in each land class, we estimate that there is the potential for upgrading productivity in approximately 73,000 hectares and conversion to more productive land usage of 18,000 hectares. The potential changes are summarised in Table . The largest changes will occur in sheep and beef, with some significant changes in dairy as well.

Table summarises stabilised year impact of the programme on gross output (total farm revenue), value added (contribution to Manawatu-Wanganui's regional GDP) and employment under a rapid development scenario. These results suggest that this intervention will be associated with the following annual additional annual impacts on employment and value added, after accounting for conversions away from some existing uses:

- For stabilised years in agriculture (dairy, sheep and beef, and horticulture), a net increase in GDP of approximately $42 million and net additional employment of approximately 270 FTEs.
- For harvest years in forestry, a net increase in GDP of approximately $16 million and net additional employment of approximately 10-20 FTEs.

Table 49: Economic impacts of productivity increases on Manawatu-Wanganui MFL

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Dairy	9,953	4,225	$84.5	$72.8	$35.7	233
Sheep and beef	63,005	8,897	$53.5	$16.8	$6.6	39
Agriculture subtotal	**72,958**	**13,122**	**$138.0**	**$89.6**	**$42.3**	**272**

Note: Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 50: Manawatu-Wanganui region: Summary of potential for change on MFL under a rapid development scenario

Sector	Land area (ha)		Total investment required (real $m, 2013-2025)	Stabilised year* economic outcomes		
	Raised farm productivity	Net conversions		Gross output (real $m)	Value added (real $m)	Employment (FTEs)
Forestry	0	5,440	$0.8	$48.0	$16.1	12

Notes:

* Dairy, sheep and beef, and horticulture stabilised year is based on 2021-2025 average; forestry is based on outcomes forecast for the projected harvest window in 2044-2052.

Table 51 summarises the total undiscounted increase in value added over the study period under rapid and slow development scenarios. The unadjusted accumulated increase provides an indication of the potential total value of the programme to the Manawatu-Wanganui region; however, it does not adjust for the fact that some impacts – e.g. those in the forestry sector – will occur much later.

Table 51: Increase in value added over study period from Māori land upgrades (in real terms, undiscounted)

Sector	Evaluation period	Accumulated increase in GDP (real $m) *	Present value of increase in GDP (real $m) **
Dairy	2013-2025	$286	$153.1
Sheep and beef	2013-2025	$53	$28.2
Agriculture subtotal	*2013-2025*	*$338*	*$181*
Forestry	2013-2055	$151	$14.2

Notes:

* Undiscounted sum of forecast annual increases in GDP over evaluation period.

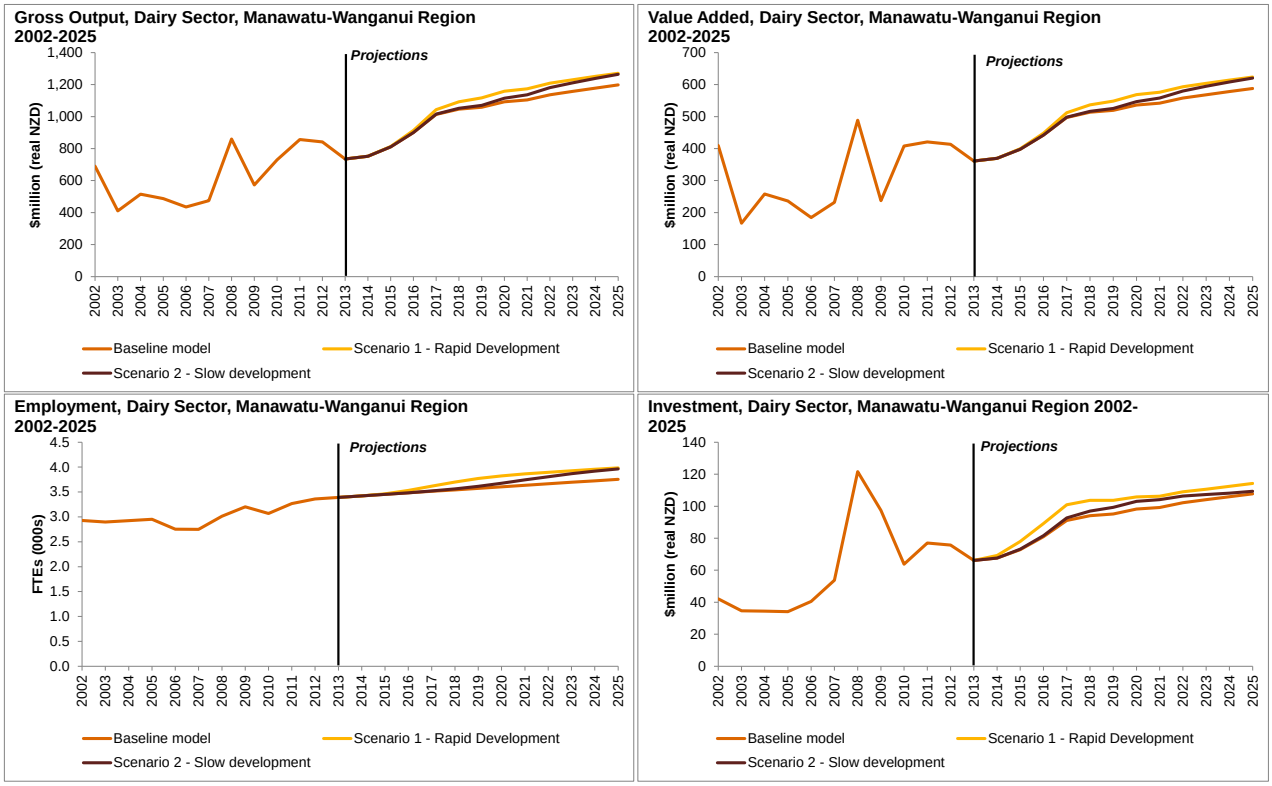
** Discounted to present value using Treasury's discount rate of 8%.

Table 51 demonstrates that our economic modelling suggests that an intervention that succeeded in raising the productivity of MFL in Manawatu-Wanganui would result in a total of approximately $338 million in value added in agriculture and $151 million in forestry in the region. This total impact would be spread throughout the study period (2013-2025 for dairy and dry stock farming, 2013-2055 for forestry).

In present value terms, the value of the long-term increase in production is worth approximately $181 million in agriculture and $14 million in forestry, depending upon the speed of development. (The low present value of economic outcomes in forestry is a result of the fact that forests will not be harvested and sold for several decades.)

The largest contribution to this increase is expected to come from the dairy industry. Figure 16 displays the impacts in this sector. It shows that the development of MFL is likely to have a significant long-term impact on the Manawatu-Wanganui dairy industry – raising employment and value added by 5.7% to 6.3% over the longer term.

Figure 16: Increase in Manawatu-Wanganui dairy gross output, value added, employment, and investment



References

This document references a number of different documents when detailing how data is collected and presented in the model.

Report of Māori Agribusiness in New Zealand, Ministry of Agriculture and Forestry, 2011. Accessed from http://www.mpi.govt.nz/news-resources/publications?title=Māori Agribusiness in New Zealand: A Study of the Māori Freehold Land Resource

Situation and Outlook for Primary Industries, Ministry for Primary Industries, 2012. Accessed from http://www.mpi.govt.nz/news-resources/publications.aspx?title=Situation and Outlook for Primary Industries SOPI 2012

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Land-Use Intensity Module: Land Use in Rural New Zealand Version 1, Joanna Hendy and Suzi Kerr, Motu Economic and Public Policy Research, June 2006

Beef and lamb stock number survey, Beef and Lamb New Zealand, 2012. Accessed http://www.beeflambnz.com/Documents/Information/Stock number survey 2030 June 2012.pdf

Appendix A – Detailed model documentation

High-level model process

The model transforms inputs (including national accounts data, regional farm production data, and agricultural land area) into four main economic outputs at a national and regional level using an approach developed in PwC's February report to MPI.

The model incorporates three elements:

- **Historical data** on each primary sector, which is used to benchmark the sector's performance over the past one to two decades.
- **Forward projections** of each primary sector under a "business as usual" scenario in which no additional Māori freehold land is brought into production.
- **Māori land projections** for each primary sector under a "change" scenario in which Māori freehold land is newly brought into production.

Model outputs are provided in charts and tables at a **national level** and a **regional level**. These outputs are based on historical performance and future scenarios for production and price growth.

The main economic outputs from the model are:

- gross farm revenue, a measure of the total income earned by farm businesses
- value added, or contribution to GDP, which measures the net effect of the primary sectors on the national economy
- employment (in full-time equivalent employees)
- gross fixed capital formation, or investment by the primary sectors.

Figure 217 summarises the model process, showing how it combines inputs (national level economic data on industries, farm production and price data, and information on the land available for upgrading) into outputs. The core elements of the model consist of:

- An **industry model** that forecasts, on the basis of historical data from Statistics New Zealand's National Accounts, the relationship between changes in farm revenue, value added, employment, and farm investment in each agriculture sector.
- Four **sector models** that use historical and forward-looking budgeted information about farms' productivity and prices for farm products to forecast future changes in farm revenue at a national level.
- **Regional models** that use data on known differences between farm productivity and labour inputs between Statistics New Zealand's regional council areas to break down the national level estimates to a regional level.

Figure 17: High level model process diagram

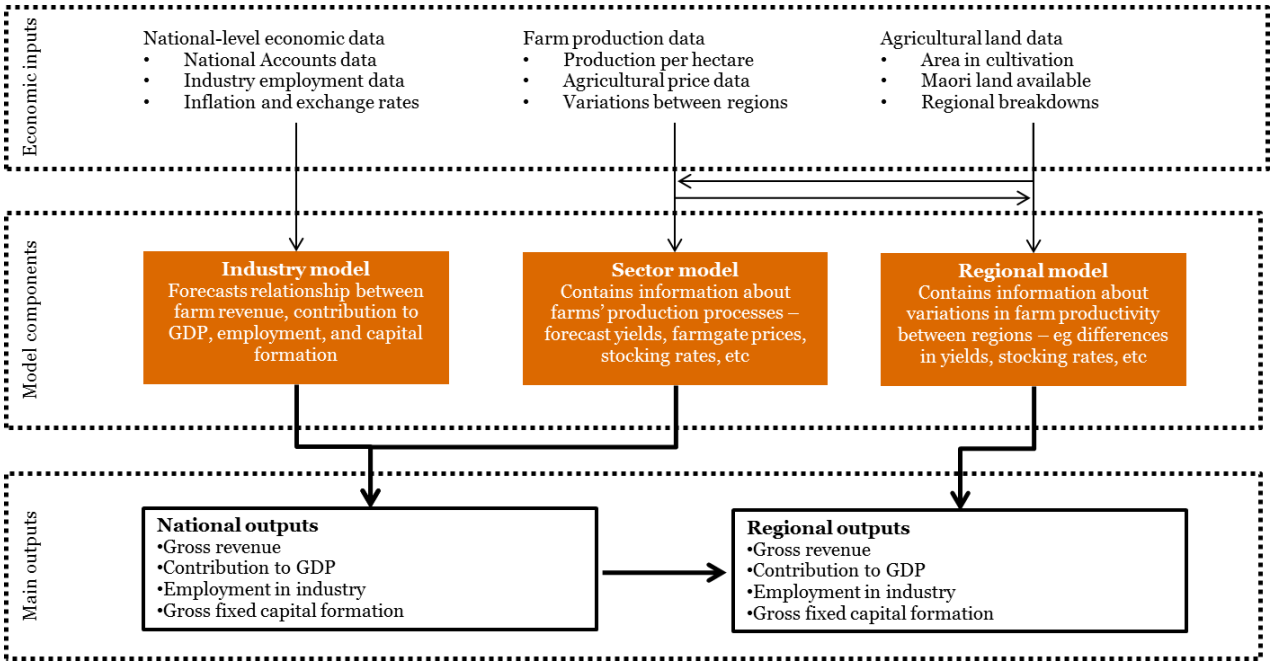
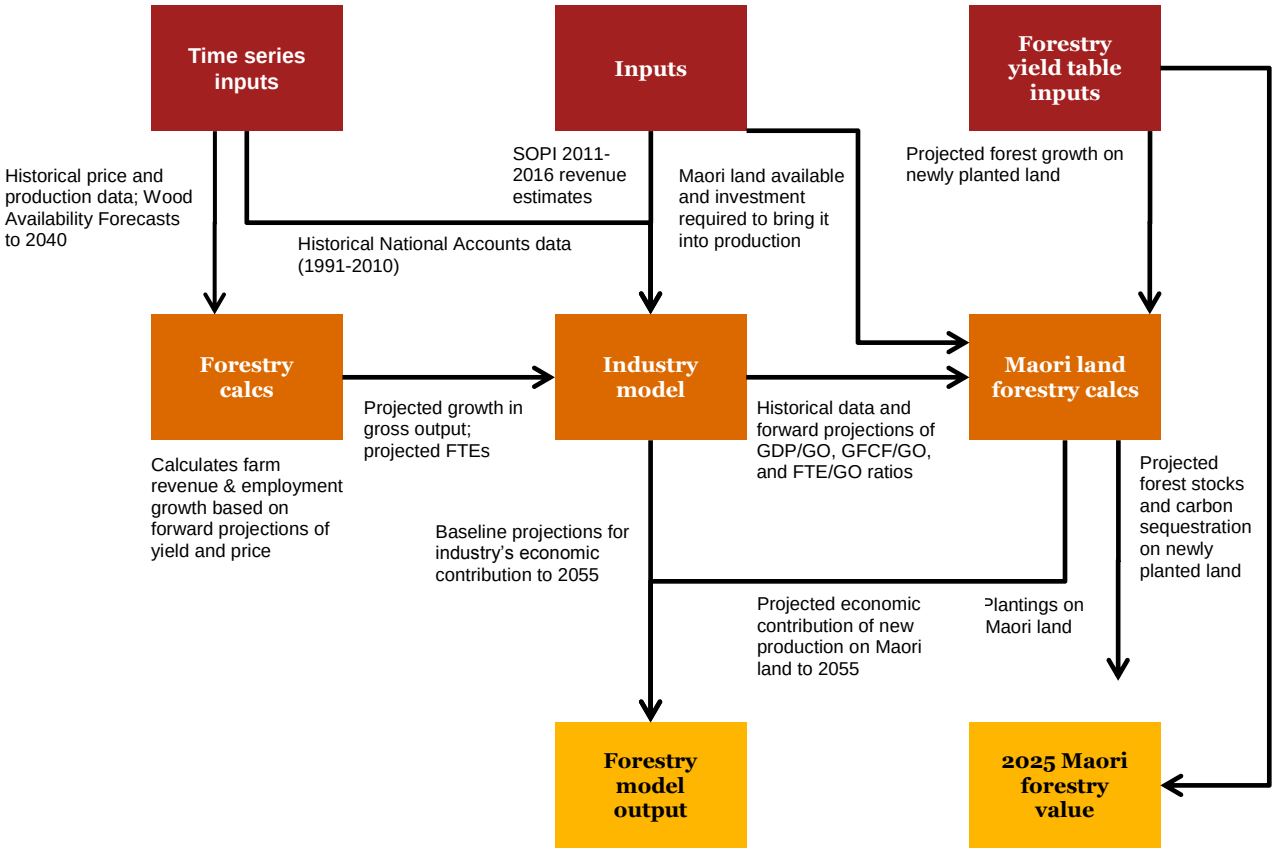


Figure 18 illustrates the working of this model in a more detailed fashion, examining the structure of the modelling process used for the forestry sector. A similar model structure has been applied across all individual sectors, albeit with different inputs as needed.

Using this approach allows new land to be input in terms of hectares available for introduction, and this introduction of new land flows through to gross output per hectare, which can then be used to measure changes in contribution to GDP, investment, and employment levels.

Figure 18: Detailed model process diagram for the forestry sector



Selection of industries

According to the Australia-New Zealand Standard Industry Classification (ANZSIC 2006 revision) used by Statistics New Zealand in its reporting of the national accounts, the primary sector comprises the following industries and sub-industries:

- agriculture
  - horticulture and fruit growing
  - sheep, beef cattle and grain farming
  - dairy cattle farming
  - poultry, deer and other livestock farming
- forestry and logging
- fishing, aquaculture and agriculture, forestry and fishing support services
  - fishing and aquaculture
  - agriculture, forestry and fishing support services and hunting.

We have based our analysis and reporting on this classification, with some exclusions, as it is consistent with Statistics New Zealand's framework and comprehensive in its coverage of the primary sector.

Our analysis focuses on four individual components of the overall primary industry:

- dairy cattle farming
- sheep and beef cattle farming [including wool production, but excluding grain farming]
- forestry and logging [including logging activities directly related to the establishment or harvesting of forests]
- horticulture and fruit growing.

At this point in time, we have excluded fishing, aquaculture, and poultry, deer and other livestock farming due to their small scale and/or difficulty in robustly identifying and measuring these industries.

Analysis period

We have chosen an analysis period that is consistent with the Government's Business Growth Agenda targets, which aim to achieve outcomes for export and productivity growth by 2025.

The economic model uses historical data to account for outcomes over the 2001-2012 period, and projects future outcomes over the 2013 to 2025 period.

The one exception to this is in the forestry sector. Our research indicated that a typical forestry development took place over a 25-30 year cycle, with on-going investment needed in that time, and that forest growth (and hence harvestable volumes) can be forecast over a long time horizon. Consequently, we have extended our analysis period to 2055 for the forestry sector only, while reporting some intermediate measures for forestry outcomes in the period to 2025.

Real versus nominal analysis

We have reported all results in real terms. This represents a change from PwC's February report, which reported values in nominal terms. Economic analysis usually distinguishes between real and nominal variables. Real variables are those that exclude the effects of inflation, whereas nominal variables are expressed in prices that include an inflation component. Values reported in real terms therefore provide a more accurate indication of changes in value within a sector.

Much of the data used in this analysis has been provided in nominal terms, including the Statistics New Zealand data on national accounts down to a more detailed industry level, as well as MPI forecasts and historical price data for agricultural commodities. We have converted historical figures to real terms using Statistics New Zealand's Consumer Price Index, the most widely-used measure of inflation (and one utilised by MPI). Future estimates of consumer price inflation have been established using NZIER's consensus forecasts of inflation for the period to 2018, followed by the assumption that inflation averages 2% (i.e. the midpoint of the Reserve Bank's target range). Consequently, our analysis captures the effect of price changes within the primary sectors relative to within the economy as a whole.

Summary of data sources

The model we have built relies on several data sources, both internal and external to PwC. This section outlines the data sources used, the variables taken from each source, and a description of the source. A more comprehensive description of the data sources used, and the use to which they have been put, is contained within tables in the Appendix.

Statistics New Zealand

The bulk of the macroeconomic data used to build industry models was drawn from the Statistics New Zealand national accounts database. These variables form the foundation of the industry models used to create a baseline model. The variables collected for individual agriculture sectors from the national accounts publications are:

- gross output (measures of overall production based on volumes and prices)
- intermediate consumption (what inputs were used in the production process in dollar terms)
- value added (or GDP, measured as the difference between gross output and intermediate consumption)

National Accounts data is available to 2010 in nominal prices; to extend the model beyond this we have used industry data gathered by MPI, plus other sources to calculate parameters. The framework used by MPI in the 2012 SOPI broadly mirrors the SNA, so we have used the MPI estimates to prepare a longer series of projections.

Ministry for Primary Industries (MPI)

When possible, MPI data was used in the model. The 2012 Situation and Outlook for Primary Industries (SOPI) document was used to obtain estimates and forecasts for output across the various primary industries from 2010 to 2016.

The Statistics New Zealand national accounts data stops at 2010, and MPI data was used to estimate actual and budgeted changes in total production from 2011 to 2016.There was an overlap in the Statistics New Zealand and MPI data sets which aided continuity. The estimates for output in SOPI were integrated with the Statistics New Zealand data to create a forward-looking model with a historical component.

Additional MPI estimates and projections for the pastoral sector were used to build the farm level models which allowed the impact of new inputs of land to be measured in terms of total sector output. Data from farm monitoring reports was used to create an estimate of the incremental revenue from additional land used for sheep and beef farming.

PwC Regional Industry Database (RID)

PwC's proprietary RID is a database developed and managed by the Finance and Economics team at PwC using Statistics New Zealand employment and economic data. The outputs from the RID are consistent with the System of National Accounts reporting described above.

The RID includes measures of employment at a regional level and at the level of individual ANZSIC industries. Employment is measured in terms of full-time equivalent employees, or FTEs, to provide a measure that reflects different ratios of part- and full-time employment and working proprietors across different sectors.

Agriculture commodity production and price data from other sources

In order to identify historical changes in production and prices and budgeted or forecast future changes, we have drawn upon data from a range of other sources, including:

- industry bodies that collect data on behalf of their members
- MPI-collected data on individual sectors and MPI farm modelling
- data from the United Nations Food and Agriculture Organisation on commodity production volumes and prices.

We provide a full summary of these data sources below.

Summary of key assumptions

In building the economic model, a number of assumptions have been made. These assumptions are either conceptual or model assumptions. Conceptual assumptions are related to the way that the model is structured, while model assumptions relate to calculations within the model and how results have been generated. This section discusses key conceptual assumptions.

Economic modelling

The model that has been developed is an economic model, not a financial model. According to the World Bank[9] economic models aim to identify and compare economic and social benefits accruing to the economy as a whole, while financial models consider the revenues and costs in an attempt to estimate a financial rate of return. Economic and financial models are not independent, and both should be considered when estimating the economic and financial viability of individual projects. In this regard:

- Financial models answer the question "is the project viable with an acceptable rate of return?"
- Economic models answer the question "is it worth the effort and resources to intervene?"

The economic modelling is based on a commonly known and accepted framework, the Statistics New Zealand system of national accounts. This means our estimates can be compared with Statistics New Zealand data on gross domestic product and value added within individual sectors or regions.

Forecast outcomes in future years

Our model relies upon historical data and budget forecasts for primary sectors wherever possible. For example, the 2012 SOPI was used to estimate changes in farm output in the pastoral and horticultural sectors over the period to 2018, while the former Ministry of Agriculture and Forestry's *Wood Availability Forecasts* were used to generate a baseline for forest harvest volumes to 2040.

While our estimates are based on MPI projections, it must be noted that there is still uncertainty regarding the accuracy of these projections. With any forecast in the future, the actual results may differ from projected results. Our model can be updated as more accurate data becomes available to reflect changes in the industry. MPI forecasts and projections for dairy prices and sheep and beef schedules only went out as far as 2017, while volume forecasts went to 2022.

As a result, our model extrapolates outcomes in future years that are not covered by budget forecasts. In general, this has relied upon linear extrapolation of existing trends modified by information provided by MPI or other industry sources.

Implementation cycles

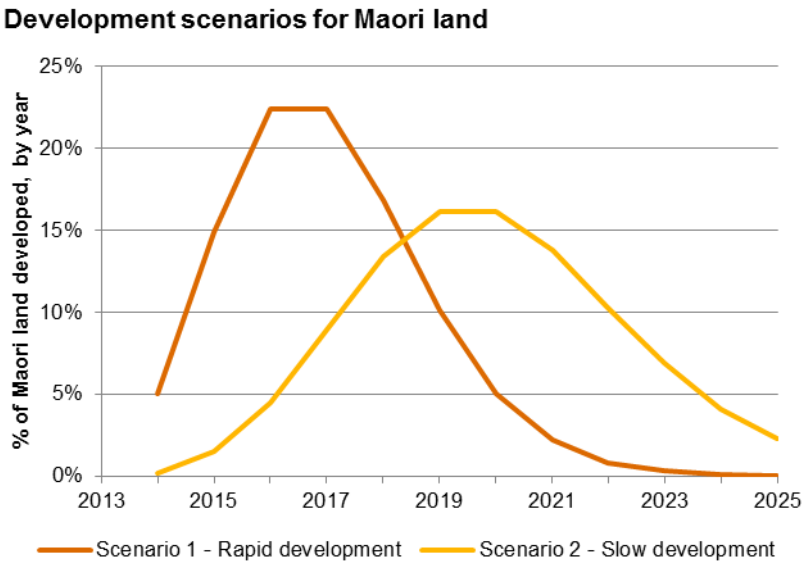
We have modelled two implementation cycles for the upgrades of Māori Freehold Land. These scenarios, which are summarised in Figure 19, reflect optimistic and conservative assumptions around the timing and speed of upgrades. These scenarios are as follows:

- Under Scenario 1, conversions and upgrades would peak in 2016 and 2017. Ninety percent of MFL would be converted or upgraded by 2019
- Under Scenario 2, conversions and upgrades would ramp up more slowly and peak in 2020 and 2021. Ninety percent of MFL would be converted or upgraded by 2024.

These assumptions have been applied across all sectors.

9 http://rru.worldbank.org/documents/toolkits/highways/3_public/33/3333.htm

Figure 19: Implementation scenarios included in model



Effective farm area

Farm monitoring reports produced by MPI reference an effective farm area, which is the total area of farm land that is available for use. Our research has found that this effective area is typically around 90% of the total farm size, so any land introduced is scaled down to find the total effective area available for farming.

Industry standards and benchmarks

The model implicitly assumes that both the new land brought into the productive sector and the lifting of the under-performing land's performance meet industry benchmarks around factors such as stocking rates, milk solids production and kill weights.

Employment

Prior to 2011, employment was taken from Statistics New Zealand industry level statistics. From the years 2012-2022, employment data has been driven by changes in the volume of output, and expected changes in output per employee (measured in production volumes per FTE). For example, increases in volume would lead to higher employment, while increases in productivity would lead to lower employment for a given level of production.

We have used historical data on employment and agricultural production to identify any trends in changing output per employee. In most sectors, we observed a trend towards fewer labour inputs required for each unit produced. In some cases – especially in the forestry sector – large changes were associated with one-off changes to harvesting and replanting.

Investment

When introducing new land into the model, several assumptions are made. There is a set up cost involved with establishing the farm, which would typically include land improvements, purchases of new machinery and other associated capital costs. Our estimates were based on a wide variety of sources[10][11][12] to get a measure of the level of investment required for each new hectare of land. For dairy this was around $10,600 per hectare (excluding supplier share purchases), while sheep and beef farms had significantly lower per hectare investment levels relative to dairying. As well as the establishment investment, there will be on-going maintenance investment to maintain the on-going effectiveness of the production assets created. The

[10] http://business-success-strategy-center.simnz.com/business-investment/farming-business/dairy-farming/how-much-does-a-dairy-conversion-cost-in-nz/

[11] http://pasturetoprofit.blogspot.co.nz/2011/01/crash-burn-dairy-farmers-bankers-go-mad.html

[12] www.side.org.nz/IM_Custom/ContentStore/Assets/9/6/28c799363388e2b07d70c7be770fe87d/Converting%20your%20farm%20to%20dairying.pdf

effect of new land injection will be highest initially when the farm is being developed, with a small increase in on-going maintenance investment.

Disposition of output

The additional output generated by the land development process (milk solids, lamb and beef) can be absorbed into national and international markets at current and projected prices.

Potential to upgrade productivity on under-performing land

Our model accounts for the potential contribution of newly introduced land (eg unused grasslands converted to farming uses) and productivity improvements on under-utilised and under-performing land. From the MAF report it was documented that under-performing land operates at around 70% of full capacity. In our model, under-performing land targeted for intervention has the potential to increase from 70% of the regional or national average productivity to 100% of average productivity. Given that this land is already developed, the level of additional investment required per hectare is expected to be proportionately lower.

Additional assumptions

Along with the conceptual assumptions discussed earlier, there are a number of assumptions specifically related to the way the model has been generated.

Non-farm income

The 2012 Situation and Outlook for Primary Industries document included a measure of non-farm income. This non-farm income was allocated to industries based on farm level data for each industry. Farms in the horticulture industry typically have a relatively high proportion of non-farm income, so the share of non-farm income allocated to horticulture is higher than for other industries which rely more on farm income.

Stocking rates

The stocking rate is a measure of the number of stocking units per hectare. Farm monitoring reports and MPI estimates provided most of these estimates, but for the sheep and beef sector there was no data beyond 2011. A 2006 paper by Motu provided a mathematical function to model stocking rate as a function of time, and this was used to project the stocking rate out to 2022.

Ratios in national accounts

The national accounts series from Statistics New Zealand runs to 2009. From 2010 onwards, several variables have been calculated based on past ratios. In most of these cases, the ratio has stayed constant over time. Intermediate consumption, subsidies, intermediate taxes and gross fixed capital formation have been computed in this manner.

Operating surplus

Operating surplus is a measure of total profits in national accounts, and is often used as a balancing item in the national accounts system. We have used a similar approach with operating surplus included as a residual to ensure that national accounts measure of value added balances with top level contribution to GDP.

Māori land development costs and scenarios

We have modelled the cost and timing of Māori land development on the basis of:

- MPI's analysis of the resource available (see the "Māori land development costs and scenarios" section and "Appendix B – Assumptions about Māori Freehold Land")
- available data on the cost of development (see below)

- scenarios for the speed and timing of development (see above)
- in addition, we are taking into account any underlying market constraints that there may be to quick development of Māori land.

Table 52: Land Development Costs

Farm type	Cost to develop new land ($/ha)	Cost to upgrade productivity ($/ha)
Sheep and beef	$1,400	$400
Dairy	$10,800	$3,200
Horticulture		
Wine grapes	$55,000	$5,500
Kiwifruit	$60,000	$6,000
Apples	$53,700	$5,400
Potatoes	$28,100	$2,800

Source: Various sources.

Table 53: Plantation forest establishment costs

Year after planting	Y0	Y1	Y2	Y3	Y10
Investment without pruning (2013 NZD / ha)	$1,500	$300	$300	$200	
Pruning labour requirements (hectares per FTE)					115 ha/FTE
Action	Mapping, fencing, planting (1/5 setup, 4/5 planting)	Post-planting costs	Post-planting costs	Post-planting costs	Pruning activities

Source: PwC discussions with MPI.

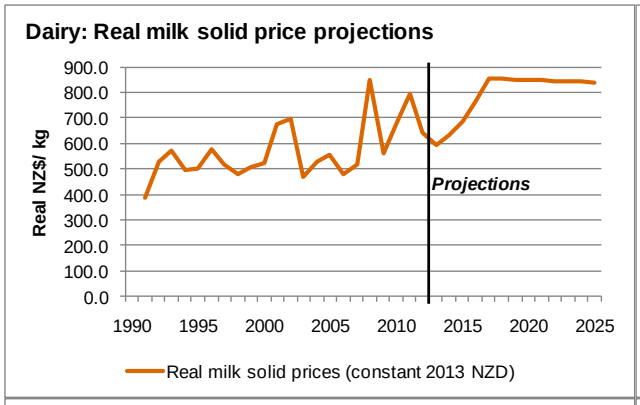
Dairy sector model

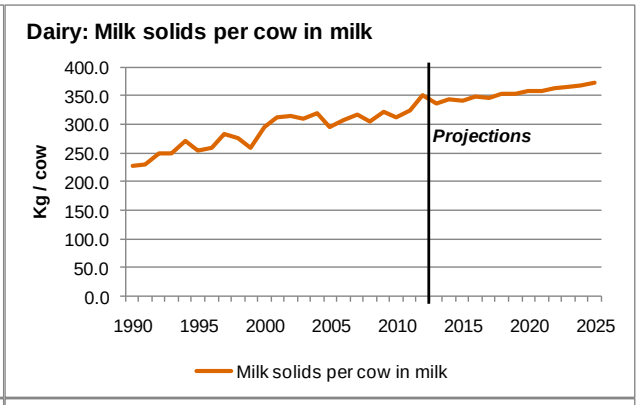
Table 54: Underlying calculations: Dairy sector model

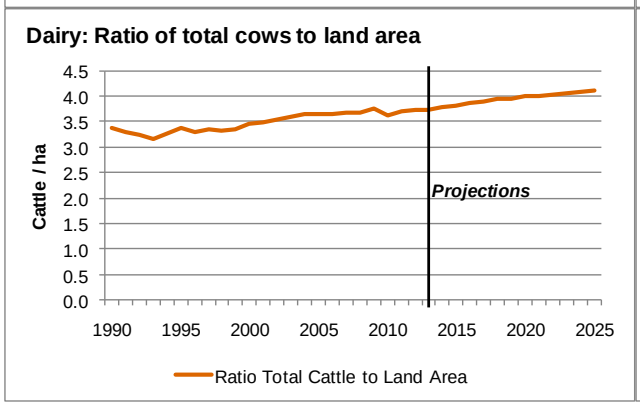
Variable	Name	Source / calculation
Farm model baseline inputs		
Land area in production	**A**	LIC (2012) historical data and projections
Total milk solids (kg)	**B**	LIC (2012) historical data and projections
Total heads of cattle	**C**	LIC (2012) historical data and projections
Milk solids per cow in milk	**D**	LIC (2012) historical data and projections
Milk solid price ($ / kg)	**E**	LIC (2012) historical data and projections
Maori land inputs		
Maori land available for production	**F**	MPI estimates
Maori land newly brought into production	**ΔF**	YOY absolute change in F
Land development cost ($/ha)	**G**	PwC estimate
Farm model baseline calculations		
Farmgate revenue (nominal NZ$)	**H**	B x E
YOY % change in farmgate revenue	**ΔH**	Annual % change in H
Maori land calculations		
Ratio of cows in milk to total cattle	**I**	(B / D) / C
Milk solids produced per hectare	**J**	C x I x D
Farmgate revenue (nominal NZ$) from Maori land	**K**	F x J x E
Baseline industry economic outputs		
Gross output (nominal NZ$)	**L**	Historical basis: Stats NZ National Accounts
		Forward projection: L x ΔH
Value added (nominal NZ$)	**M**	Historical basis: Stats NZ National Accounts
		Forward projection: L X P
Employment (FTEs)	**N**	Historical basis: PwC RID
		Forward projection: B x S
Investment (nominal NZ$)	**O**	Historical basis: Stats NZ National Accounts
		Forward projection: L x Q
Underlying ratios		
Value added / gross output ratio	**P**	Forward projections based on historical ratio: M / L
Investment / gross output ratio	**Q**	Forward projections based on historical ratio: O / L
Employment / production volume ratio	**R**	Forward projections based on historical ratio: N / B
Maori land economic outputs		
Gross output (nominal NZ$)	**K**	(K calculated above)
Value added (nominal NZ$)	**S**	K x P
Employment (FTEs)	**T**	K x (N / L)
Investment (nominal NZ$)	**U**	(ΔF x G) + (K x Q)

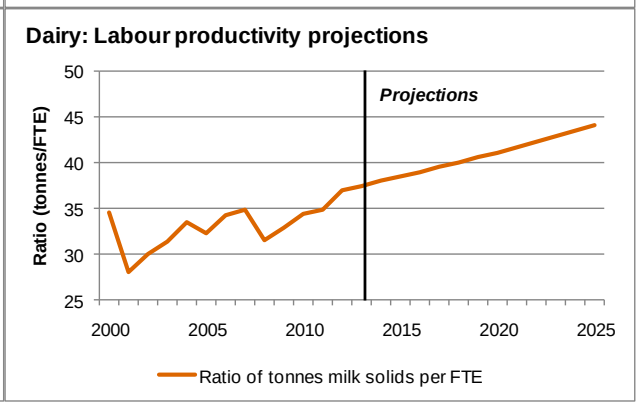
Source: PwC.

Main variables









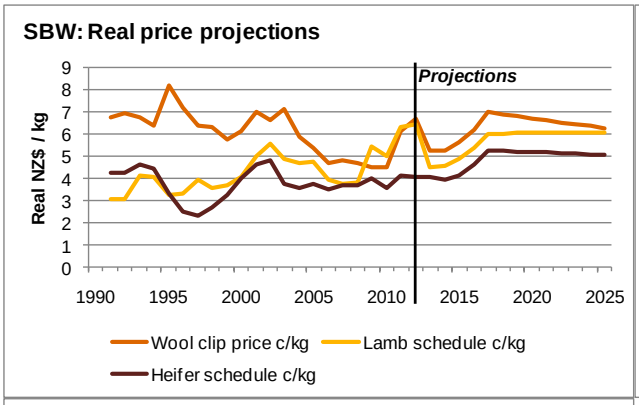
Sheep and beef sector model

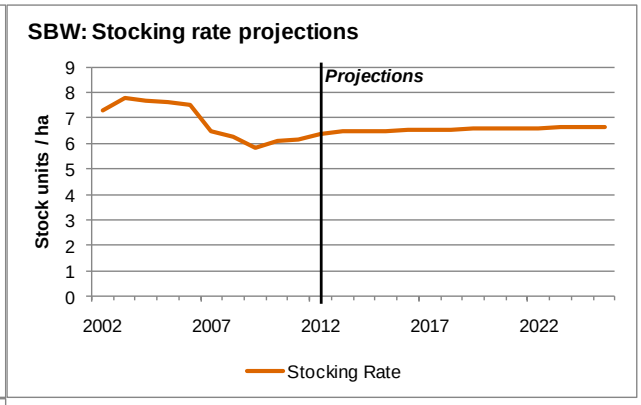
Table 55: Underlying calculations: Sheep and beef sector model

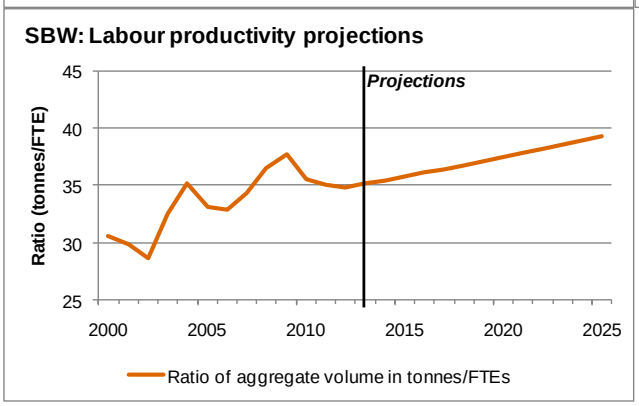
Variable	Name	Source / calculation
Farm model baseline inputs		
Land area in production	**A**	N / A
Sheep and cattle numbers	**B**	MPI farm monitoring projections, by livestock category
Total wool and meat production (kg)	**C**	MPI farm monitoring projections, by livestock category
Wool and meat prices ($ / kg)	**D**	MPI farm monitoring projections, by livestock category
Stocking rate (stock units / ha)	**E**	Projections based on MPI farm monitoring data
Revenue per stocking unit ($ / stock unit)	**F**	Projections based on MPI farm monitoring data
Maori land inputs		
Maori land available for production	**G**	MPI estimates
Maori land newly brought into production	**ΔG**	YOY absolute change in G
Land development cost ($/ha)	**H**	PwC estimate
Farm model baseline calculations		
Farmgate revenue (nominal NZ$)	**I**	∑(C x D)
YOY % change in farmgate revenue	**ΔI**	Annual % change in H
Maori land calculations		
Farmgate revenue (nominal NZ$) from Maori land	**J**	G x E x F
Baseline industry economic outputs		
Gross output (nominal NZ$)	**K**	Historical basis: Stats NZ National Accounts
		Forward projection: K x ΔH
Value added (nominal NZ$)	**L**	Historical basis: Stats NZ National Accounts
		Forward projection: K x O
Employment (FTEs)	**M**	Historical basis: PwC RID
		Forward projection: ∑C x Q
Investment (nominal NZ$)	**N**	Historical basis: Stats NZ National Accounts
		Forward projection: K x P
Underlying ratios		
Value added / gross output ratio	**O**	Forward projections based on historical ratio: L / K
Investment / gross output ratio	**P**	Forward projections based on historical ratio: N / K
Employment / production volume ratio	**Q**	Forward projections based on historical ratio: M / ∑C
Maori land economic outputs		
Gross output (nominal NZ$)	**J**	(J calculated above)
Value added (nominal NZ$)	**R**	J x O
Employment (FTEs)	**S**	J x (M / J)
Investment (nominal NZ$)	**T**	(ΔG x H) + (J x P)

Source: PwC.

Main variables







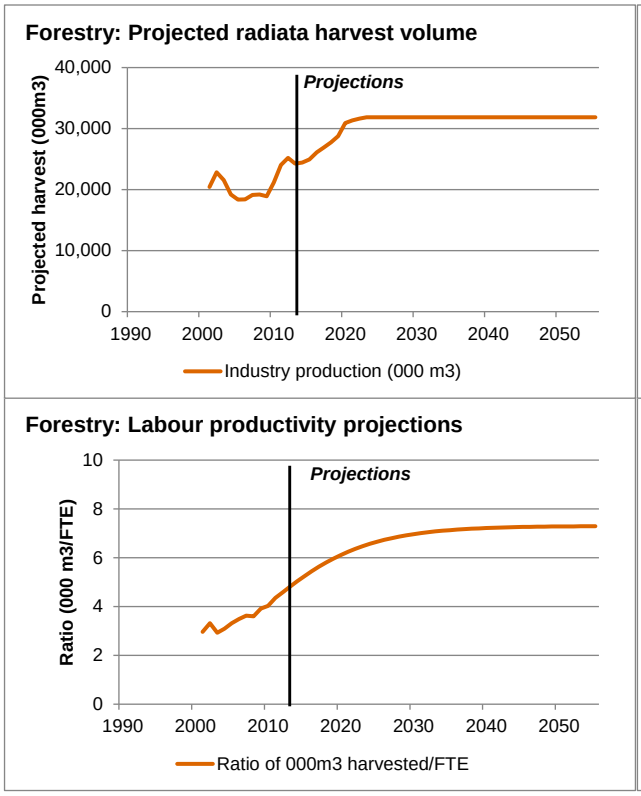
Forestry sector model

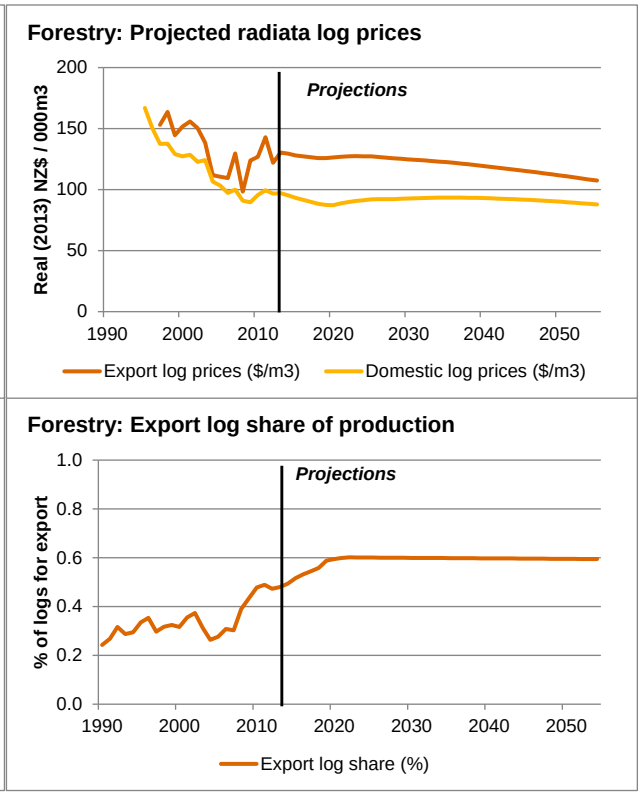
Table 56: Underlying calculations: Forestry sector model

Variable	Name	Source / calculation
Farm model baseline inputs		
Land area in production, by crop	**A**	Historical data: Statistics New Zealand
Projected growth for new forests (000m3/ha/year)	**B**	MPI Forestry Yield Tables 40-year yield projection for new plantings
Forecast production volumes (000m3)	**C**	MAF Wood Availability Forecasts to 2040
Log harvest by market		
Export logs	**D1**	Historical data: Stats NZ Roundwood Removals data
Domestic logs	**D2**	Forward projection: linear growth in domestic demand; rest exported
Log prices (nominal NZ$ / tonne)		
Export logs	**E1**	Historical data: MPI Indicative Radiata Pine Log Prices
Domestic logs	**E2**	Forward projection: linear projection of observed trend
Maori land inputs		
Maori land available for planting	**F**	MPI estimates
Maori land newly planted	**∆F**	YOY absolute change in E
Land development cost ($/ha)	**G**	PwC estimates
Farm model baseline calculations		
Average log price	**H**	(D1 x E1 + D2 x E2) / (D1 + D2)
Forest farmgate revenue (nominal NZ$)	**I**	C x H
YOY % change in farmgate revenue	**∆I**	Annual % change in H
Maori land calculations		
Log harvest from Maori land (000m3)	**J**	Future calculations based on F x B
Farmgate revenue (nominal NZ$) from Maori land	**K**	J x H
Baseline industry economic outputs		
Gross output (nominal NZ$)	**L**	Historical basis: Stats NZ National Accounts
		Forward projection: L x ∆I
Value added (nominal NZ$)	**M**	Historical basis: Stats NZ National Accounts
		Forward projection: L x P
Employment (FTEs)	**N**	Historical basis: PwC RID
		Forward projection: C x R
Investment (nominal NZ$)	**O**	Historical basis: Stats NZ National Accounts
		Forward projection: L x Q
Underlying ratios		
Value added / gross output ratio	**P**	Forward projections based on historical ratio: M / L
Investment / gross output ratio	**Q**	Forward projections based on historical ratio: O / L
Employment / production volume ratio	**R**	Forward projections based on historical ratio: N / (D1+D2)
Maori land economic outputs		
Gross output (nominal NZ$)	**S**	K + (∆F x G)
Value added (nominal NZ$)	**T**	S x P
Employment (FTEs)	**U**	S x (N / L)
Investment (nominal NZ$)	**V**	S x Q

Source: PwC.

Main variables





Horticulture sector model

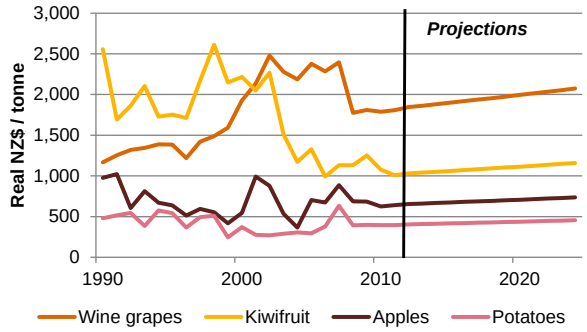
Table 57: Underlying calculations: Horticulture sector model

Variable	Name	Source / calculation
Farm model baseline inputs		
Land area in production, by crop	**A**	Historical basis: UN FAO / Statistics New Zealand
		Forward projection: Area in production stays constant
Yield for major crops (tonnes / ha)	**B**	Historical basis: UN FAO monitoring data
		Forward projection based on trends over last decade
Production volumes for major crops (tonnes)	**C**	Historical basis: UN FAO monitoring data
		Forward projection:A x B
Farmgate prices (nominal NZ$ / tonne)	**D**	Historical basis: UN FAO monitoring data
		Forward projection: Prices increase at CPI+1%
Maori land inputs		
Maori land available for production, by crop	**E**	MPI estimates
Maori land newly brought into production	Δ**E**	YOY absolute change in E
Land development cost ($/ha)	**F**	PwC estimates
Farm model baseline calculations		
Farmgate revenue (nominal NZ$)	**G**	$\sum$(C x D)
YOY % change in farmgate revenue	Δ**G**	Annual % change in H
Maori land calculations		
Farmgate revenue (nominal NZ$) from Maori land	**H**	$\sum$(E x B x D)
Baseline industry economic outputs		
Gross output (nominal NZ$)	**I**	Historical basis: Stats NZ National Accounts
		Forward projection: I x ΔG
Value added (nominal NZ$)	**J**	Historical basis: Stats NZ National Accounts
		Forward projection: I x M
Employment (FTEs)	**K**	Historical basis: PwC RID
		Forward projection: $\sum$C x O
Investment (nominal NZ$)	**L**	Historical basis: Stats NZ National Accounts
		Forward projection: I x N
Underlying ratios		
Value added / gross output ratio	**M**	Forward projections based on historical ratio: J / I
Investment / gross output ratio	**N**	Forward projections based on historical ratio: L / I
Employment / production volume ratio	**O**	Forward projections based on historical ratio: K / $\sum$C
Maori land economic outputs		
Gross output (nominal NZ$)	**H**	(H calculated above)
Value added (nominal NZ$)	**P**	H x M
Employment (FTEs)	**Q**	H x (K / I)
Investment (nominal NZ$)	**R**	(ΔE x F) + (H x N)

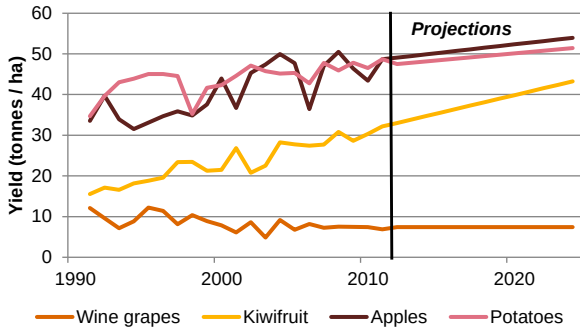
Source: PwC.

Main variables

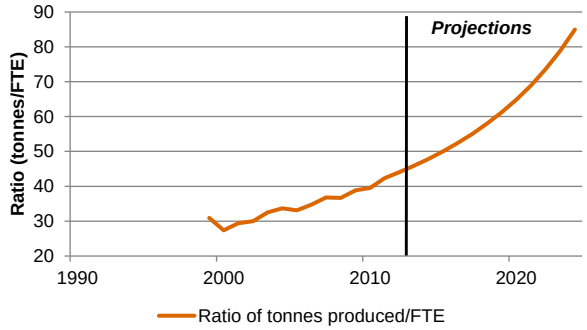
Horticulture: Farmgate real price projections



Horticulture: Production yield projections



Horticulture: Labour productivity projections



Appendix B – Assumptions about Māori Freehold Land

In this Appendix, we summarise in detail our assumptions around current land use on MFL and the potential for future change. We also provide more detailed breakdowns of estimated current and future land use outcomes by region.

In addition, we reiterate that this analysis **is not a model for making decisions on land use or for making policy recommendations**.

This Appendix simply reports on the assumptions that have been made in order to obtain an "order of magnitude" estimate of the potential from partnerships to improve the productivity of Māori freehold land. The aim is to improve the information available to MPI to support policy analysis and explain the impact of its framework for improving governance and management of Māori agribusinesses.

Definition of land use capability classes

Table 58 summarises land use capability classes (LUCs).[13] We have used these classes as the basis of our analysis due to the fact that Māori Land Court data on MFL groups blocks according to their LUC.

This classification groups land blocks based on the degree of limitation or hazard to use and versatility of use. LUC 1 is the most versatile and productive land, while LUC 8 is largely unusable for most forms of production. It is important to note, however, that LUCs cannot be used to identify whether there are any farming or forestry activities currently taking place on a block of land, and, if so, what activities are occurring. In order to estimate current land uses, it has been necessary to apply additional assumptions and estimates.

Table 58: Definition and description of land use capability classes

LUC	Description
1	Very good multiple-use land. Nearly level, has deep easily worked soils which are well drained but not seriously affected by drought and usually well supplied with plant nutrients and responsive to applied fertilisers. Climate is favourable for growth of wide range of cultivated crops/pasture/forestry. Practically no risk of erosion.
2	Good land with slight limitations. Management/conservation practices to overcome these limitations are easy to apply. Land used for cultivated crops/pasture/forestry. Limitations occur singly or combined: (a) slight to moderate susceptibility to erosion, (b) gentle slopes, (c) soils of only moderate depth, (d) wetness, existing permanently as a slight limitation after drainage, (e) occasional damaging overflow, (f) unfavourable structure and difficulty in working, (g) slight to moderate salinity, (h) slight climatic limitations.
3	Moderate limitations restricting choice of plants grown and/or make special conservation practices necessary. May be used for cultivated crops/pasture/forestry. Limitation result from one or more of the following: (a) moderate to high susceptibility to erosion or severe effects of past erosion,(b) rolling slopes,(c) shallow soils,(d) wetness or continued water logging after drainage,(e) frequent damaging overflow,(f) low moisture holding capacity,(g) moderate salinity,(h) moderate climatic limitations,(I) low fertility, not easily corrected.
4	Severe limitations to arable use restricting choice of crops grown and/or necessitate intensive

[13] Lynn, I., Manderson, A., Page, M., Harmsworth, G., Eyles, G., Douglas, G., Mackay, A., Newsome, P. (2009). Land Use Capability Survey Handbook (3rd ed.). Hamilton: AgResearch; Lincoln: Landcare Research; Lower Hutt: GNS Science.

LUC	Description
	conservation treatment and/or very careful management. Land kept in pasture for long periods with cash for cropping should be restricted to, say, once in five years or less frequently. Limiting features occurring alone or in combination: (a) high susceptibility to erosion or very severe effects of past erosion,(b) strongly rolling slopes,(c) very shallow soils,(d) excessive wetness with continuing hazard of water logging after drainage,(e) frequent overflow with severe damage,(f) very low moisture holding capacity,(g) high salinity,(h) severe climatic limitations,(I) low fertility very difficult to correct.
5	High producing land with physical limitations which make it unsuitable for cultivated crops but suitable (with slight limitations) for pastoral, vineyard, and forestry use. The most common limitations that preclude arable use are (a) moderately steep slopes, (b) erosion, (c) stoniness,(d) excessive wetness and (e) frequent flooding. There is very little Māori freehold land in this category and no Class 5 land on East Coast.
6	Fairly good stable hill country where soil erosion can be minimised by good pasture establishment/management. Also includes flat rolling land with an erosion risk or other limitation too great to allow safe cropping use but which has moderate limitations/hazards under perennial vegetation. Usually well suited to grazing/forestry. Soils responsive to fertiliser. Limitations are (usually in combination): (a) slight to moderate erosion hazard under perennial vegetation,(b) steep/very steep slopes,(c) very stony/very shallow soils,(d) excessive wetness or overflow,(e) frequent flooding with severe damage to pastures,(f) low moisture holding capacity,(g) severe salinity,(h) moderate climatic limitations.
7	Unsuitable for arable use and has severe limitations/hazards under perennial vegetation. Usually not suited for grazing, as it requires special soil conservation practices, moderately well suited to forestry. Limitations are similar to Class VI but are intensified. Limitations are usually in combination: (a) severe erosion hazards or severe effects of past erosion,(b) very steep slopes,(c) very stony/very shallow soils,(d) extreme wetness of soils,(e) very frequent damaging flooding,(f) very erodible rock type,(g) very high salinity,(h) severe climatic limitations,(I) very low moisture holding capacity,(j) low fertility, very difficult to correct.
8	Predominantly very steep mountain land, mostly above 4000 ft, descending to lower levels in unfavourable situations and on very steep land in high rainfall areas. Most common limitation is extreme erosion or erosion hazard which may be combined with severe limitations of climate or low fertility. Management for pastoral/forestry production not very commercial as it will be increasingly necessary to give protection for plant growth for on and off site benefits. Therefore, unsuitable for pasture or commercial forestry. Use is restricted to catchment protection and recreation.

Source: MPI, available online at http://www.mpi.govt.nz/forestry/funding-programmes/east-coast-forestry-project/land-use-capability-classes-in-New-Zealand.

Estimated potential for change,

After estimating current land uses on the basis of LUC, we applied an additional set of assumptions to estimate the future potential for change in land use.

These assumptions, which were developed by MPI, are based on the following general principles:

- There is likely to be minimal potential for change in LUCs 1 and 2, as this reflects land that is versatile and productive and therefore more likely to already be in its best use[14], and LUC 8, as this land is unlikely to be useful for any agricultural or forestry applications.
- Within LUCs 3 and 4, which are suitable for arable production, landowners will have opportunities to upgrade the productivity of existing dairy, sheep and beef (grazing), and horticulture operations. In addition, there will be significant opportunities to convert unused grassland and plantation forests to

[14] Compare this to the assumption made in the February 2013 report, which allocated MFL into Tier 1, 2, and 3 land based on broader assumptions, and assumed that Tier 1 land was already in its optimal use.

dairy and sheep and beef. A small proportion of natural forest that is regenerating scrubland may also be available for conversion.

- There is relatively little MFL in LUC 5. However, we have assumed that the small quantity that is available will see similar outcomes to LUCs 3 and 4, except that plantation forests will not be suitable for conversion.
- Within LUCs 6 and 7, which are suitable for non-arable production and some grazing activities, landowners will have opportunities to raise productivity on existing dairy and sheep and beef (grazing) operations. Grassland with no known use may also be available for conversion to dairy, grazing, or plantation forests, with plantation forests playing a more important role in LUC 7.
- Land that is currently under-performing has productivity equal to 70% of the regional (or national) average farm productivity. This land has the potential to improve to 100% of average farm productivity while remaining in current use.

There are a number of caveats to this analysis. For example, the model assumes that in some cases that natural forest will be converted to grazing or forestry. Natural forest includes regenerating manuka and kanuka, which is a more likely to be subject to conversion than mature native forest. In practice, any such conversions will be subject to restrictions, and as a result this model takes a relatively conservative view on the potential for change on this type of land.

The restrictions include those imposed by regional councils under the RMA, which will vary from region to region. There are also restrictions around the commercial harvesting of indigenous forest imposed by MPI (such as the need for an indigenous forest plan or permit).

Table 59 summarises these assumptions in detail. It shows the share of all land in each LUC and estimated current land use that will be retained in existing use, upgraded in productivity, or converted between uses.

Table 59: Estimated potential for change in land use, by LUC and current land use

LUC 1								
No potential for change to land use								
LUC 2								
No potential for change to land use								
LUC 3								
Potential future land use	**Retain in existing use**	**Upgrade productivity**	**Convert to dairy**	**Convert to grazing**	**Convert to planted forest**	**Convert to horticulture**	**Introduce apiculture**	**Total**
Estimated current land use								
Natural forest	90%	0%	5%	5%	0%	0%	0%	100%
Planted forest	0%	0%	48%	52%	0%	0%	0%	100%
Dairy	0%	100%	0%	0%	0%	0%	0%	100%
Grazing animals	0%	100%	0%	0%	0%	0%	0%	100%
High-producing grassland with no known use	0%	0%	40%	52%	0%	8%	0%	100%
Low-producing grassland with no known use	0%	0%	40%	52%	0%	8%	0%	100%
Unused grassland with woody biomass	100%	0%	0%	0%	0%	0%	0%	100%
Horticulture	0%	100%	0%	0%	0%	0%	0%	100%

LUC 4

Potential future land use	Retain in existing use	Upgrade productivity	Convert to dairy	Convert to grazing	Convert to planted forest	Convert to horticulture	Introduce apiculture	Total
Estimated current land use								
Natural forest	90%	0%	6%	4%	0%	0%	0%	100%
Planted forest	0%	0%	61%	39%	0%	0%	0%	100%
Dairy	0%	100%	0%	0%	0%	0%	0%	100%
Grazing animals	0%	100%	0%	0%	0%	0%	0%	100%
High-producing grassland with no known use	0%	0%	58%	39%	0%	3%	0%	100%
Low-producing grassland with no known use	0%	0%	58%	39%	0%	3%	0%	100%
Unused grassland with woody biomass	100%	0%	0%	0%	0%	0%	0%	100%
Horticulture	0%	100%	0%	0%	0%	0%	0%	100%

LUC 5

Potential future land use	Retain in existing use	Upgrade productivity	Convert to dairy	Convert to grazing	Convert to planted forest	Convert to horticulture	Introduce apiculture	Total
Estimated current land use								
Natural forest	90%	0%	2%	7%	1%	0%	0%	100%
Planted forest	100%	0%	0%	0%	0%	0%	0%	100%
Dairy	0%	100%	0%	0%	0%	0%	0%	100%
Grazing animals	0%	100%	0%	0%	0%	0%	0%	100%
High-producing grassland with no known use	0%	0%	22%	70%	8%	0%	0%	100%
Low-producing grassland with no known use	0%	0%	22%	70%	8%	0%	0%	100%
Unused grassland with woody biomass	100%	0%	0%	0%	0%	0%	0%	100%
Horticulture	100%	0%	0%	0%	0%	0%	0%	100%

LUC 6

Potential future land use	Retain in existing use	Upgrade productivity	Convert to dairy	Convert to grazing	Convert to planted forest	Convert to horticulture	Introduce apiculture	Total
Estimated current land use								
Natural forest	90%	0%	1%	7%	2%	0%	0%	100%
Planted forest	100%	0%	0%	0%	0%	0%	0%	100%
Dairy	0%	100%	0%	0%	0%	0%	0%	100%
Grazing animals	0%	100%	0%	0%	0%	0%	0%	100%
High-producing grassland with no known use	0%	0%	8%	73%	19%	0%	0%	100%
Low-producing grassland with no known use	0%	0%	8%	73%	19%	0%	0%	100%
Unused grassland with woody biomass	100%	0%	0%	0%	0%	0%	0%	100%
Horticulture	100%	0%	0%	0%	0%	0%	0%	100%

LUC 7								
Potential future land use	**Retain in existing use**	**Upgrade productivity**	**Convert to dairy**	**Convert to grazing**	**Convert to planted forest**	**Convert to horticulture**	**Introduce apiculture**	**Total**
Estimated current land use								
Natural forest	80%	0%	0%	0%	0%	0%	20%	100%
Planted forest	100%	0%	0%	0%	0%	0%	0%	100%
Dairy	0%	100%	0%	0%	0%	0%	0%	100%
Grazing animals	0%	84%	0%	0%	16%	0%	0%	100%
High-producing grassland with no known use	0%	0%	0%	50%	50%	0%	0%	100%
Low-producing grassland with no known use	0%	0%	0%	50%	50%	0%	0%	100%
Unused grassland with woody biomass	100%	0%	0%	0%	0%	0%	0%	100%
Horticulture	100%	0%	0%	0%	0%	0%	0%	100%
LUC 8								
No potential for change to land use								

Source: MPI Analysis and assumptions.

Detailed summary of MFL land use analysis

Here, we summarise, at a more detailed level, the outputs of our analysis of the potential for change on MFL. The figures in these tables have been calculated using the approach described in this Appendix and in the 'Māori Freehold Land available for development' section.

Estimated potential for change on MFL, all regions

These tables summarise potential changes to land use for all regional council areas. Table 60 corresponds to Table 226 in the main body of the report, which reported results for the six main regions only, while Table 61 corresponds to Table 27.

Table 60: High-level summary of potential change to land uses, for all regional councils

Region	No change - retain existing land use	Improve productivity of existing land use	Change land use
Auckland	2,456	3,188	904
Bay of Plenty*	112,499	81,701	27,065
Canterbury	1,326	2,073	538
Gisborne*	86,257	74,637	24,126
Hawke's Bay*	87,485	56,935	17,896
Manawatu-Wanganui*	80,359	79,325	24,190
Marlborough	3,296	2,669	912
Nelson	1	2	0
Northland*	42,209	59,748	17,126
Otago	1,207	2,417	652
Southland	8,678	13,057	3,472
Taranaki	13,311	11,618	3,057
Tasman	11	15	4
Waikato*	86,301	103,547	30,041
Wellington	5,425	4,844	1,579
West Coast	1,121	2,389	870

Region	No change - retain existing land use	Improve productivity of existing land use	Change land use
National total	**531,944**	**498,165**	**152,433**

Note: Indicates six regions that account for 92% of MFL
Source: MLC, MPI, PwC Calculations

Table 61: Detailed summary of potential change to land uses, for all regional councils

Land use change	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Manawatu-Wanganui	Marlborough	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	Wellington	West Coast	National Total
Retain as Natural forest	1,347	72,373	616	55,953	57,834	53,074	2,271	1	27,717	800	5,843	4,182	7	55,340	3,510	857	341,724
Retain as Planted forest	558	16,947	272	17,607	12,662	15,550	730	0	10,868	385	2,797	1,439	3	17,299	1,004	222	98,342
Retain as Dairy	199	2,902	169	2,760	707	1,251	48	0	669	0	0	2,869	1	1,620	194	0	13,389
Retain as Grazing animals	159	5,497	128	3,254	3,685	2,684	73	0	911	5	8	1,947	0	3,203	233	9	21,795
Retain as High-producing grassland with no known use	110	1,599	93	1,520	381	678	27	0	370	0	0	1,520	0	889	107	0	7,293
Retain as Low-producing grassland with no known use	23	9,505	2	3,383	9,189	5,164	104	0	1,149	13	23	242	0	5,746	249	25	34,818
Retain as Unused grassland with woody biomass	7	2,893	1	1,030	2,797	1,572	32	0	350	4	7	74	0	1,749	76	8	10,597
Retain as Horticulture	53	784	46	752	230	387	13	0	176	0	0	1,038	0	454	53	0	3,986
Total land retained in present use	*2,456*	*112,499*	*1,326*	*86,257*	*87,485*	*80,359*	*3,296*	*1*	*42,209*	*1,207*	*8,678*	*13,311*	*11*	*86,301*	*5,425*	*1,121*	*531,944*
Upgrade productivity of Dairy	465	9,386	396	6,921	5,925	9,953	157	0	8,144	373	1,438	2,316	2	15,373	580	476	61,905
Upgrade productivity of Grazing animals	2,553	63,322	1,574	58,846	44,990	63,005	2,123	2	48,866	2,016	11,143	8,624	12	83,686	3,644	1,784	396,190

Land use change	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Manawatu-Wanganui	Marlborough	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	Wellington	West Coast	National Total
Upgrade productivity of Horticulture	40	740	51	497	421	770	2	0	480	19	42	269	0	1,029	70	30	4,459
Total land with upgraded productivity	*3,057*	*73,448*	*2,021*	*66,264*	*51,336*	*73,728*	*2,283*	*2*	*57,489*	*2,408*	*12,623*	*11,209*	*15*	*100,088*	*4,294*	*2,290*	*462,554*
Convert Natural forest to Dairy	12	236	7	159	140	265	4	0	257	13	51	36	0	474	9	17	1,680
Convert Planted forest to Dairy	67	1,381	40	524	537	1,400	1	0	1,390	74	176	220	0	2,851	46	150	8,857
Convert unused grassland to Dairy	123	2,420	93	1,336	1,241	2,561	17	0	2,323	116	349	528	0	4,594	118	193	16,016
Convert Natural forest to Grazing	58	1,036	30	1,051	836	1,284	36	0	1,187	55	318	134	0	1,952	49	23	8,050
Convert Planted forest to Grazing	48	979	34	412	406	996	1	0	936	48	115	184	0	1,928	41	97	6,225
Convert unused grassland to Grazing	370	10,253	228	9,748	7,272	9,635	369	0	6,953	266	1,573	1,278	2	11,797	617	247	60,608
Convert Natural forest to Planted Forest	14	246	7	264	206	310	9	0	285	13	80	28	0	459	12	3	1,936
Convert Grazing animals to Planted Forest	70	4,449	28	4,514	3,019	3,017	208	0	1,218	5	234	220	0	1,865	297	54	19,199
Convert unused grassland to Planted Forest	130	5,855	58	5,995	4,130	4,508	266	0	2,422	55	559	364	1	3,794	374	73	28,585
Convert unused grassland to Horticulture	11	208	12	124	109	215	0	0	155	7	16	64	0	327	16	12	1,277
Total land converted between uses	*904*	*27,065*	*538*	*24,126*	*17,896*	*24,190*	*912*	*0*	*17,126*	*652*	*3,472*	*3,057*	*4*	*30,041*	*1,579*	*870*	*152,433*
Introduce apiculture on Natural forest	130	8,253	52	8,372	5,600	5,597	387	0	2,259	9	434	409	1	3,459	550	100	35,611
TOTAL	**6,548**	**221,265**	**3,937**	**185,020**	**162,317**	**183,874**	**6,878**	**4**	**119,083**	**4,276**	**25,207**	**27,986**	**30**	**219,889**	**11,848**	**4,380**	**1,182,542**

Source: MLC data, MPI estimations, PwC calculations.

Estimated final land uses, all regions

This table below summarises estimated final land uses after all productivity increases within each regional council area. It corresponds to 28 in the main body of the report, which presented results for the six main regions only.

Table 62: Potential final land uses on MFL, for all regional councils

Region	Potential final land use							
	Natural forest (no apiculture)	Planted forest	Dairy	Grazing animals	Unused grassland	Horticulture	Apiculture on natural forest	
Auckland	1,347	772	867	3,188	140	104	130	6,548
Bay of Plenty*	72,373	27,497	16,325	81,088	13,997	1,732	8,253	221,265
Canterbury	616	366	705	1,994	95	110	52	3,937
Gisborne*	55,953	28,380	11,701	73,310	5,932	1,372	8,372	185,020
Hawke's Bay*	57,834	20,018	8,551	57,188	12,366	760	5,600	162,317
Manawatu-Wanganui*	53,074	23,385	15,429	77,604	7,413	1,372	5,597	183,874
Marlborough	2,271	1,214	228	2,602	162	15	387	6,878
Nelson	1	1	0	2	0	0	0	4
Northland*	27,717	14,793	12,783	58,853	1,868	811	2,259	119,083
Otago	800	457	576	2,391	17	26	9	4,276
Southland	5,843	3,670	2,014	13,158	30	58	434	25,207
Taranaki	4,182	2,051	5,969	12,167	1,836	1,372	409	27,986
Tasman	7	4	3	15	1	1	1	30
Waikato*	55,340	23,417	24,913	102,566	8,384	1,810	3,459	219,889
Wellington	3,510	1,686	947	4,584	432	139	550	11,848
West Coast	857	352	837	2,159	33	42	100	4,380
National total	**341,724**	**148,062**	**101,848**	**492,868**	**52,707**	**9,722**	**35,611**	**1,182,542**

Note: indicates six regions that account for 92%of MFL.

Source: MLC, MPI, PwC Calculations.

Appendix C – Full model outputs

Table 63: National outputs in table format: Dairy industry

Dairy Model Results	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Dairy																									
ALL VALUES ARE IN REAL TERMS																									
Baseline model																									
Gross Output	7,037.2	8,145.8	5,561.8	6,369.3	6,386.1	5,834.1	6,496.8	11,675.8	7,705.5	9,887.4	12,193.7	12,042.6	11,361.2	11,764.3	12,815.5	14,388.0	16,363.1	17,071.4	17,430.7	18,163.9	18,517.1	19,236.6	19,757.5	20,269.5	20,772.5
Value added	4,133.5	4,830.7	2,263.1	3,190.9	3,096.5	2,473.1	3,178.7	6,629.3	3,191.8	5,530.1	5,985.8	5,911.7	5,577.2	5,775.1	6,291.1	7,063.1	8,032.6	8,380.3	8,556.7	8,916.6	9,090.0	9,443.2	9,698.9	9,950.2	10,197.2
Employment	39,154.6	38,322.1	38,001.4	37,448.3	37,585.2	37,176.2	37,726.8	40,317.3	42,383.6	41,851.3	43,388.2	45,752.0	44,535.8	46,143.2	45,935.0	47,356.4	47,309.8	48,939.1	49,378.8	50,855.7	51,246.3	52,629.0	53,441.2	54,209.1	54,932.6
Investment	367.8	496.5	470.1	426.4	447.4	543.3	736.7	1,650.4	1,310.9	864.6	1,096.6	1,083.0	1,021.7	1,058.0	1,152.5	1,293.9	1,471.5	1,535.2	1,567.5	1,633.5	1,665.2	1,729.9	1,776.8	1,822.8	1,868.0
Scenario 1 - Rapid development																									
Additional economic impact																									
Gross Output													0.0	0.0	14.1	65.1	153.0	241.4	302.6	350.6	368.0	387.1	394.1	398.9	402.6
Value added													0.0	0.0	6.9	31.9	75.1	118.5	148.6	172.1	180.7	190.0	193.5	195.8	197.6
Employment													0.0	0.0	50.6	214.2	442.4	692.0	857.3	981.7	1,018.5	1,059.1	1,066.0	1,066.7	1,064.5
Investment - one-off associated with development													0.0	24.3	72.3	108.7	108.7	81.6	49.0	24.3	10.7	3.9	1.5	0.5	0.0
Investment - ongoing associated with operations													0.0	0.0	1.3	5.9	13.8	21.7	27.2	31.5	33.1	34.8	35.4	35.9	36.2
Total (baseline + ML injection)																									
Gross Output													11,361.2	11,764.3	12,829.6	14,453.1	16,516.1	17,312.8	17,733.3	18,514.5	18,885.1	19,623.7	20,151.6	20,668.3	21,175.0
Value added													5,577.2	5,775.1	6,298.0	7,095.0	8,107.7	8,498.8	8,705.2	9,088.7	9,270.7	9,633.2	9,892.4	10,146.0	10,394.8
Employment													44,535.8	46,143.2	45,985.6	47,570.6	47,752.2	49,631.2	50,236.1	51,837.4	52,264.8	53,688.0	54,507.2	55,275.8	55,997.1
Investment - total													1,021.7	1,082.2	1,226.1	1,408.5	1,594.0	1,638.5	1,643.8	1,689.3	1,709.0	1,768.6	1,813.7	1,859.2	1,904.3
Scenario 2 - Slow development																									
Additional economic impact																									
Gross Output													0.0	0.0	0.6	5.6	22.4	56.3	105.8	170.7	231.3	291.9	335.5	366.1	385.6
Value added													0.0	0.0	0.3	2.7	11.0	27.7	51.9	83.8	113.5	143.3	164.7	179.7	189.3
Employment													0.0	0.0	2.0	18.3	64.8	161.5	299.8	478.0	640.0	798.6	907.6	979.2	1,019.8
Investment - one-off associated with development													0.0	1.0	7.3	21.8	43.2	65.1	78.2	78.2	67.0	50.0	33.5	19.9	11.2
Investment - ongoing associated with operations													0.0	0.0	0.1	0.5	2.0	5.1	9.5	15.4	20.8	26.2	30.2	32.9	34.7
Total (baseline + ML injection)																									
Gross Output													11,361.2	11,764.3	12,816.1	14,393.6	16,385.6	17,127.8	17,536.5	18,334.6	18,748.4	19,528.5	20,093.0	20,635.6	21,158.1
Value added													5,577.2	5,775.1	6,291.4	7,065.8	8,043.6	8,408.0	8,608.6	9,000.4	9,203.5	9,586.5	9,863.6	10,130.0	10,386.5
Employment													44,535.8	46,143.2	45,937.1	47,374.7	47,374.7	49,100.6	49,678.6	51,333.7	51,886.3	53,427.6	54,348.8	55,188.3	55,952.4
Investment - total													1,021.7	1,058.9	1,159.8	1,316.2	1,516.7	1,605.3	1,655.2	1,727.0	1,753.0	1,806.2	1,840.4	1,875.6	1,913.9

Table 64: National outputs in table format: Sheep and beef industry

Sheep and beef Model Results	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Sheep and beef																									
ALL VALUES ARE IN REAL TERMS																									
Baseline model																									
Gross Output	7,810.5	8,664.5	7,787.6	7,004.4	7,059.7	6,791.4	6,115.2	5,754.8	6,453.3	6,708.2	6,807.0	7,252.9	6,800.4	6,465.5	6,755.3	7,390.0	8,355.4	8,324.1	8,372.7	8,392.2	8,512.2	8,528.6	8,577.0	8,623.0	8,666.5
Value added	3,805.9	4,050.7	3,422.4	2,983.4	3,006.0	2,495.5	2,405.0	2,078.2	2,676.2	2,789.7	2,658.0	2,832.2	2,655.4	2,524.7	2,637.8	2,885.7	3,262.6	3,250.4	3,269.4	3,277.0	3,323.9	3,330.3	3,349.2	3,367.2	3,384.1
Employment	44,841.8	44,271.8	41,650.9	39,522.8	40,968.8	41,005.6	40,050.2	37,890.0	33,621.0	35,195.2	34,321.5	34,026.3	35,172.8	34,058.7	33,875.6	33,506.6	33,268.9	33,089.9	33,149.6	33,043.7	33,332.8	33,217.0	33,244.8	33,266.0	33,280.7
Investment	809.5	829.7	838.5	652.8	687.0	727.9	533.8	915.5	711.5	750.1	693.6	739.1	692.9	658.8	688.3	753.0	851.4	848.2	853.2	855.1	867.4	869.0	874.0	878.7	883.1
Scenario 1 - Rapid development																									
Additional economic impact																									
Gross Output													0.0	0.0	6.3	27.8	67.2	102.1	129.0	144.5	153.4	156.3	157.6	158.0	158.0
Value added													0.0	0.0	2.5	11.2	27.0	41.1	51.8	57.9	61.4	62.7	63.2	63.5	63.5
Employment													0.0	0.0	31.5	126.2	267.6	405.8	510.8	569.1	600.5	608.8	610.7	609.4	606.8
Investment - one-off associated with development													0.0	12.5	37.3	56.0	56.0	42.0	25.3	12.5	5.5	2.0	0.8	0.3	0.0
Investment - ongoing associated with operations													0.0	0.0	0.6	2.8	6.8	10.4	13.1	14.7	15.6	15.9	16.1	16.1	16.1
Total (baseline + ML injection)																									
Gross Output													6,800.4	6,465.5	6,761.5	7,417.8	8,422.6	8,426.2	8,501.7	8,536.7	8,665.5	8,684.9	8,734.6	8,781.0	8,824.5
Value added													2,655.4	2,524.7	2,640.3	2,896.8	3,289.7	3,291.6	3,321.2	3,334.9	3,385.3	3,393.0	3,412.4	3,430.6	3,447.6
Employment													35,172.8	34,058.7	33,907.1	33,632.8	33,536.6	33,495.7	33,660.4	33,612.8	33,933.3	33,825.8	33,855.5	33,875.5	33,887.6
Investment - total													692.9	671.3	726.3	811.9	914.3	900.6	891.6	882.4	888.5	887.0	890.8	895.0	899.2
Scenario 2 - Slow development																									
Additional economic impact																									
Gross Output													0.0	0.0	0.3	2.4	9.9	23.8	45.1	70.4	96.4	117.9	134.1	145.0	151.4
Value added													0.0	0.0	0.1	1.0	4.0	9.6	18.1	28.2	38.6	47.3	53.8	58.2	60.8
Employment													0.0	0.0	1.3	10.8	39.2	94.7	178.6	277.1	377.3	459.0	520.0	559.4	581.3
Investment - one-off associated with development													0.0	0.5	3.8	11.3	22.3	33.5	40.3	40.3	34.5	25.8	17.3	10.3	5.8
Investment - ongoing associated with operations													0.0	0.0	0.0	0.2	1.0	2.4	4.6	7.2	9.8	12.0	13.7	14.8	15.4
Total (baseline + ML injection)																									
Gross Output													6,800.4	6,465.5	6,755.5	7,392.4	8,365.2	8,347.9	8,417.8	8,462.6	8,608.5	8,646.5	8,711.2	8,768.0	8,817.9
Value added													2,655.4	2,524.7	2,637.9	2,886.6	3,266.6	3,260.0	3,287.5	3,305.2	3,362.5	3,377.5	3,403.1	3,425.4	3,445.0
Employment													35,172.8	34,058.7	33,876.9	33,517.3	33,308.2	33,184.6	33,328.2	33,320.8	33,710.1	33,676.0	33,764.7	33,825.4	33,862.1
Investment - total													692.9	659.3	692.1	764.5	874.7	884.2	898.0	902.6	911.7	906.8	904.9	903.7	904.3

Table 65: National outputs in table format: Forestry and logging industry 2001-2030

Forestry Model Results	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forestry																														
ALL VALUES ARE IN REAL TERMS																														
Baseline model																														
Gross Output	4,197.9	4,063.7	4,116.6	3,340.6	2,946.1	2,782.4	2,897.3	2,674.5	2,984.1	3,240.2	4,050.4	3,856.6	3,834.2	3,821.9	3,864.8	4,027.3	4,125.1	4,232.3	4,388.0	4,778.3	4,892.3	4,979.0	5,035.2	5,044.1	5,052.7	5,042.3	5,028.4	5,012.2	5,007.1	4,998.5
Value added	1,351.9	1,266.2	1,271.3	1,013.7	975.5	947.9	1,154.1	997.5	974.7	1,093.6	1,358.2	1,293.2	1,285.7	1,281.6	1,295.9	1,350.4	1,383.2	1,419.1	1,471.4	1,602.3	1,640.5	1,669.5	1,688.4	1,691.4	1,694.3	1,690.8	1,686.1	1,680.7	1,679.0	1,676.1
Employment	6,900.5	6,883.5	7,377.1	6,213.6	5,538.1	5,273.5	5,273.1	5,335.3	4,825.0	5,250.6	5,520.4	5,507.2	5,038.3	4,849.5	4,755.0	4,789.6	4,773.6	4,779.0	4,819.2	5,057.6	5,016.3	4,970.6	4,919.0	4,847.0	4,783.7	4,728.6	4,680.8	4,639.2	4,603.0	4,571.5
Investment	122.2	194.7	200.9	137.1	154.0	277.5	194.8	126.4	269.8	261.1	244.8	233.1	231.7	231.0	233.6	243.4	249.3	255.8	265.2	288.8	295.7	300.9	304.3	304.9	305.4	304.7	303.9	302.9	302.6	302.1
Scenario 1 - Rapid development																														
Additional economic impact																														
Gross Output - Forestry Revenue													0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gross Output - Planting Expenditure													0.0	2.7	8.4	13.9	16.0	14.4	10.8	6.9	3.8	1.8	0.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0
Gross Output - Pruning Expenditure													0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	4.9	7.4	7.4	5.5	3.3	1.6
Value added													0.0	0.9	2.8	4.7	5.4	4.8	3.6	2.3	1.3	0.6	0.3	0.7	1.7	2.5	2.5	1.9	1.1	0.6
Employment													0.0	3.4	10.4	16.5	18.5	16.3	11.9	7.3	3.9	1.8	0.8	15.4	45.0	67.5	67.5	50.6	30.4	15.1
Investment													0.0	0.2	0.5	0.8	1.0	0.9	0.7	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (baseline + ML injection)																														
Gross Output													3,834.2	3,824.6	3,873.2	4,041.2	4,141.1	4,246.7	4,398.9	4,785.2	4,896.1	4,980.8	5,036.0	5,046.0	5,057.7	5,049.8	5,035.8	5,017.7	5,010.5	5,000.1
Value added													1,285.7	1,282.5	1,298.7	1,355.1	1,388.6	1,424.0	1,475.0	1,604.6	1,641.7	1,670.2	1,688.6	1,692.0	1,695.9	1,693.3	1,688.6	1,682.5	1,680.1	1,676.6
Employment													5,038.3	4,852.9	4,765.3	4,806.2	4,792.0	4,795.3	4,831.1	5,064.9	5,020.2	4,972.5	4,919.8	4,862.3	4,828.7	4,796.1	4,748.3	4,689.8	4,633.4	4,586.6
Investment													231.7	231.2	234.1	244.2	250.3	256.7	265.9	289.2	295.9	301.0	304.4	304.9	305.4	304.8	303.9	302.9	302.6	302.1
Scenario 2 - Slow development																														
Additional economic impact																														
Gross Output - Forestry Revenue													0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gross Output - Planting Expenditure													0.0	0.1	0.8	2.6	5.3	8.6	11.1	12.1	11.5	9.6	7.2	4.8	3.0	1.1	0.5	0.2	0.0	0.0
Gross Output - Pruning Expenditure													0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	1.5	2.9	4.4	5.3	5.3
Value added													0.0	0.0	0.3	0.9	1.8	2.9	3.7	4.1	3.8	3.2	2.4	1.6	1.2	0.9	1.2	1.5	1.8	1.8
Employment													0.0	0.1	1.0	3.0	6.2	9.7	12.2	12.8	11.8	9.5	7.0	5.3	7.4	14.6	27.3	40.5	48.5	48.5
Investment													0.0	0.0	0.0	0.2	0.3	0.5	0.7	0.7	0.7	0.6	0.4	0.3	0.2	0.1	0.0	0.0	0.0	0.0
Total (baseline + ML injection)																														
Gross Output													3,834.2	3,822.0	3,865.6	4,029.9	4,130.5	4,240.8	4,399.1	4,790.4	4,903.7	4,988.5	5,042.3	5,049.0	5,056.2	5,044.9	5,031.8	5,016.8	5,012.5	5,003.8
Value added													1,285.7	1,281.6	1,296.2	1,351.3	1,385.0	1,422.0	1,475.1	1,606.3	1,644.3	1,672.7	1,690.8	1,693.0	1,695.4	1,691.7	1,687.3	1,682.2	1,680.8	1,677.8
Employment													5,038.3	4,849.7	4,756.0	4,792.7	4,779.8	4,788.7	4,831.4	5,070.4	5,028.0	4,980.2	4,926.0	4,852.2	4,791.1	4,743.2	4,708.1	4,679.7	4,651.5	4,620.0
Investment													231.7	231.0	233.6	243.6	249.6	256.3	265.9	289.5	296.4	301.5	304.7	305.1	305.6	304.8	303.9	302.9	302.6	302.1

Table 66: National outputs in table format: Forestry and logging industry 2031-2055

Forestry Model Results	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
Forestry																									
ALL VALUES ARE IN REAL TERMS																									
Baseline model																									
Gross Output	4,990.4	4,982.0	4,972.6	4,961.7	4,948.7	4,933.7	4,916.4	4,897.3	4,876.7	4,855.0	4,832.4	4,809.1	4,785.3	4,760.8	4,735.5	4,709.4	4,682.3	4,654.5	4,625.9	4,596.5	4,566.4	4,535.8	4,504.6	4,472.9	4,440.7
Value added	1,673.4	1,670.6	1,667.4	1,663.7	1,659.4	1,654.3	1,648.6	1,642.1	1,635.2	1,628.0	1,620.4	1,612.6	1,604.6	1,596.4	1,587.9	1,579.1	1,570.1	1,560.7	1,551.1	1,541.3	1,531.2	1,520.9	1,510.5	1,499.8	1,489.1
Employment	4,544.1	4,520.4	4,499.7	4,481.7	4,466.0	4,452.4	4,440.6	4,430.3	4,421.4	4,413.6	4,406.8	4,400.9	4,395.8	4,391.4	4,387.5	4,384.1	4,381.2	4,378.7	4,376.5	4,374.5	4,372.9	4,371.4	4,370.1	4,369.0	4,368.1
Investment	301.6	301.1	300.5	299.9	299.1	298.2	297.1	296.0	294.7	293.4	292.1	290.7	289.2	287.7	286.2	284.6	283.0	281.3	279.6	277.8	276.0	274.1	272.2	270.3	268.4
Scenario 1 - Rapid development																									
Additional economic impact																									
Gross Output - Forestry Revenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	171.7	508.9	760.8	756.4	563.9	336.9	165.7	72.4	26.2	9.7	3.2	0.0
Gross Output - Planting Expenditure	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gross Output - Pruning Expenditure	0.7	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value added	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.6	170.6	255.1	253.6	189.1	113.0	55.6	24.3	8.8	3.3	1.1	0.0
Employment	6.6	2.4	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	158.3	471.5	708.2	707.8	530.5	318.8	157.7	69.4	25.2	9.4	3.1	0.0
Investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	30.8	46.0	45.7	34.1	20.4	10.0	4.4	1.6	0.6	0.2	0.0
Total (baseline + ML injection)																									
Gross Output	4,991.1	4,982.3	4,972.7	4,961.7	4,948.7	4,933.7	4,916.4	4,897.3	4,876.7	4,855.0	4,832.4	4,809.1	4,785.3	4,932.4	5,244.4	5,470.1	5,438.7	5,218.4	4,962.8	4,762.2	4,638.9	4,562.0	4,514.3	4,476.1	4,440.7
Value added	1,673.6	1,670.7	1,667.4	1,663.7	1,659.4	1,654.3	1,648.6	1,642.1	1,635.2	1,628.0	1,620.4	1,612.6	1,604.6	1,653.9	1,758.5	1,834.2	1,823.7	1,749.8	1,664.1	1,596.8	1,555.5	1,529.7	1,513.7	1,500.9	1,489.1
Employment	4,550.8	4,522.8	4,500.6	4,482.0	4,466.0	4,452.4	4,440.6	4,430.3	4,421.4	4,413.6	4,406.8	4,400.9	4,395.8	4,549.7	4,859.0	5,092.4	5,089.0	4,909.2	4,695.2	4,532.3	4,442.2	4,396.7	4,379.6	4,372.2	4,368.1
Investment	301.6	301.1	300.5	299.9	299.1	298.2	297.1	296.0	294.7	293.4	292.1	290.7	289.2	298.1	317.0	330.6	328.7	315.4	299.9	287.8	280.4	275.7	272.8	270.5	268.4
Scenario 2 - Slow development																									
Additional economic impact																									
Gross Output - Forestry Revenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	51.2	152.8	300.5	449.8	537.1	533.7	454.4	336.9	224.1	132.3	73.7
Gross Output - Planting Expenditure	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gross Output - Pruning Expenditure	4.6	3.4	2.3	1.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value added	1.5	1.1	0.8	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	17.2	51.2	100.8	150.8	180.1	178.9	152.4	113.0	75.2	44.4	24.7
Employment	41.6	31.0	20.8	12.3	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	47.4	142.3	281.2	423.1	508.1	507.9	435.2	324.7	217.4	129.2	72.4
Investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	3.1	9.2	18.2	27.2	32.5	32.3	27.5	20.4	13.5	8.0	4.5
Total (baseline + ML injection)																									
Gross Output	4,994.9	4,985.4	4,974.9	4,963.0	4,949.5	4,933.7	4,916.4	4,897.3	4,876.7	4,855.0	4,832.4	4,809.1	4,785.3	4,767.6	4,786.7	4,862.2	4,982.9	5,104.3	5,162.9	5,130.1	5,020.9	4,872.7	4,728.7	4,605.2	4,514.4
Value added	1,674.9	1,671.7	1,668.2	1,664.2	1,659.7	1,654.3	1,648.6	1,642.1	1,635.2	1,628.0	1,620.4	1,612.6	1,604.6	1,598.7	1,605.1	1,630.4	1,670.8	1,711.6	1,731.2	1,720.2	1,683.6	1,633.9	1,585.6	1,544.2	1,513.8
Employment	4,585.7	4,551.4	4,520.4	4,494.0	4,473.0	4,452.4	4,440.6	4,430.3	4,421.4	4,413.6	4,406.8	4,400.9	4,395.8	4,397.7	4,434.9	4,526.4	4,662.4	4,801.8	4,884.6	4,882.4	4,808.1	4,696.1	4,587.6	4,498.3	4,440.5
Investment	301.6	301.1	300.5	299.9	299.1	298.2	297.1	296.0	294.7	293.4	292.1	290.7	289.2	288.1	289.3	293.9	301.2	308.5	312.0	310.1	303.4	294.5	285.8	278.3	272.8

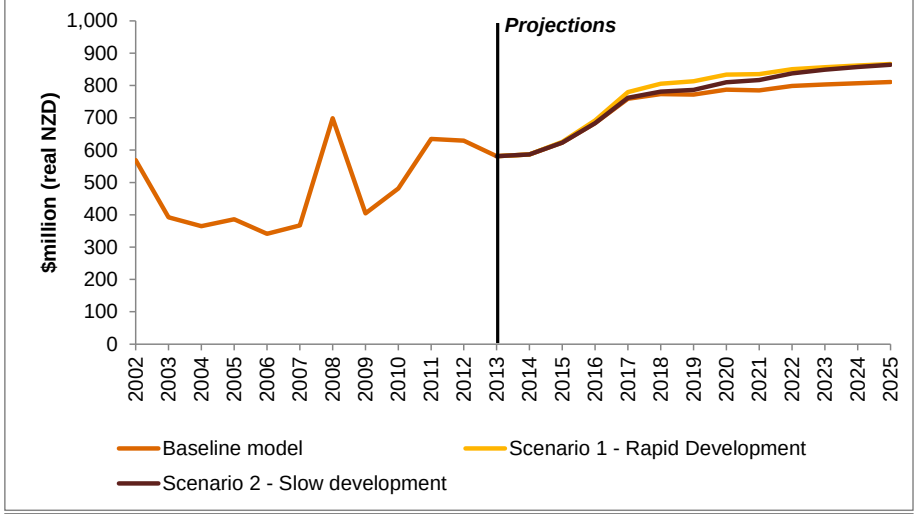
Table 67: National outputs in table format: Horticulture industry

Horticulture Model Results	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Horticulture																									
ALL VALUES ARE IN REAL TERMS																									
Baseline model																									
Gross Output	2,828.6	2,976.6	3,160.9	3,260.1	3,069.6	2,842.4	3,177.5	3,205.5	3,507.3	3,308.6	3,253.6	3,325.8	3,203.9	3,351.4	3,522.6	3,889.7	3,967.9	4,047.3	4,127.9	4,209.8	4,292.8	4,377.1	4,462.6	4,549.4	4,637.4
Value added	1,196.1	1,280.5	1,397.5	1,391.1	1,177.2	1,077.2	1,256.7	1,202.6	1,193.4	1,130.0	1,111.2	1,135.9	1,094.2	1,144.6	1,203.1	1,328.4	1,355.2	1,382.3	1,409.8	1,437.8	1,466.1	1,494.9	1,524.1	1,553.7	1,583.8
Employment	48,094.9	47,532.6	43,892.9	46,702.7	44,073.9	41,346.2	42,652.1	44,017.9	43,841.8	41,003.8	40,874.9	39,262.4	38,160.4	37,025.0	35,856.4	34,654.5	33,419.3	32,150.8	30,849.1	29,514.0	28,145.7	26,744.1	25,309.2	23,841.1	22,339.6
Investment	264.5	338.4	311.7	281.7	300.7	316.3	333.2	470.0	417.7	227.9	324.5	331.7	319.5	334.2	351.3	387.9	395.7	403.6	411.7	419.8	428.1	436.5	445.0	453.7	462.5
Scenario 1 - Rapid development																									
Additional economic impact																									
Gross Output													0.0	0.0	4.0	17.2	37.5	58.7	75.7	87.1	94.1	98.5	101.6	104.3	106.8
Value added													0.0	0.0	1.4	5.9	12.8	20.0	25.9	29.8	32.1	33.6	34.7	35.6	36.5
Employment													0.0	0.0	40.9	153.2	315.5	466.2	565.9	611.0	616.9	601.9	576.4	546.7	514.6
Investment - one-off associated with development													0.0	4.5	13.4	20.1	20.1	15.1	9.1	4.5	2.0	0.7	0.3	0.1	0.0
Investment - ongoing associated with operations													0.0	0.0	0.4	1.7	3.7	5.9	7.6	8.7	9.4	9.8	10.1	10.4	10.7
Total (baseline + ML injection)																									
Gross Output													3,203.9	3,351.4	3,526.7	3,906.9	4,005.4	4,106.0	4,203.7	4,296.9	4,386.9	4,475.6	4,564.3	4,653.7	4,744.3
Value added													1,094.2	1,144.6	1,204.4	1,334.3	1,368.0	1,402.3	1,435.7	1,467.5	1,498.3	1,528.5	1,558.8	1,589.4	1,620.3
Employment													38,160.4	37,025.0	35,897.3	34,807.7	33,734.8	32,617.0	31,414.9	30,125.0	28,762.6	27,346.0	25,885.7	24,387.7	22,854.3
Investment													319.5	338.7	365.1	409.7	419.6	424.6	428.3	433.0	439.5	447.1	455.4	464.2	473.1
Scenario 2 - Slow development																									
Additional economic impact																									
Gross Output													0.0	0.0	0.1	1.2	4.4	10.9	21.0	33.7	46.9	59.0	68.7	76.0	81.3
Value added													0.0	0.0	0.0	0.4	1.5	3.7	7.2	11.5	16.0	20.1	23.5	26.0	27.8
Employment													0.0	0.0	1.3	10.4	36.7	86.3	157.0	236.1	307.7	360.2	389.6	398.4	391.4
Investment - one-off associated with development													0.0	0.2	1.2	3.6	7.1	10.8	12.9	12.9	11.1	8.3	5.5	3.3	1.8
Investment - ongoing associated with operations													0.0	0.0	0.0	0.1	0.4	1.1	2.1	3.4	4.7	5.9	6.9	7.6	8.1
Total (baseline + ML injection)																									
Gross Output													3,203.9	3,351.4	3,522.8	3,890.9	3,972.3	4,058.2	4,148.9	4,243.5	4,339.8	4,436.1	4,531.3	4,625.4	4,718.7
Value added													1,094.2	1,144.6	1,203.1	1,328.8	1,356.6	1,386.0	1,417.0	1,449.3	1,482.1	1,515.0	1,547.6	1,579.7	1,611.6
Employment													38,160.4	37,025.0	35,857.7	34,664.9	33,456.0	32,237.1	31,006.1	29,750.1	28,453.4	27,104.4	25,698.8	24,239.4	22,731.1
Investment													319.5	334.4	352.5	391.6	403.3	415.5	426.7	436.1	443.9	450.7	457.4	464.6	472.4

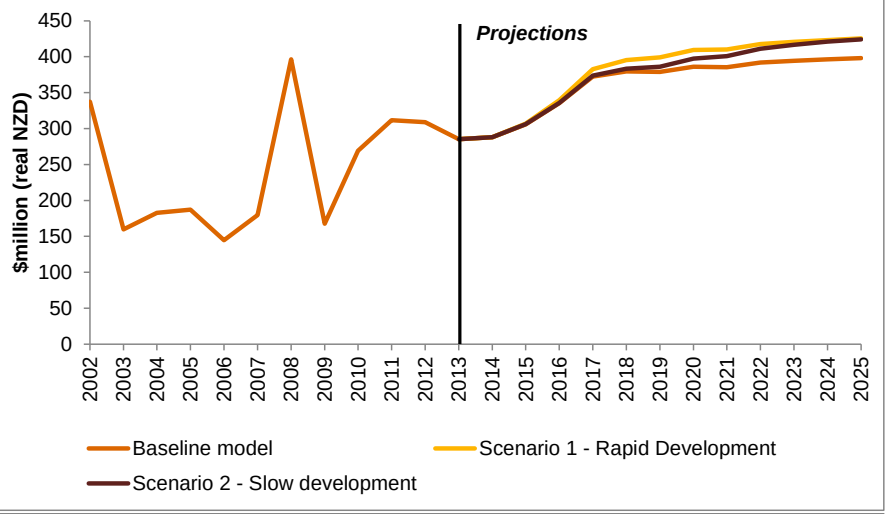
Chart outputs for all regions and industries

Northland

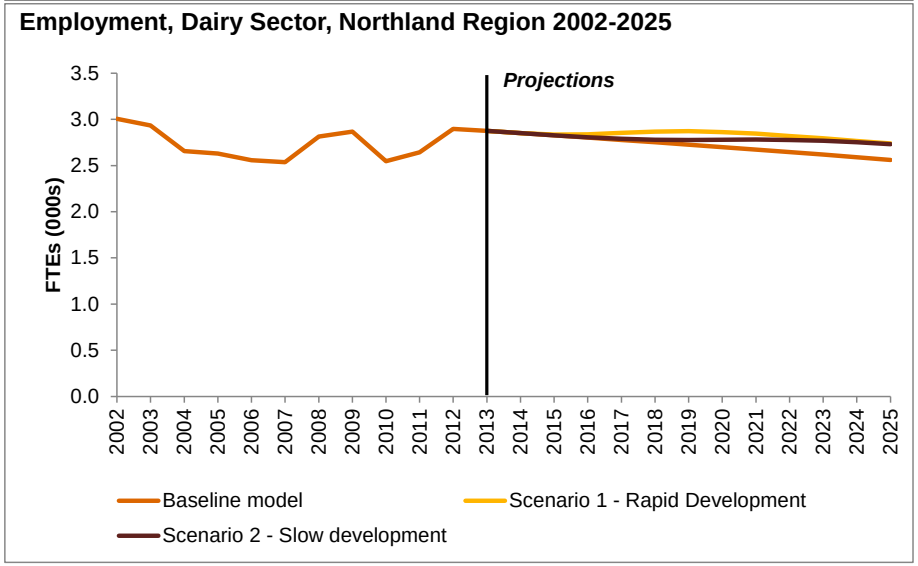
Gross Output, Dairy Sector, Northland Region 2002-2025



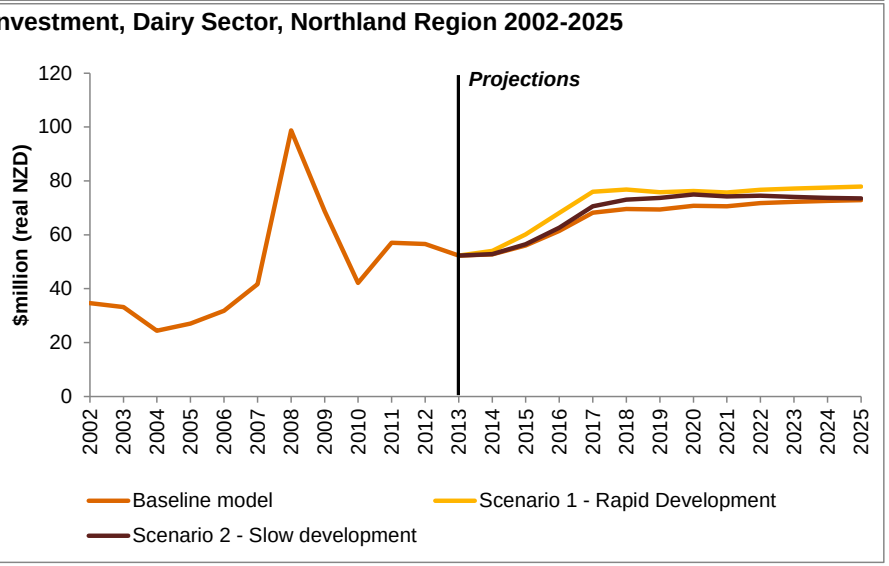
Value Added, Dairy Sector, Northland Region 2002-2025



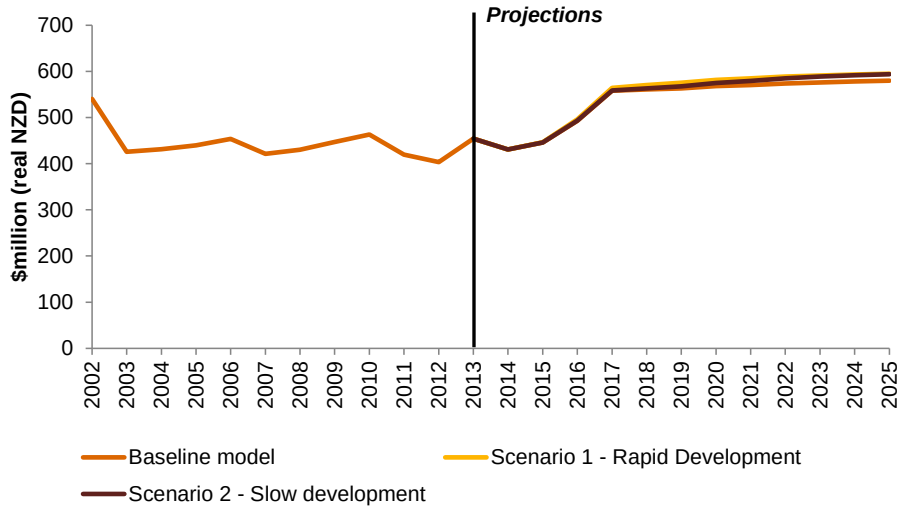
Employment, Dairy Sector, Northland Region 2002-2025



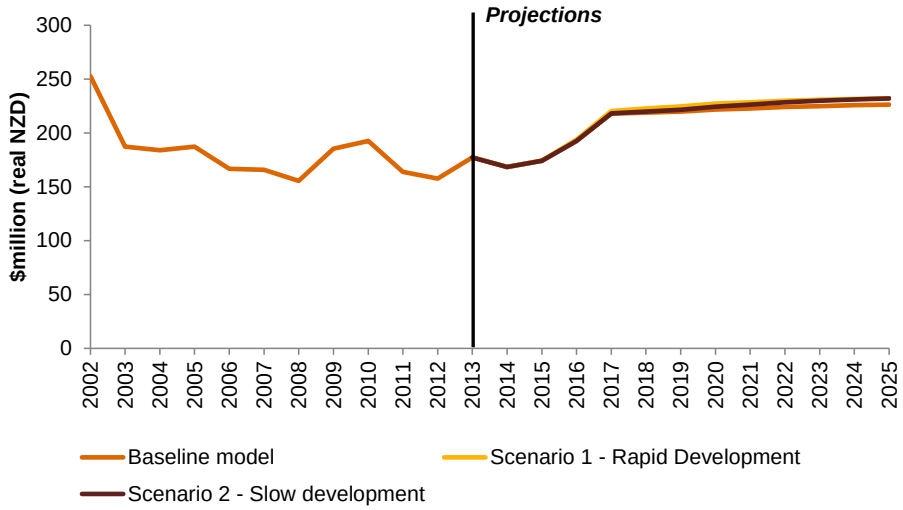
Investment, Dairy Sector, Northland Region 2002-2025



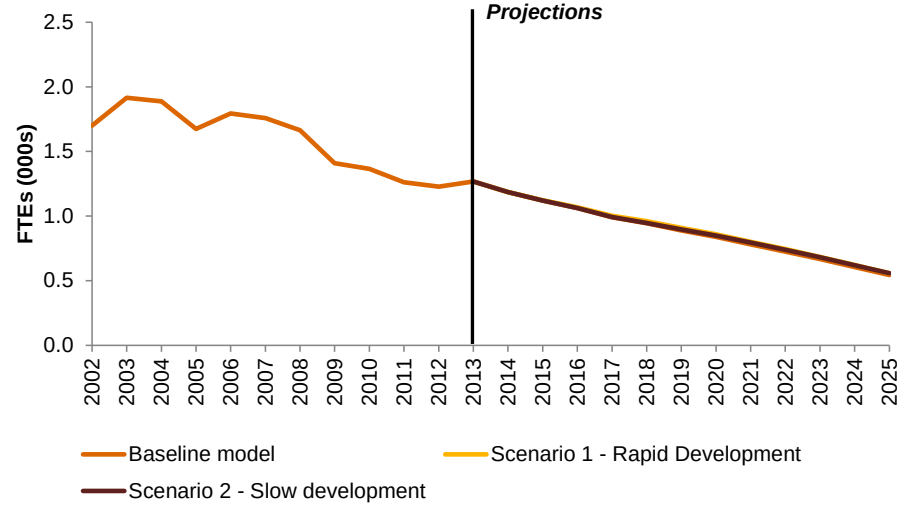
Gross Output, Sheep & Beef Sector, Northland Region 2002-2025



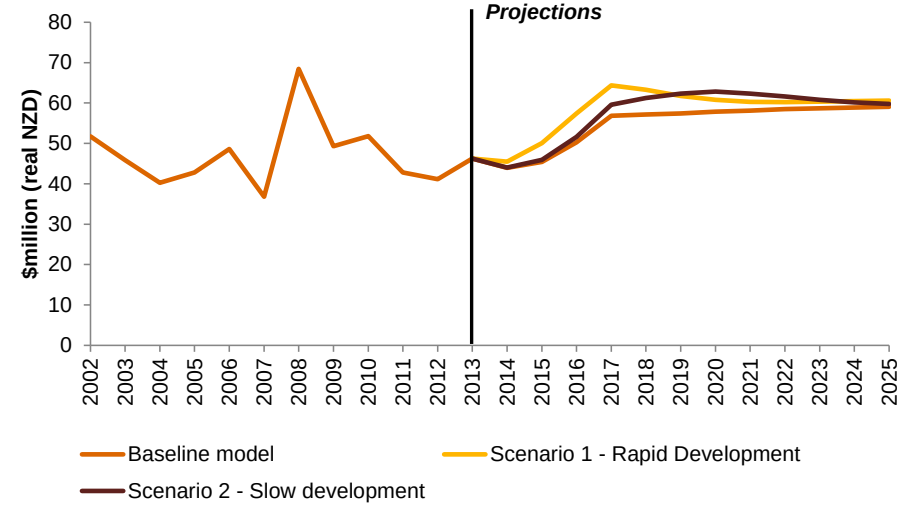
Value Added, Sheep & Beef Sector, Northland Region 2002-2025



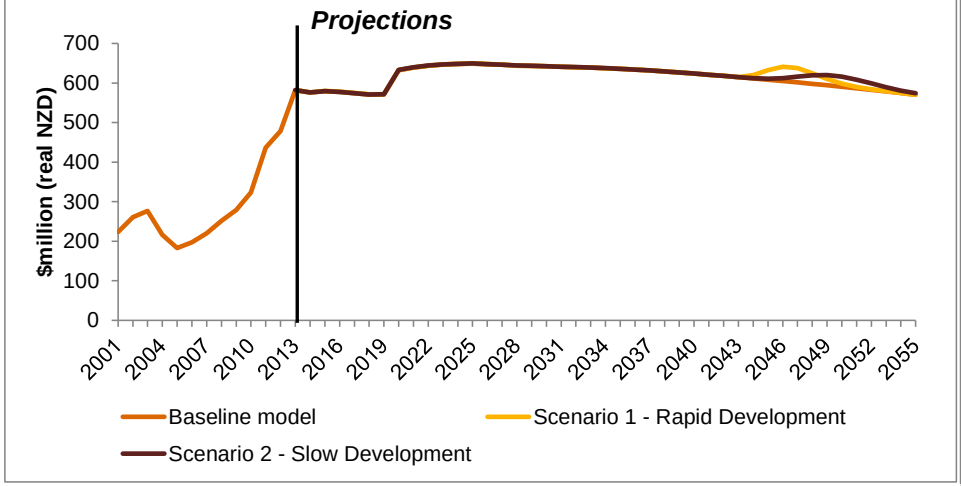
Employment, Sheep & Beef Sector, Northland Region 2002-2025



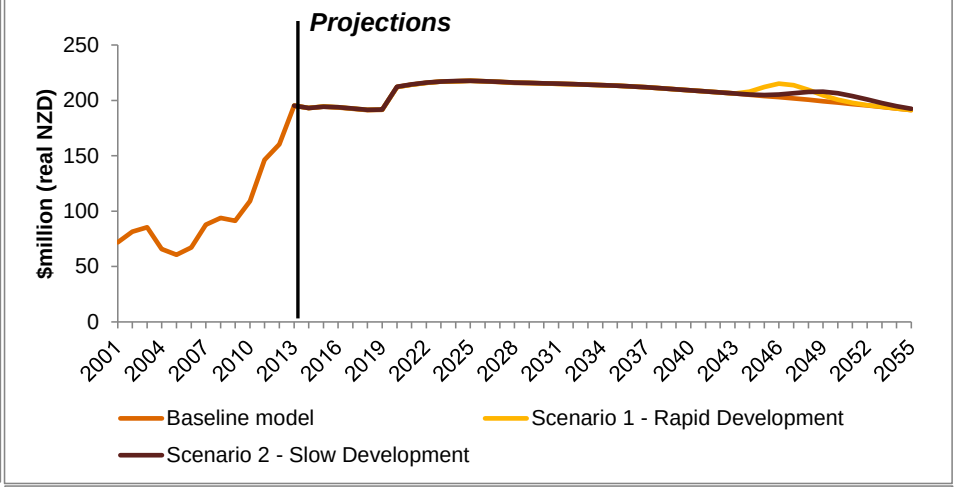
Investment, Sheep & Beef Sector, Northland Region 2002-2025



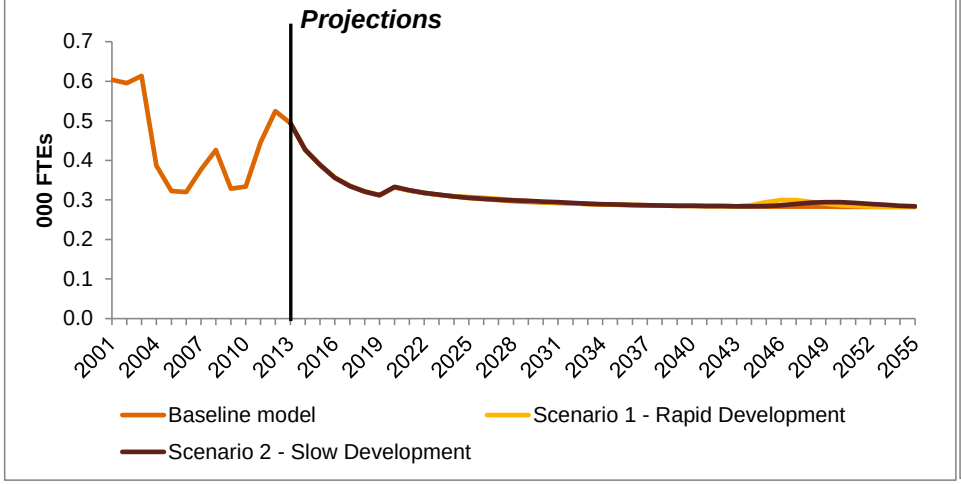
Gross Output, Forestry Sector, Northland Region 2001-2055



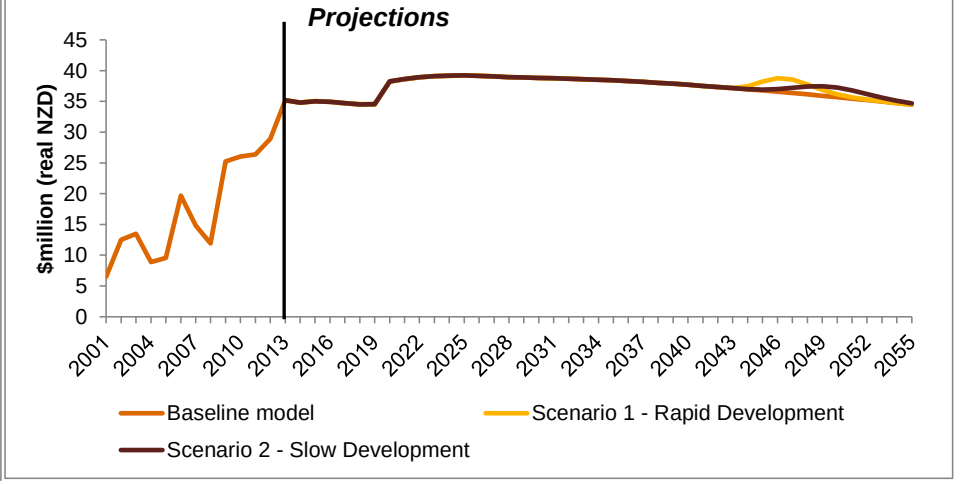
Value added, Forestry Sector, Northland Region 2001-2055



Employment, Forestry Sector, Northland Region 2001-2055

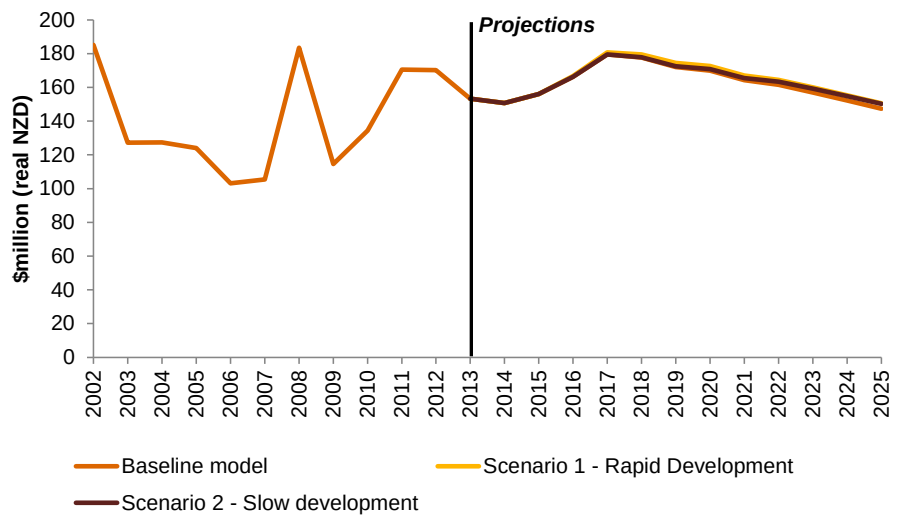


Investment, Forestry Sector, Northland Region 2001-2055

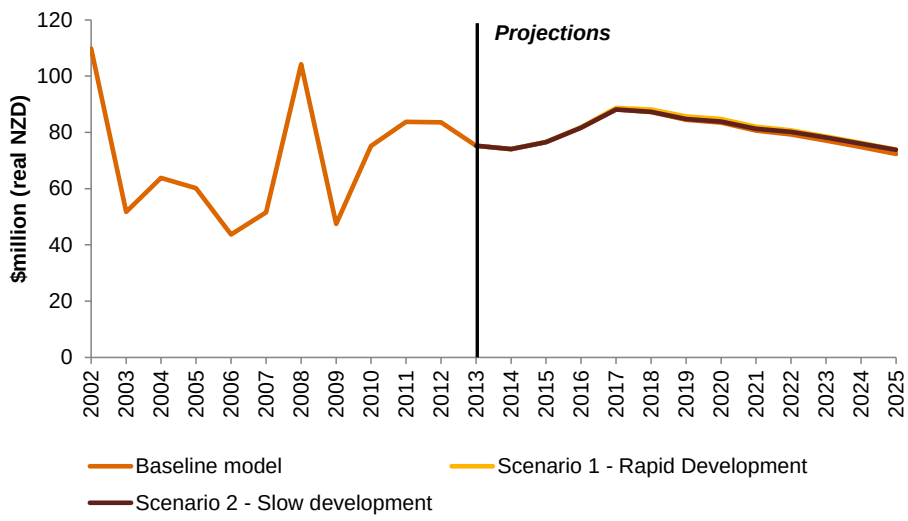


Auckland

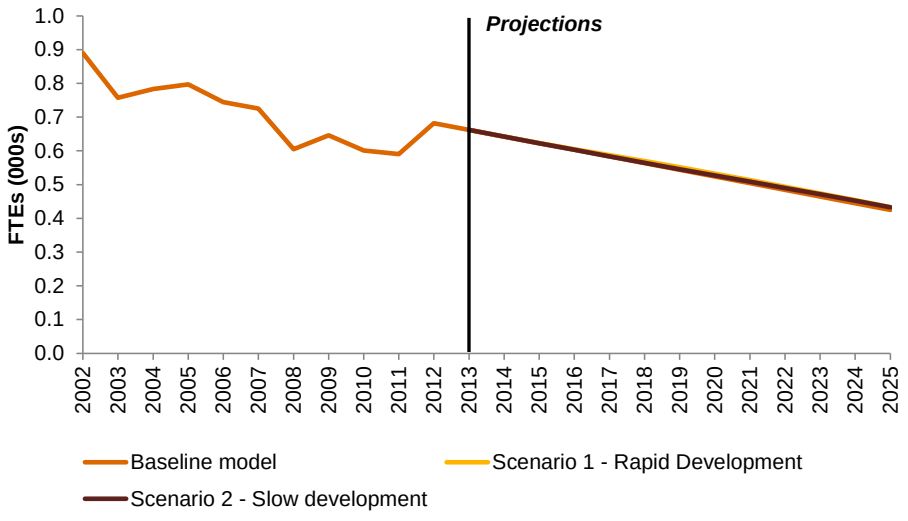
Gross Output, Dairy Sector, Auckland Region 2002-2025



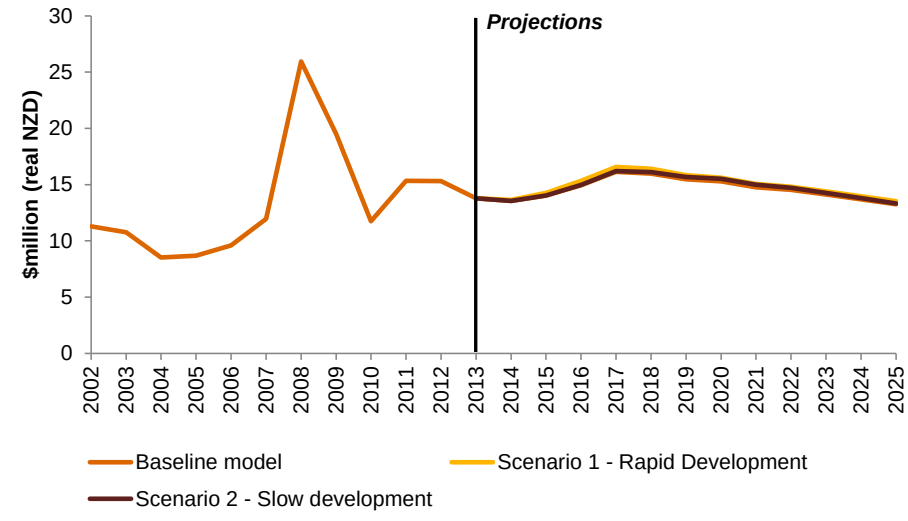
Value Added, Dairy Sector, Auckland Region 2002-2025

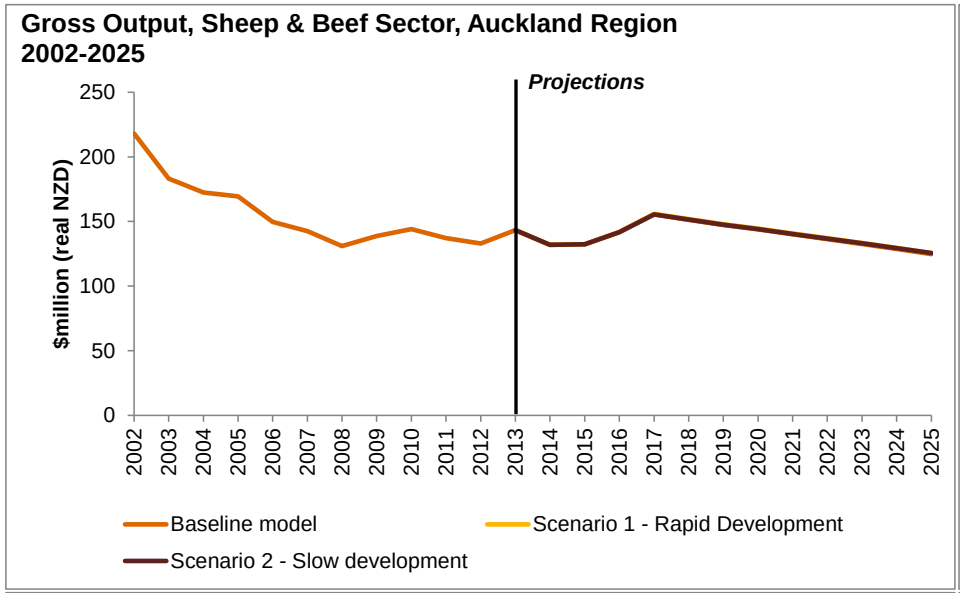


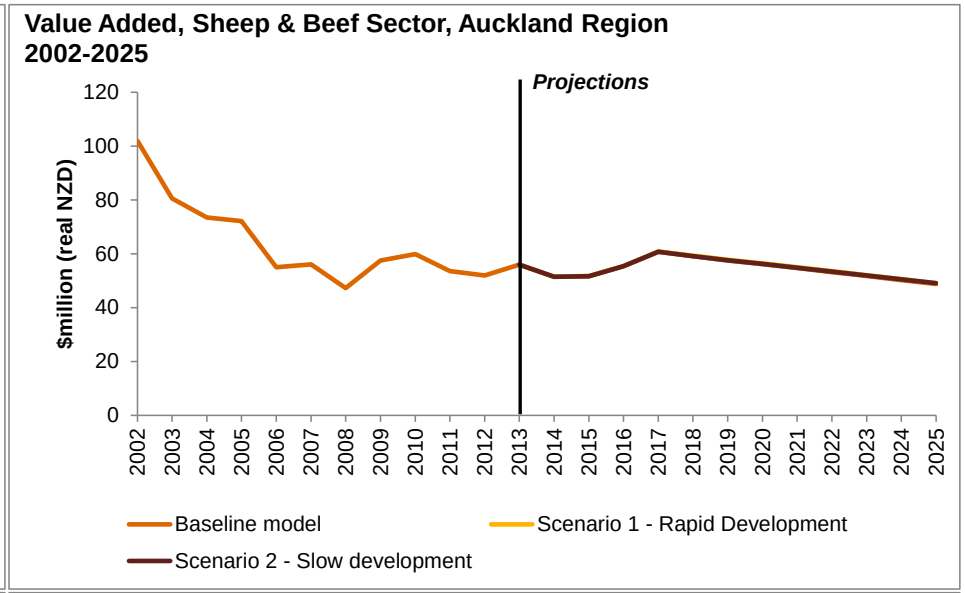
Employment, Dairy Sector, Auckland Region 2002-2025

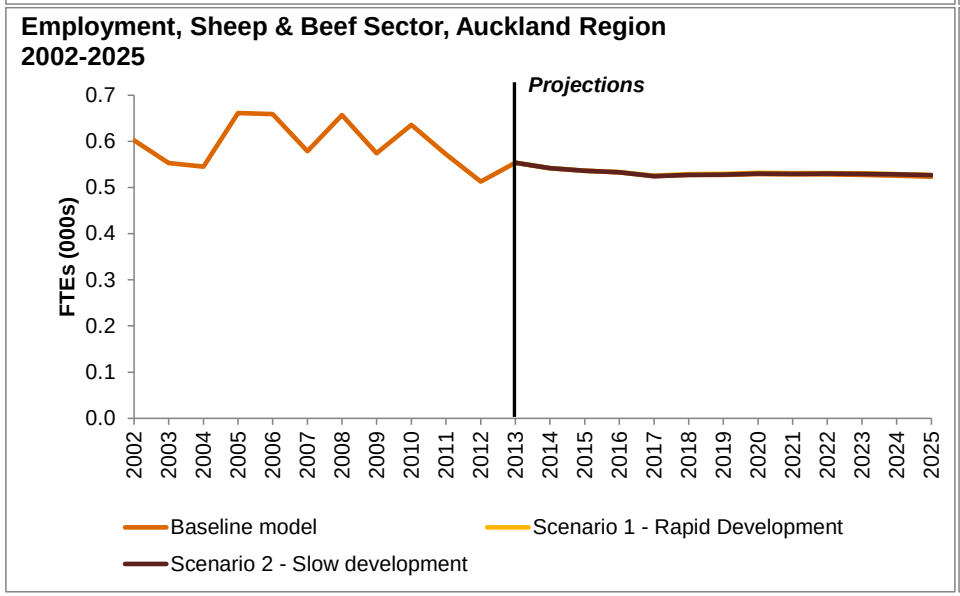


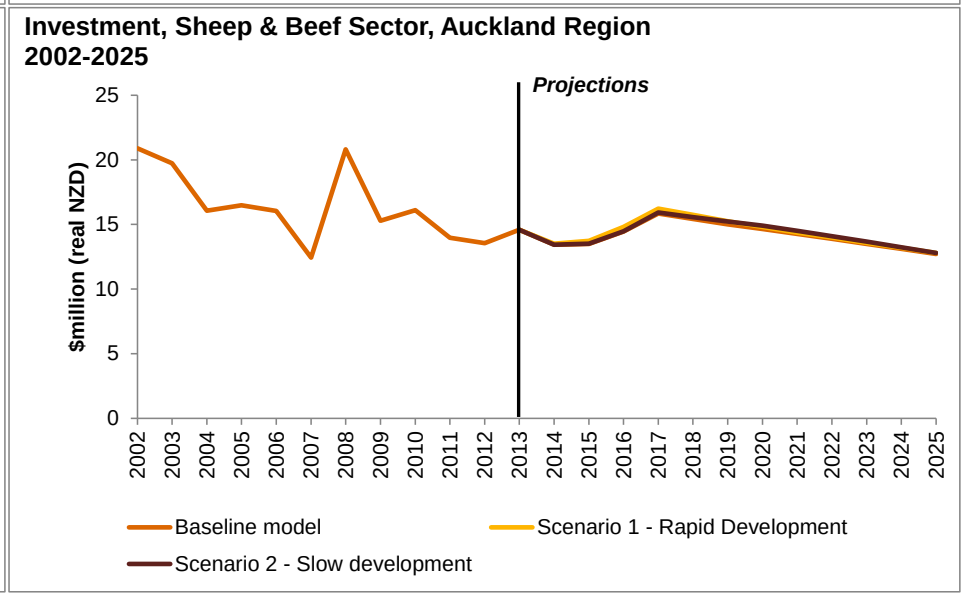
Investment, Dairy Sector, Auckland Region 2002-2025



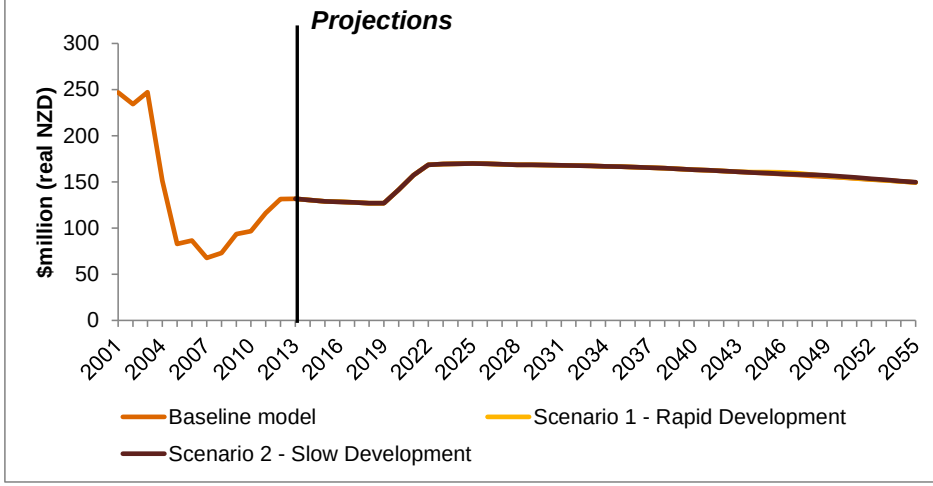

Gross Output, Sheep & Beef Sector, Auckland Region
2002-2025
Projections
$million (real NZD)
250
200
150
100
50
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Value Added, Sheep & Beef Sector, Auckland Region
2002-2025
Projections
$million (real NZD)
120
100
80
60
40
20
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

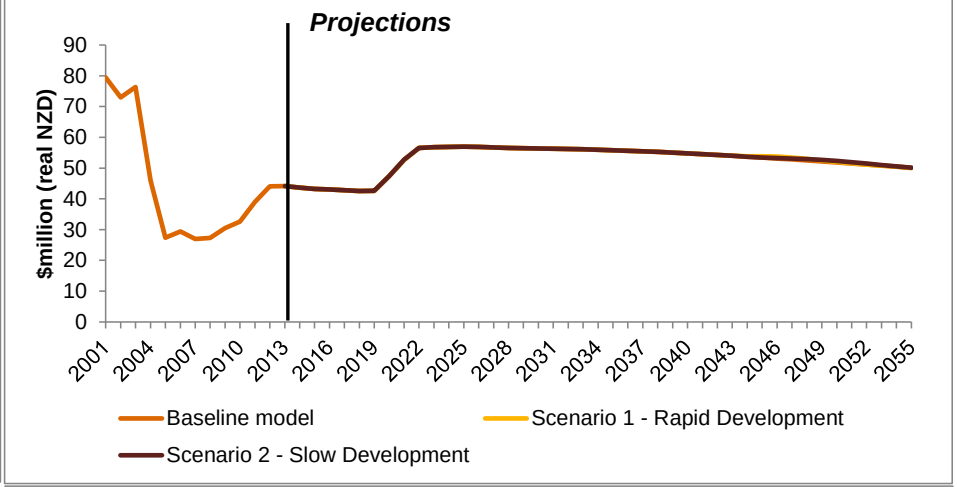

Employment, Sheep & Beef Sector, Auckland Region
2002-2025
Projections
FTEs (000s)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, Auckland Region
2002-2025
Projections
$million (real NZD)
25
20
15
10
5
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

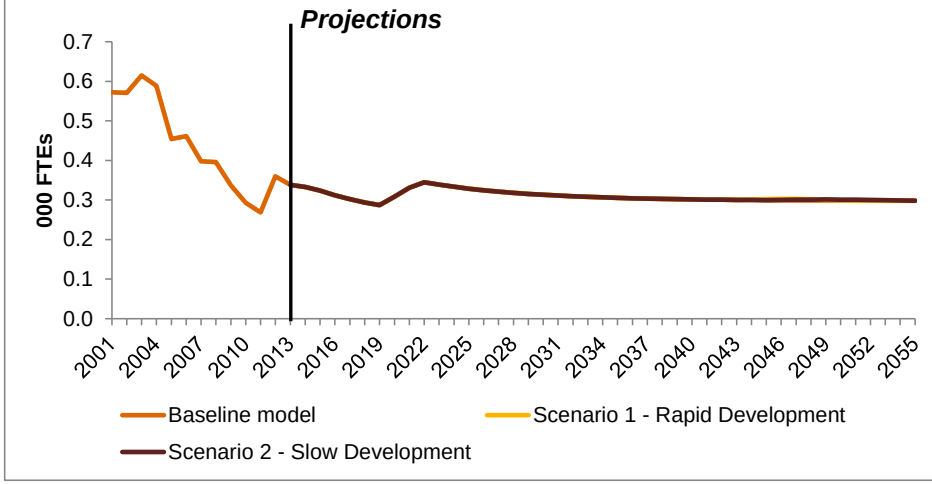
Gross Output, Forestry Sector, Auckland Region 2001-2055



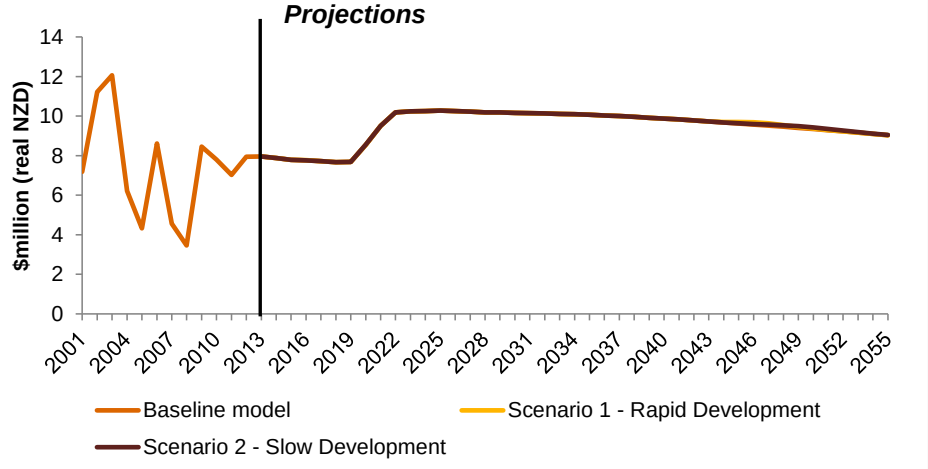
Value added, Forestry Sector, Auckland Region 2001-2055



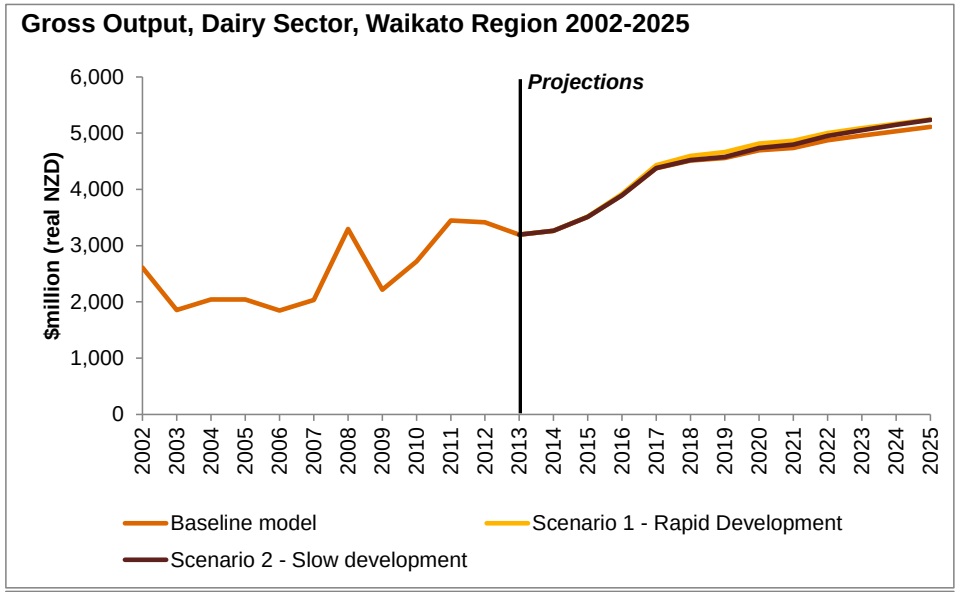
Employment, Forestry Sector, Auckland Region 2001-2055

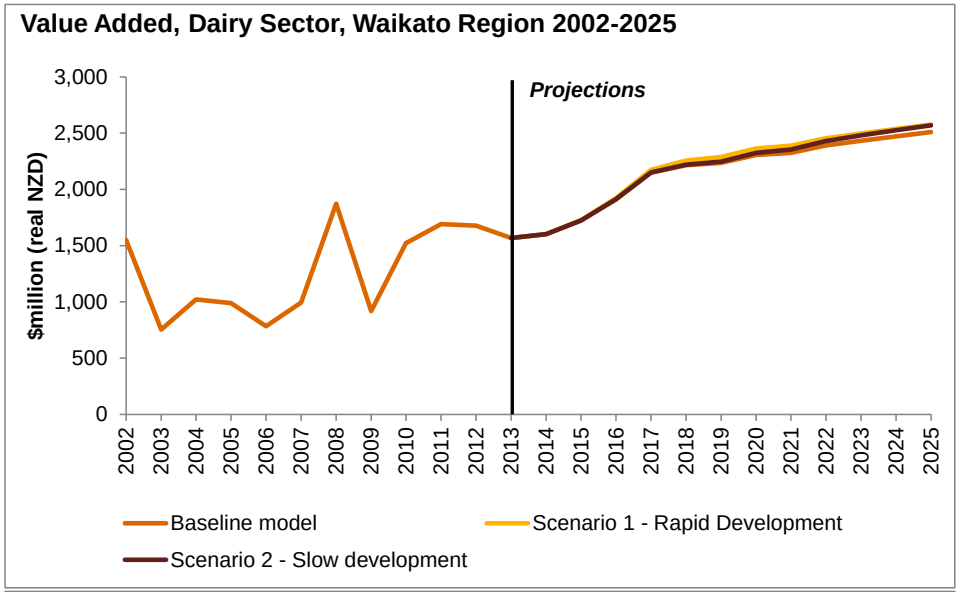


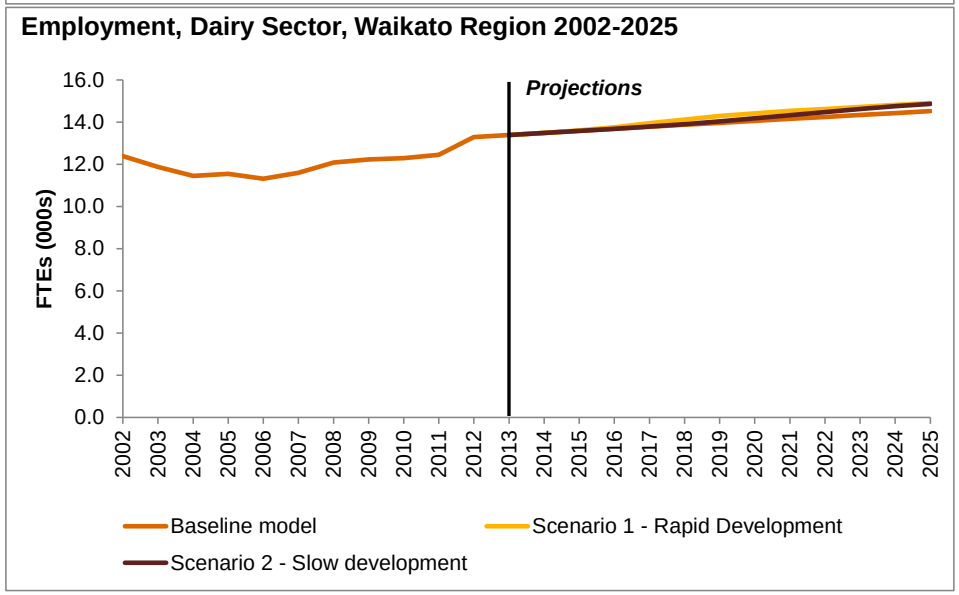
Investment, Forestry Sector, Auckland Region 2001-2055

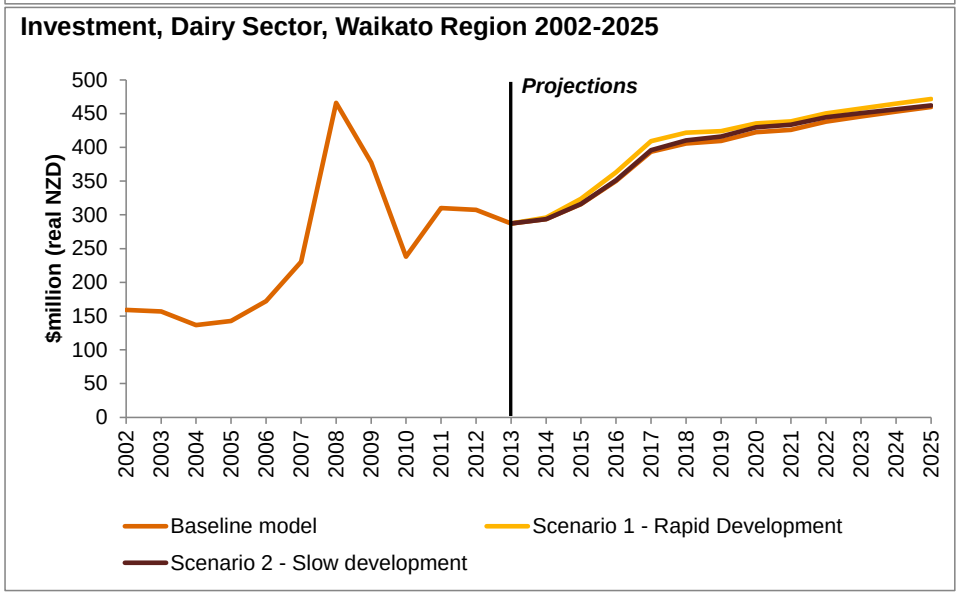


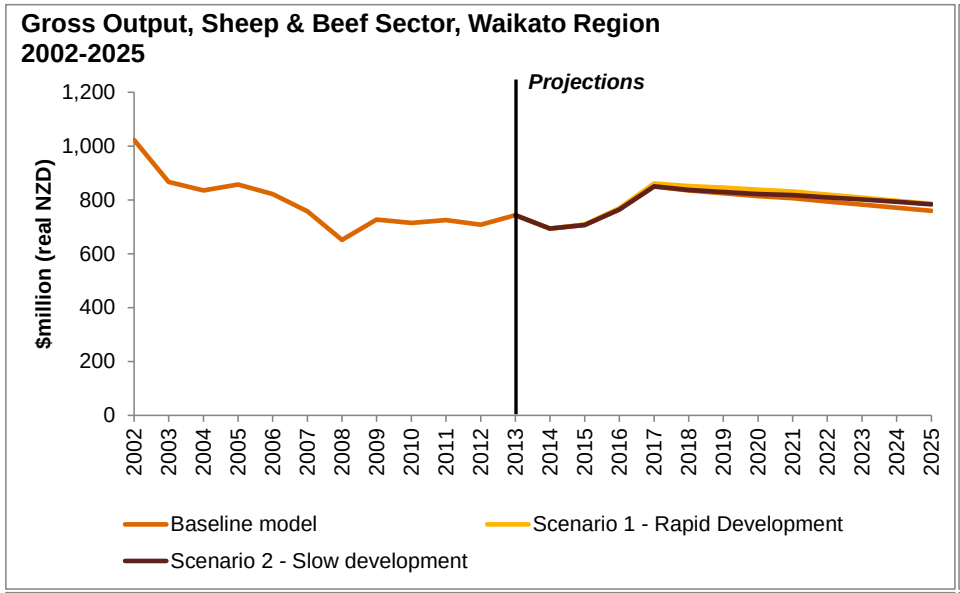
Waikato

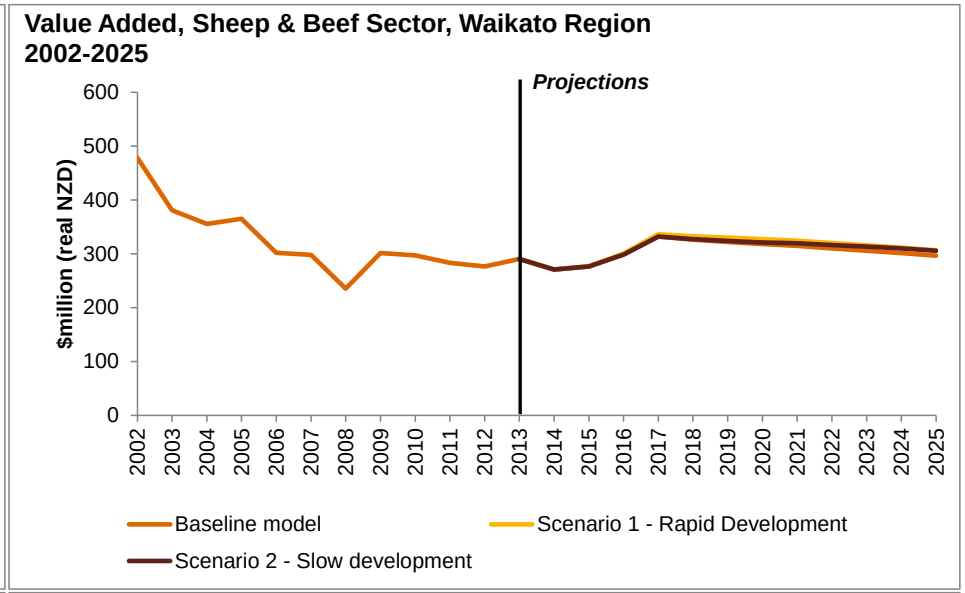

Gross Output, Dairy Sector, Waikato Region 2002-2025
$million (real NZD)
6,000
5,000
4,000
3,000
2,000
1,000
0
Projections
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

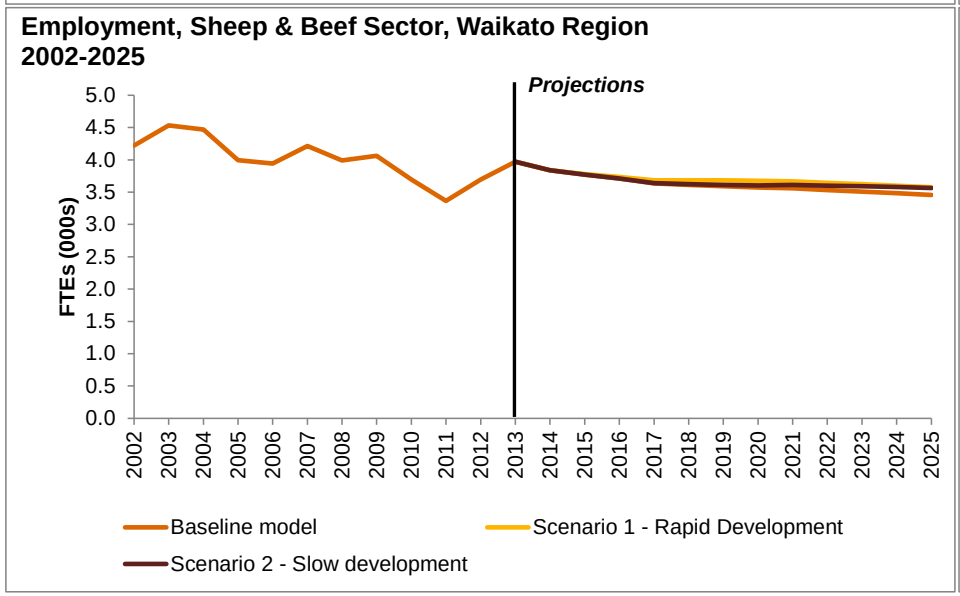

Value Added, Dairy Sector, Waikato Region 2002-2025
$million (real NZD)
3,000
2,500
2,000
1,500
1,000
500
0
Projections
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

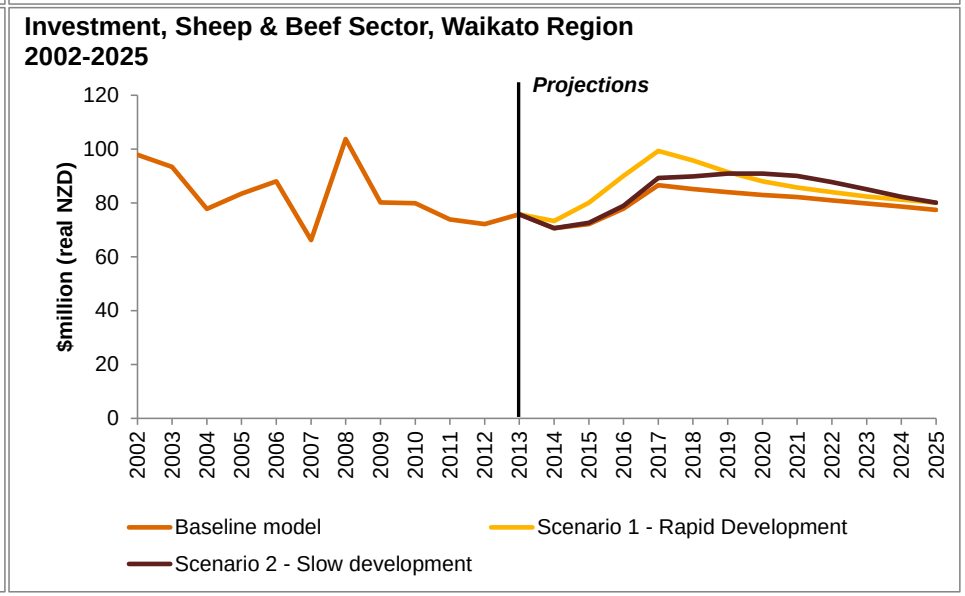

Employment, Dairy Sector, Waikato Region 2002-2025
FTEs (000s)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Projections
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Dairy Sector, Waikato Region 2002-2025
$million (real NZD)
500
450
400
350
300
250
200
150
100
50
0
Projections
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

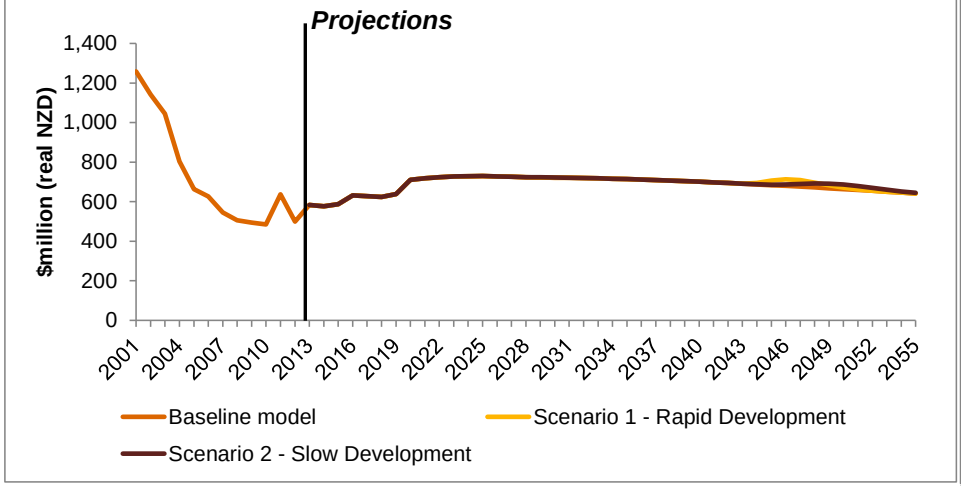

Gross Output, Sheep & Beef Sector, Waikato Region
2002-2025
Projections
$million (real NZD)
1,200
1,000
800
600
400
200
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Value Added, Sheep & Beef Sector, Waikato Region
2002-2025
Projections
$million (real NZD)
600
500
400
300
200
100
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

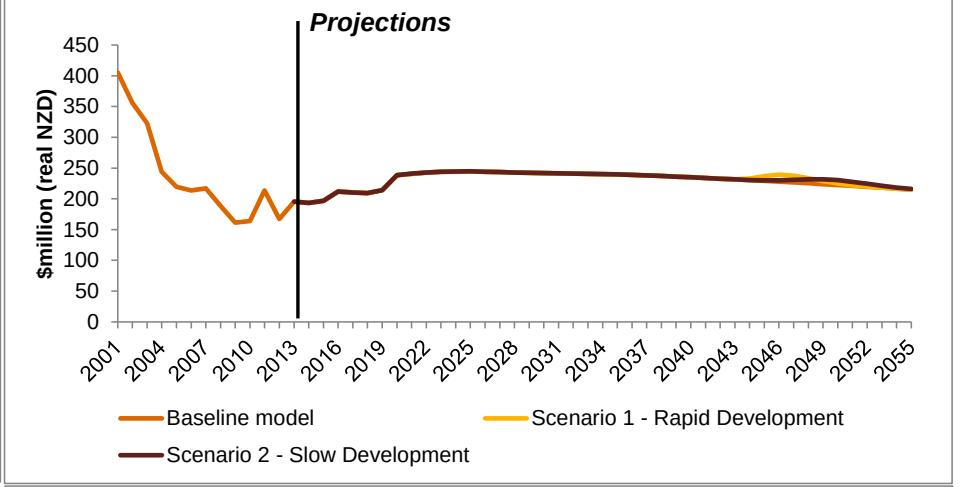

Employment, Sheep & Beef Sector, Waikato Region
2002-2025
Projections
FTEs (000s)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, Waikato Region
2002-2025
Projections
$million (real NZD)
120
100
80
60
40
20
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

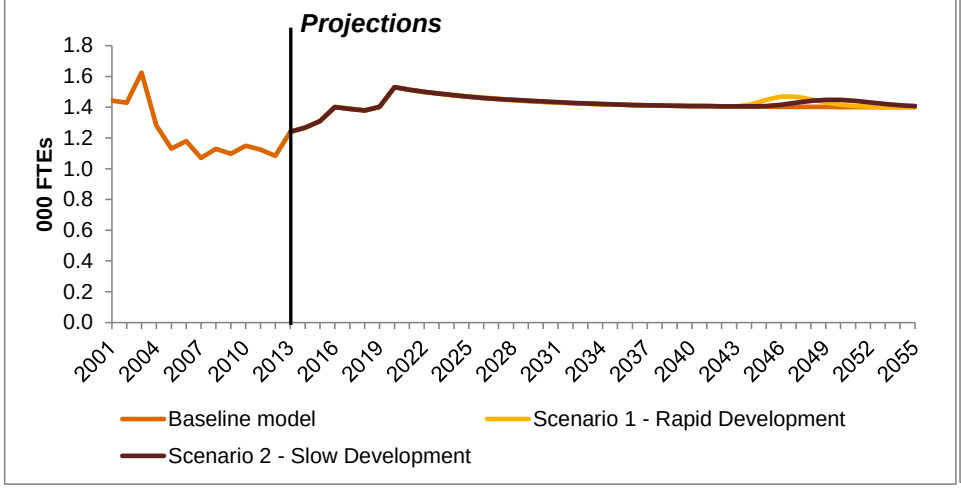
Gross Output, Forestry Sector, Waikato Region 2001-2055



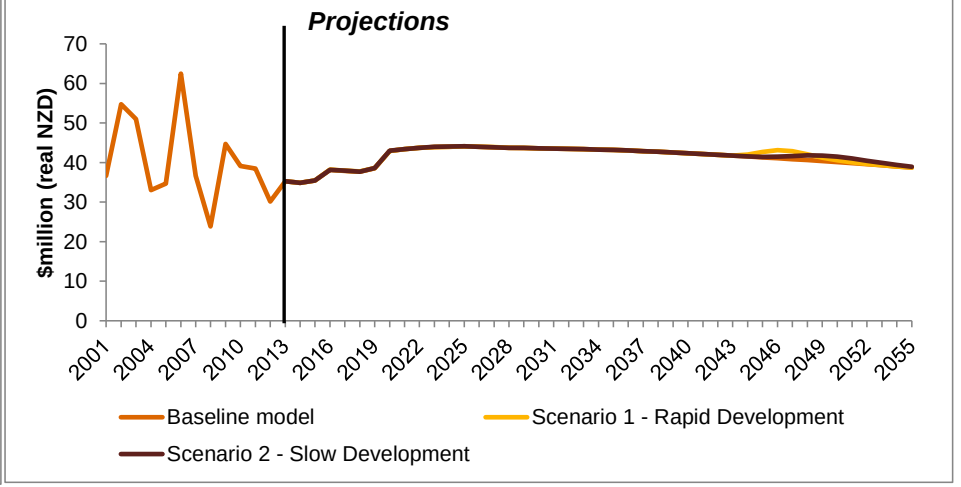
Value added, Forestry Sector, Waikato Region 2001-2055



Employment, Forestry Sector, Waikato Region 2001-2055

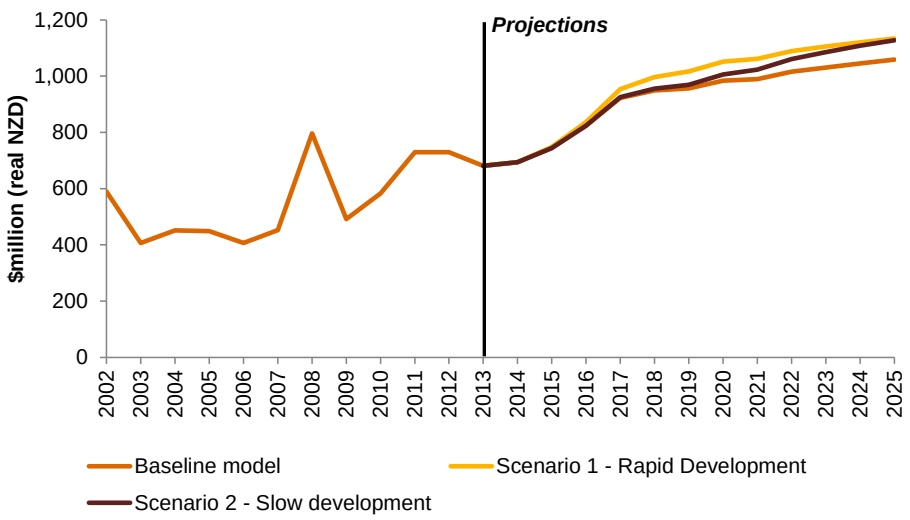


Investment, Forestry Sector, Waikato Region 2001-2055

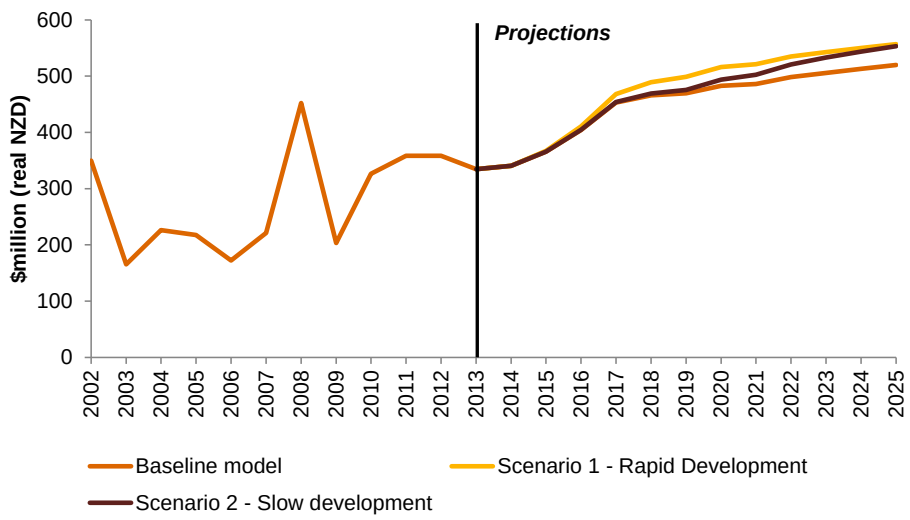


Bay of Plenty

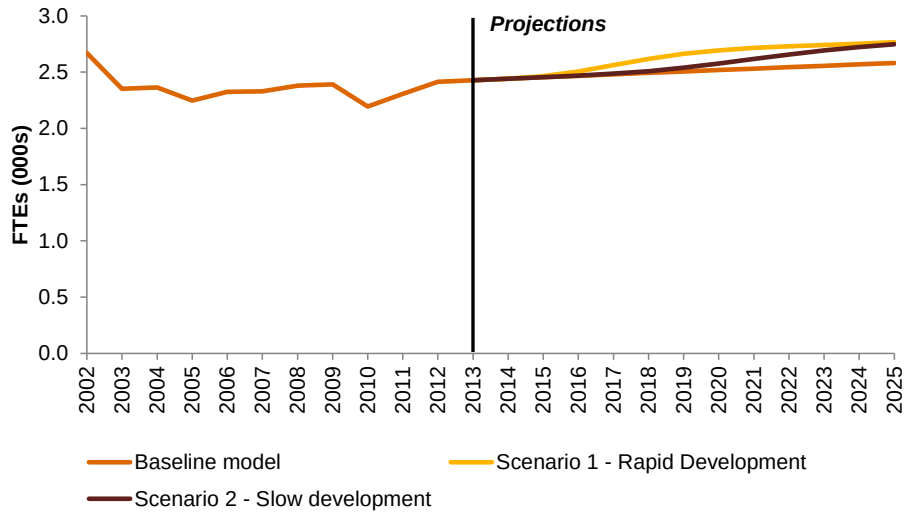
Gross Output, Dairy Sector, Bay of Plenty Region 2002-2025



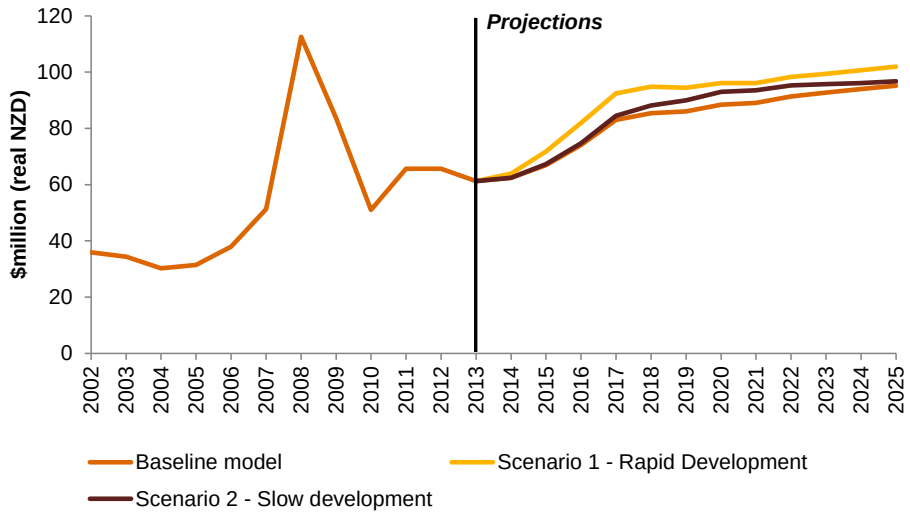
Value Added, Dairy Sector, Bay of Plenty Region 2002-2025



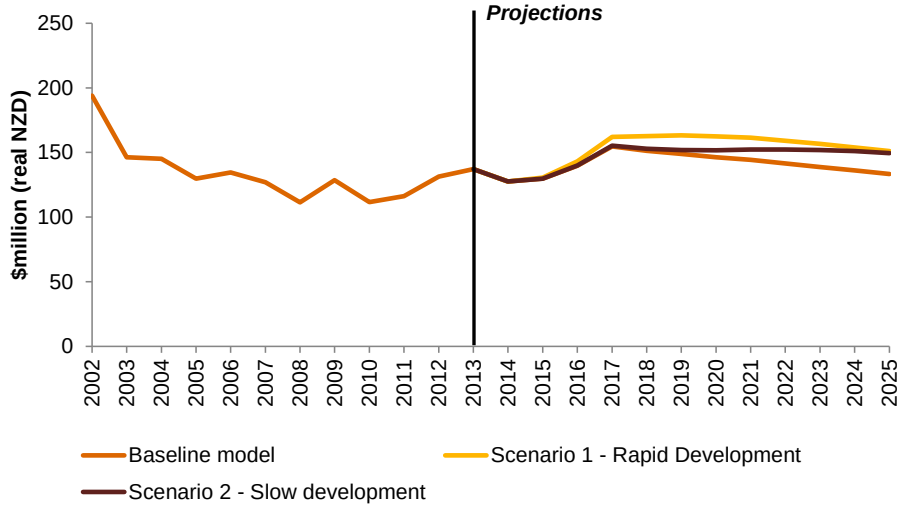
Employment, Dairy Sector, Bay of Plenty Region 2002-2025



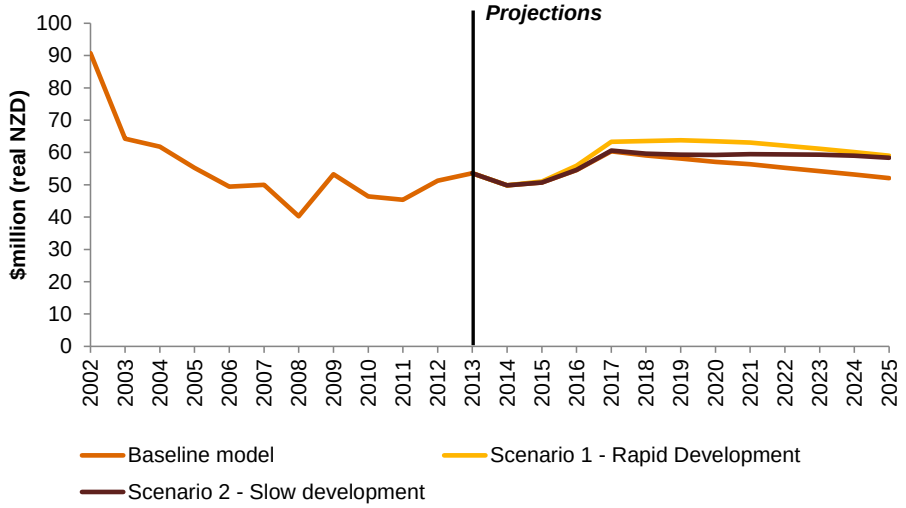
Investment, Dairy Sector, Bay of Plenty Region 2002-2025



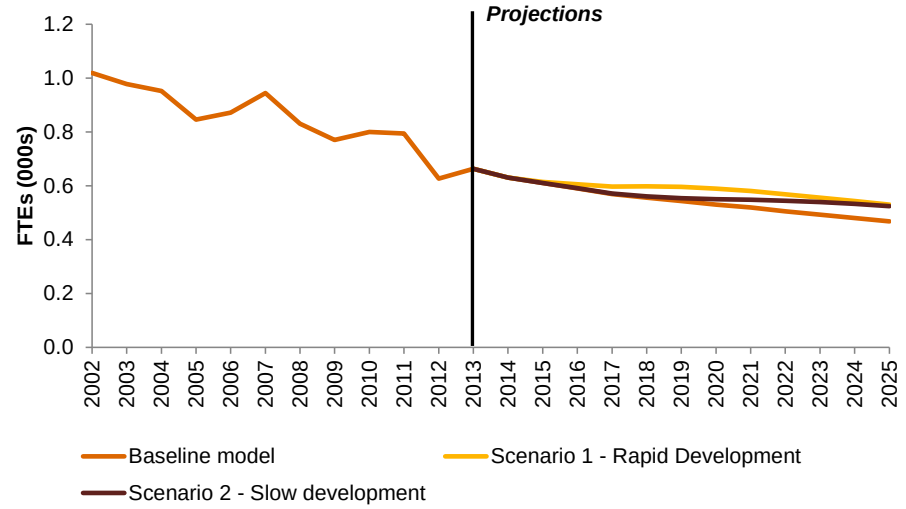
Gross Output, Sheep & Beef Sector, Bay of Plenty Region 2002-2025



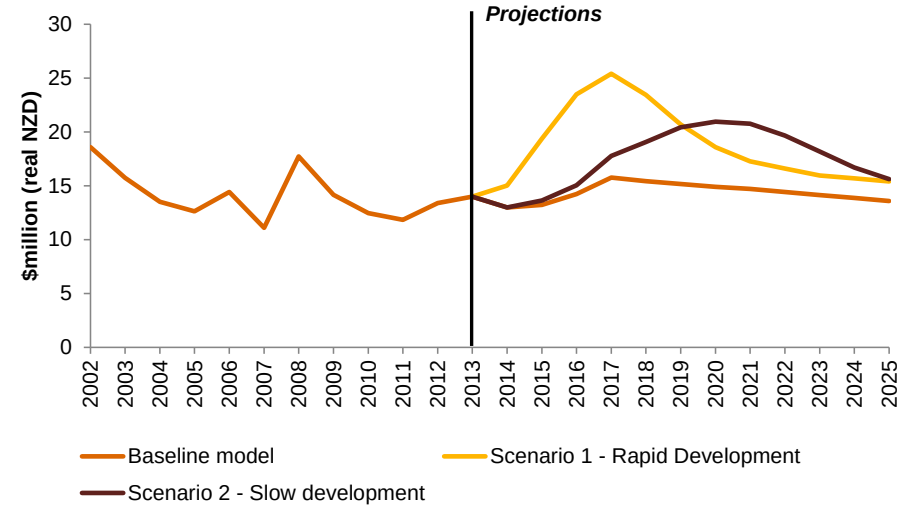
Value Added, Sheep & Beef Sector, Bay of Plenty Region 2002-2025

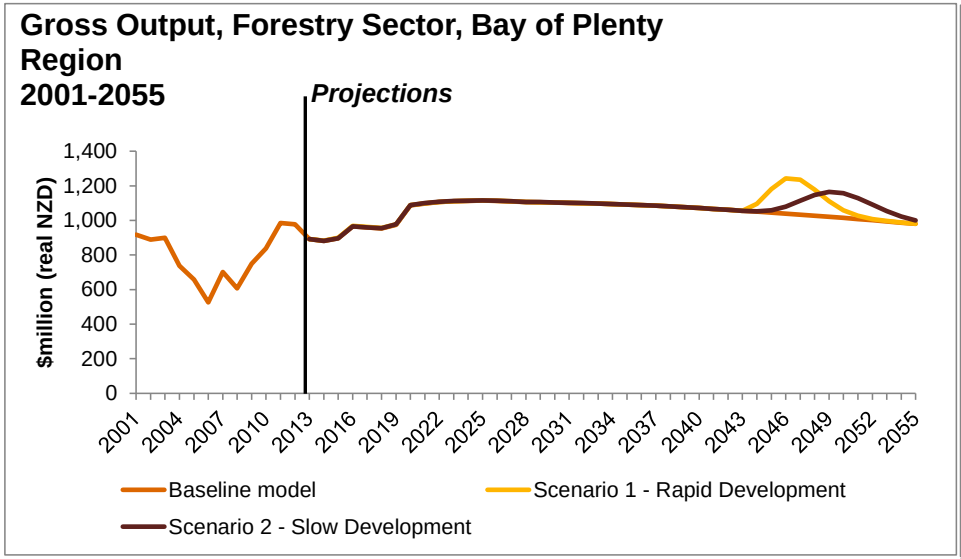


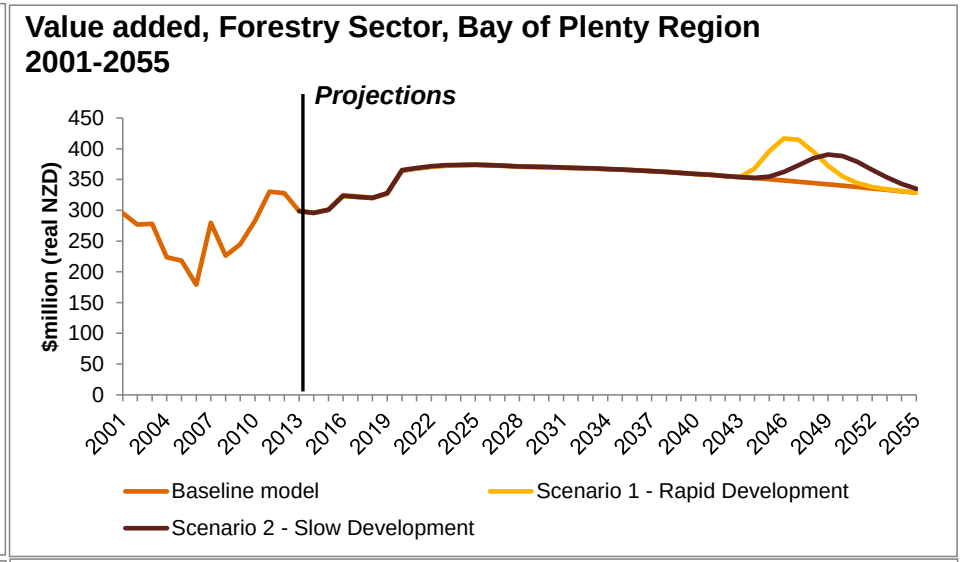
Employment, Sheep & Beef Sector, Bay of Plenty Region 2002-2025

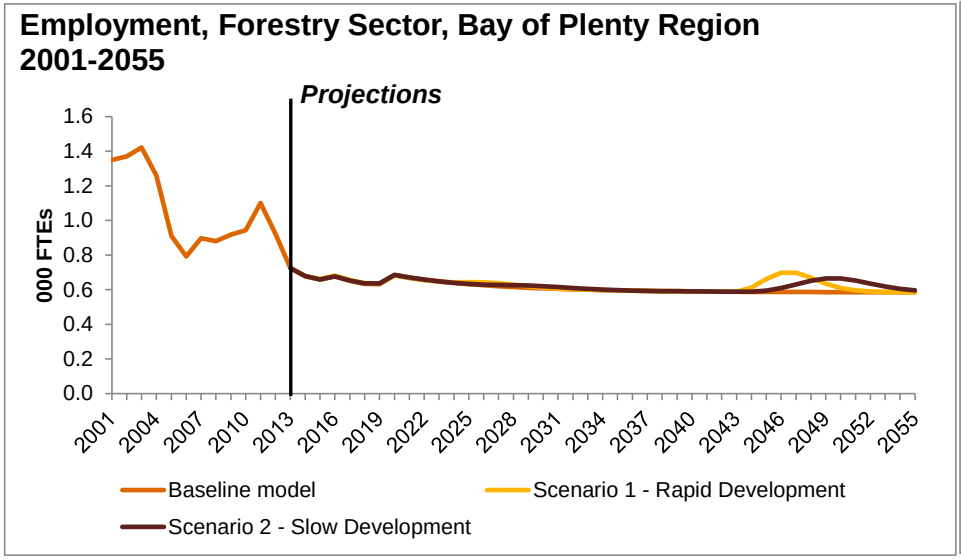


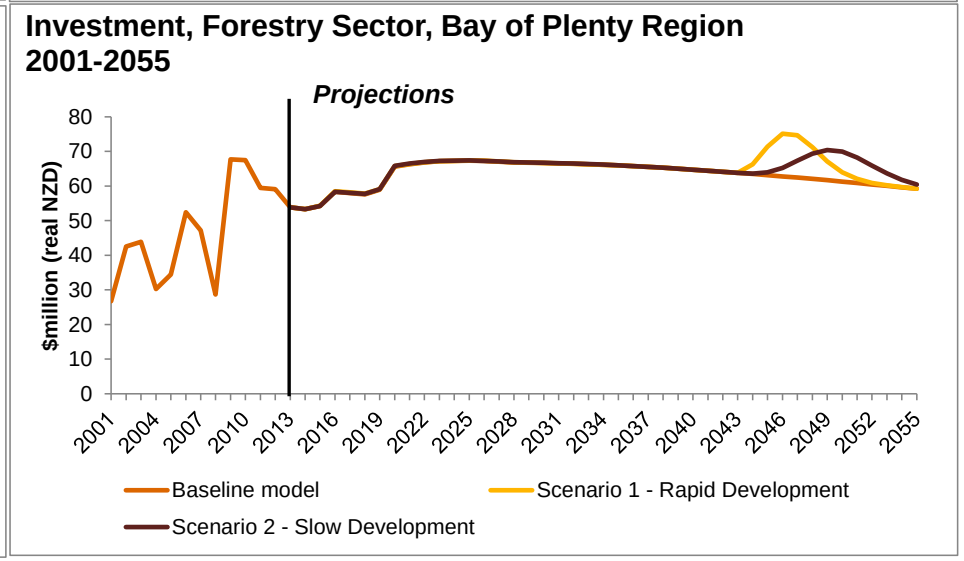
Investment, Sheep & Beef Sector, Bay of Plenty Region 2002-2025



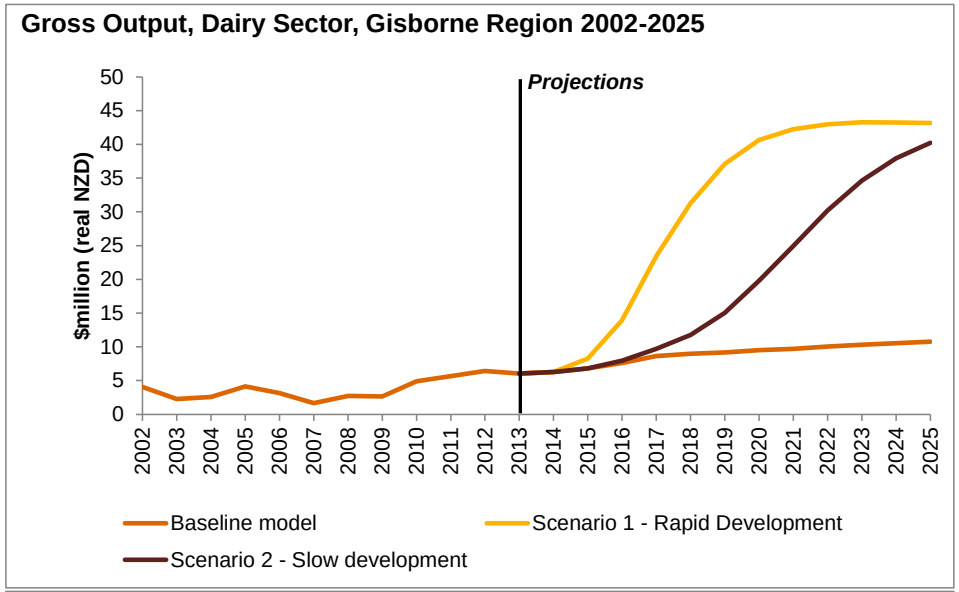

Gross Output, Forestry Sector, Bay of Plenty Region
2001-2055
Projections
$million (real NZD)
1,400
1,200
1,000
800
600
400
200
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

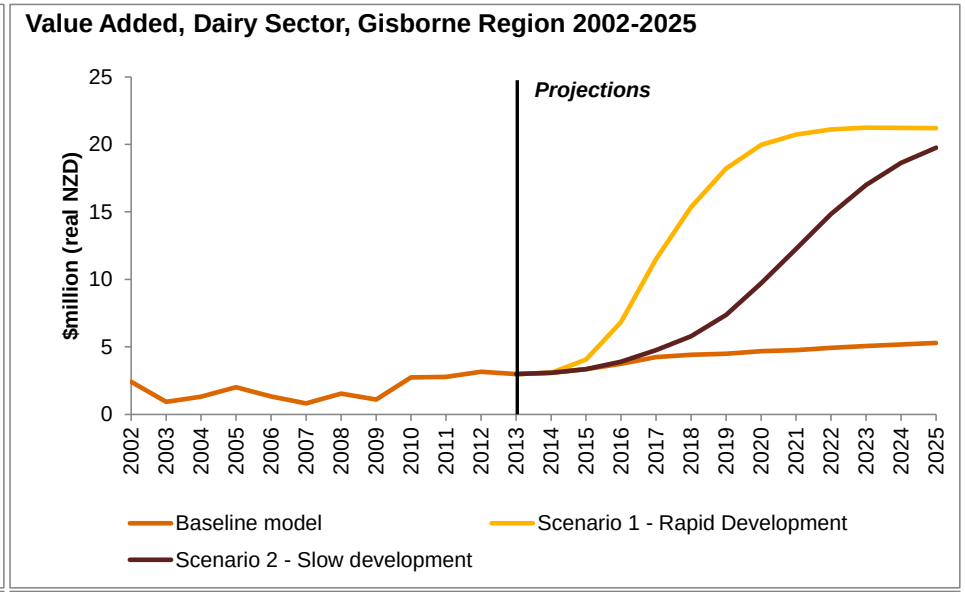

Value added, Forestry Sector, Bay of Plenty Region
2001-2055
Projections
$million (real NZD)
450
400
350
300
250
200
150
100
50
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

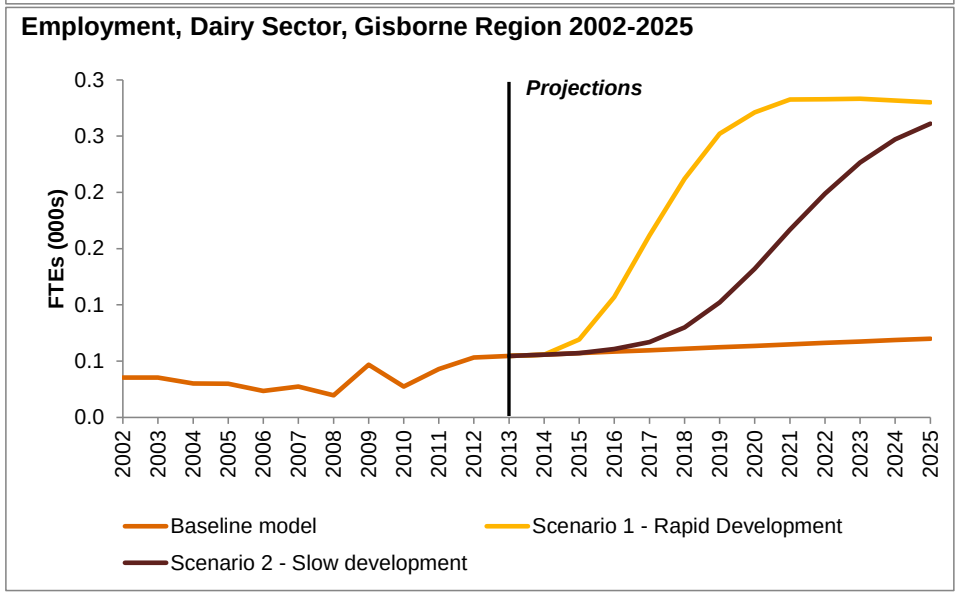

Employment, Forestry Sector, Bay of Plenty Region
2001-2055
Projections
000 FTEs
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

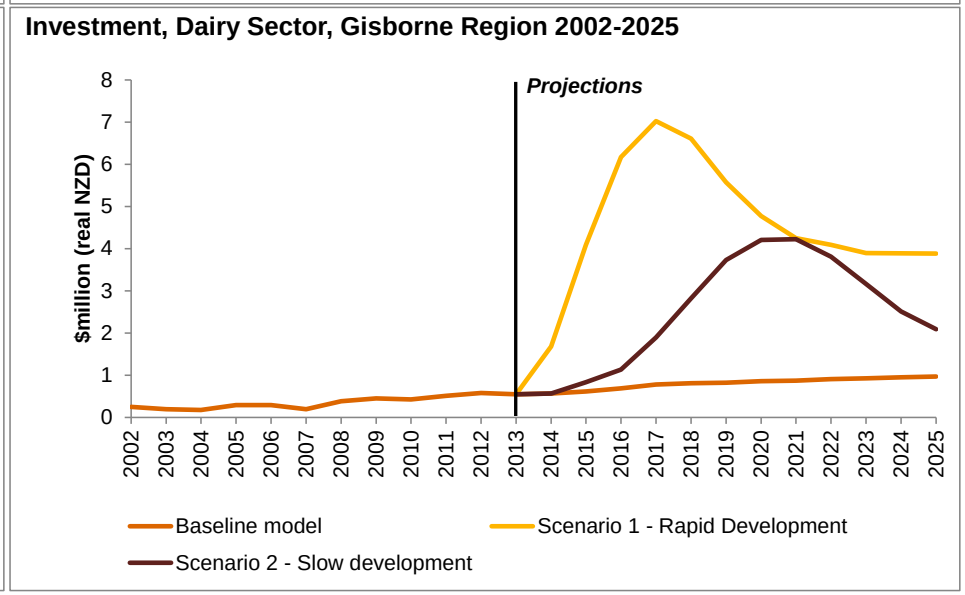

Investment, Forestry Sector, Bay of Plenty Region
2001-2055
Projections
$million (real NZD)
80
70
60
50
40
30
20
10
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

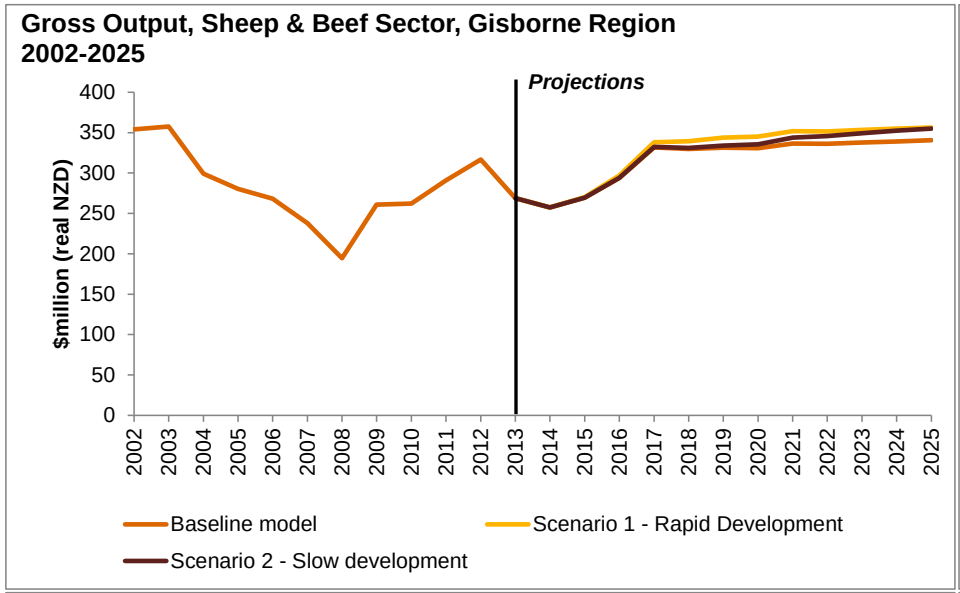
Gisborne

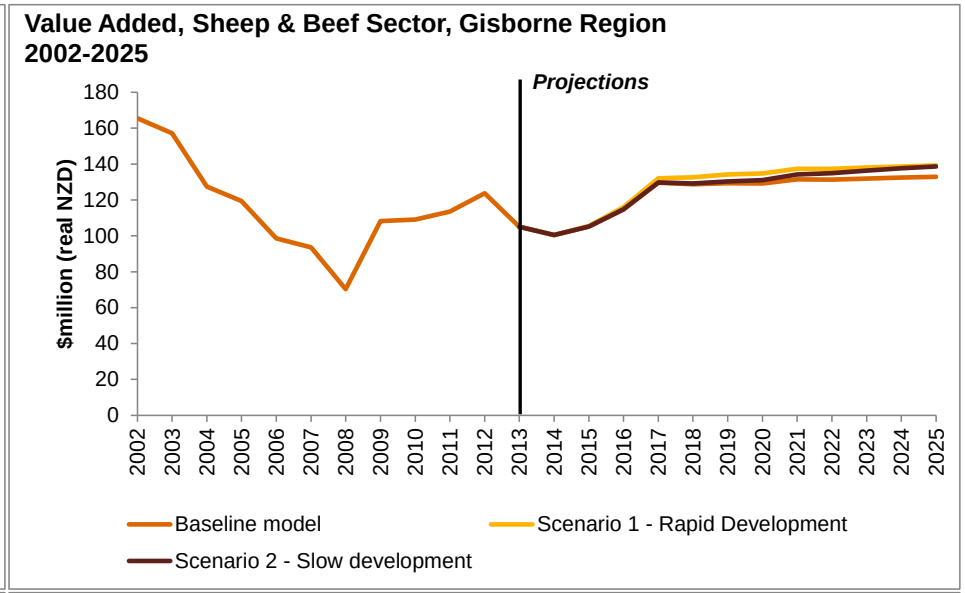

Gross Output, Dairy Sector, Gisborne Region 2002-2025
$million (real NZD)
Projections
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

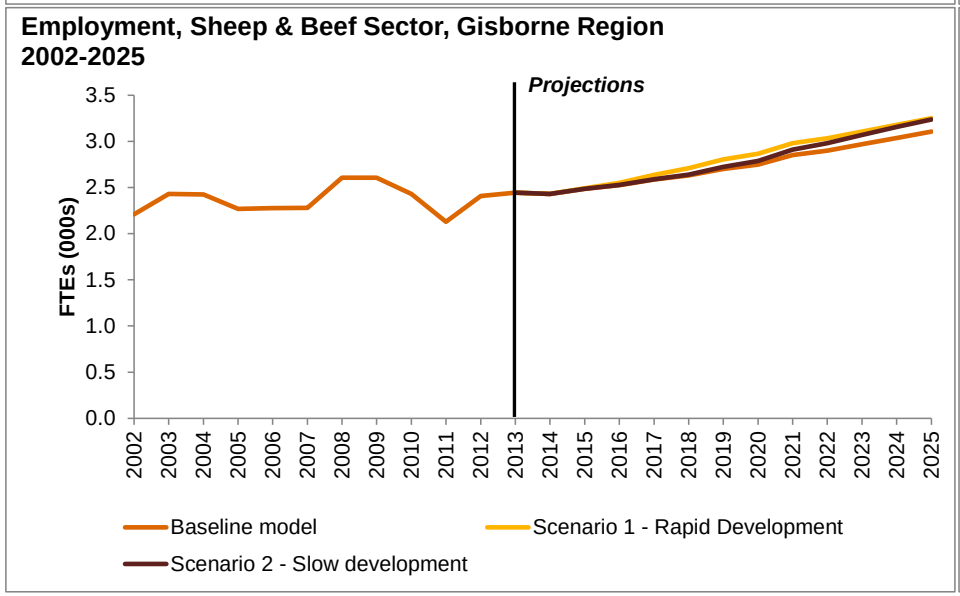

Value Added, Dairy Sector, Gisborne Region 2002-2025
$million (real NZD)
Projections
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

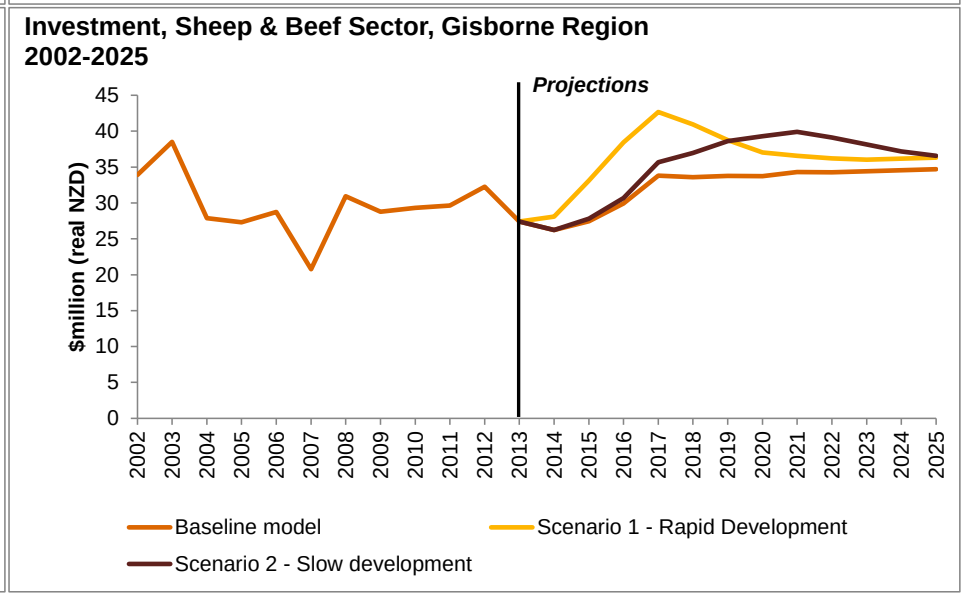

Employment, Dairy Sector, Gisborne Region 2002-2025
FTEs (000s)
Projections
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Dairy Sector, Gisborne Region 2002-2025
$million (real NZD)
Projections
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Gross Output, Sheep & Beef Sector, Gisborne Region
2002-2025
Projections
$million (real NZD)
400
350
300
250
200
150
100
50
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

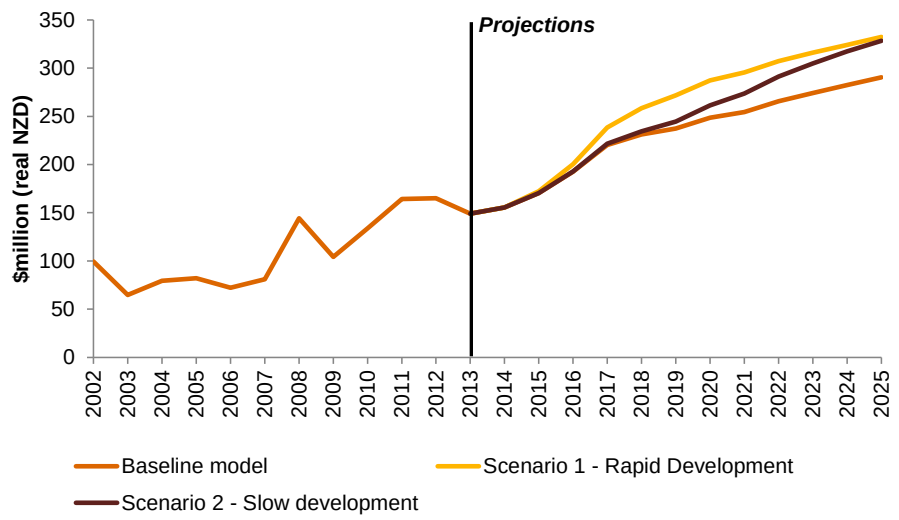

Value Added, Sheep & Beef Sector, Gisborne Region
2002-2025
Projections
$million (real NZD)
180
160
140
120
100
80
60
40
20
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Employment, Sheep & Beef Sector, Gisborne Region
2002-2025
Projections
FTEs (000s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

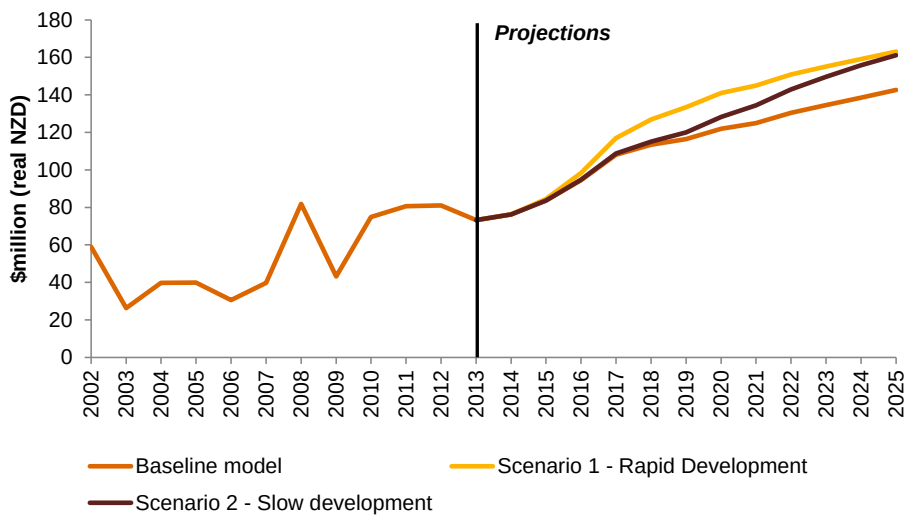

Investment, Sheep & Beef Sector, Gisborne Region
2002-2025
Projections
$million (real NZD)
45
40
35
30
25
20
15
10
5
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

Hawke's Bay

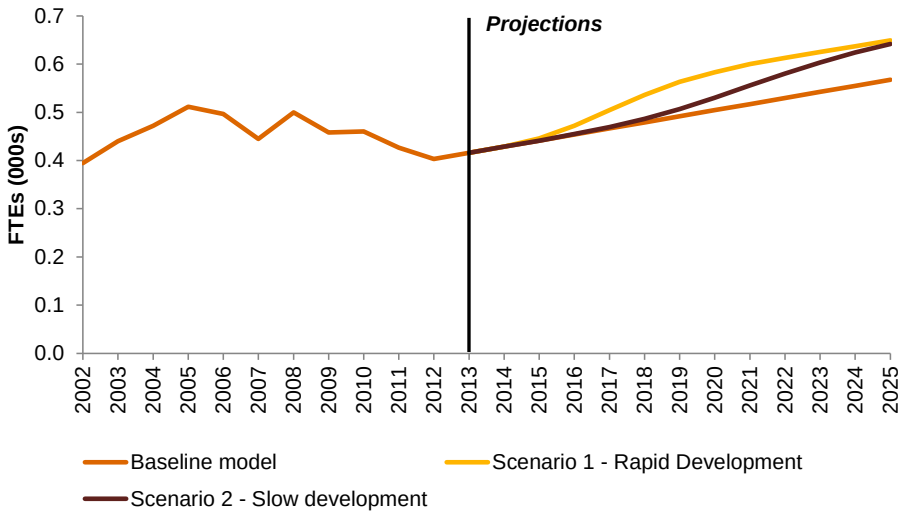
Gross Output, Dairy Sector, Hawke's Bay Region 2002-2025



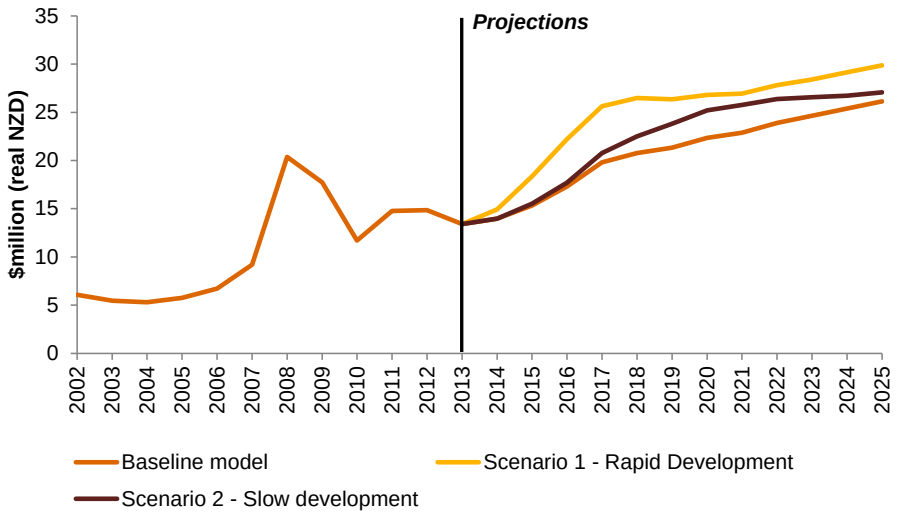
Value Added, Dairy Sector, Hawke's Bay Region 2002-2025

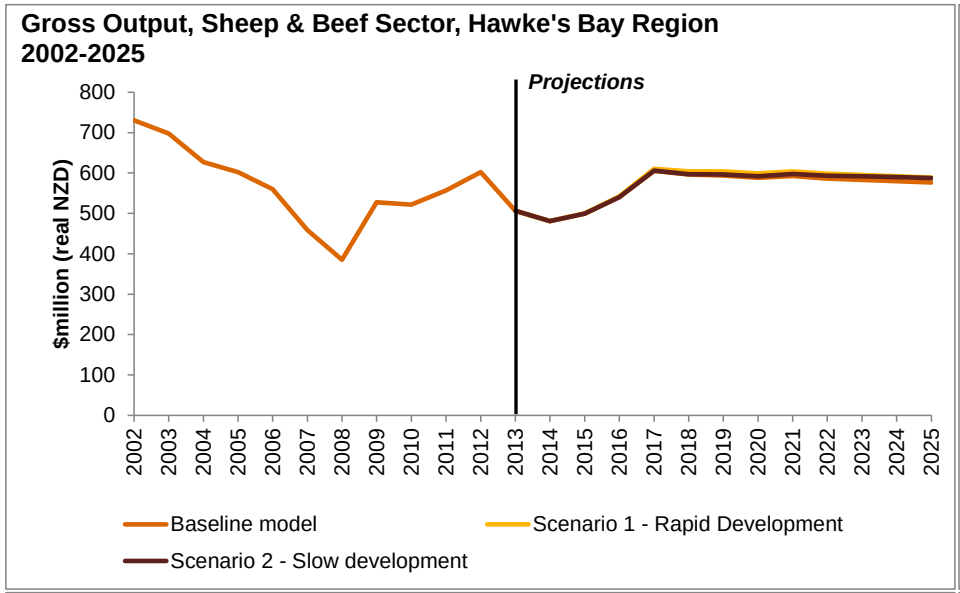


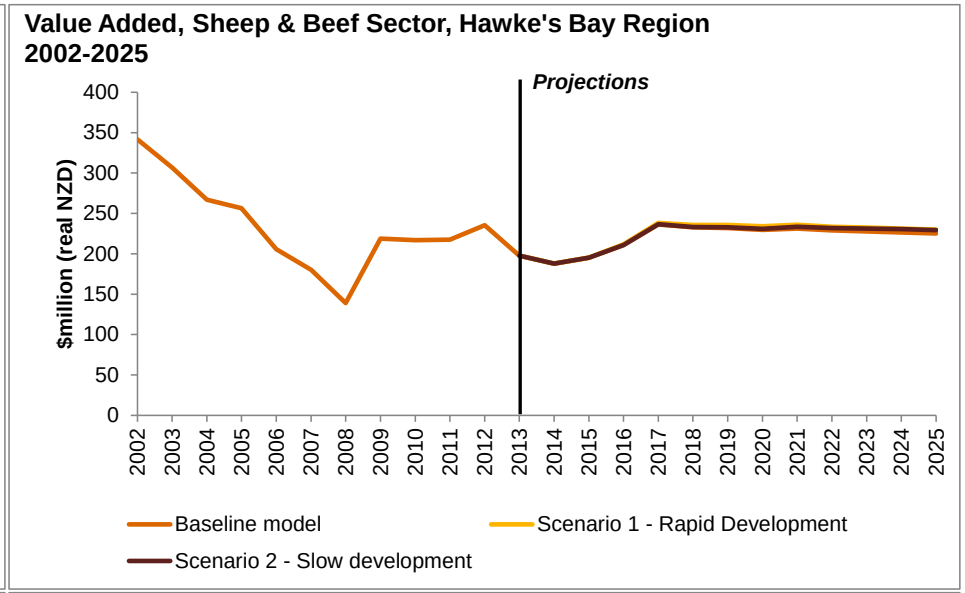
Employment, Dairy Sector, Hawke's Bay Region 2002-2025

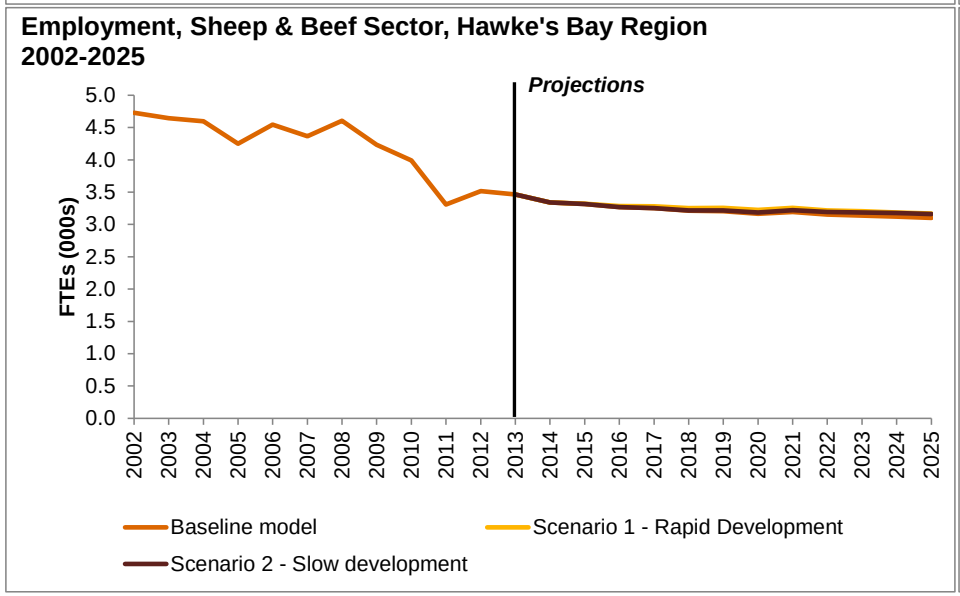


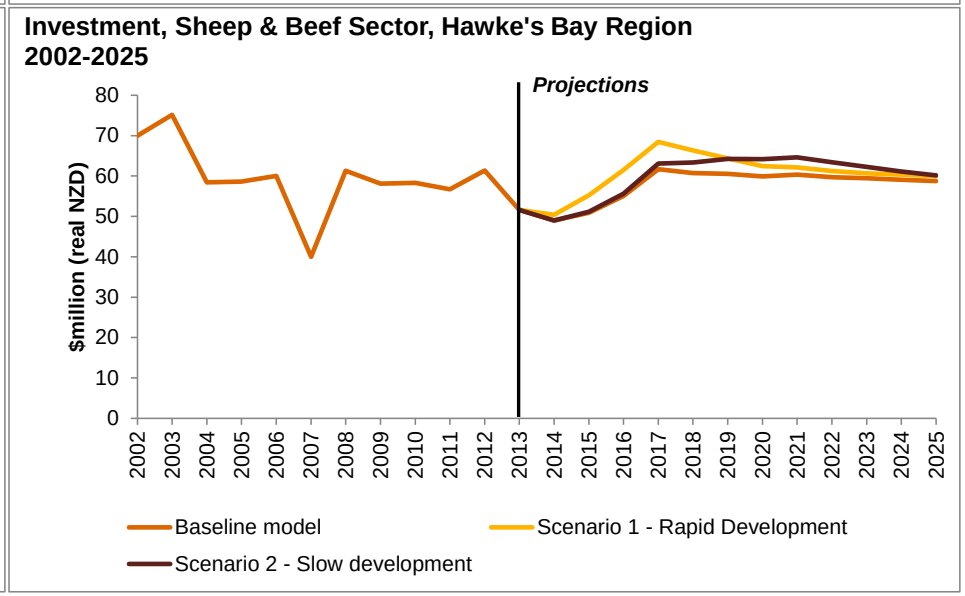
Investment, Dairy Sector, Hawke's Bay Region 2002-2025

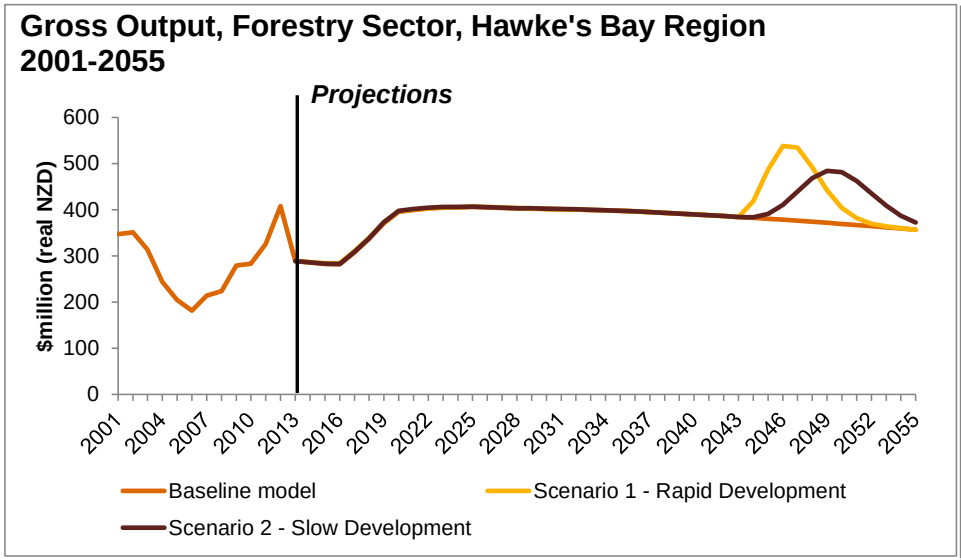


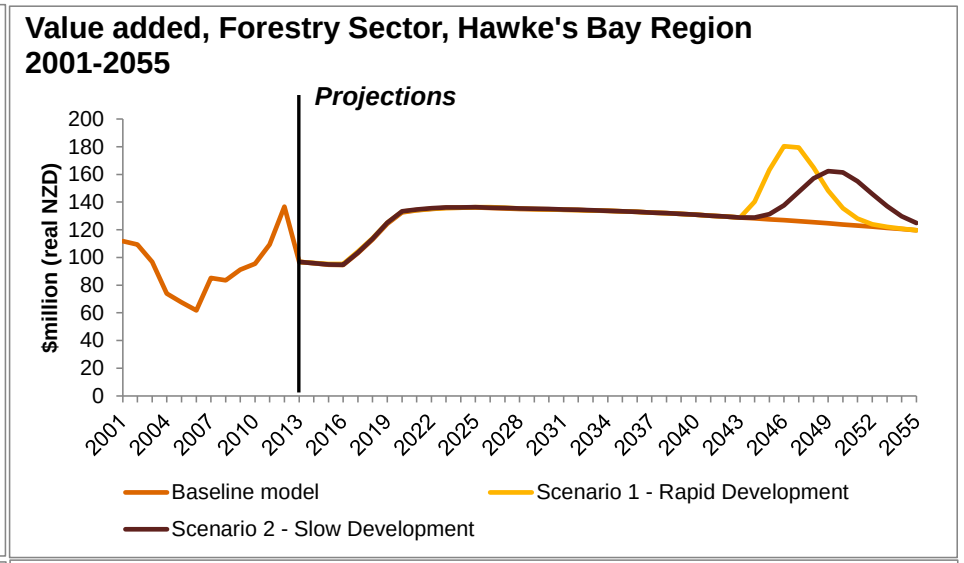

Gross Output, Sheep & Beef Sector, Hawke's Bay Region
2002-2025
Projections
$million (real NZD)
800
700
600
500
400
300
200
100
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

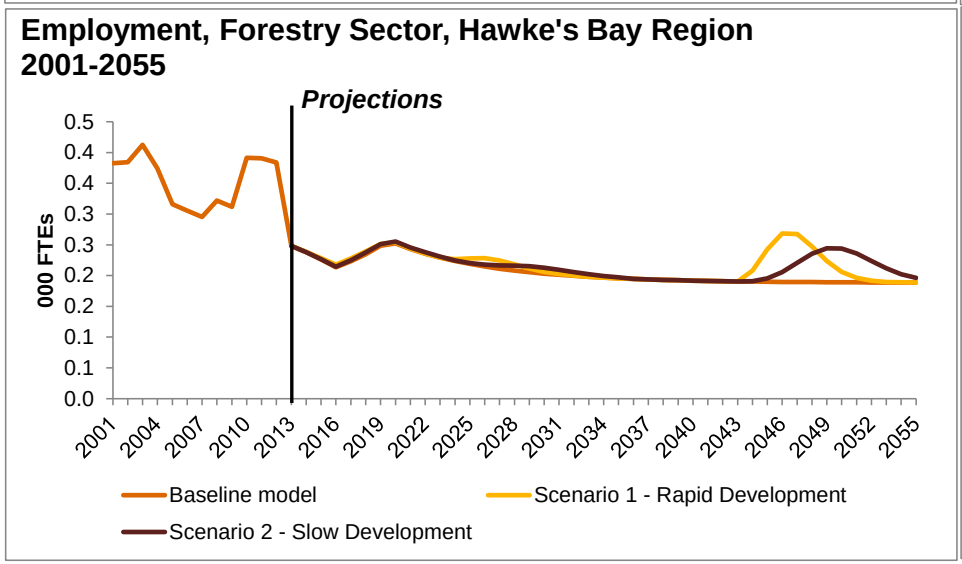

Value Added, Sheep & Beef Sector, Hawke's Bay Region
2002-2025
Projections
$million (real NZD)
400
350
300
250
200
150
100
50
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

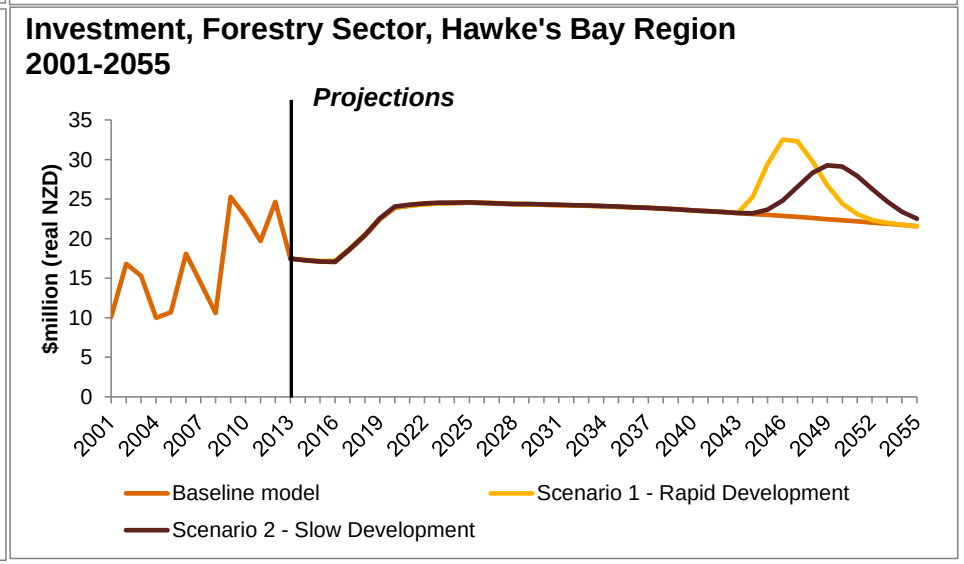

Employment, Sheep & Beef Sector, Hawke's Bay Region
2002-2025
Projections
FTEs (000s)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, Hawke's Bay Region
2002-2025
Projections
$million (real NZD)
80
70
60
50
40
30
20
10
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Gross Output, Forestry Sector, Hawke's Bay Region
2001-2055
Projections
$million (real NZD)
600
500
400
300
200
100
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

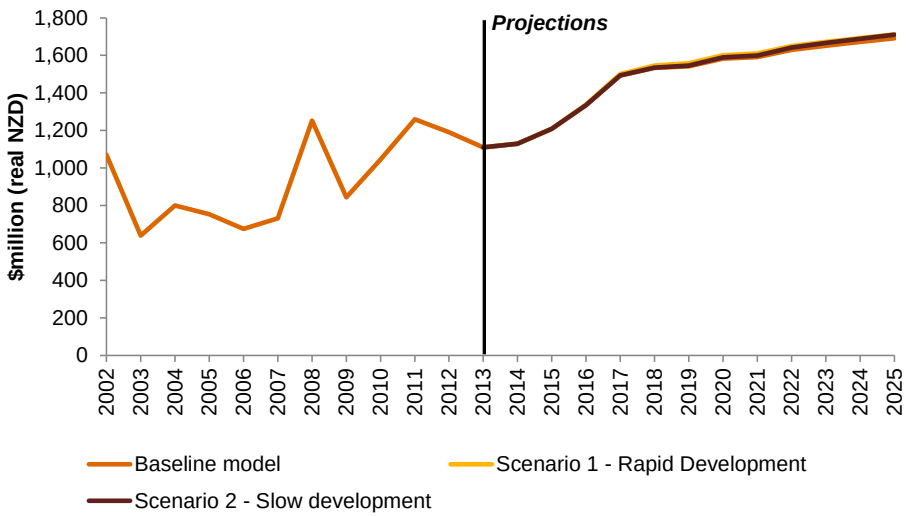

Value added, Forestry Sector, Hawke's Bay Region
2001-2055
Projections
$million (real NZD)
200
180
160
140
120
100
80
60
40
20
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development


Employment, Forestry Sector, Hawke's Bay Region
2001-2055
Projections
000 FTEs
0.5
0.4
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

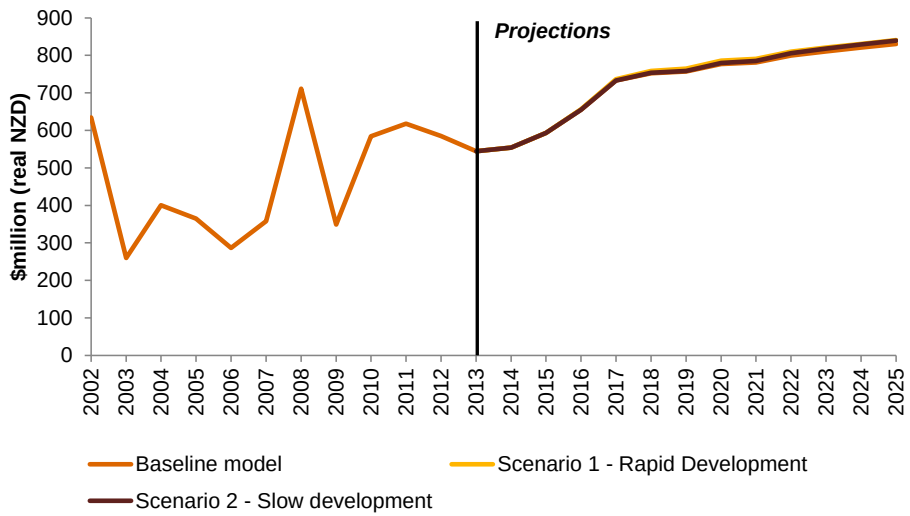

Investment, Forestry Sector, Hawke's Bay Region
2001-2055
Projections
$million (real NZD)
35
30
25
20
15
10
5
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

Taranaki

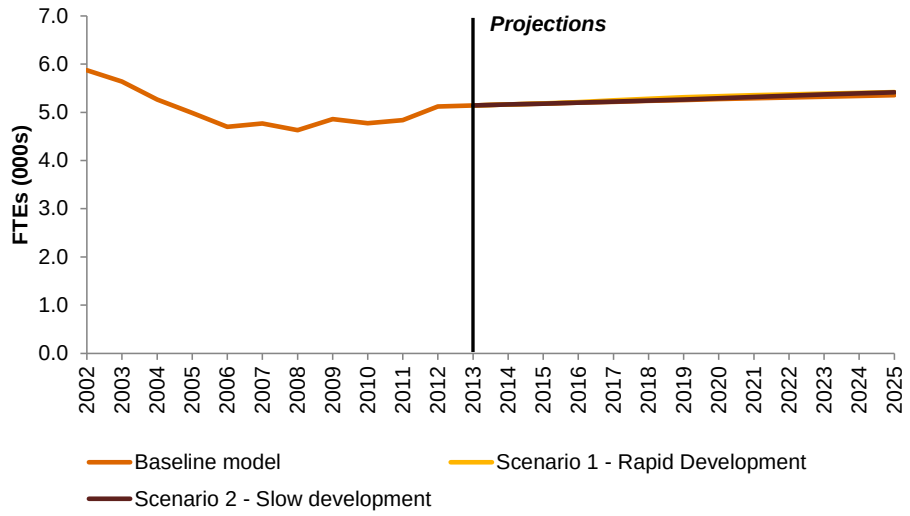
Gross Output, Dairy Sector, Taranaki Region 2002-2025



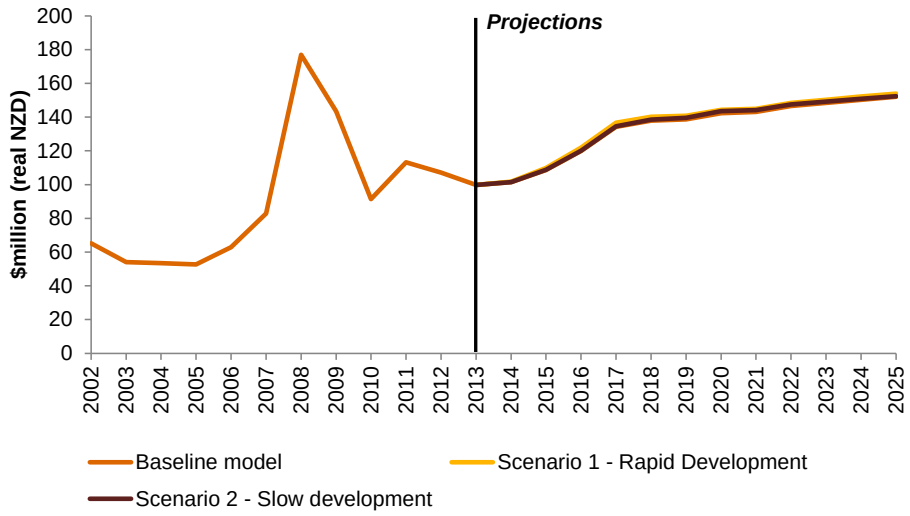
Value Added, Dairy Sector, Taranaki Region 2002-2025



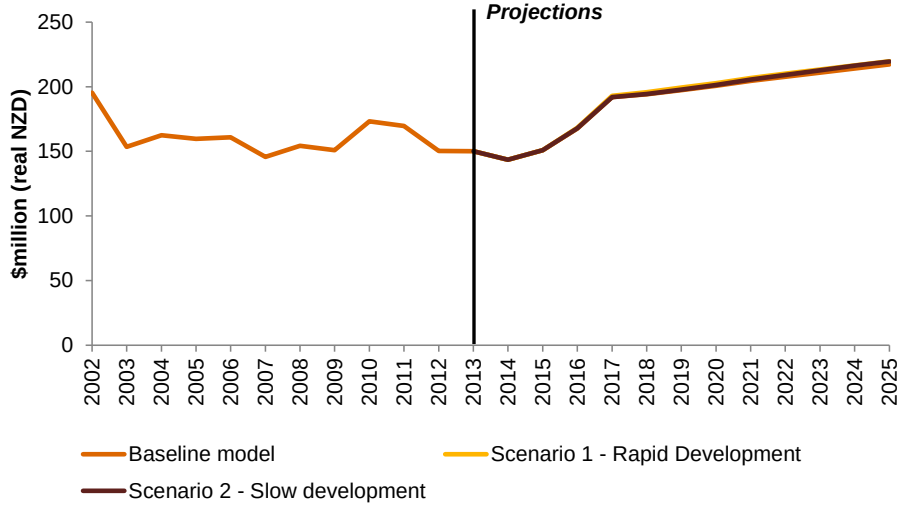
Employment, Dairy Sector, Taranaki Region 2002-2025



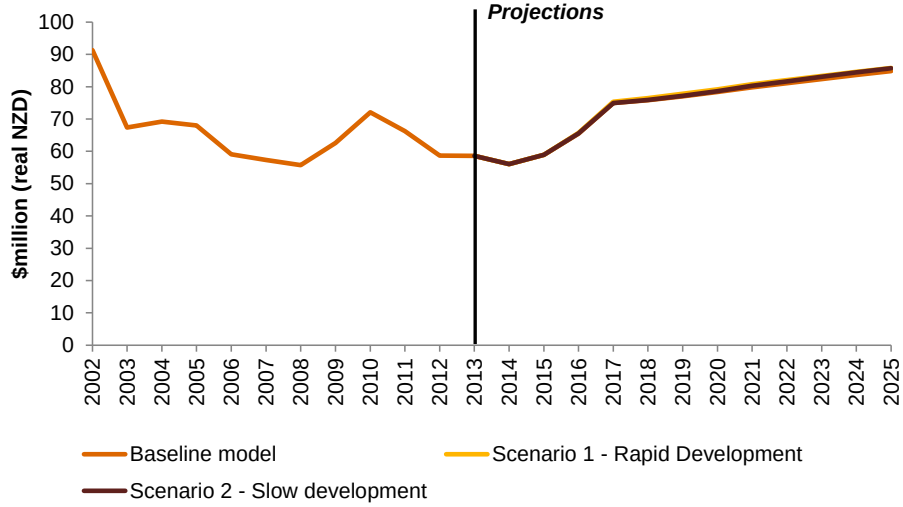
Investment, Dairy Sector, Taranaki Region 2002-2025



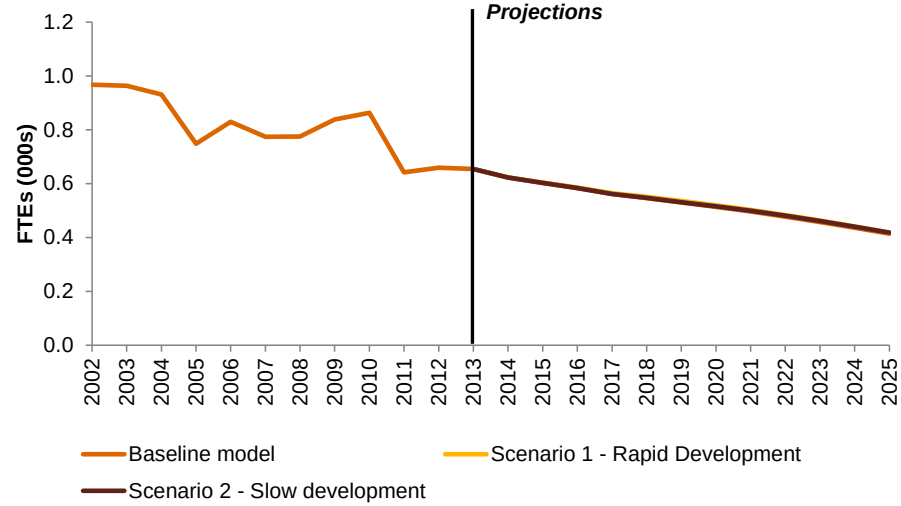
Gross Output, Sheep & Beef Sector, Taranaki Region 2002-2025



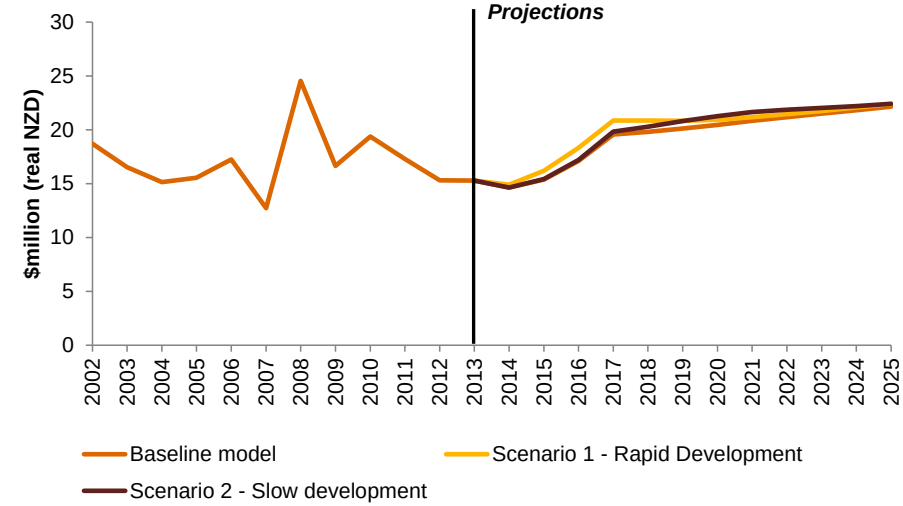
Value Added, Sheep & Beef Sector, Taranaki Region 2002-2025



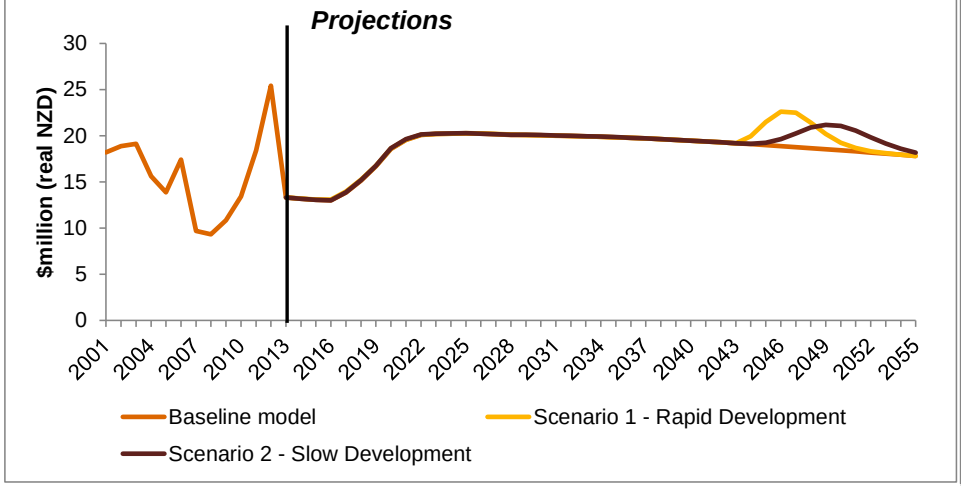
Employment, Sheep & Beef Sector, Taranaki Region 2002-2025



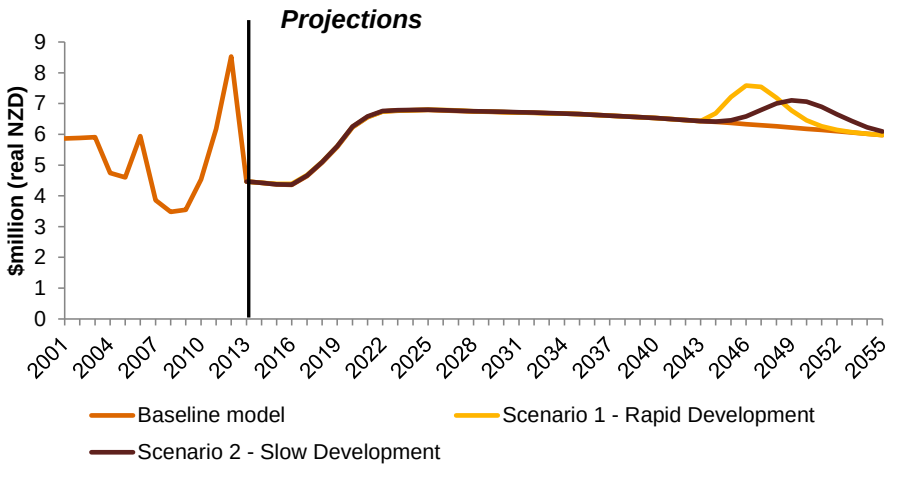
Investment, Sheep & Beef Sector, Taranaki Region 2002-2025



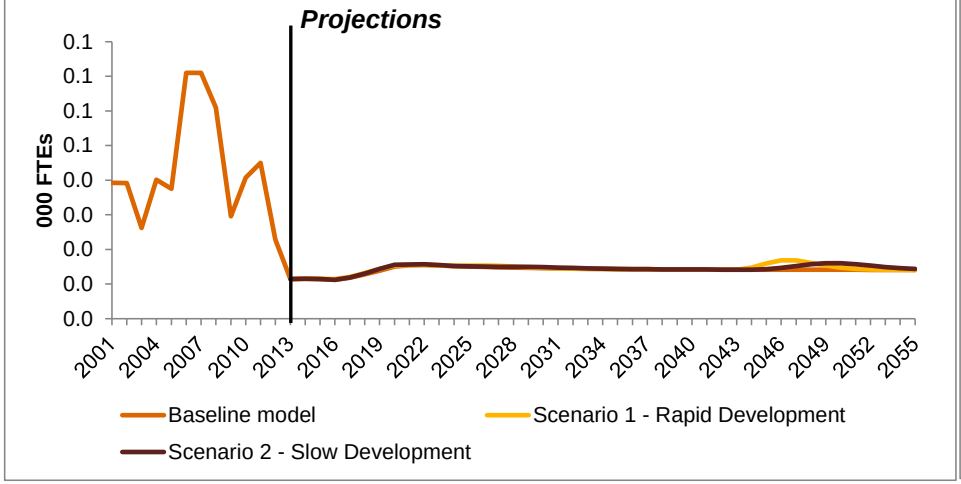
Gross Output, Forestry Sector, Taranaki Region 2001-2055



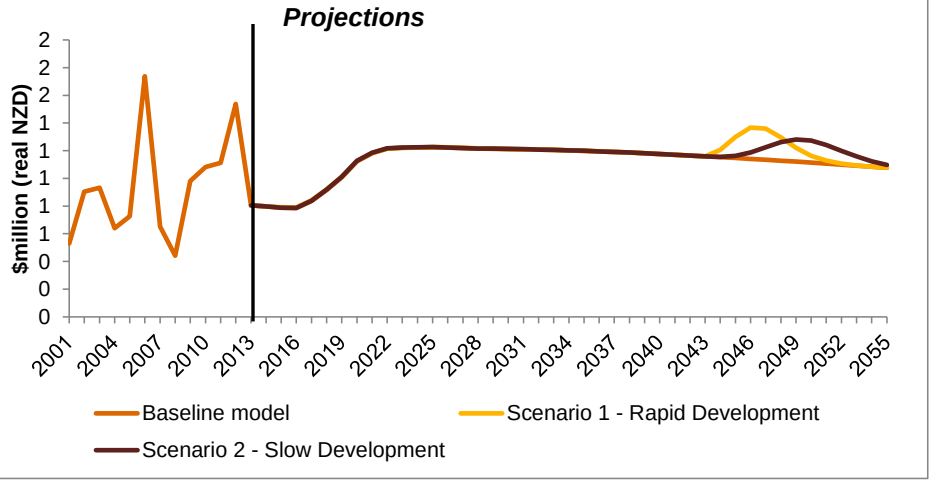
Value added, Forestry Sector, Taranaki Region 2001-2055



Employment, Forestry Sector, Taranaki Region 2001-2055

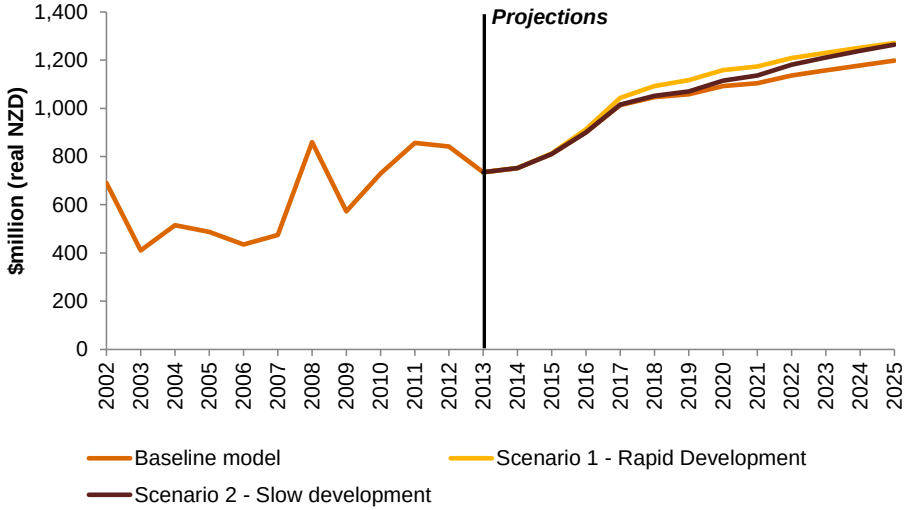


Investment, Forestry Sector, Taranaki Region 2001-2055

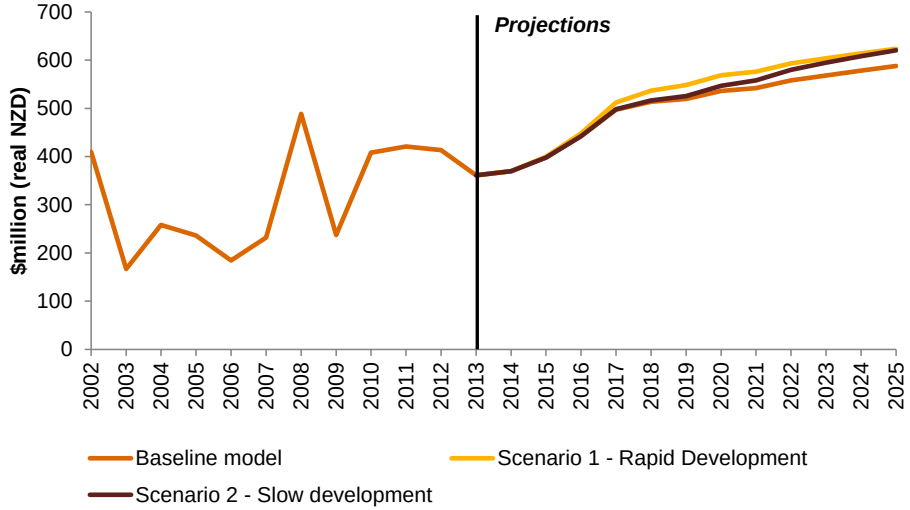


Manawatu-Wanganui

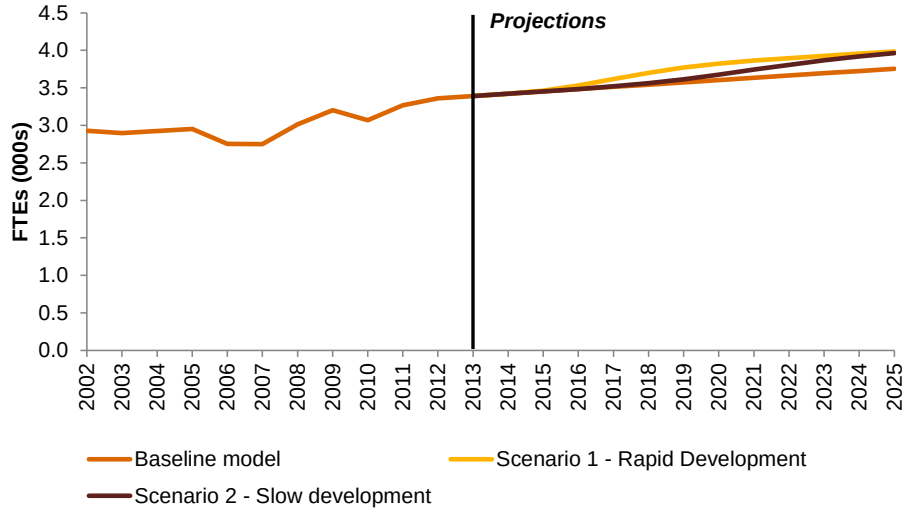
Gross Output, Dairy Sector, Manawatu-Wanganui Region 2002-2025



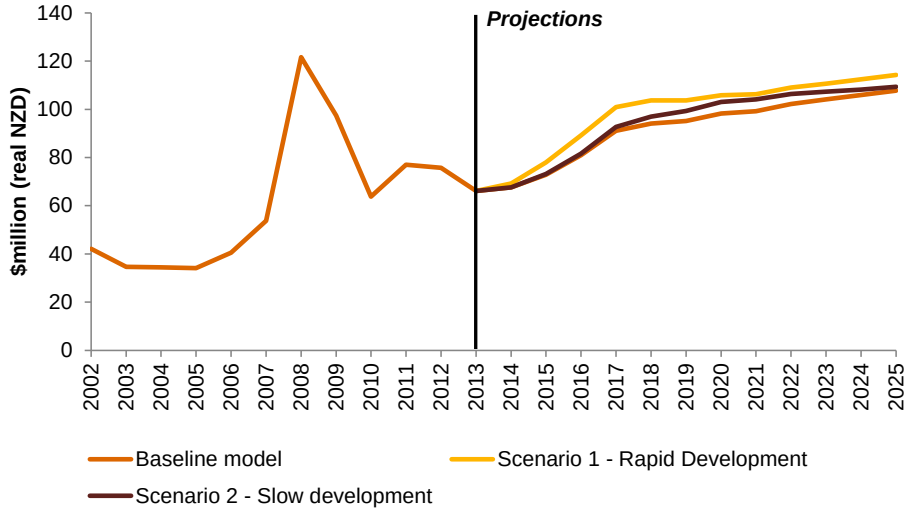
Value Added, Dairy Sector, Manawatu-Wanganui Region 2002-2025

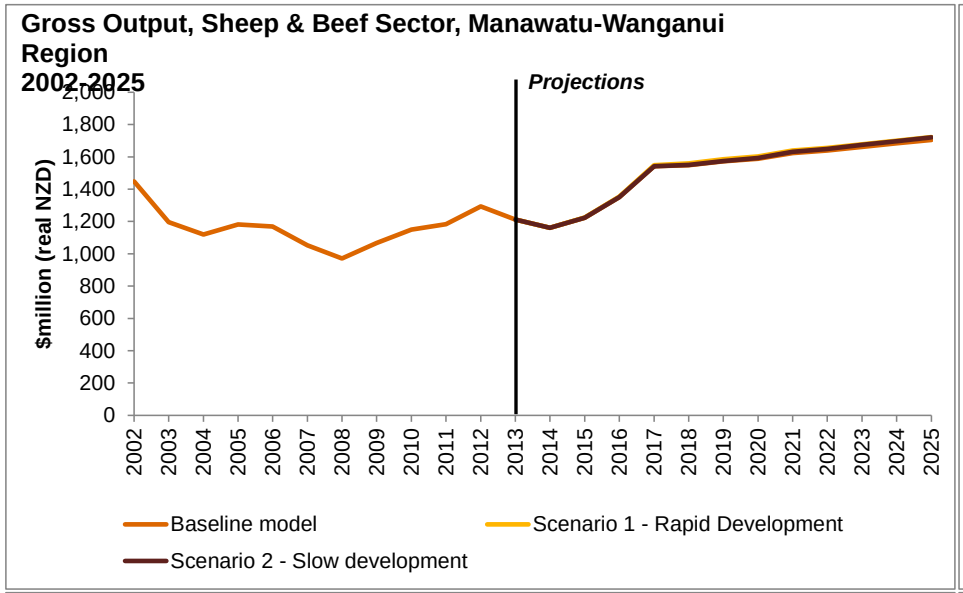


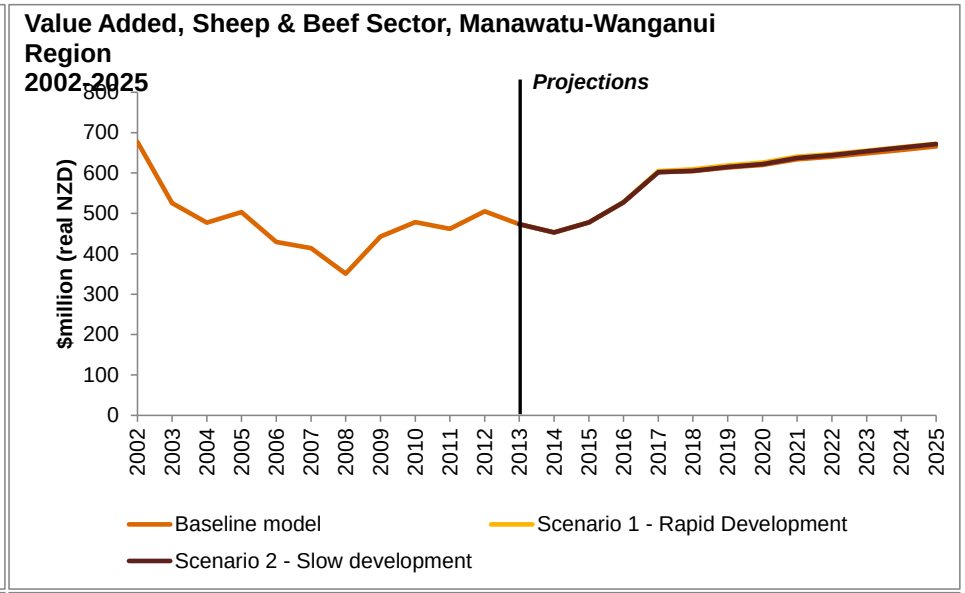
Employment, Dairy Sector, Manawatu-Wanganui Region 2002-2025

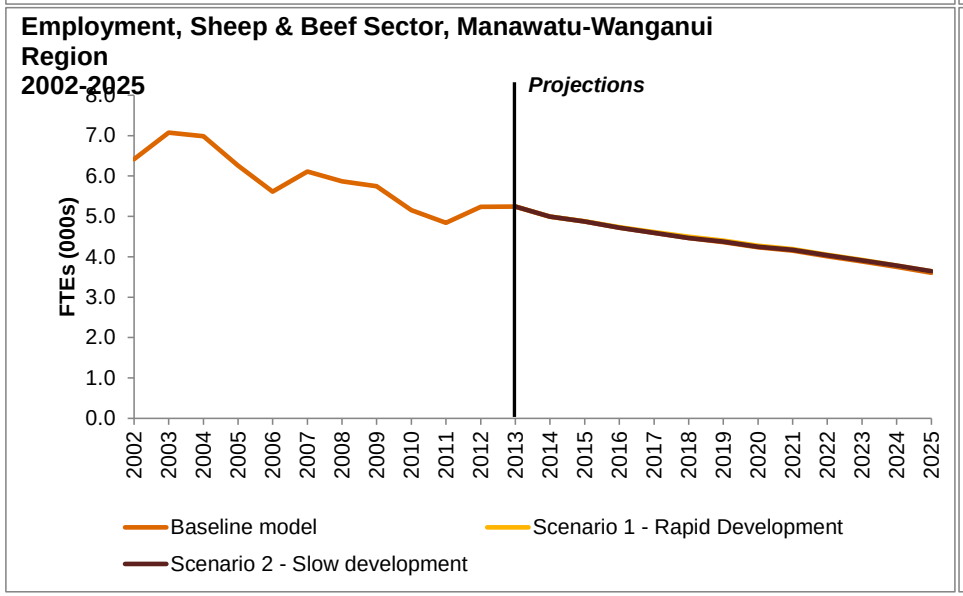


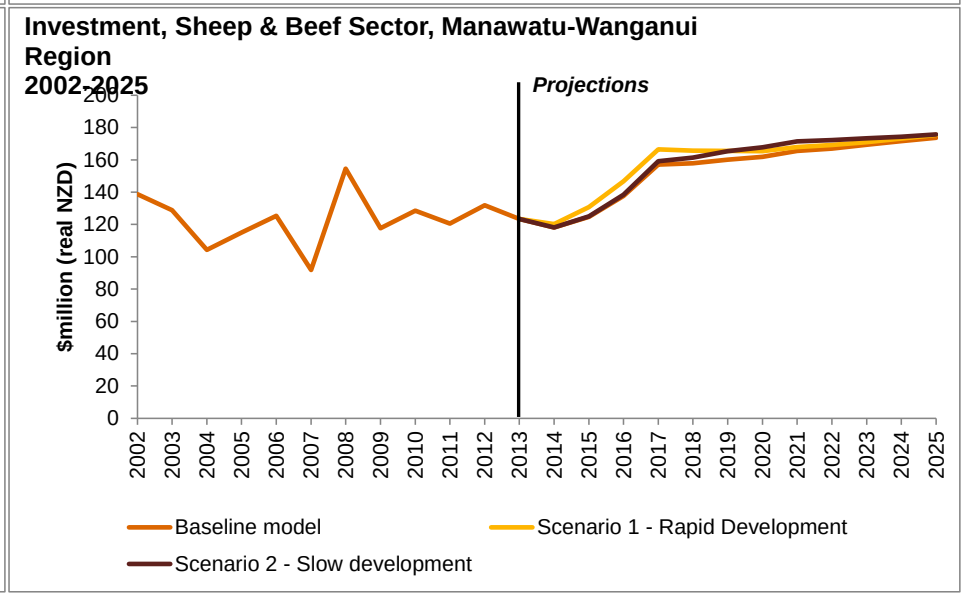
Investment, Dairy Sector, Manawatu-Wanganui Region 2002-2025

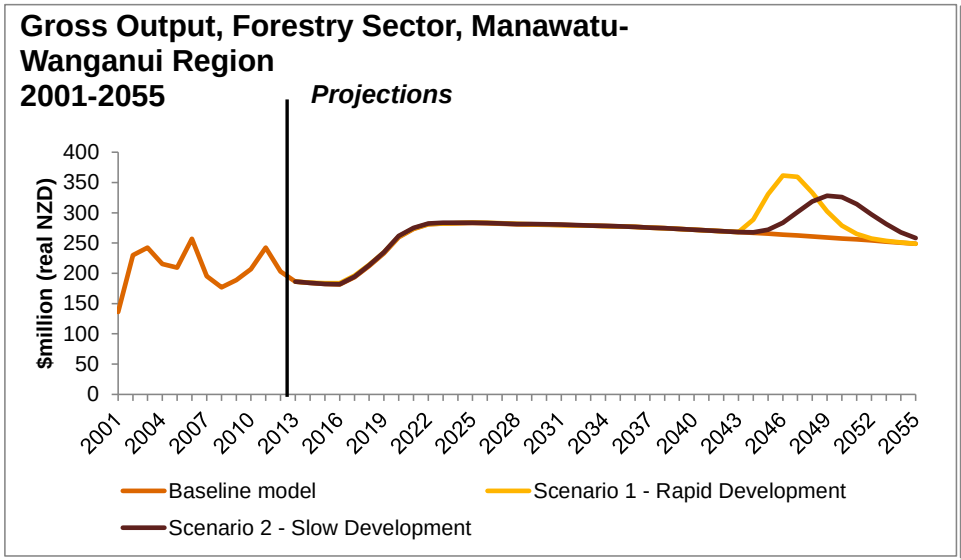


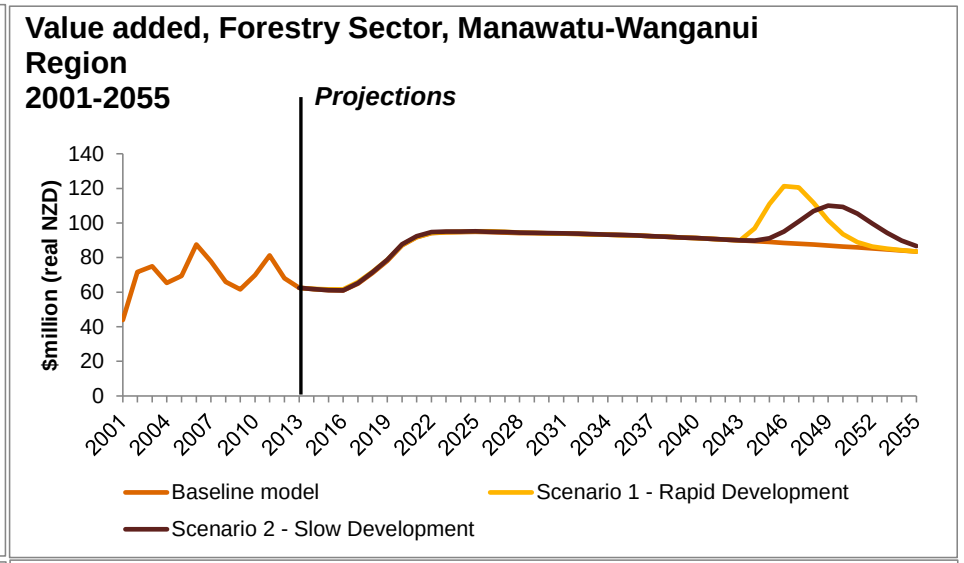

Gross Output, Sheep & Beef Sector, Manawatu-Wanganui Region
2002-2025
Projections
$million (real NZD)
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

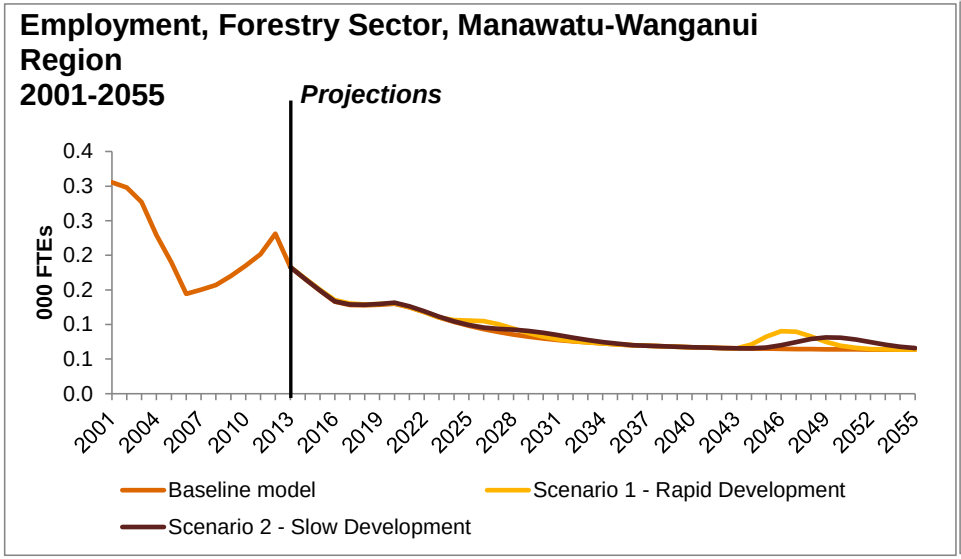

Value Added, Sheep & Beef Sector, Manawatu-Wanganui Region
2002-2025
Projections
$million (real NZD)
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

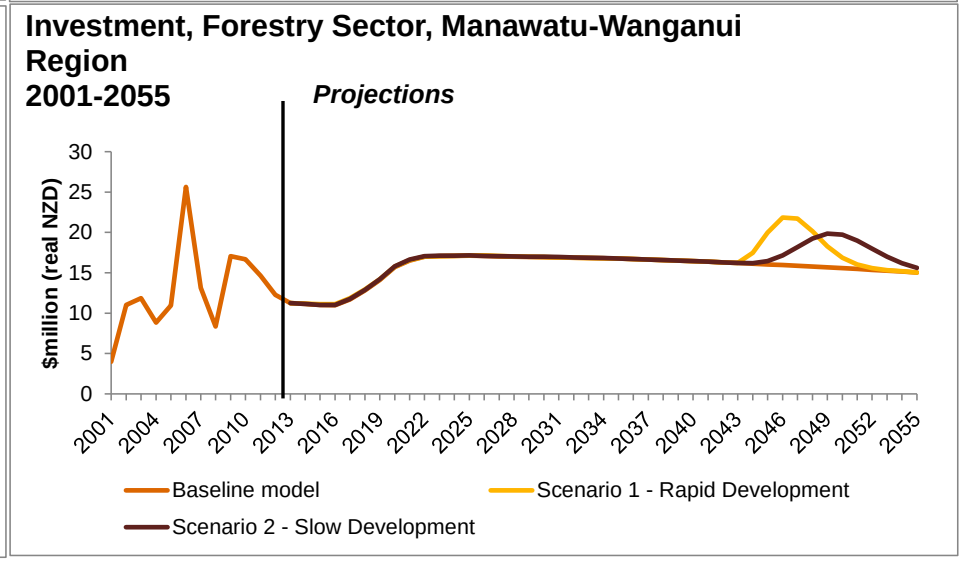

Employment, Sheep & Beef Sector, Manawatu-Wanganui Region
2002-2025
Projections
FTEs (000s)
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, Manawatu-Wanganui Region
2002-2025
Projections
$million (real NZD)
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Gross Output, Forestry Sector, Manawatu-Wanganui Region
2001-2055
Projections
$million (real NZD)
400
350
300
250
200
150
100
50
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

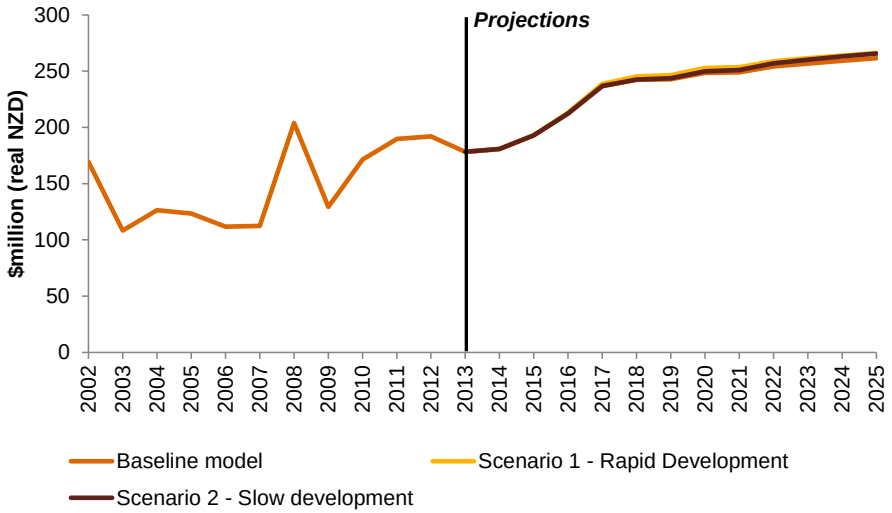

Value added, Forestry Sector, Manawatu-Wanganui Region
2001-2055
Projections
$million (real NZD)
140
120
100
80
60
40
20
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development


Employment, Forestry Sector, Manawatu-Wanganui Region
2001-2055
Projections
000 FTEs
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

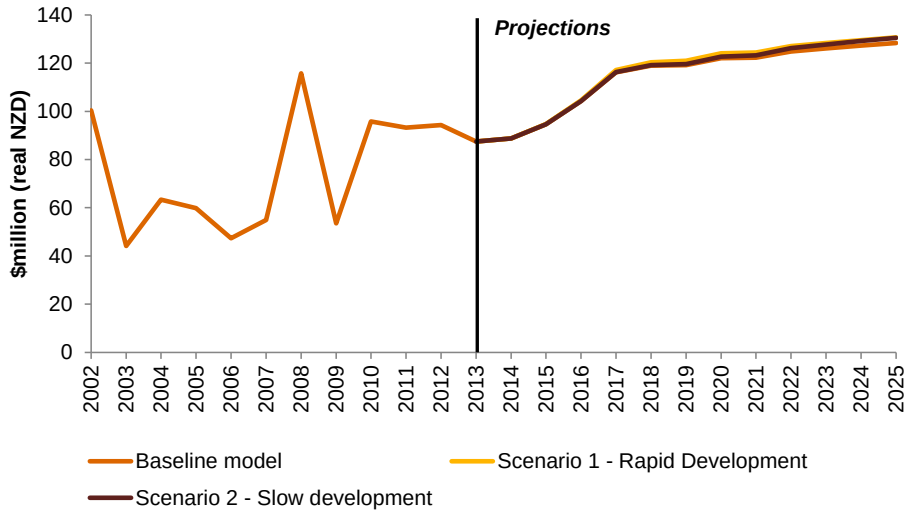

Investment, Forestry Sector, Manawatu-Wanganui Region
2001-2055
Projections
$million (real NZD)
30
25
20
15
10
5
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

Wellington

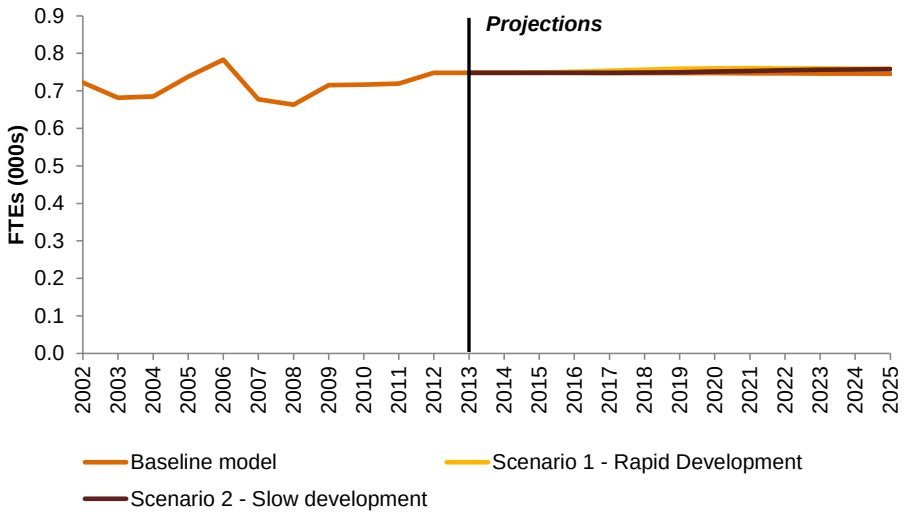
Gross Output, Dairy Sector, Wellington Region 2002-2025



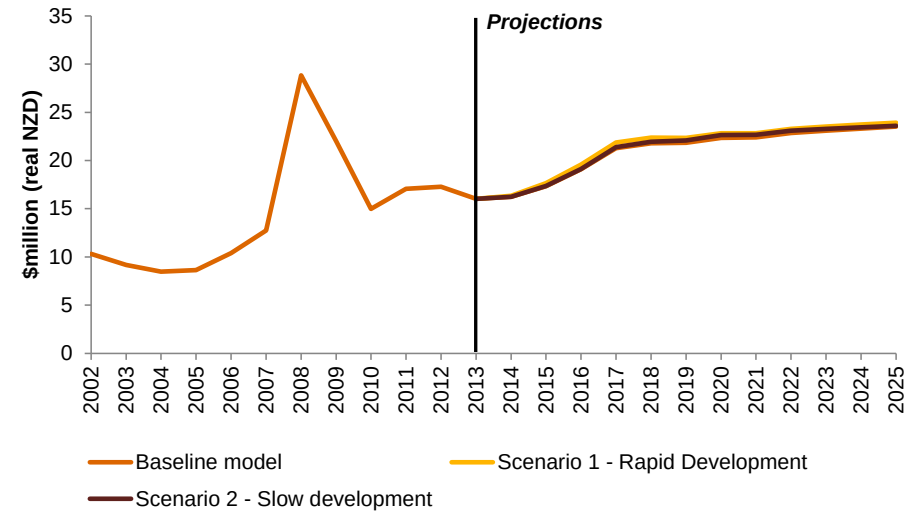
Value Added, Dairy Sector, Wellington Region 2002-2025

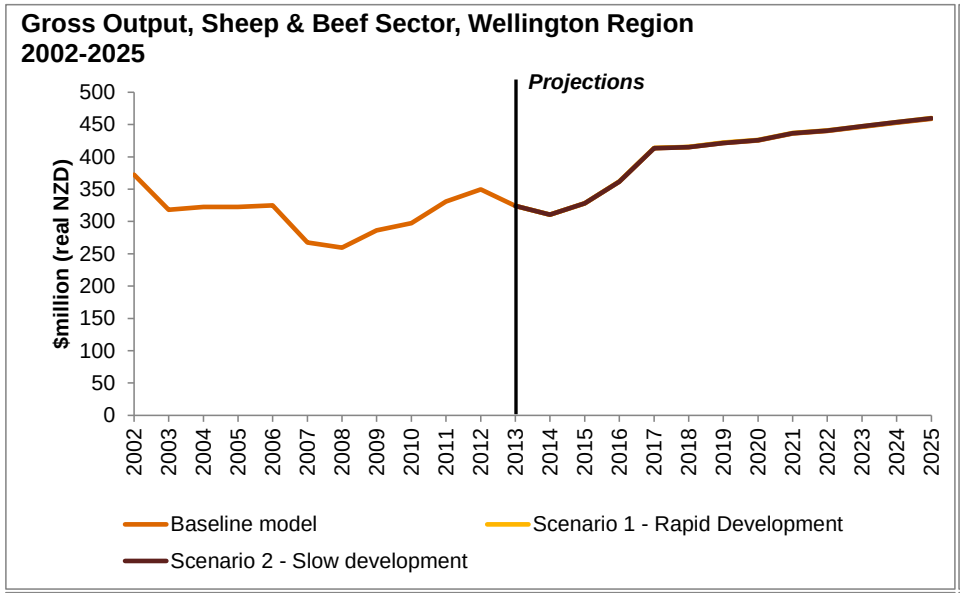


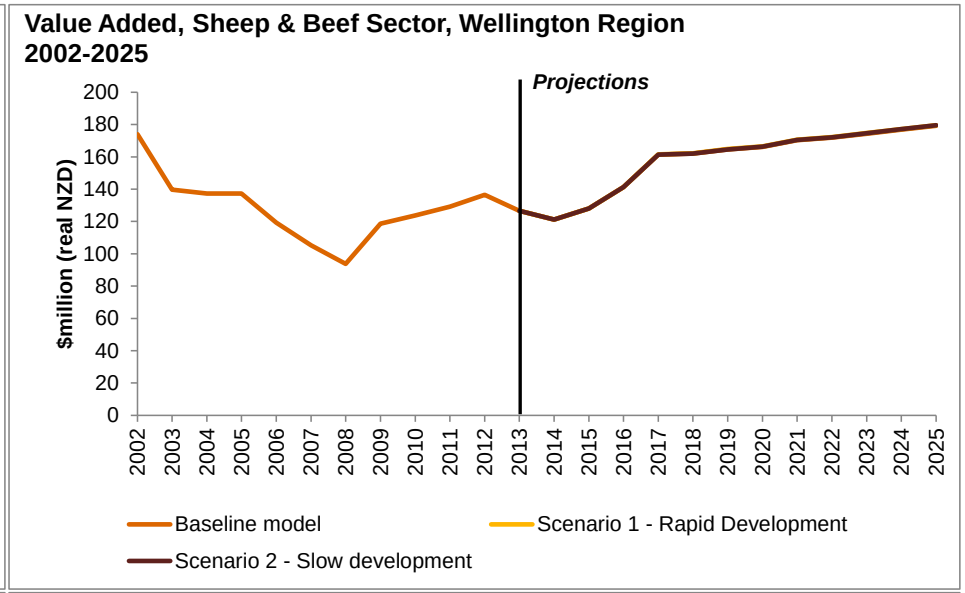
Employment, Dairy Sector, Wellington Region 2002-2025

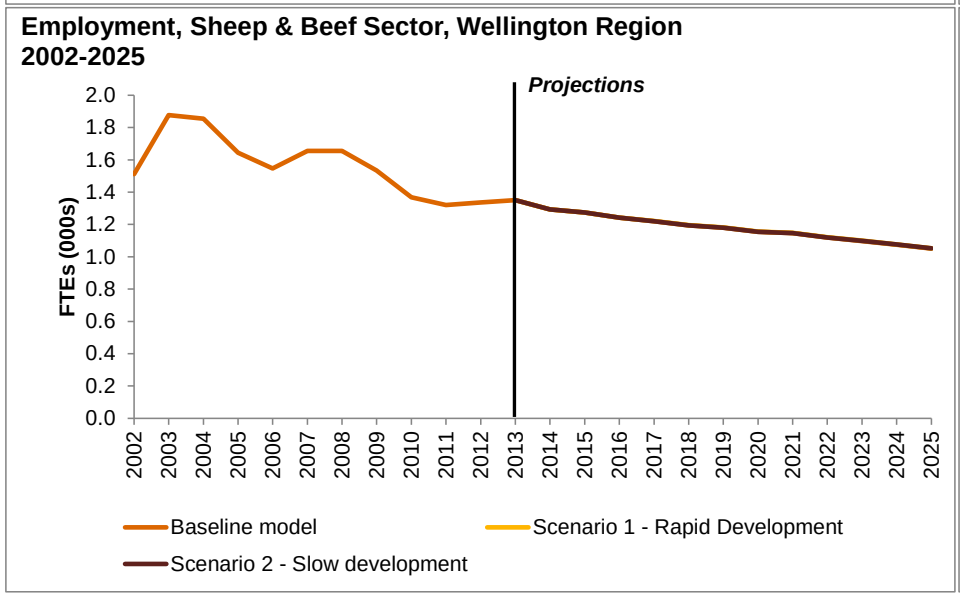


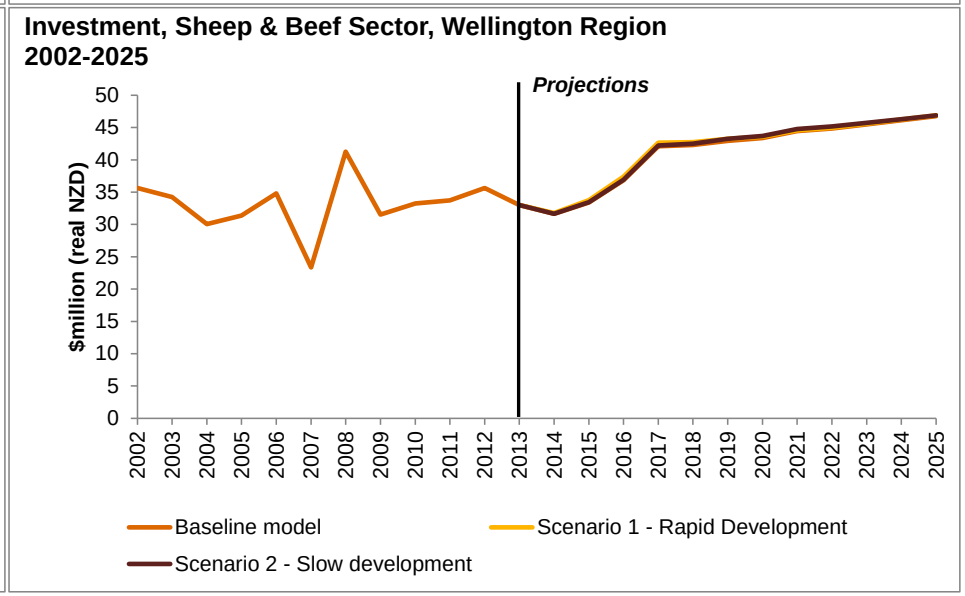
Investment, Dairy Sector, Wellington Region 2002-2025



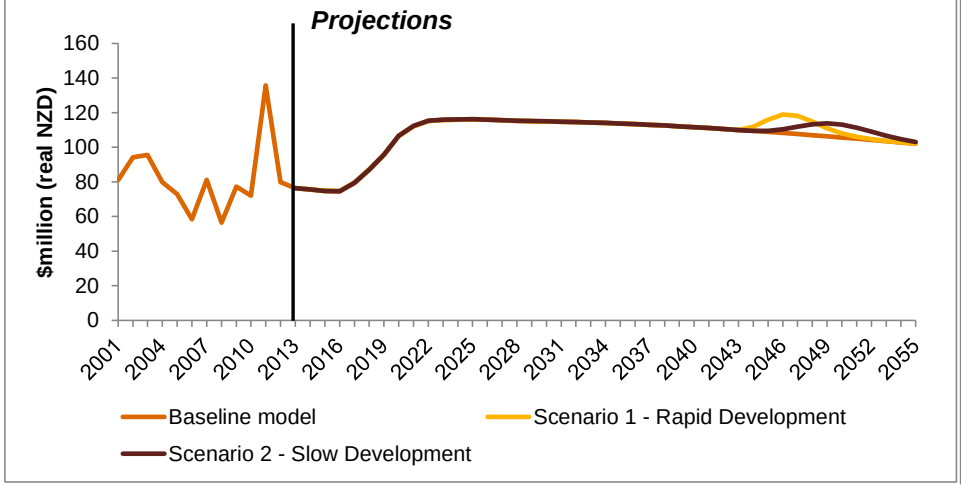

Gross Output, Sheep & Beef Sector, Wellington Region
2002-2025
Projections
$million (real NZD)
0
50
100
150
200
250
300
350
400
450
500
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Value Added, Sheep & Beef Sector, Wellington Region
2002-2025
Projections
$million (real NZD)
0
20
40
60
80
100
120
140
160
180
200
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

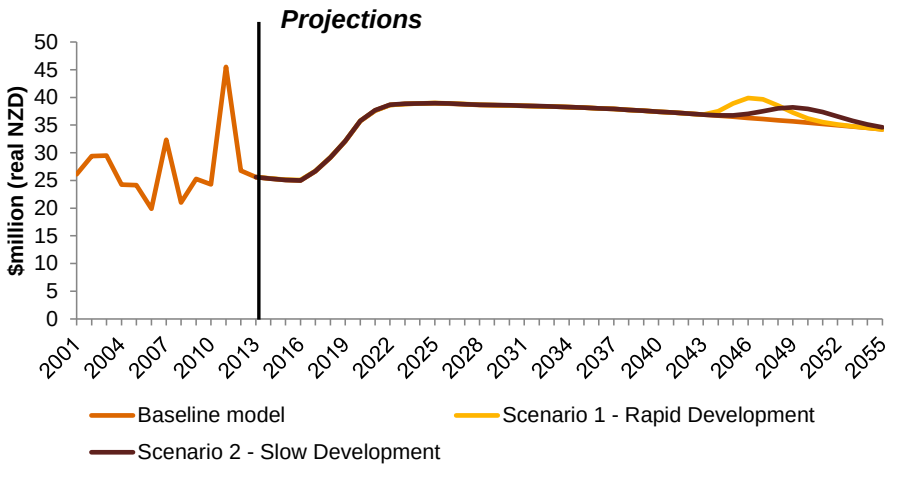

Employment, Sheep & Beef Sector, Wellington Region
2002-2025
Projections
FTEs (000s)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, Wellington Region
2002-2025
Projections
$million (real NZD)
0
5
10
15
20
25
30
35
40
45
50
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

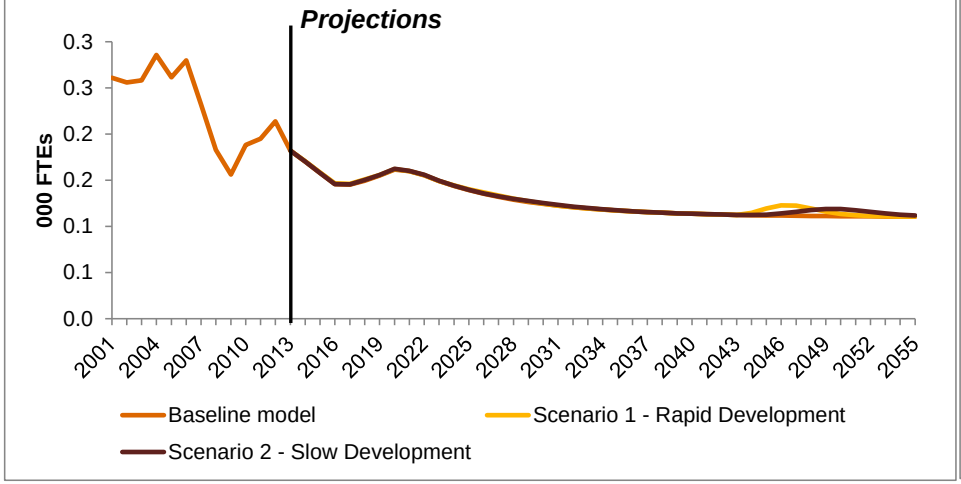
Gross Output, Forestry Sector, Wellington Region 2001-2055



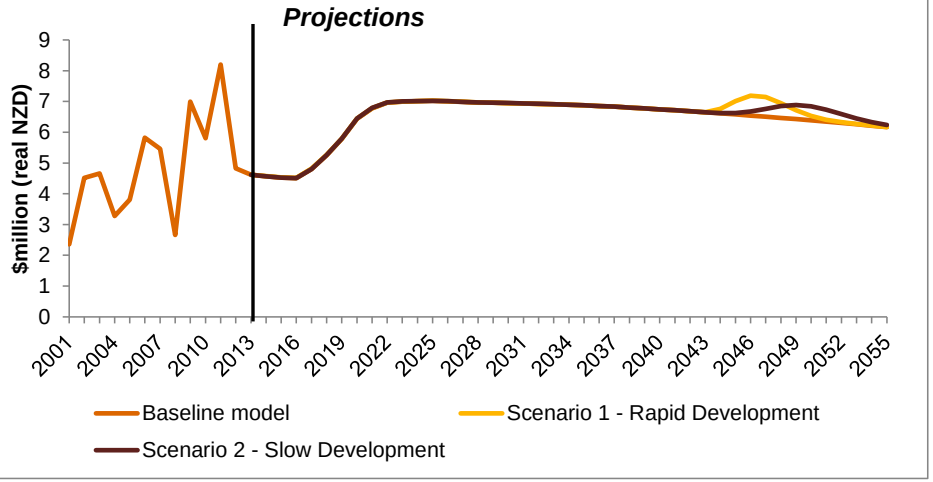
Value added, Forestry Sector, Wellington Region 2001-2055



Employment, Forestry Sector, Wellington Region 2001-2055

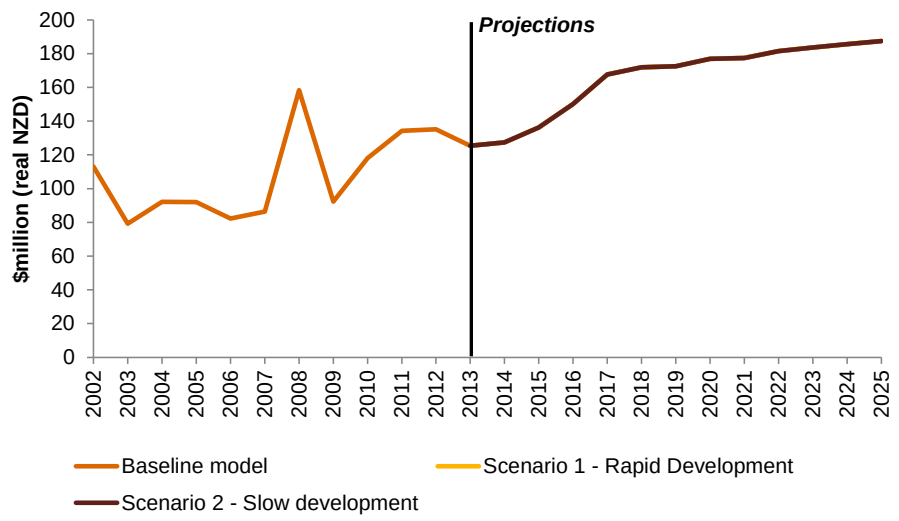


Investment, Forestry Sector, Wellington Region 2001-2055

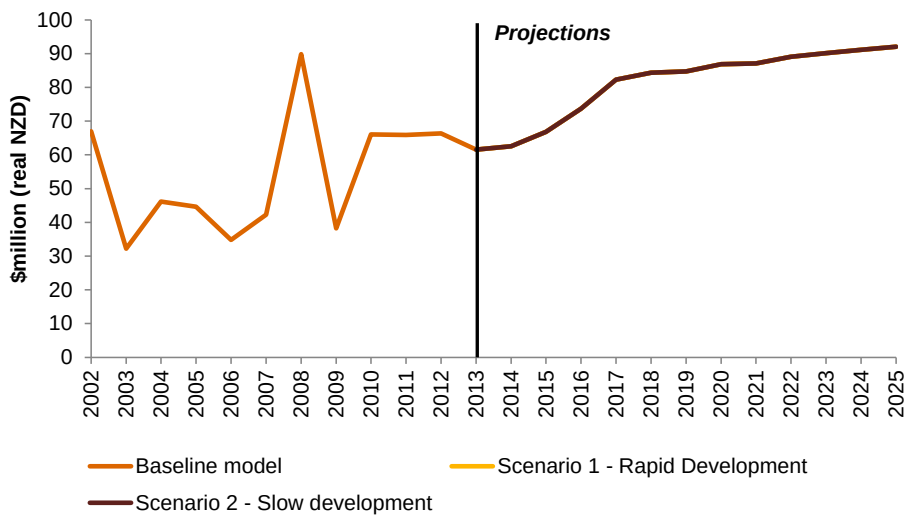


Tasman

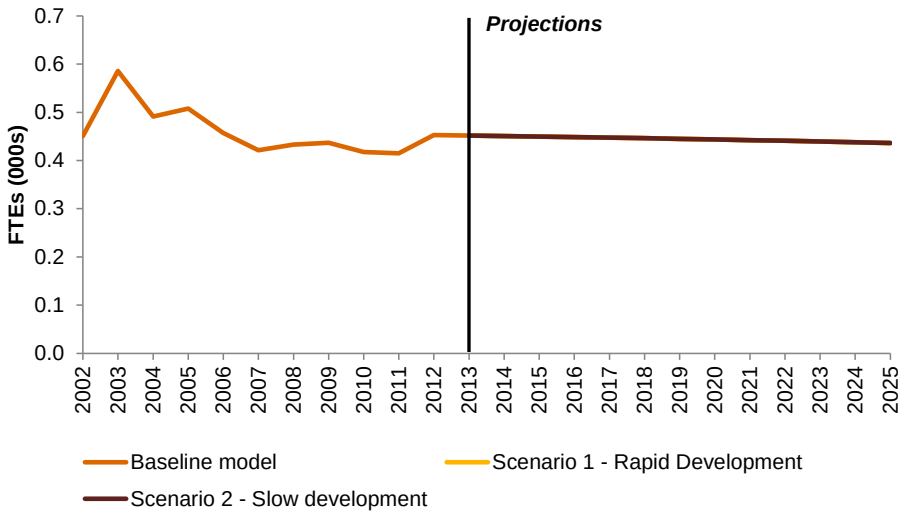
Gross Output, Dairy Sector, Tasman Region 2002-2025



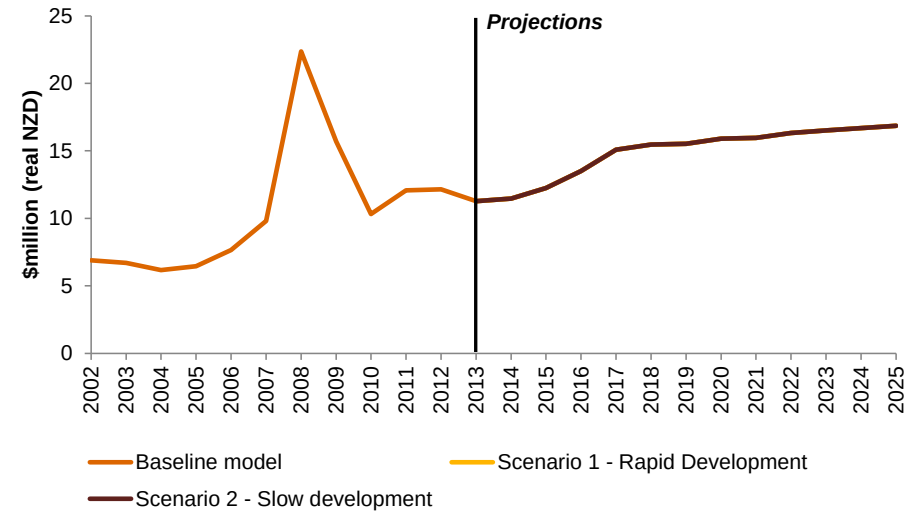
Value Added, Dairy Sector, Tasman Region 2002-2025

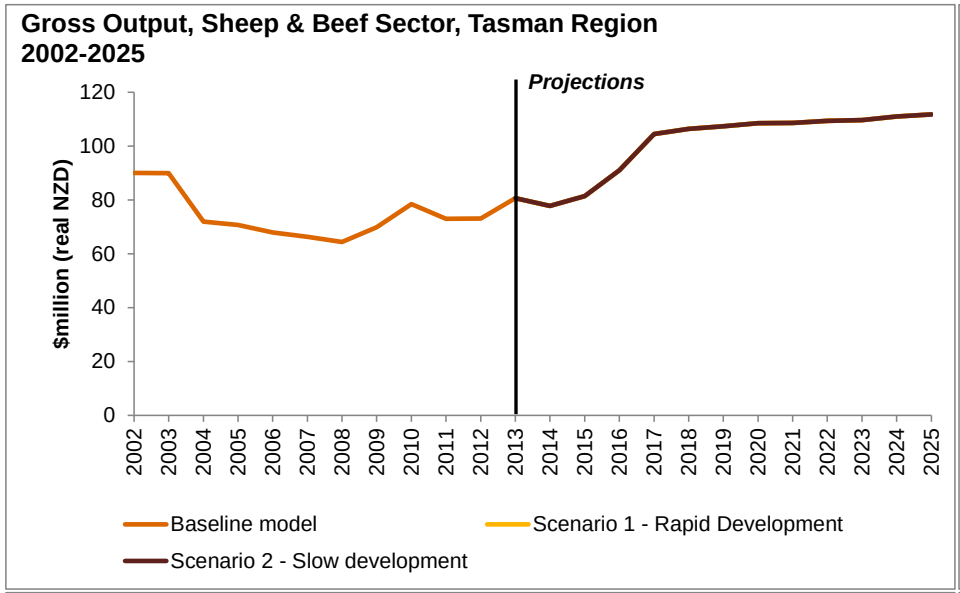


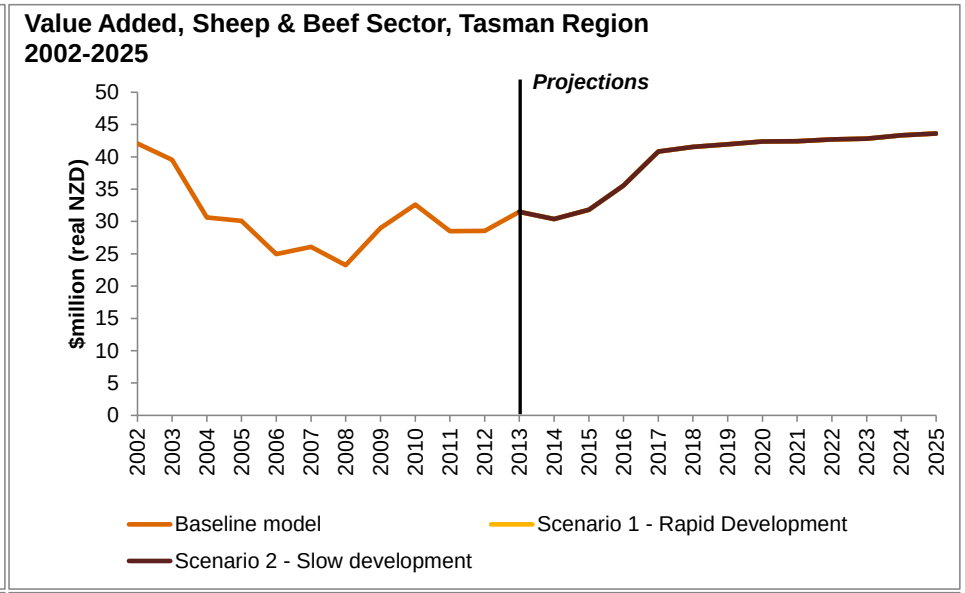
Employment, Dairy Sector, Tasman Region 2002-2025

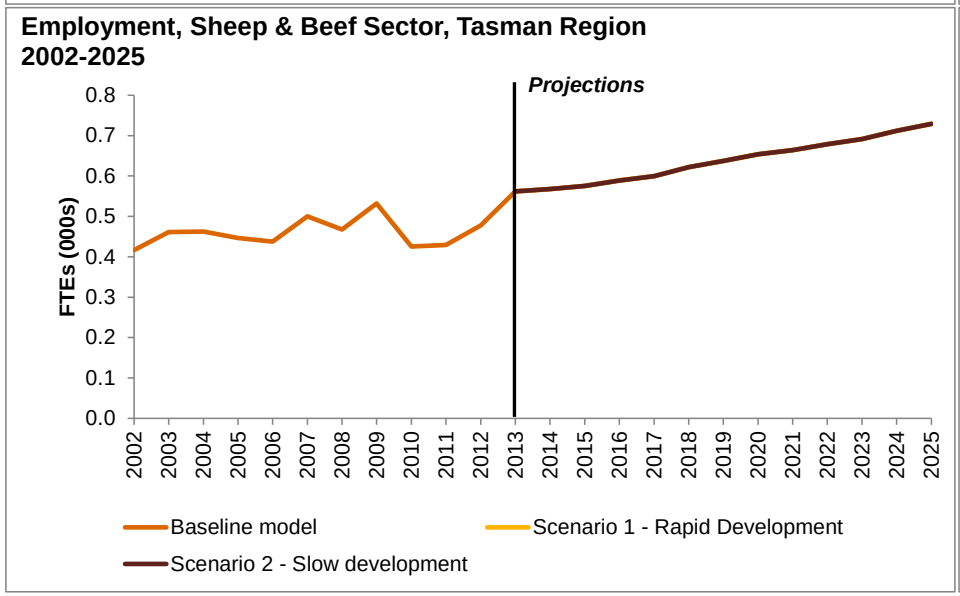


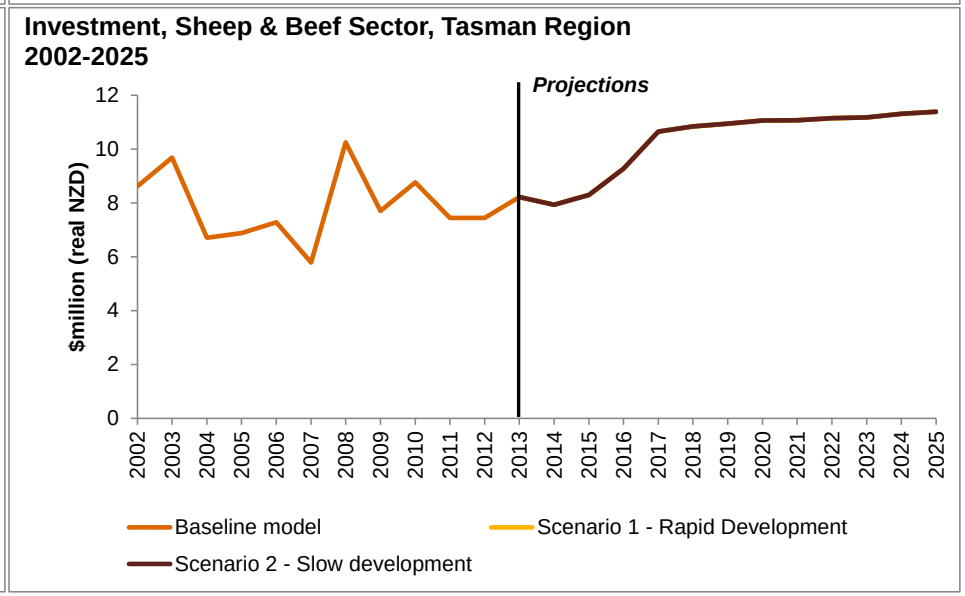
Investment, Dairy Sector, Tasman Region 2002-2025

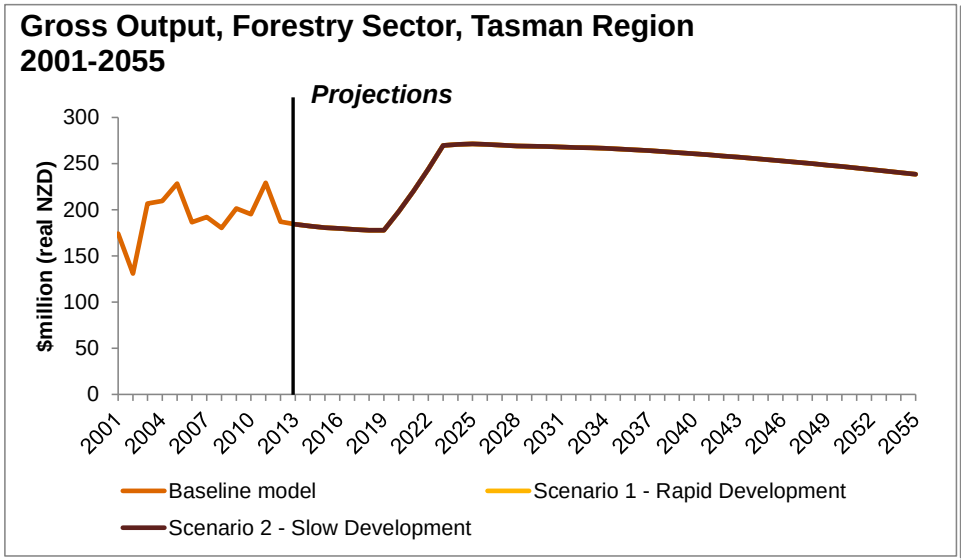


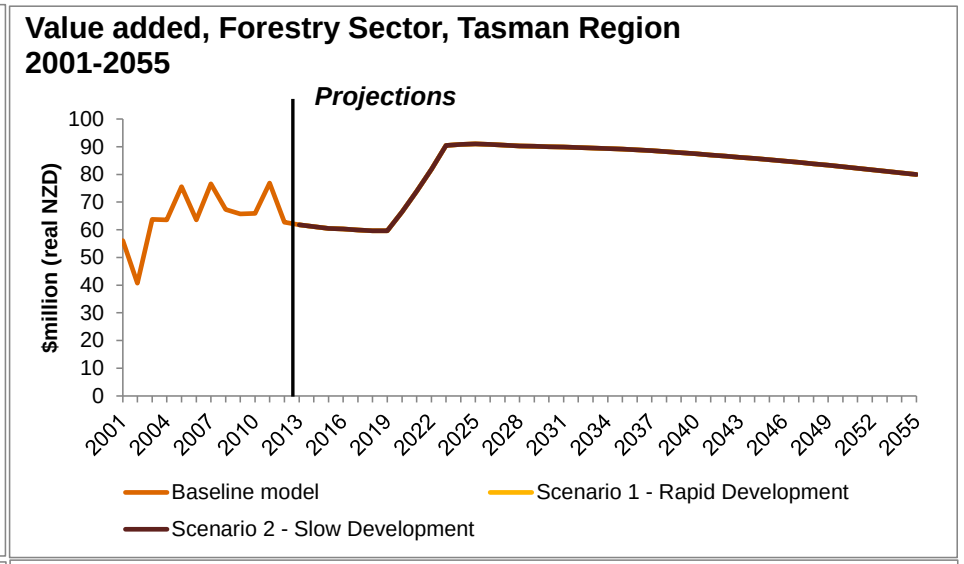

Gross Output, Sheep & Beef Sector, Tasman Region
2002-2025
Projections
$million (real NZD)
120
100
80
60
40
20
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

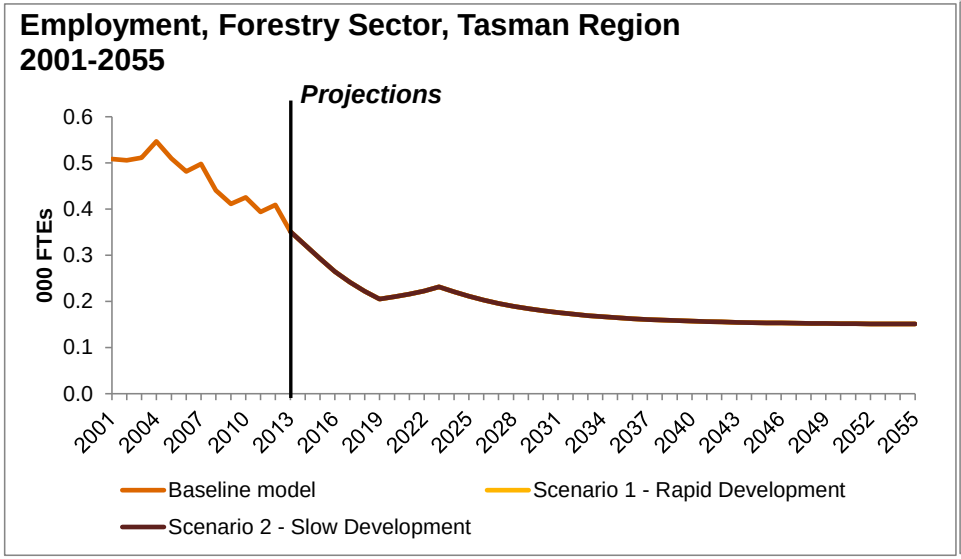

Value Added, Sheep & Beef Sector, Tasman Region
2002-2025
Projections
$million (real NZD)
50
45
40
35
30
25
20
15
10
5
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

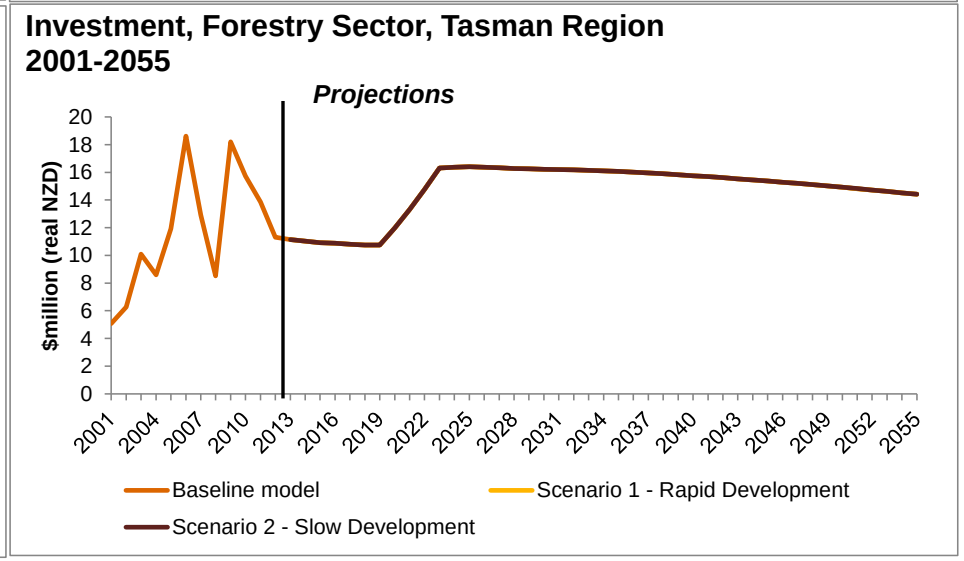

Employment, Sheep & Beef Sector, Tasman Region
2002-2025
Projections
FTEs (000s)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, Tasman Region
2002-2025
Projections
$million (real NZD)
12
10
8
6
4
2
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Gross Output, Forestry Sector, Tasman Region
2001-2055
Projections
$million (real NZD)
300
250
200
150
100
50
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

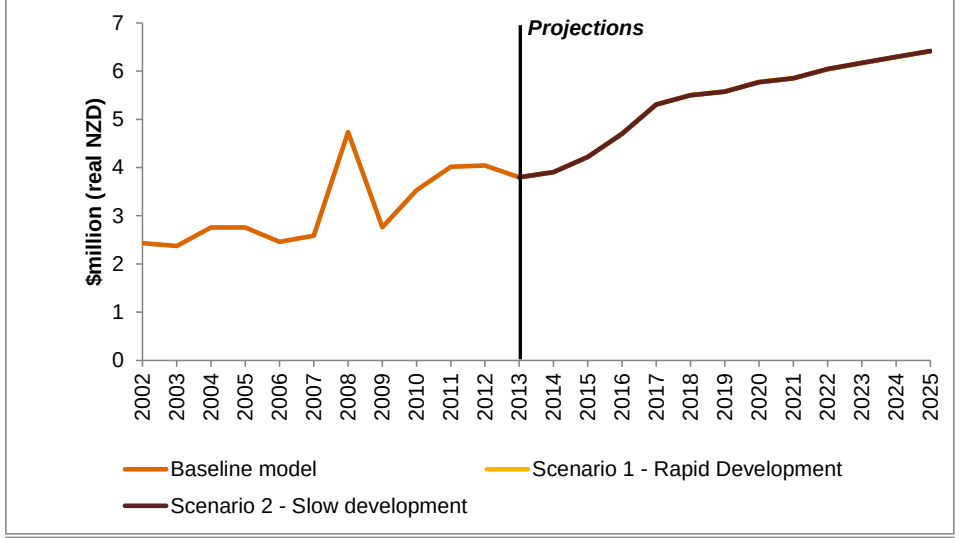

Value added, Forestry Sector, Tasman Region
2001-2055
Projections
$million (real NZD)
100
90
80
70
60
50
40
30
20
10
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development


Employment, Forestry Sector, Tasman Region
2001-2055
Projections
000 FTEs
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

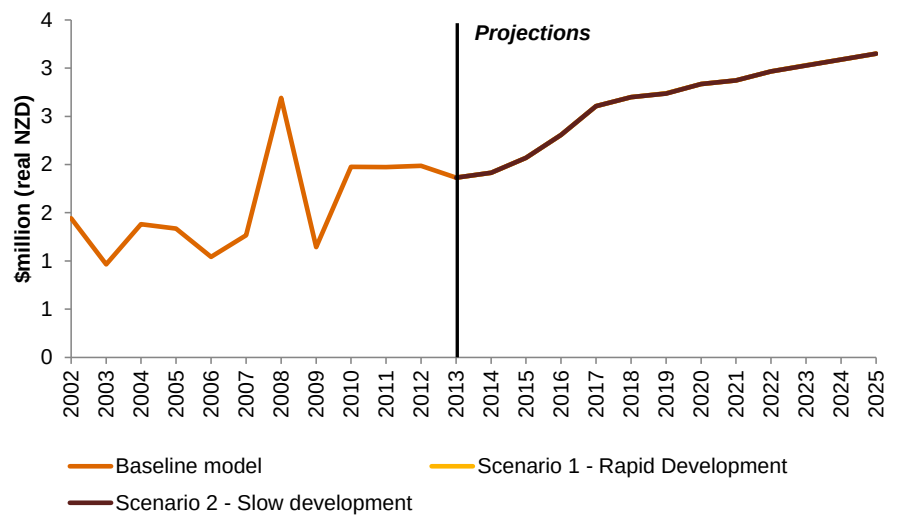

Investment, Forestry Sector, Tasman Region
2001-2055
Projections
$million (real NZD)
20
18
16
14
12
10
8
6
4
2
0
2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049 2052 2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

Nelson

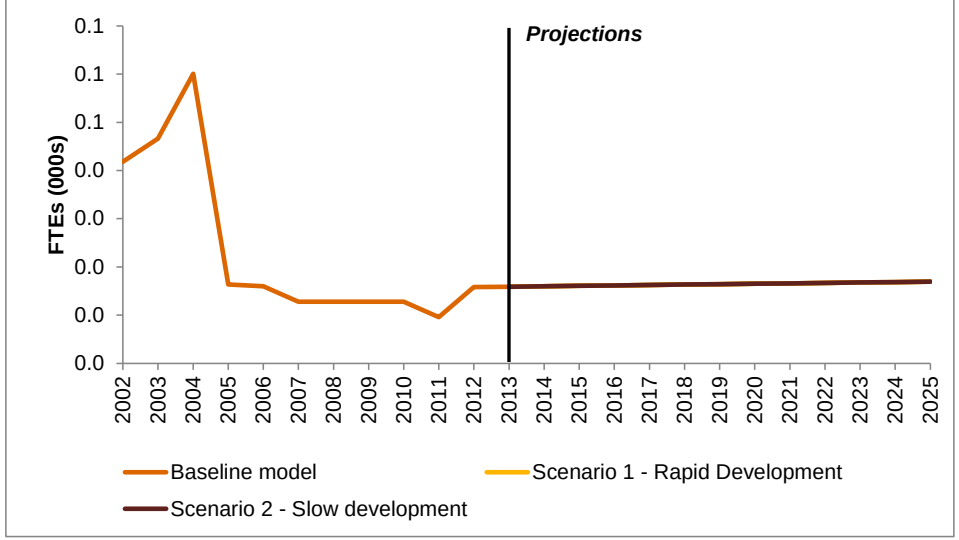
Gross Output, Dairy Sector, Nelson Region 2002-2025



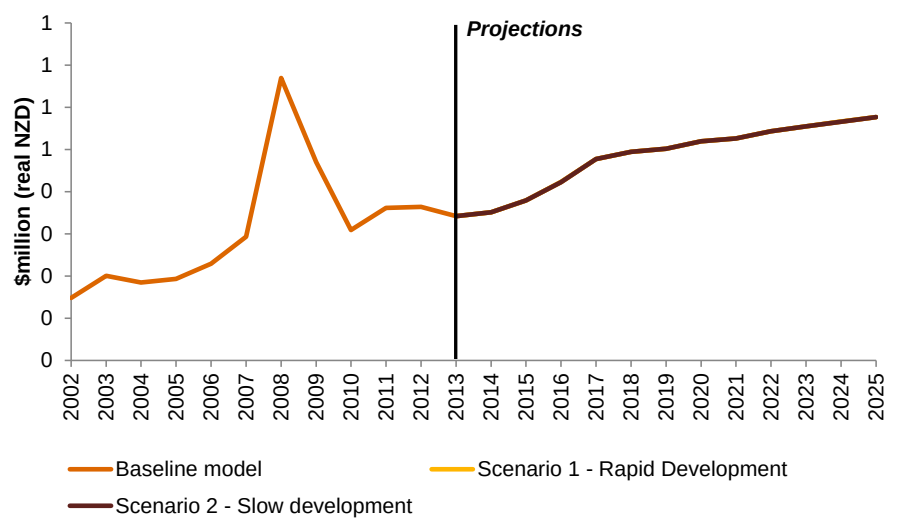
Value Added, Dairy Sector, Nelson Region 2002-2025



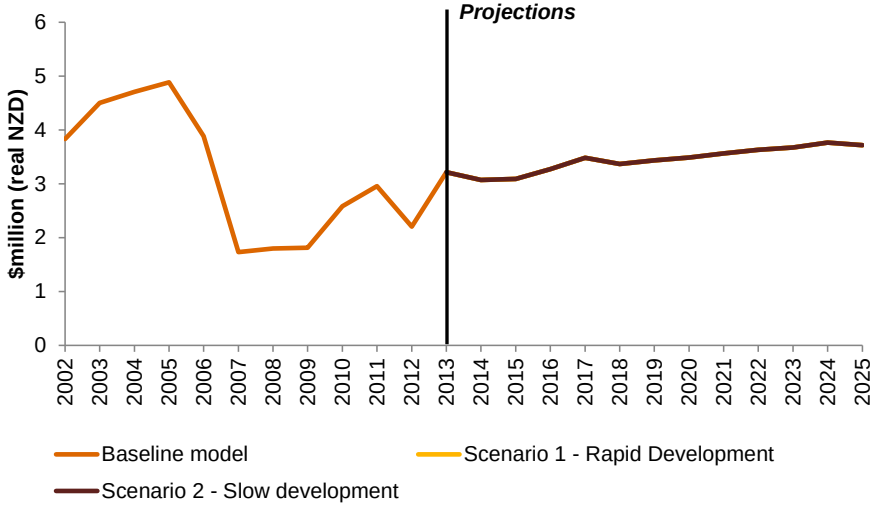
Employment, Dairy Sector, Nelson Region 2002-2025



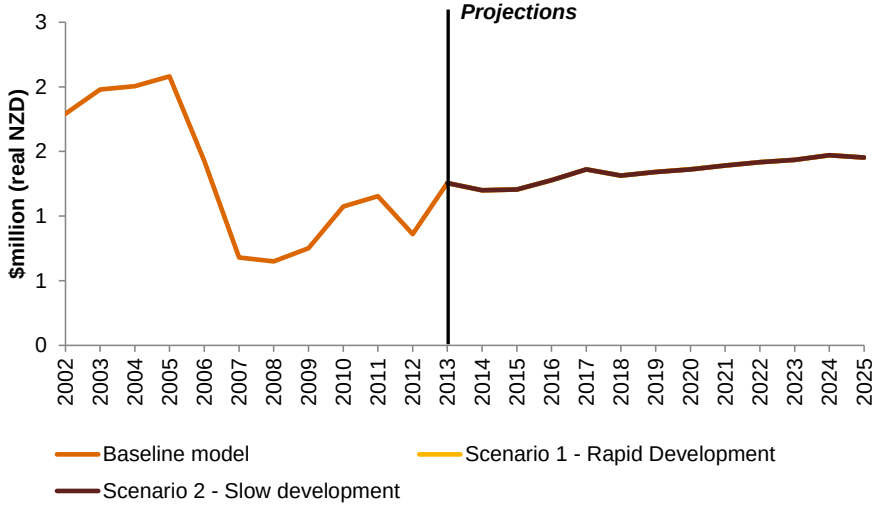
Investment, Dairy Sector, Nelson Region 2002-2025



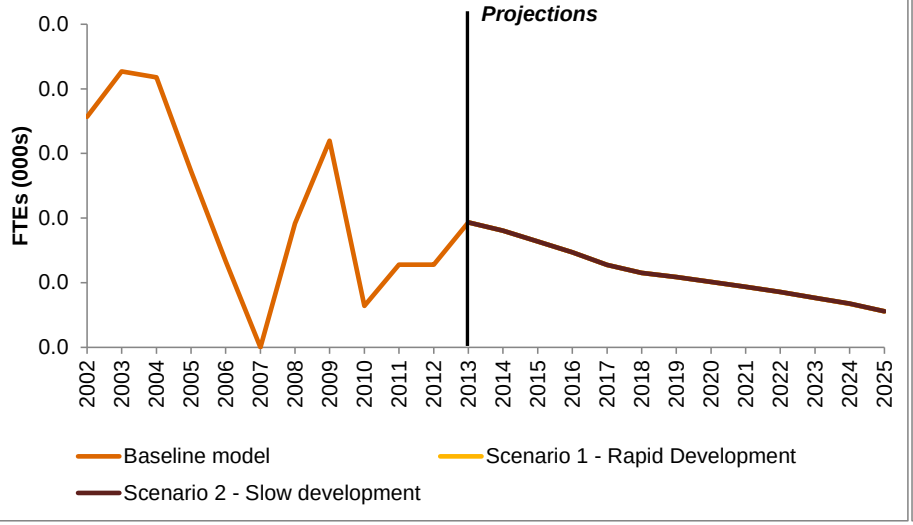
Gross Output, Sheep & Beef Sector, Nelson Region 2002-2025



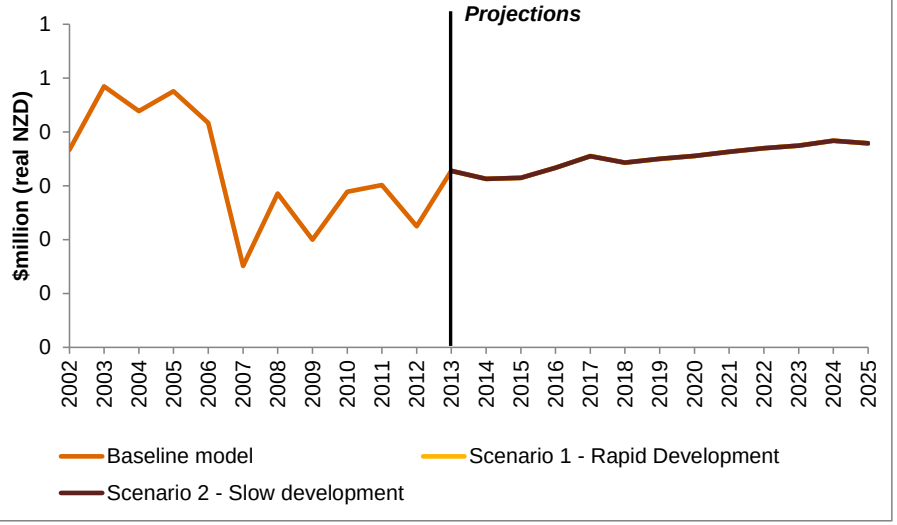
Value Added, Sheep & Beef Sector, Nelson Region 2002-2025



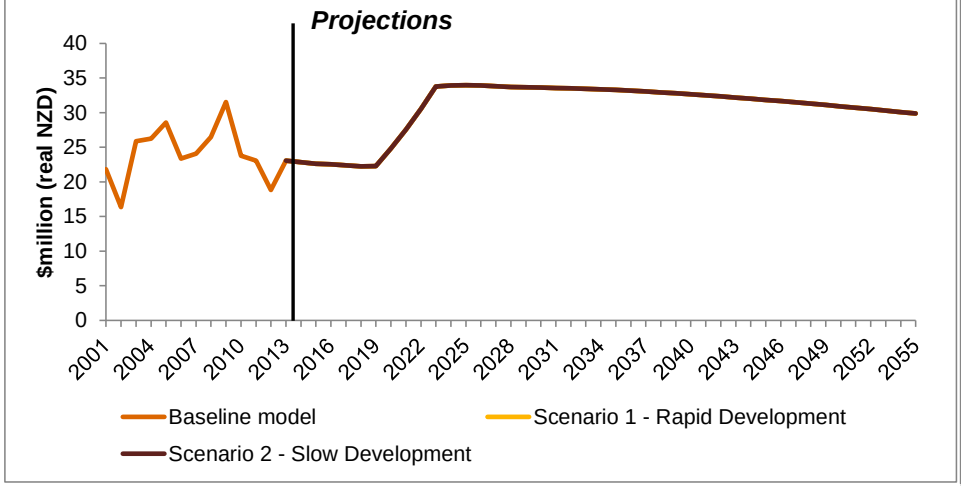
Employment, Sheep & Beef Sector, Nelson Region 2002-2025



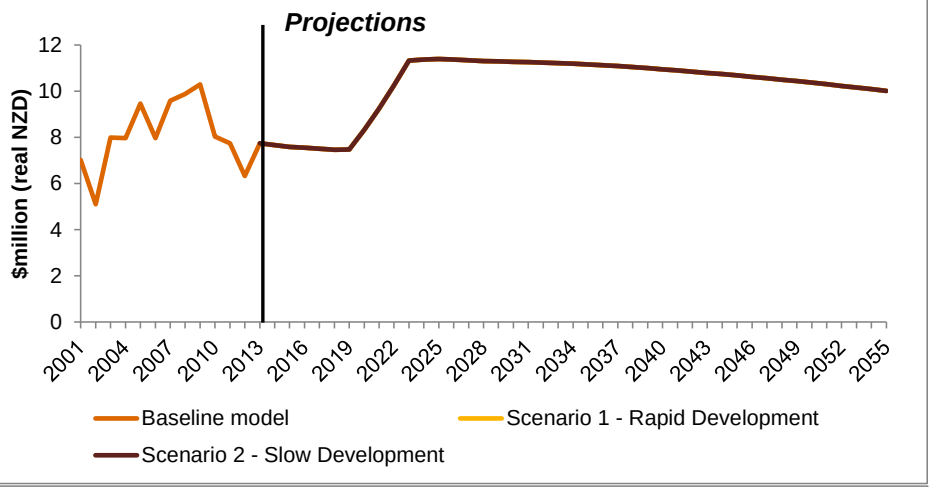
Investment, Sheep & Beef Sector, Nelson Region 2002-2025



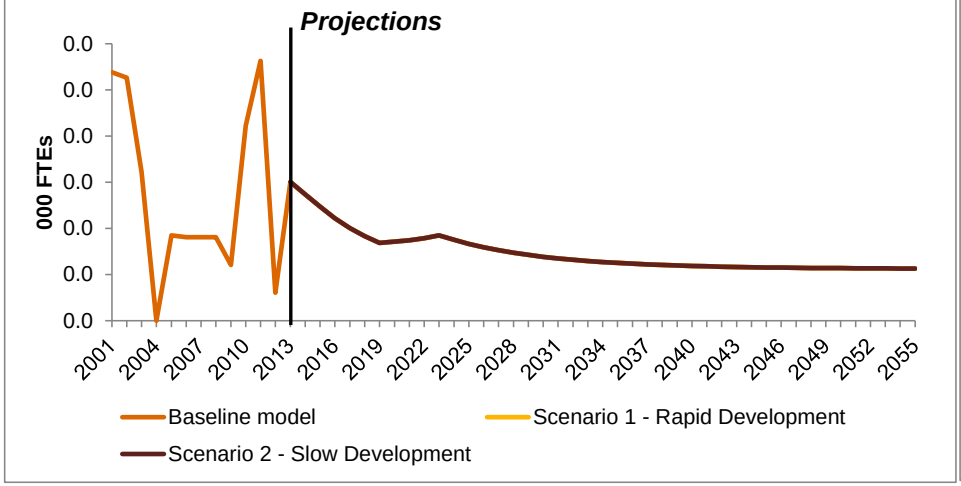
Gross Output, Forestry Sector, Nelson Region 2001-2055



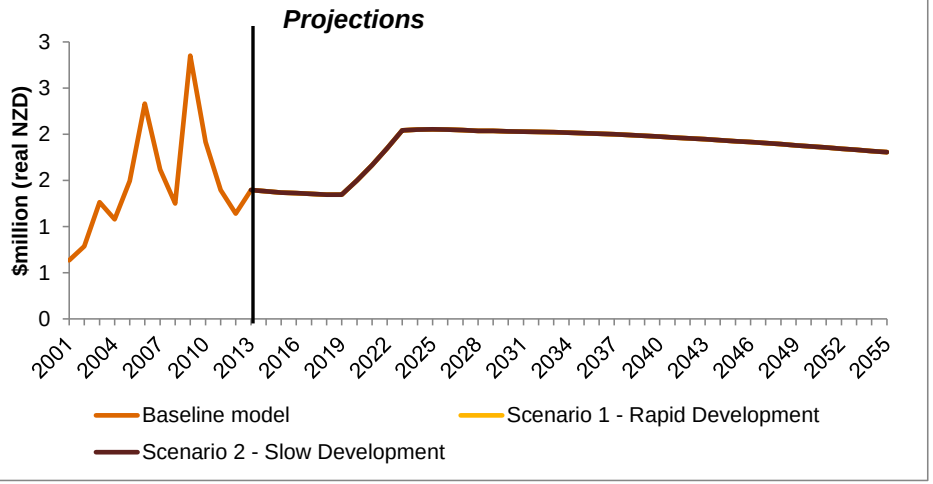
Value added, Forestry Sector, Nelson Region 2001-2055



Employment, Forestry Sector, Nelson Region 2001-2055

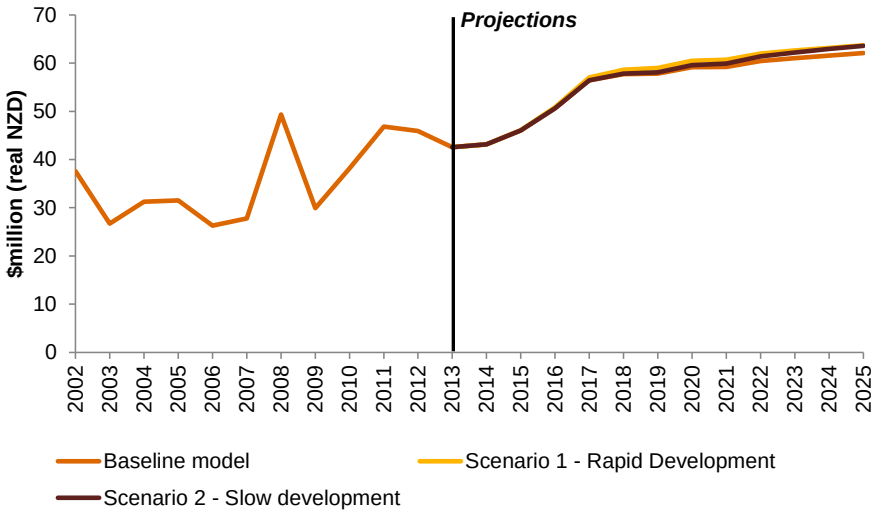


Investment, Forestry Sector, Nelson Region 2001-2055

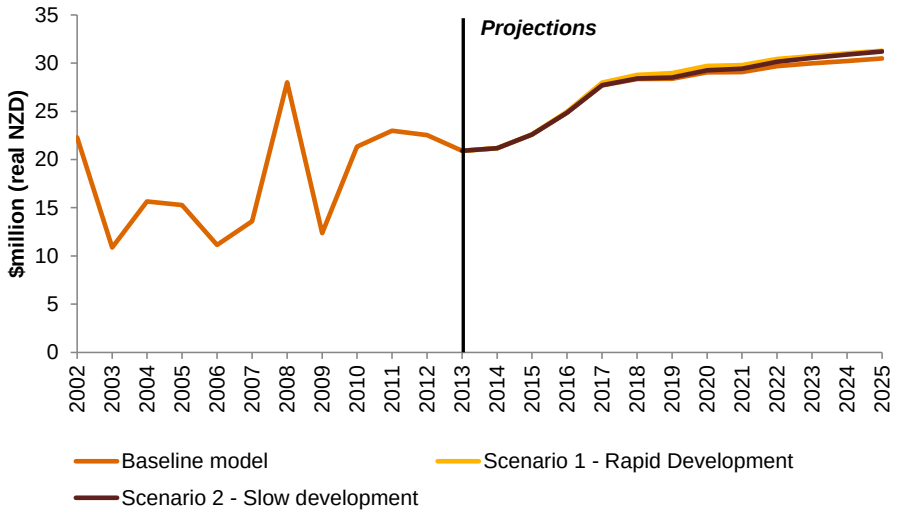


Marlborough

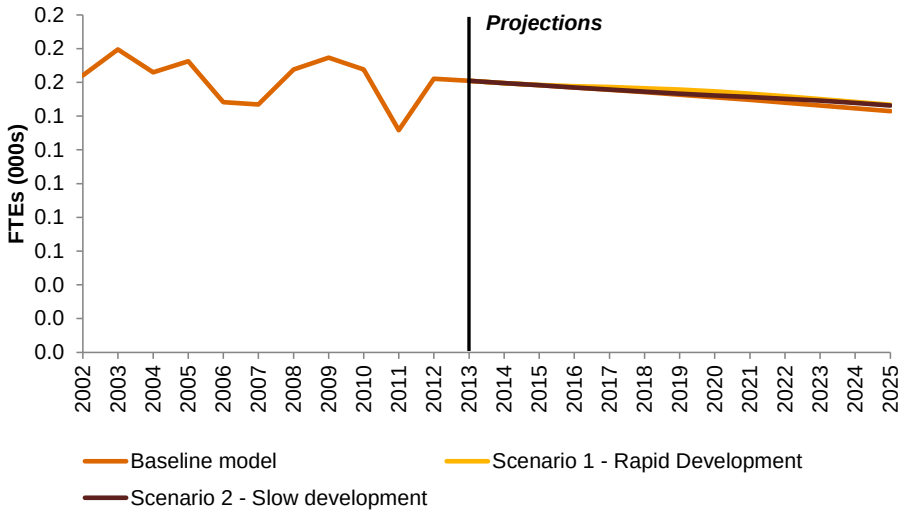
Gross Output, Dairy Sector, Marlborough Region 2002-2025



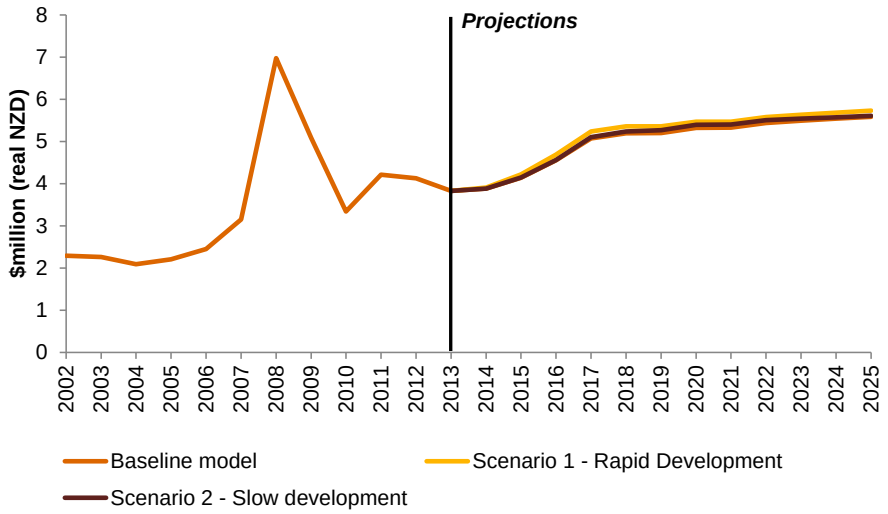
Value Added, Dairy Sector, Marlborough Region 2002-2025

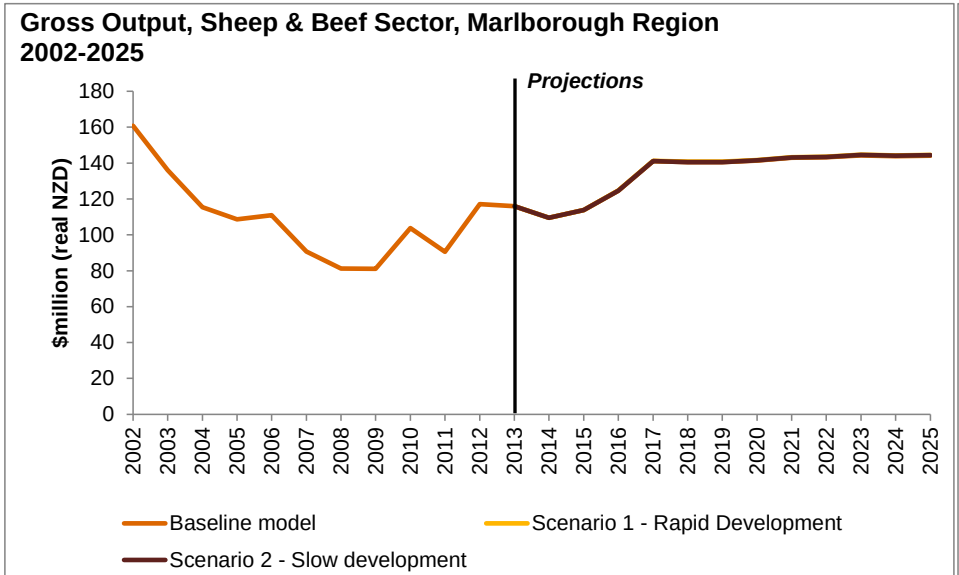


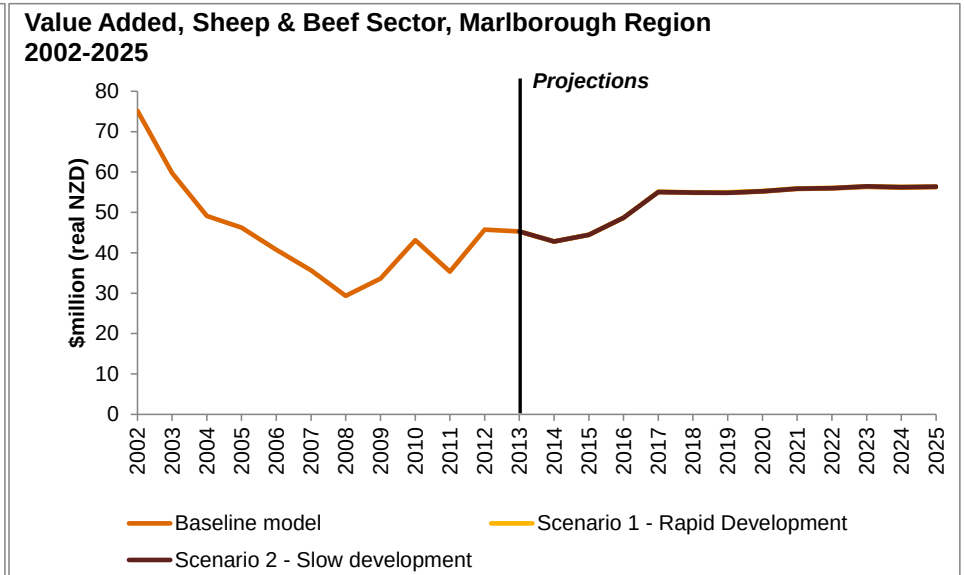
Employment, Dairy Sector, Marlborough Region 2002-2025

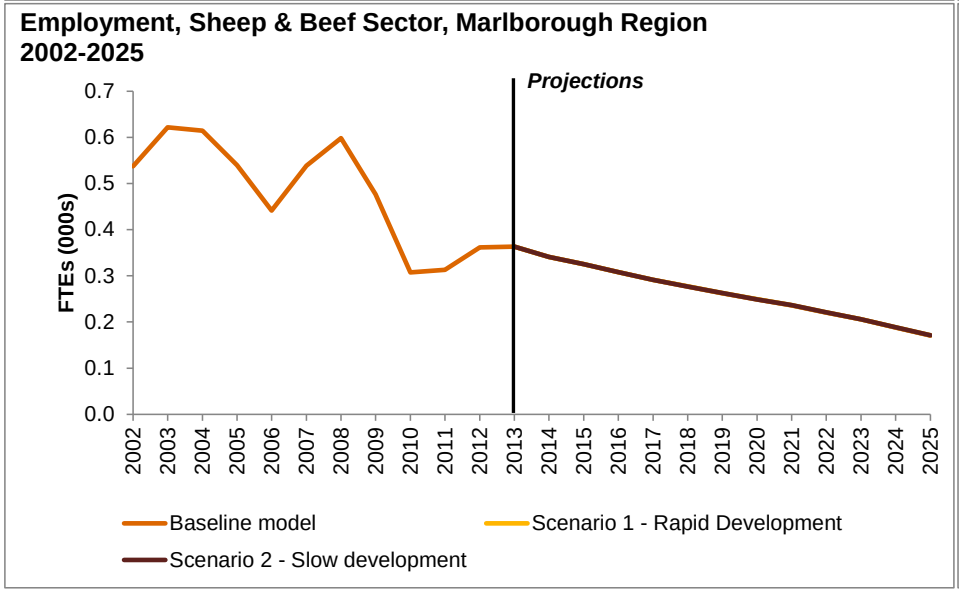


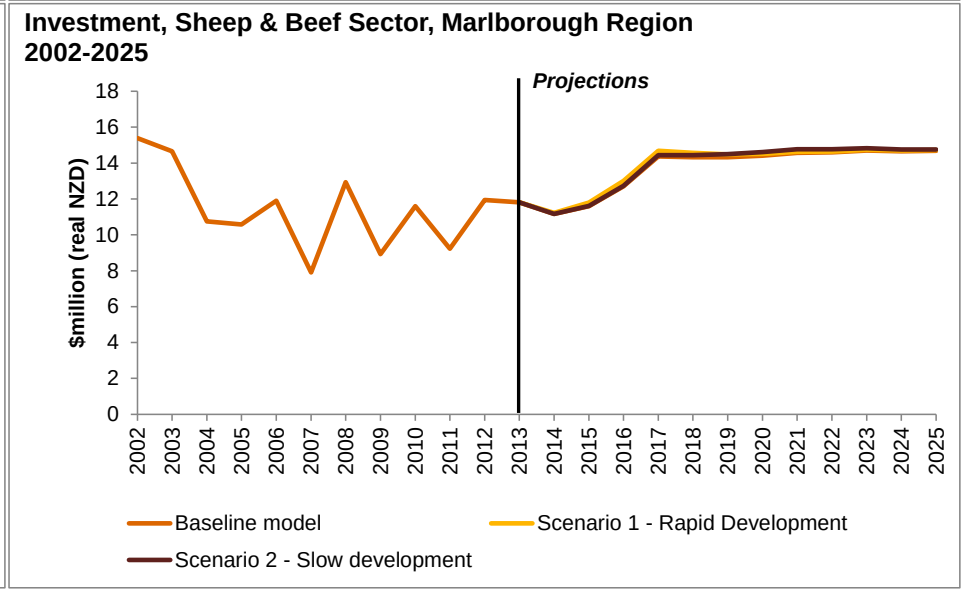
Investment, Dairy Sector, Marlborough Region 2002-2025



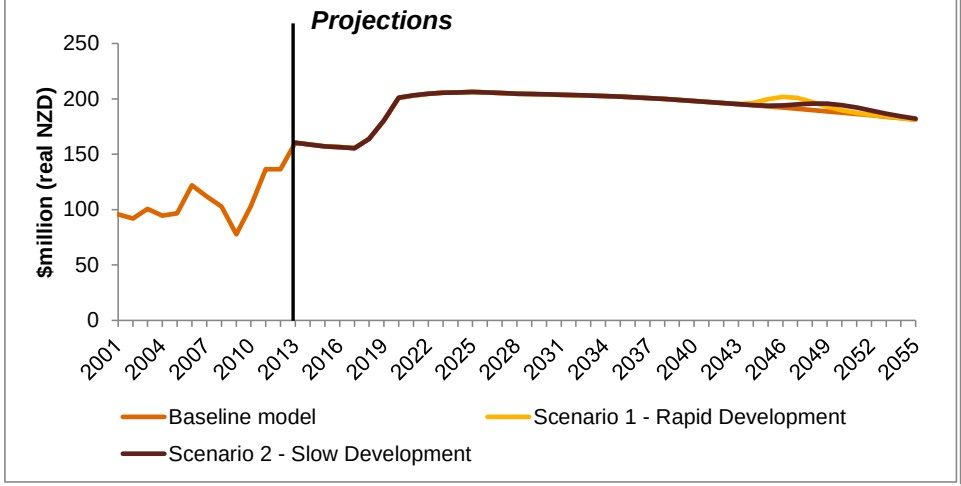

Gross Output, Sheep & Beef Sector, Marlborough Region
2002-2025
Projections
$million (real NZD)
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Value Added, Sheep & Beef Sector, Marlborough Region
2002-2025
Projections
$million (real NZD)
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

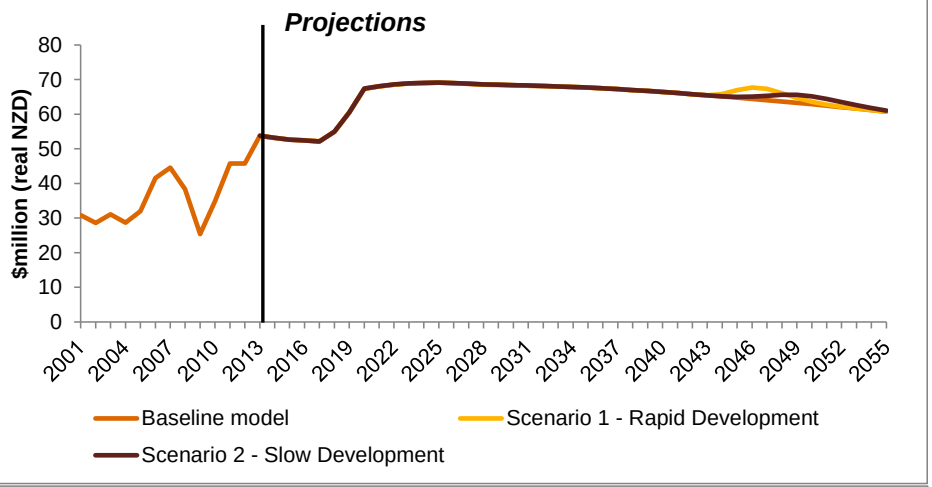

Employment, Sheep & Beef Sector, Marlborough Region
2002-2025
Projections
FTEs (000s)
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, Marlborough Region
2002-2025
Projections
$million (real NZD)
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

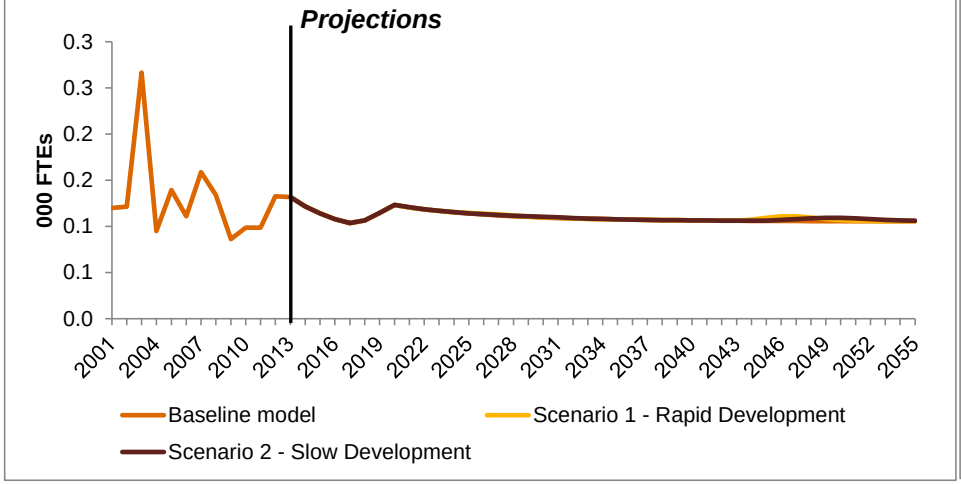
Gross Output, Forestry Sector, Marlborough Region 2001-2055



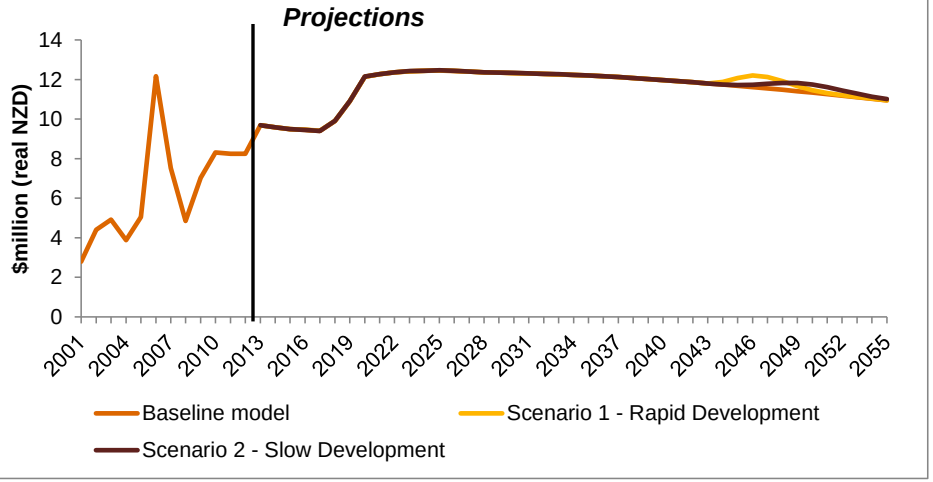
Value added, Forestry Sector, Marlborough Region 2001-2055



Employment, Forestry Sector, Marlborough Region 2001-2055

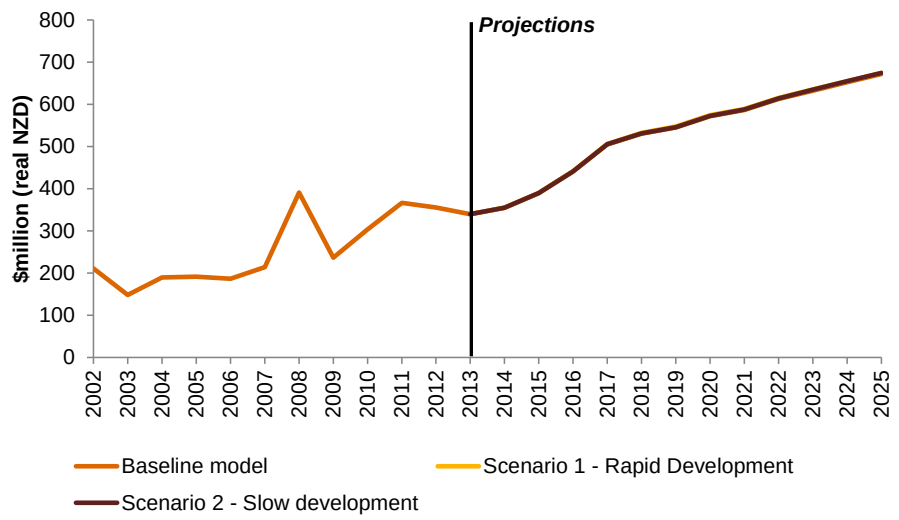


Investment, Forestry Sector, Marlborough Region 2001-2055

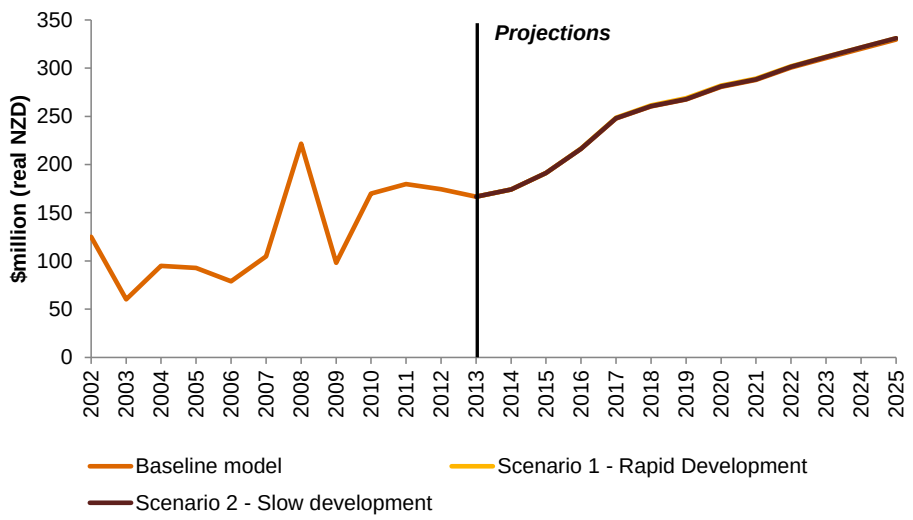


West Coast

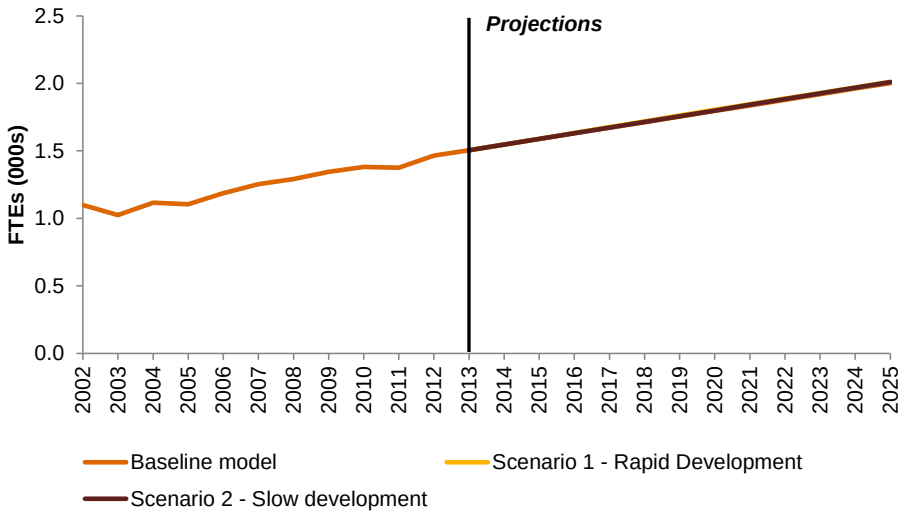
Gross Output, Dairy Sector, West Coast Region 2002-2025



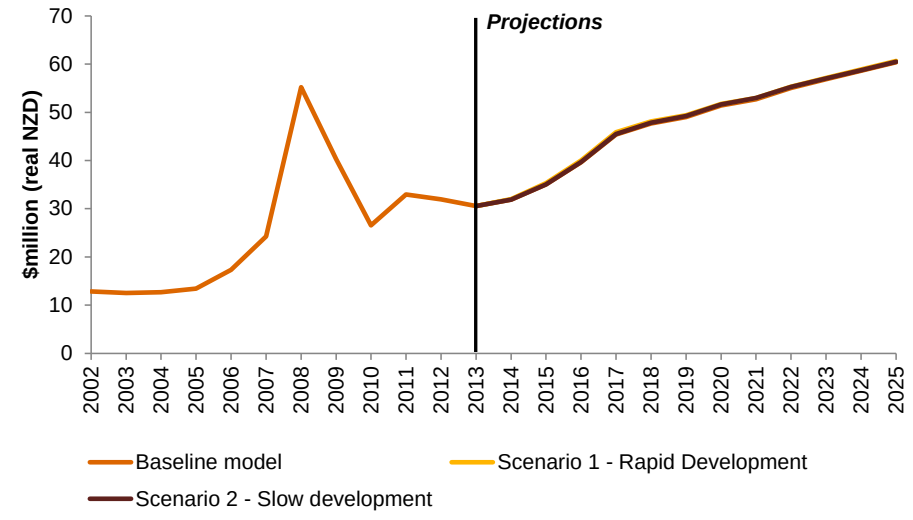
Value Added, Dairy Sector, West Coast Region 2002-2025

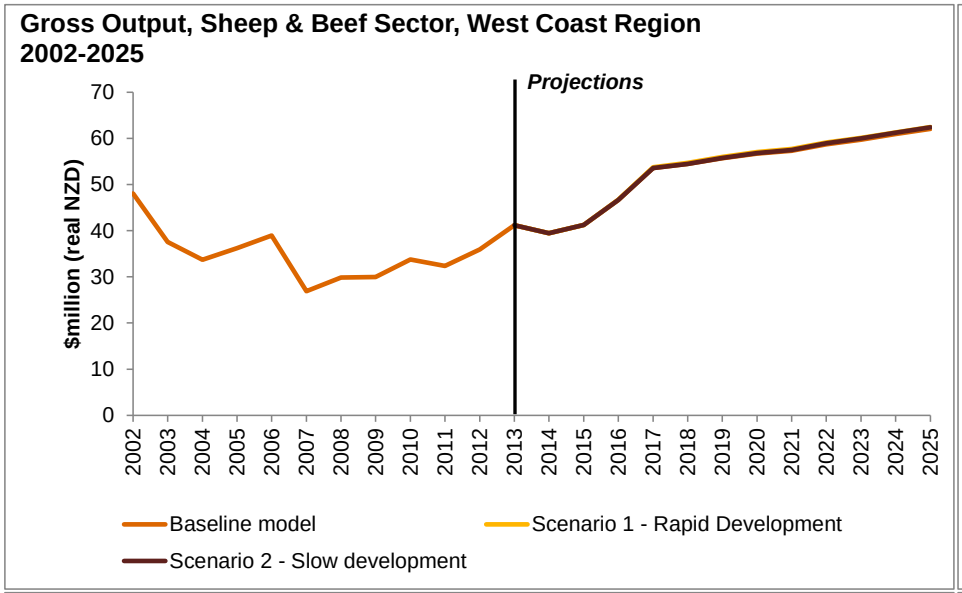


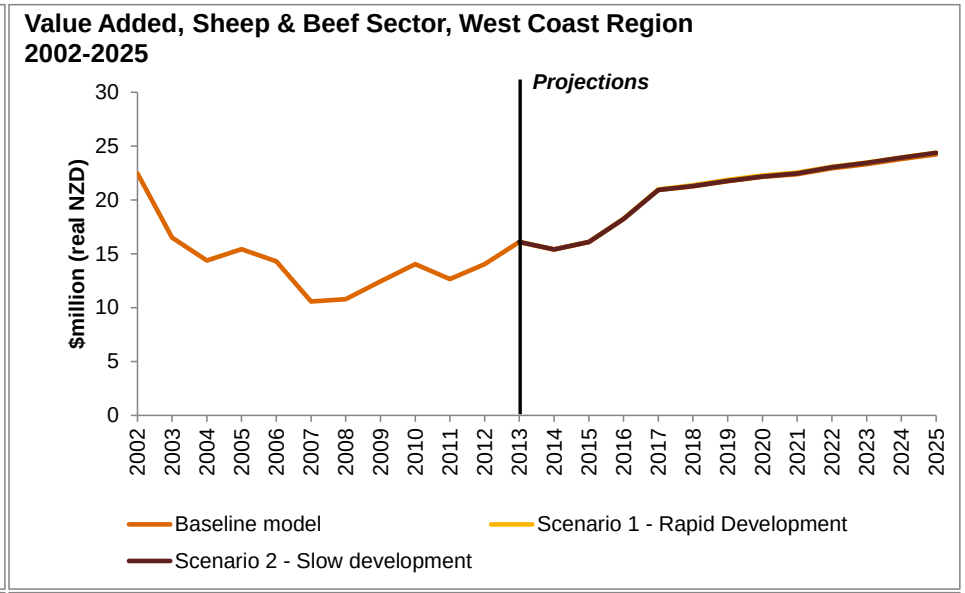
Employment, Dairy Sector, West Coast Region 2002-2025

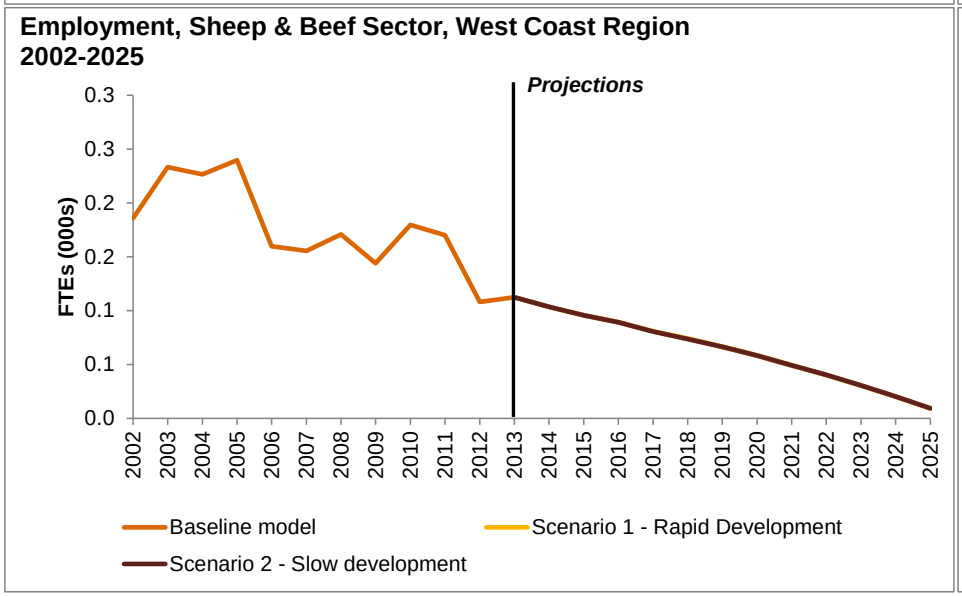


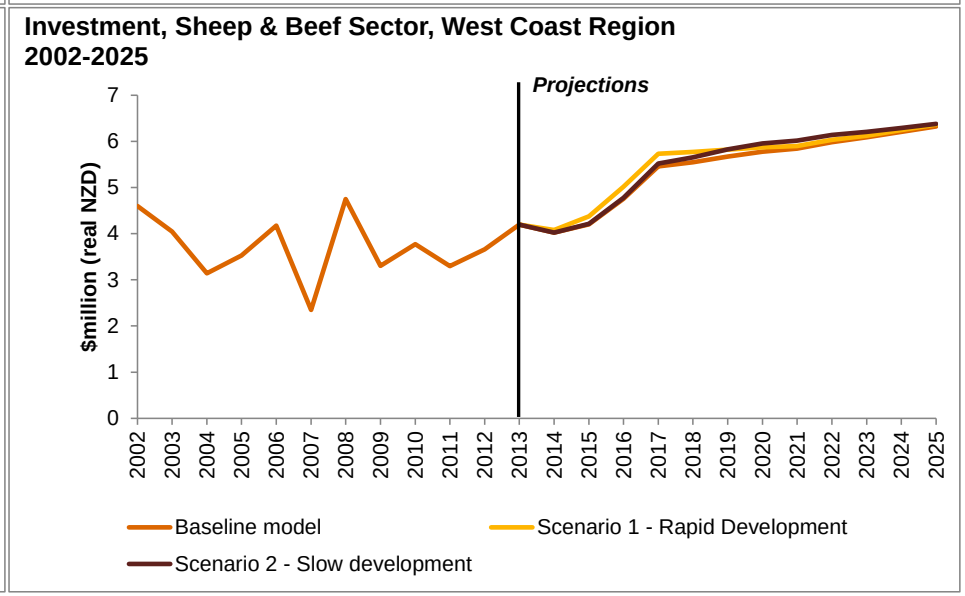
Investment, Dairy Sector, West Coast Region 2002-2025

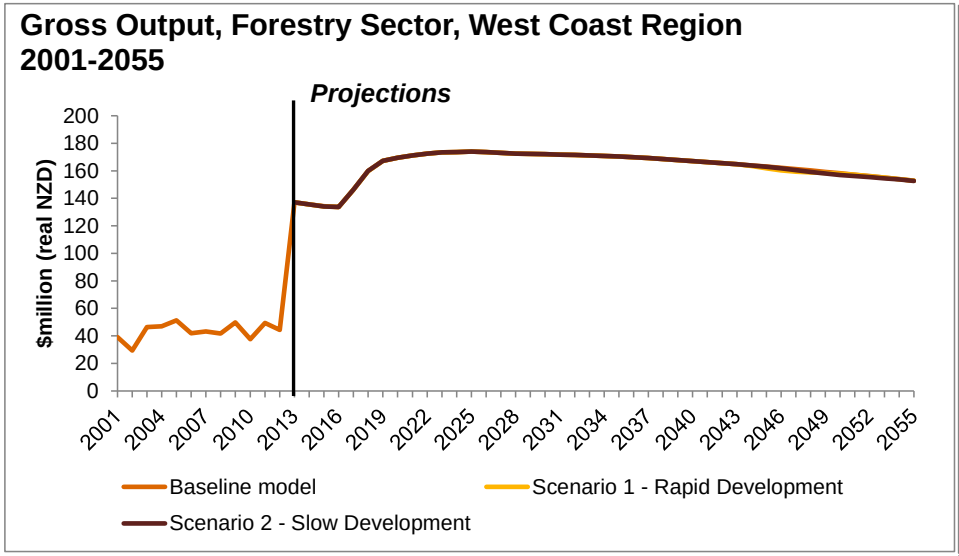


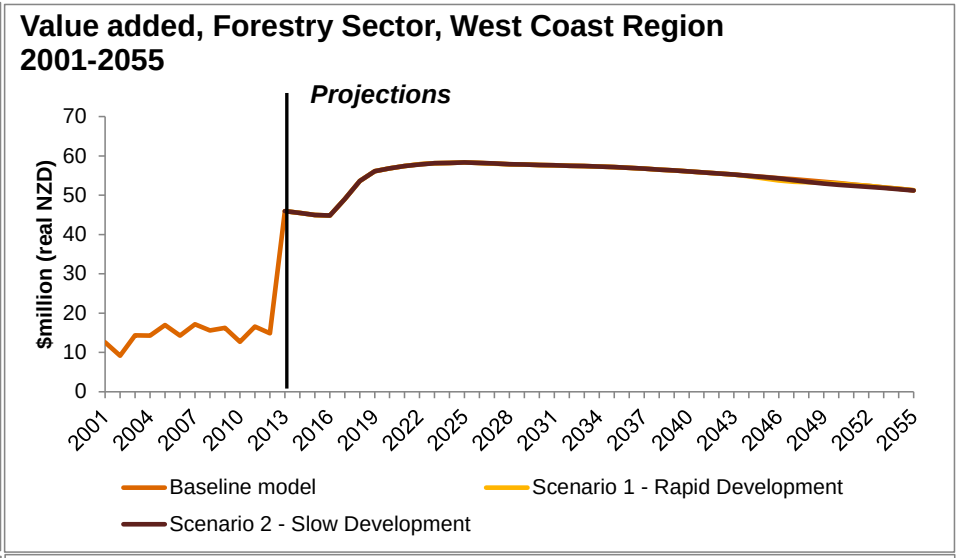

Gross Output, Sheep & Beef Sector, West Coast Region
2002-2025
Projections
$million (real NZD)
70
60
50
40
30
20
10
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

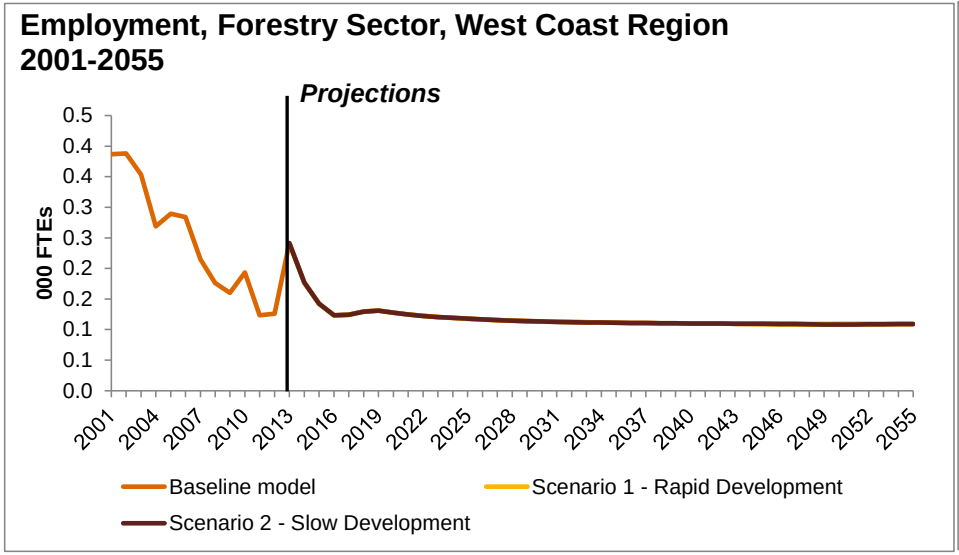

Value Added, Sheep & Beef Sector, West Coast Region
2002-2025
Projections
$million (real NZD)
30
25
20
15
10
5
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

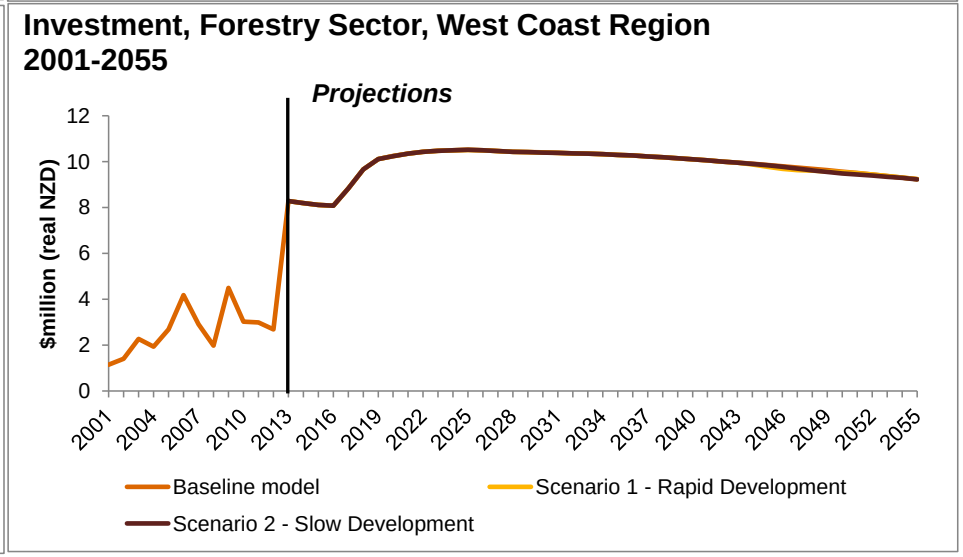

Employment, Sheep & Beef Sector, West Coast Region
2002-2025
Projections
FTEs (000s)
0.3
0.3
0.2
0.2
0.1
0.1
0.0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, West Coast Region
2002-2025
Projections
$million (real NZD)
7
6
5
4
3
2
1
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Gross Output, Forestry Sector, West Coast Region
2001-2055
Projections
$million (real NZD)
200
180
160
140
120
100
80
60
40
20
0
2001
2004
2007
2010
2013
2016
2019
2022
2025
2028
2031
2034
2037
2040
2043
2046
2049
2052
2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

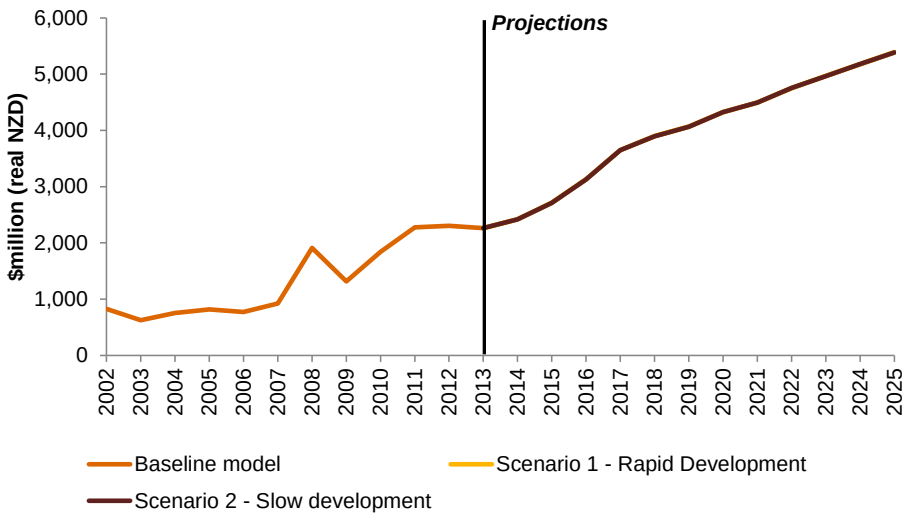

Value added, Forestry Sector, West Coast Region
2001-2055
Projections
$million (real NZD)
70
60
50
40
30
20
10
0
2001
2004
2007
2010
2013
2016
2019
2022
2025
2028
2031
2034
2037
2040
2043
2046
2049
2052
2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development


Employment, Forestry Sector, West Coast Region
2001-2055
Projections
000 FTEs
0.5
0.4
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
2001
2004
2007
2010
2013
2016
2019
2022
2025
2028
2031
2034
2037
2040
2043
2046
2049
2052
2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

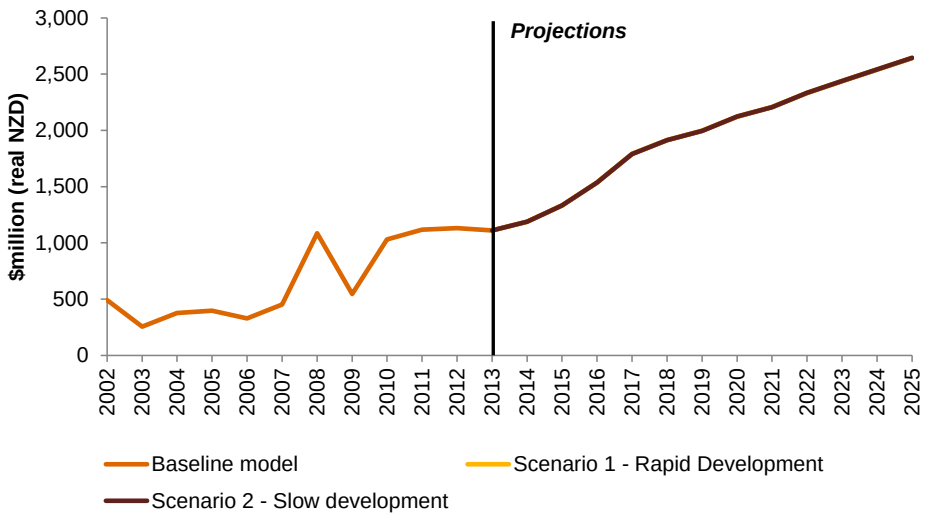

Investment, Forestry Sector, West Coast Region
2001-2055
Projections
$million (real NZD)
12
10
8
6
4
2
0
2001
2004
2007
2010
2013
2016
2019
2022
2025
2028
2031
2034
2037
2040
2043
2046
2049
2052
2055
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow Development

Canterbury

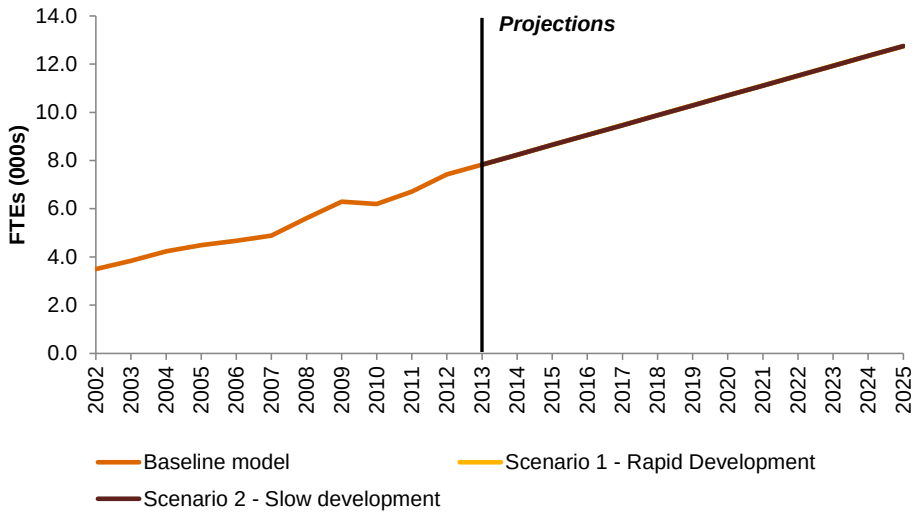
Gross Output, Dairy Sector, Canterbury Region 2002-2025



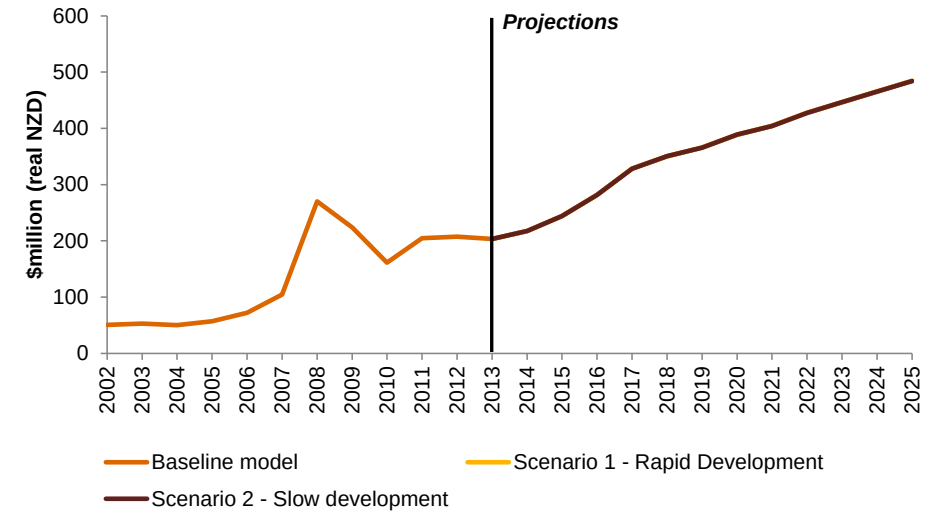
Value Added, Dairy Sector, Canterbury Region 2002-2025

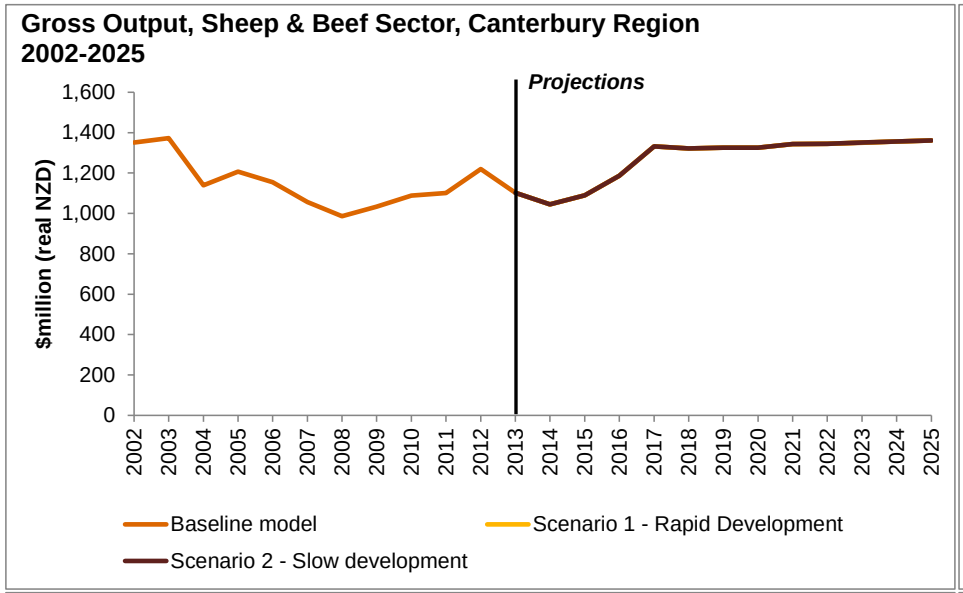


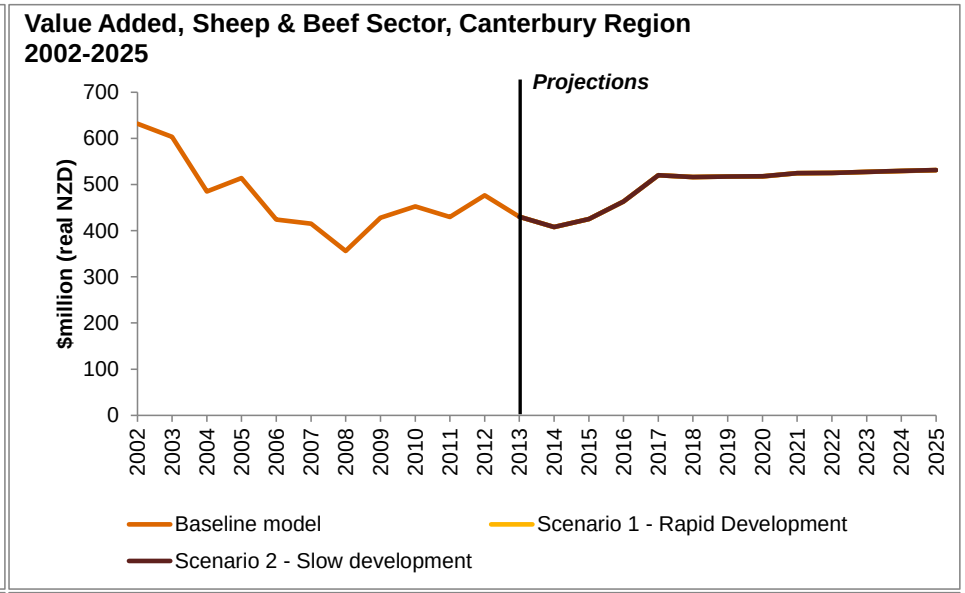
Employment, Dairy Sector, Canterbury Region 2002-2025

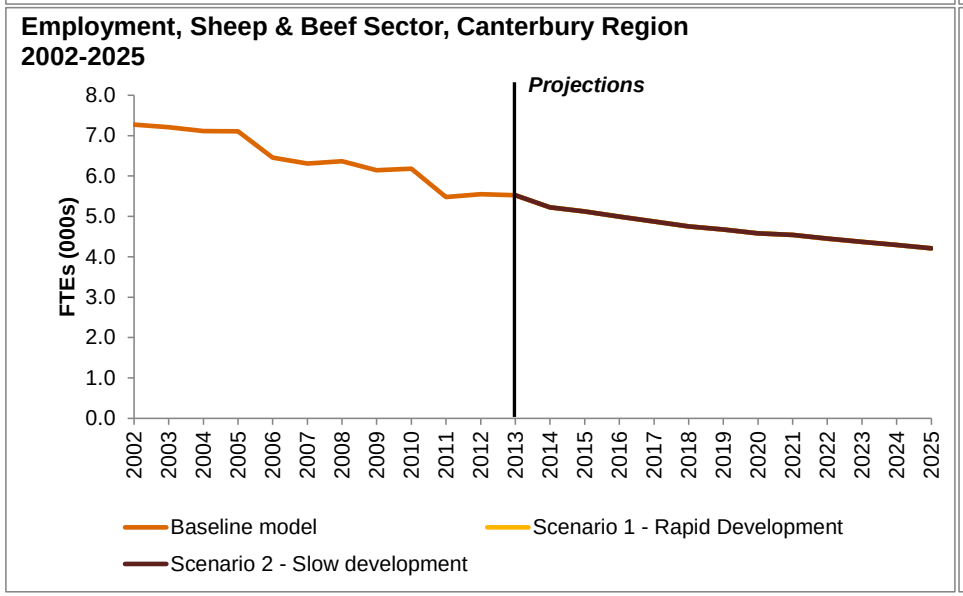


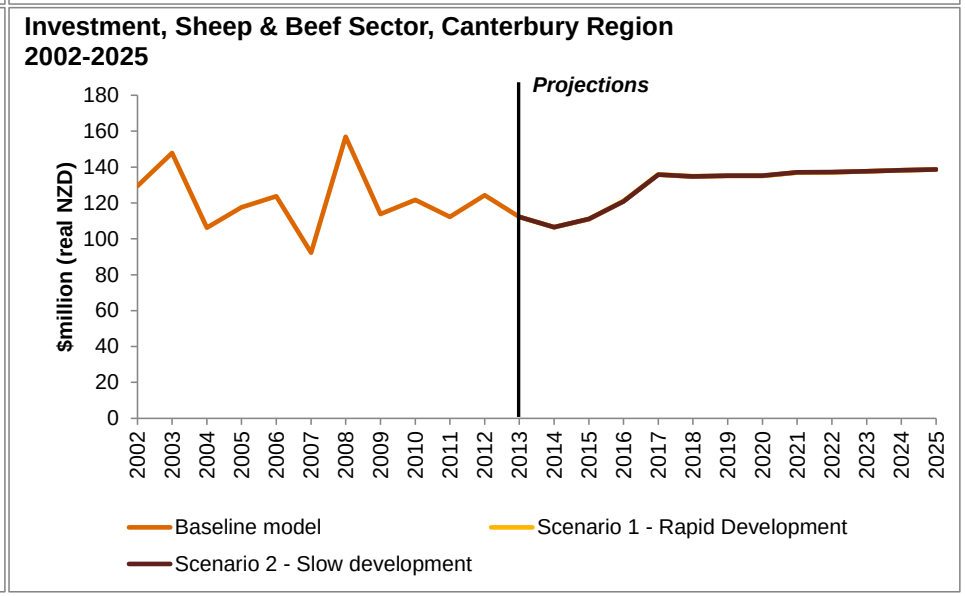
Investment, Dairy Sector, Canterbury Region 2002-2025



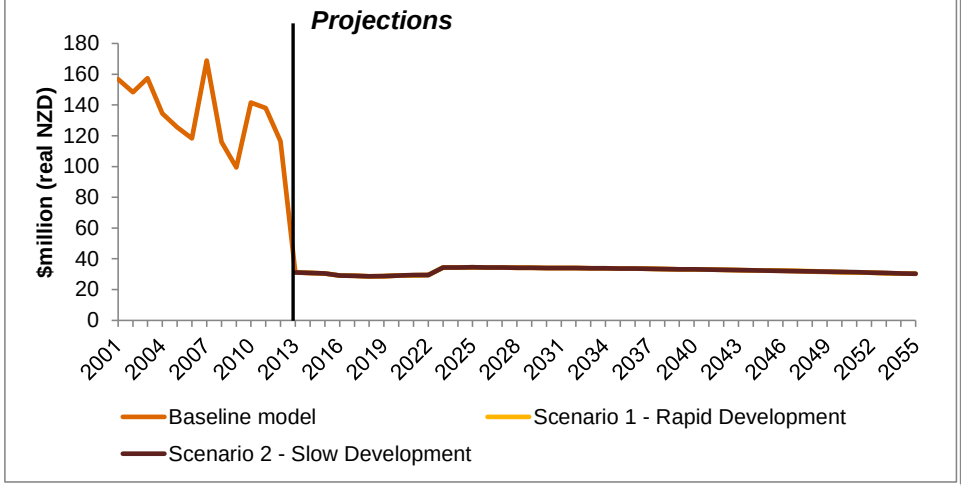

Gross Output, Sheep & Beef Sector, Canterbury Region
2002-2025
Projections
$million (real NZD)
1,600
1,400
1,200
1,000
800
600
400
200
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Value Added, Sheep & Beef Sector, Canterbury Region
2002-2025
Projections
$million (real NZD)
700
600
500
400
300
200
100
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

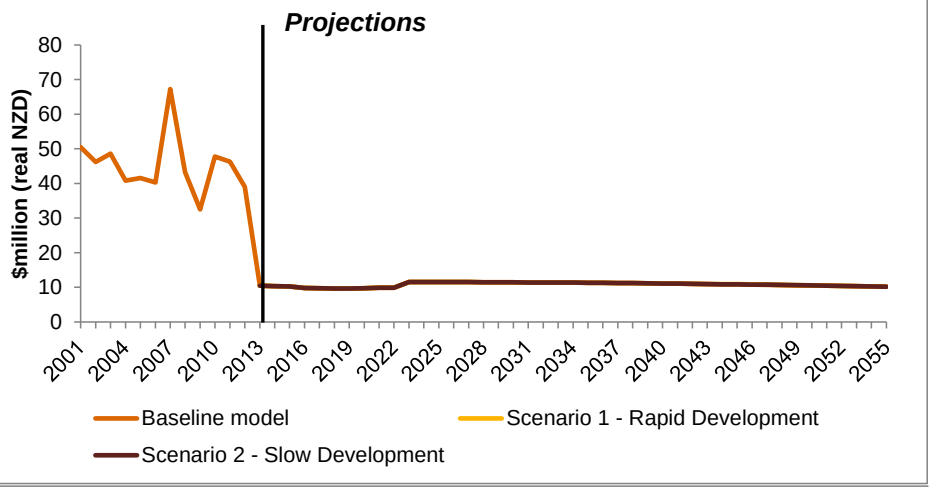

Employment, Sheep & Beef Sector, Canterbury Region
2002-2025
Projections
FTEs (000s)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, Canterbury Region
2002-2025
Projections
$million (real NZD)
180
160
140
120
100
80
60
40
20
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

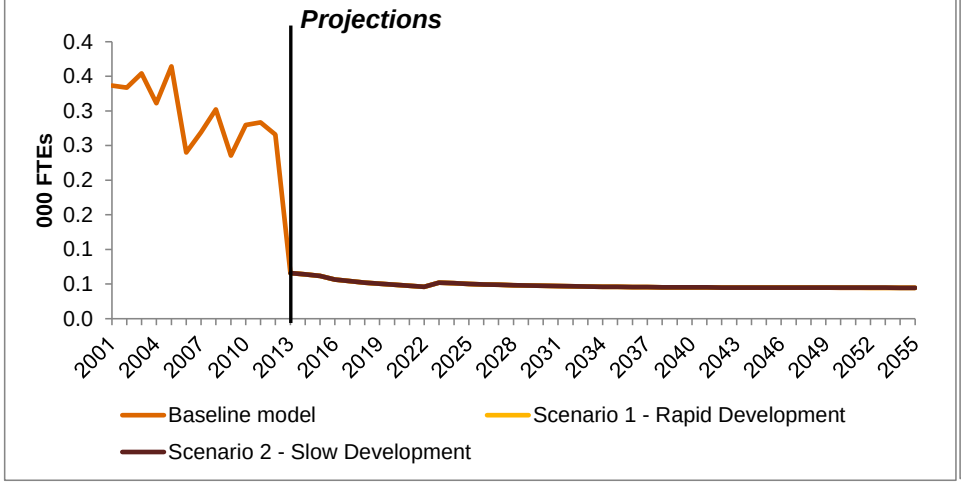
Gross Output, Forestry Sector, Canterbury Region 2001-2055



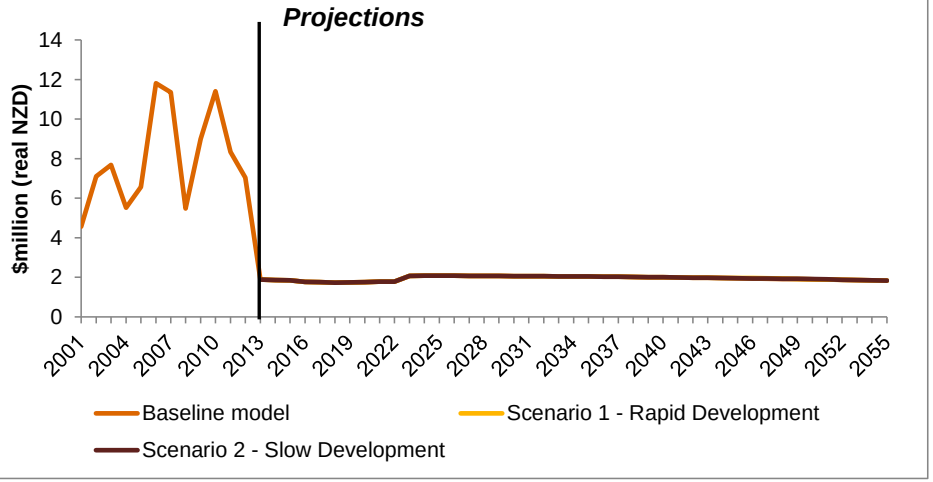
Value added, Forestry Sector, Canterbury Region 2001-2055



Employment, Forestry Sector, Canterbury Region 2001-2055

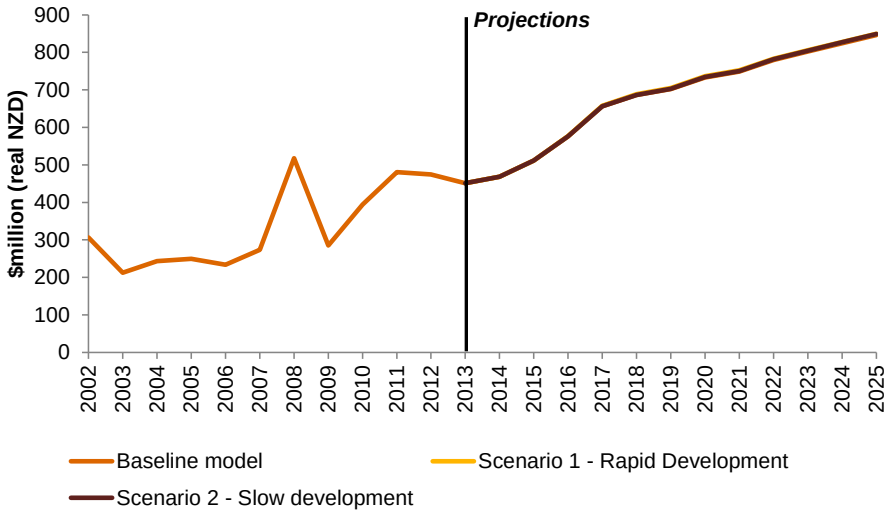


Investment, Forestry Sector, Canterbury Region 2001-2055

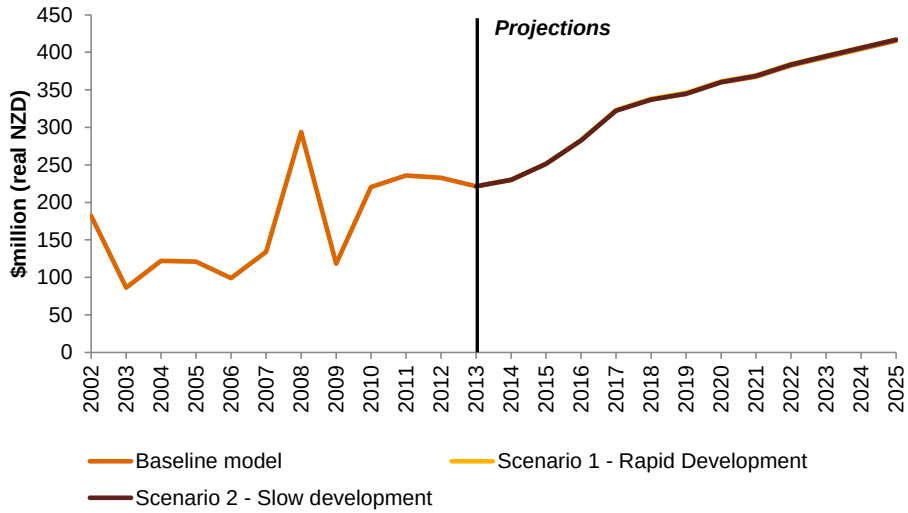


Otago

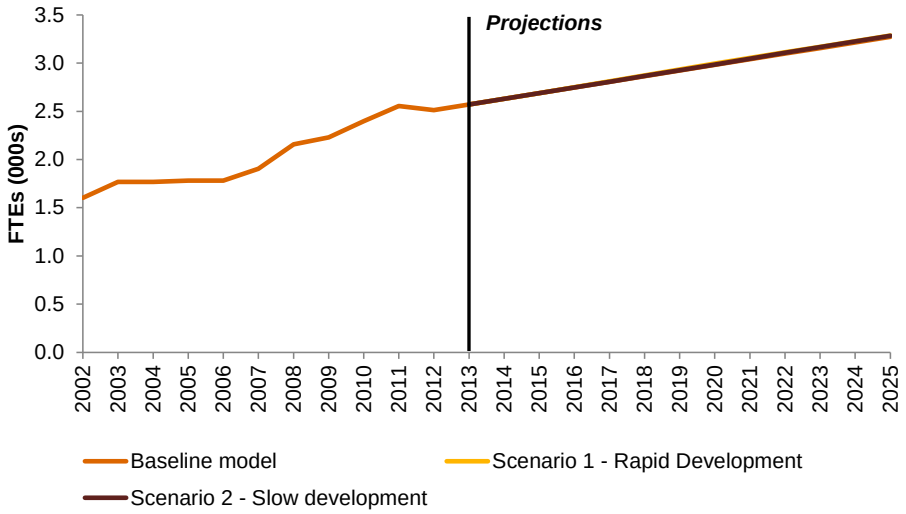
Gross Output, Dairy Sector, Otago Region 2002-2025



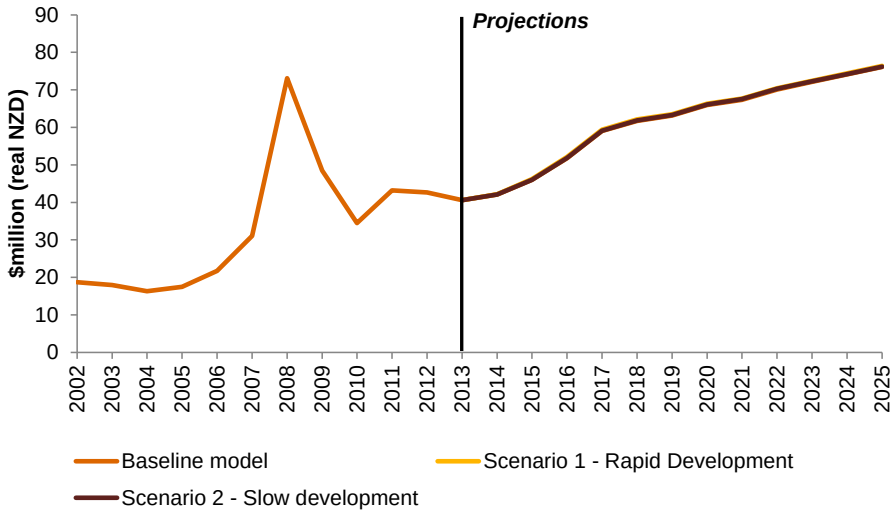
Value Added, Dairy Sector, Otago Region 2002-2025

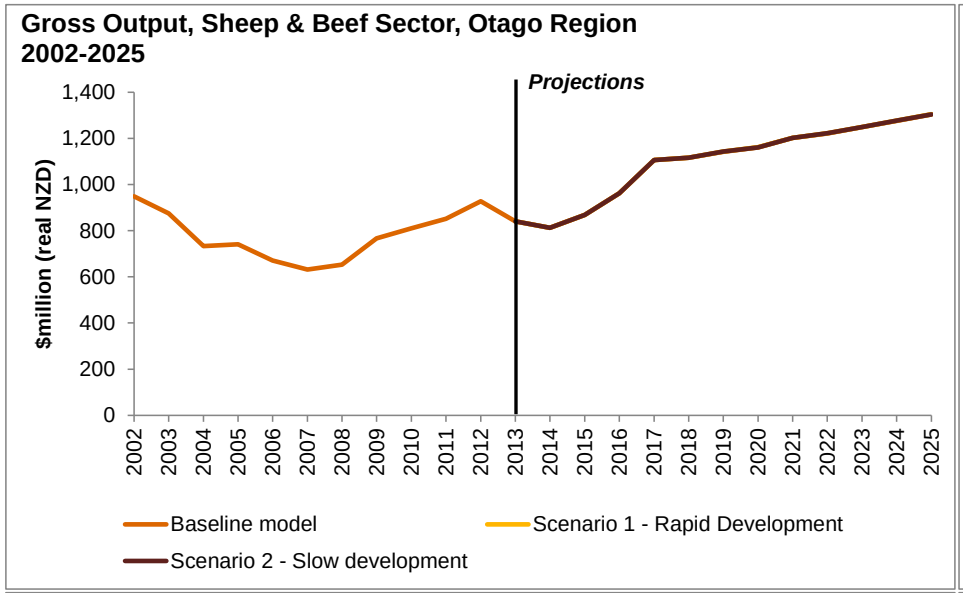


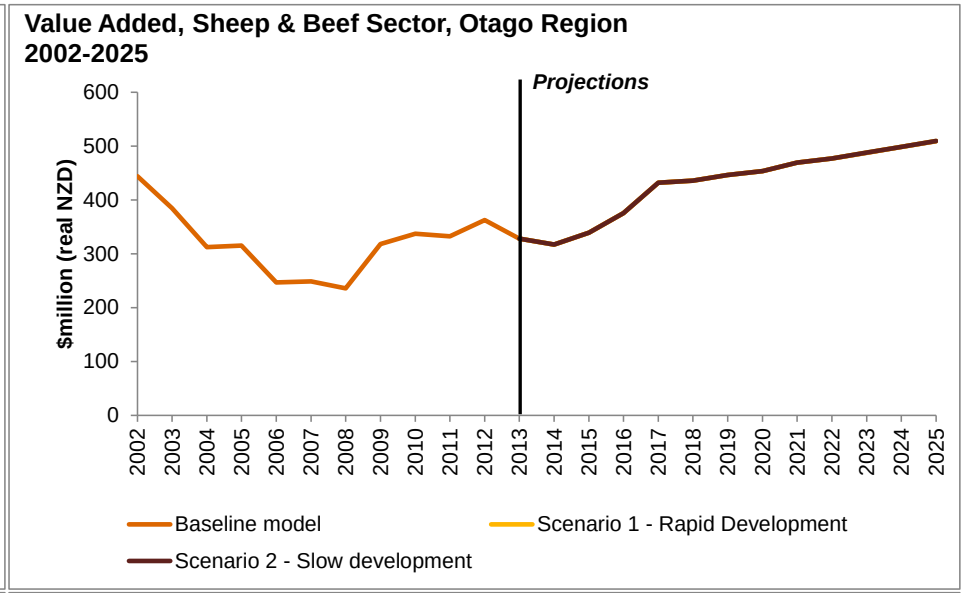
Employment, Dairy Sector, Otago Region 2002-2025

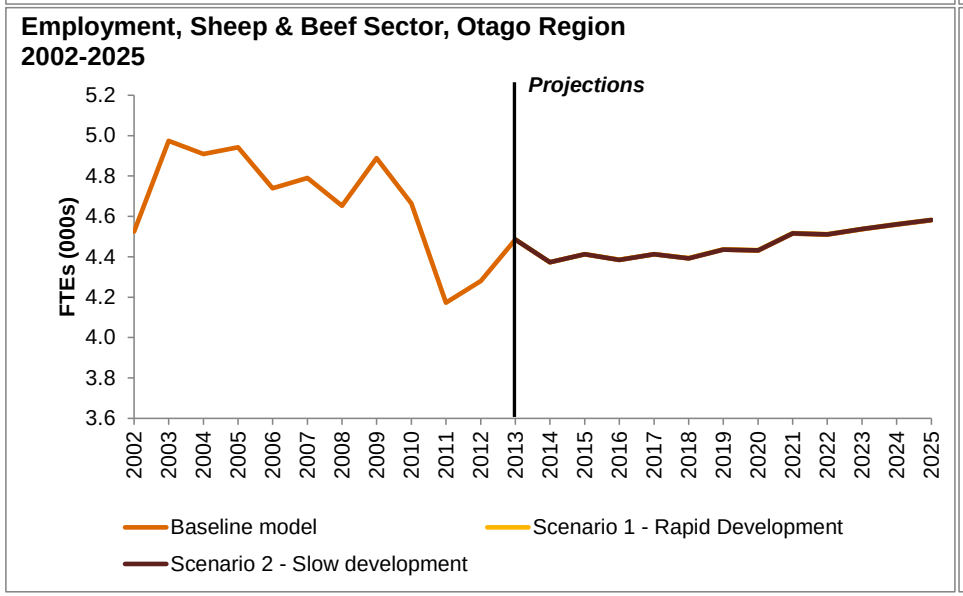


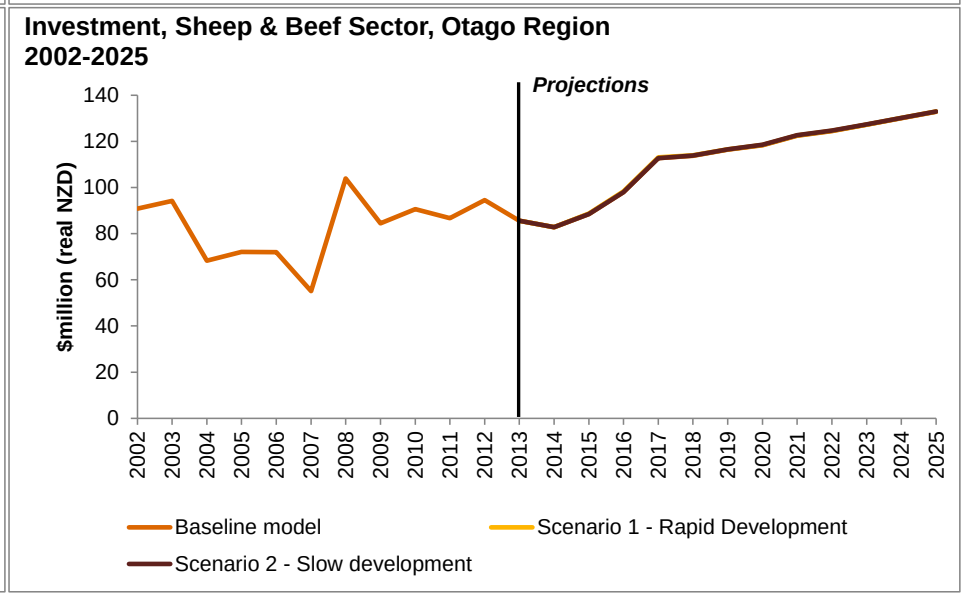
Investment, Dairy Sector, Otago Region 2002-2025



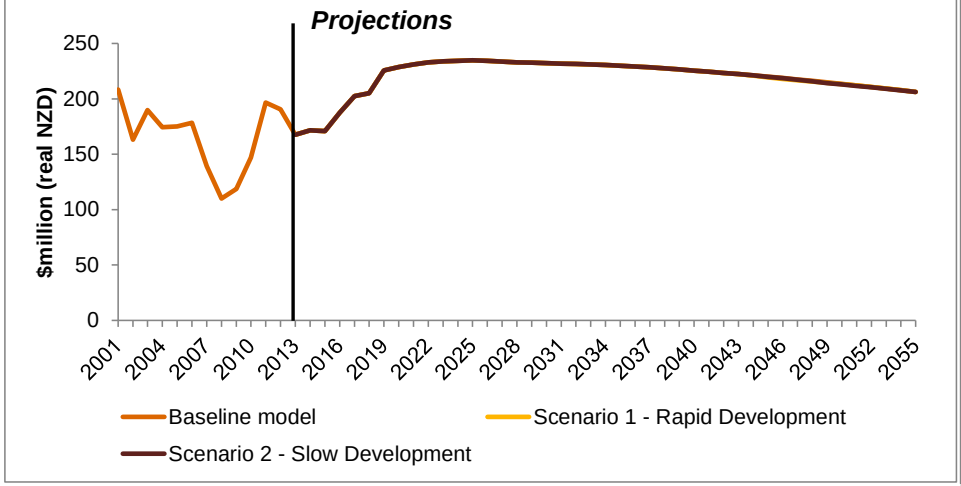

Gross Output, Sheep & Beef Sector, Otago Region
2002-2025
Projections
$million (real NZD)
1,400
1,200
1,000
800
600
400
200
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Value Added, Sheep & Beef Sector, Otago Region
2002-2025
Projections
$million (real NZD)
600
500
400
300
200
100
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

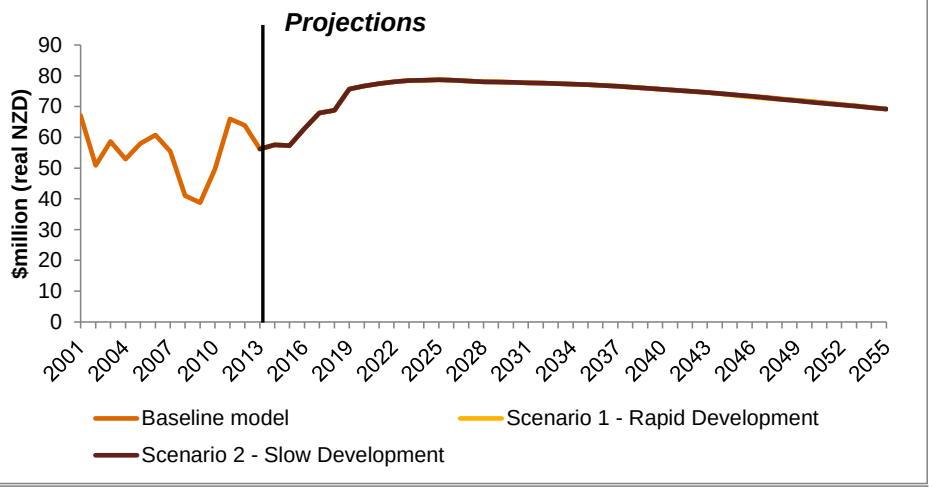

Employment, Sheep & Beef Sector, Otago Region
2002-2025
Projections
FTEs (000s)
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, Otago Region
2002-2025
Projections
$million (real NZD)
140
120
100
80
60
40
20
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

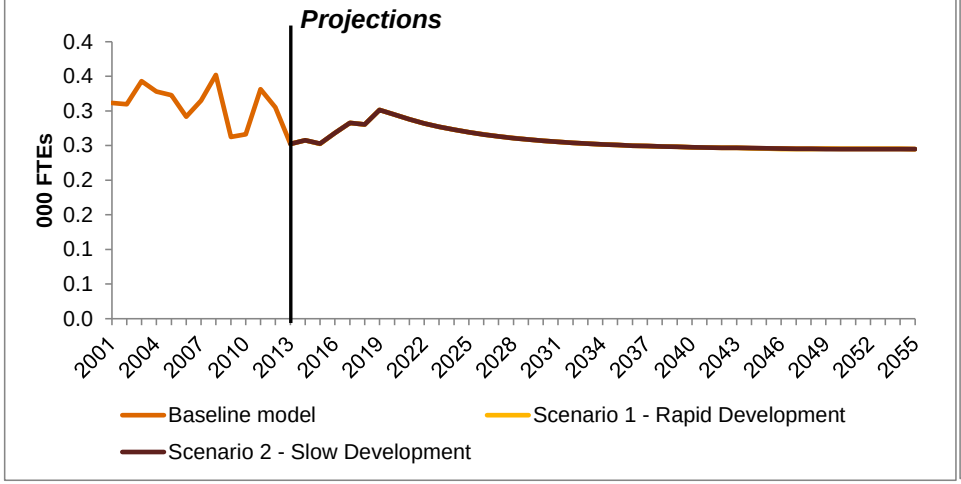
Gross Output, Forestry Sector, Otago Region 2001-2055



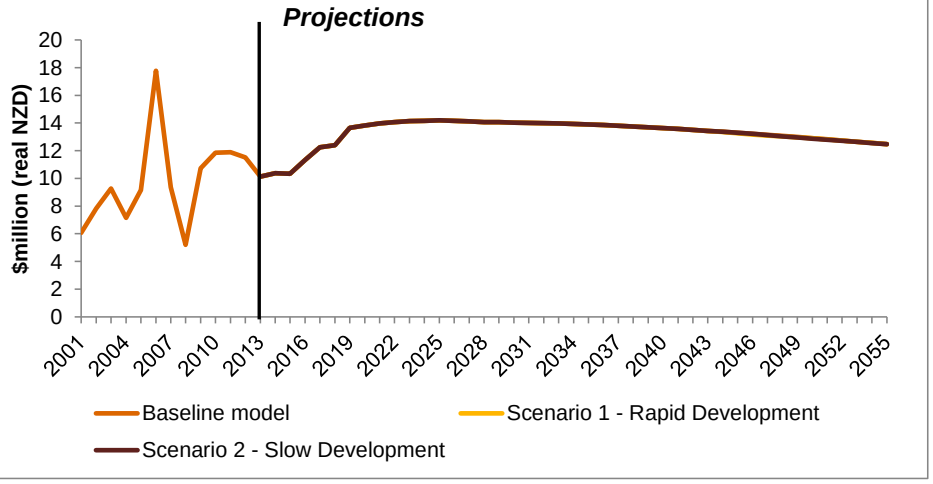
Value added, Forestry Sector, Otago Region 2001-2055



Employment, Forestry Sector, Otago Region 2001-2055

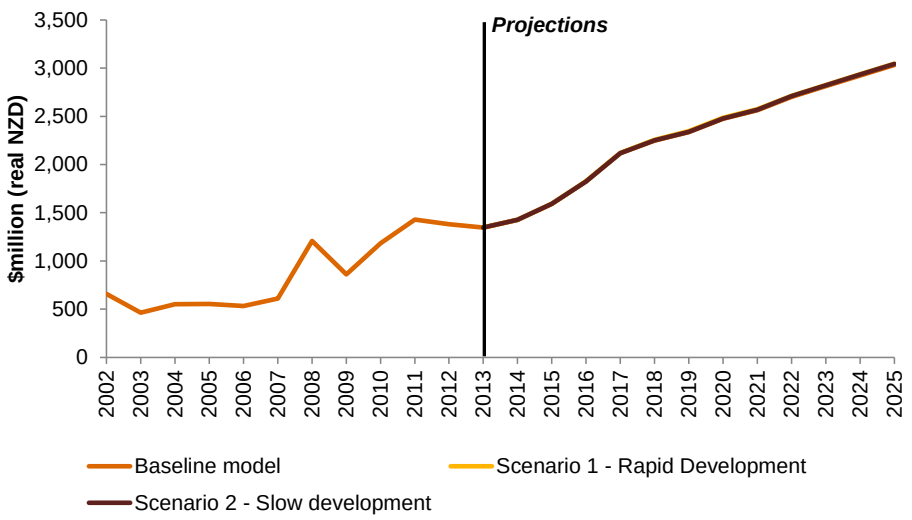


Investment, Forestry Sector, Otago Region 2001-2055

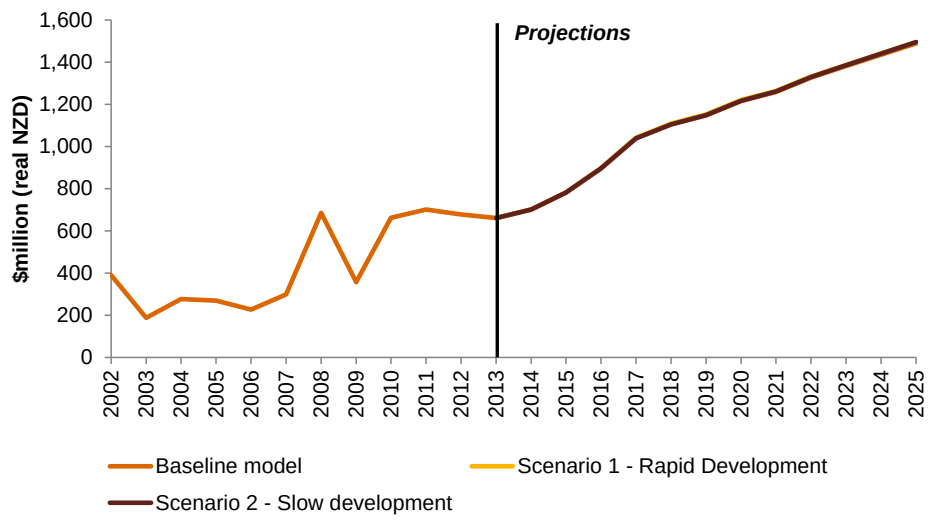


Southland

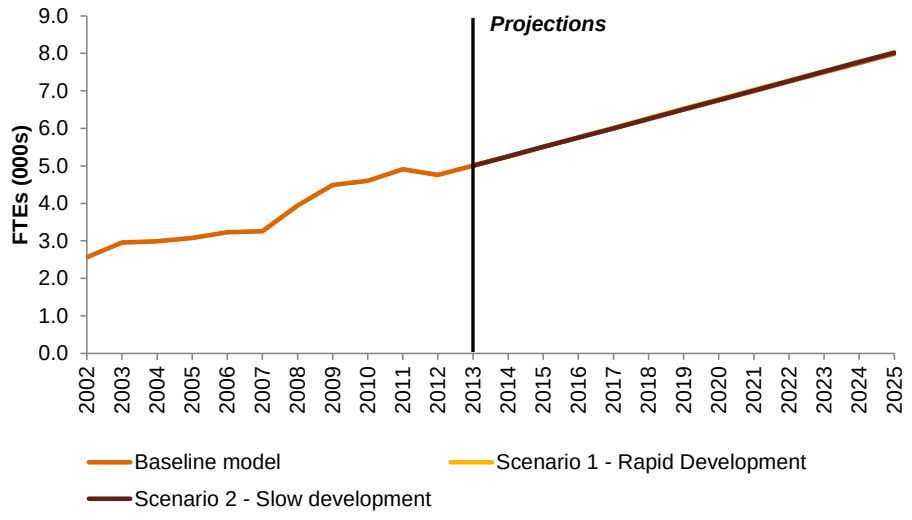
Gross Output, Dairy Sector, Southland Region 2002-2025



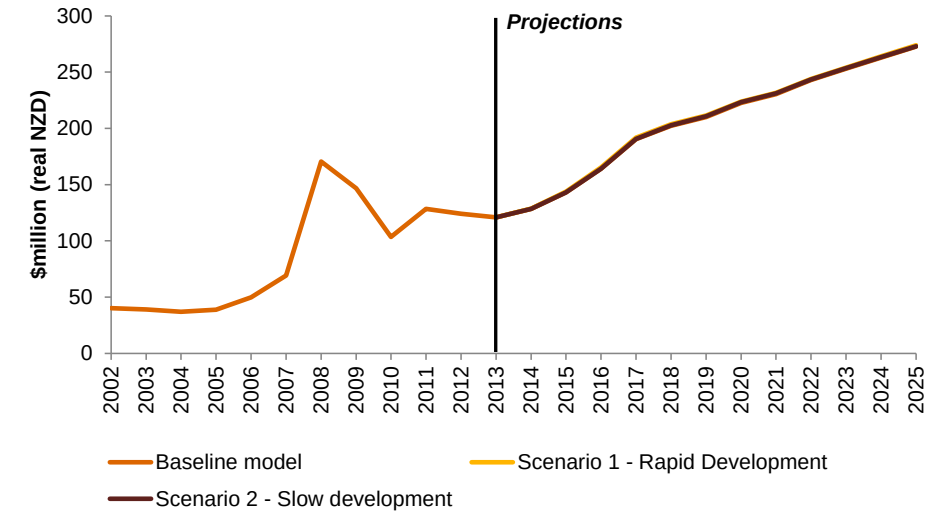
Value Added, Dairy Sector, Southland Region 2002-2025

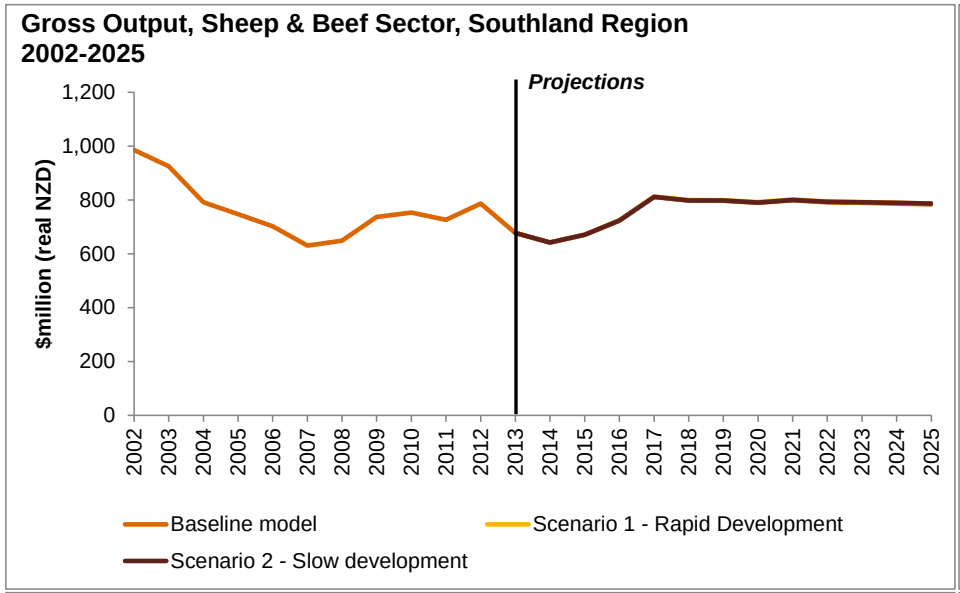


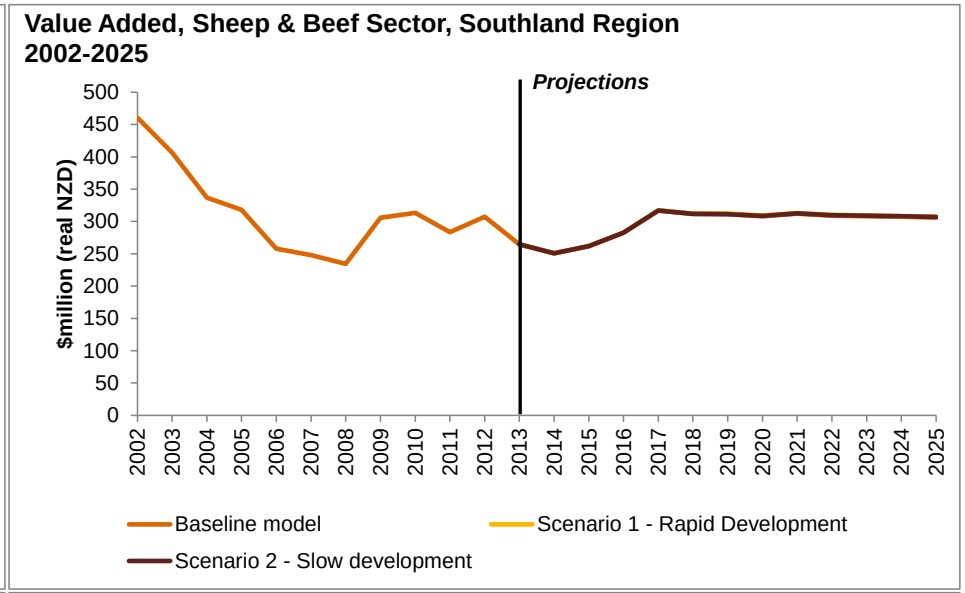
Employment, Dairy Sector, Southland Region 2002-2025

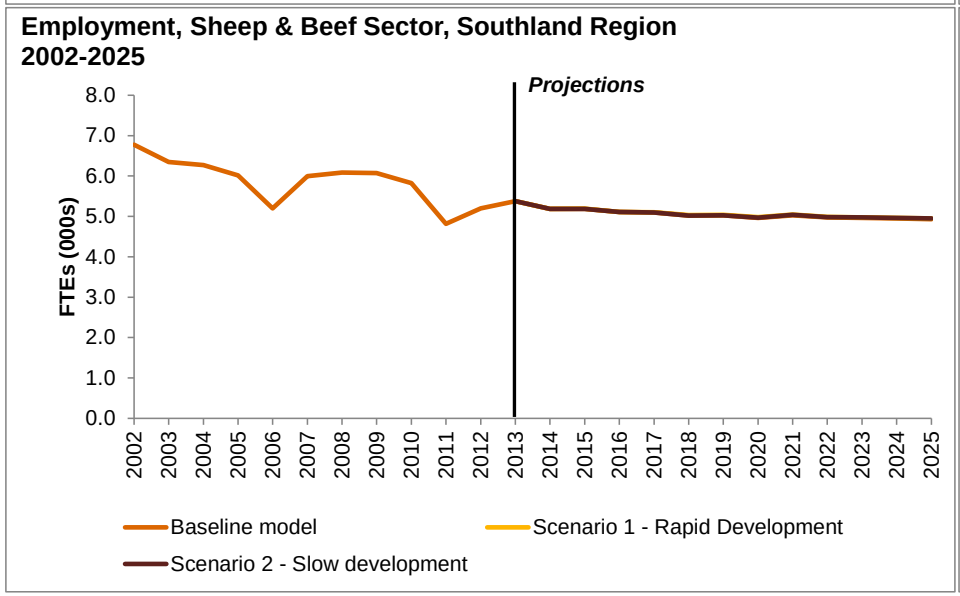


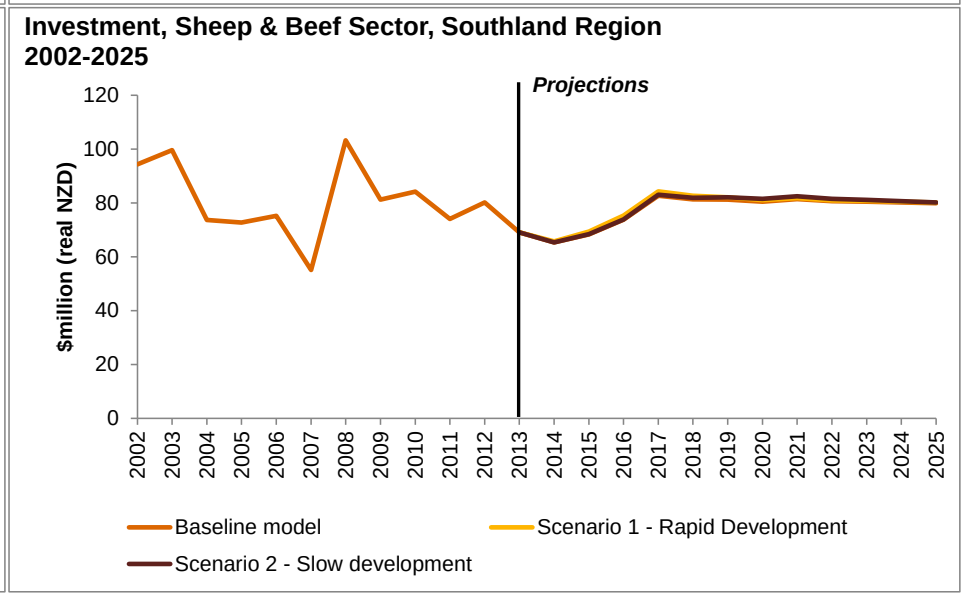
Investment, Dairy Sector, Southland Region 2002-2025



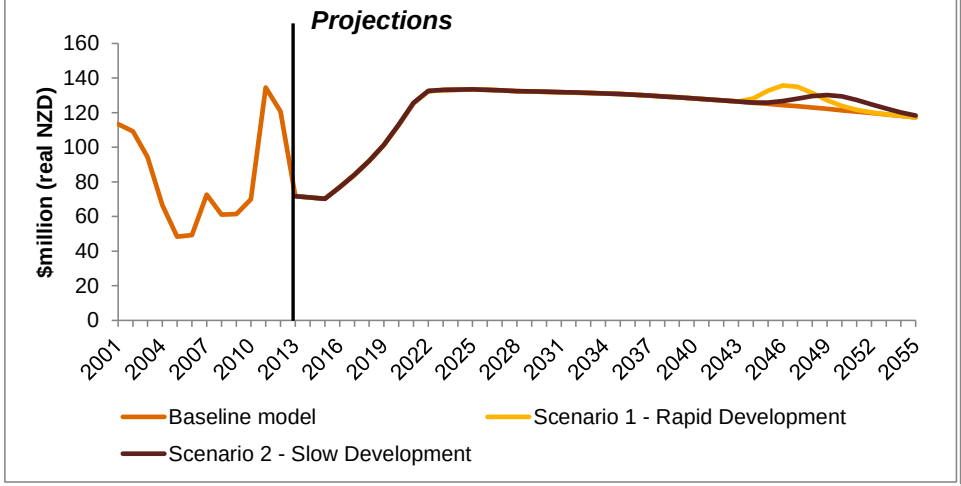

Gross Output, Sheep & Beef Sector, Southland Region
2002-2025
Projections
$million (real NZD)
1,200
1,000
800
600
400
200
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Value Added, Sheep & Beef Sector, Southland Region
2002-2025
Projections
$million (real NZD)
500
450
400
350
300
250
200
150
100
50
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

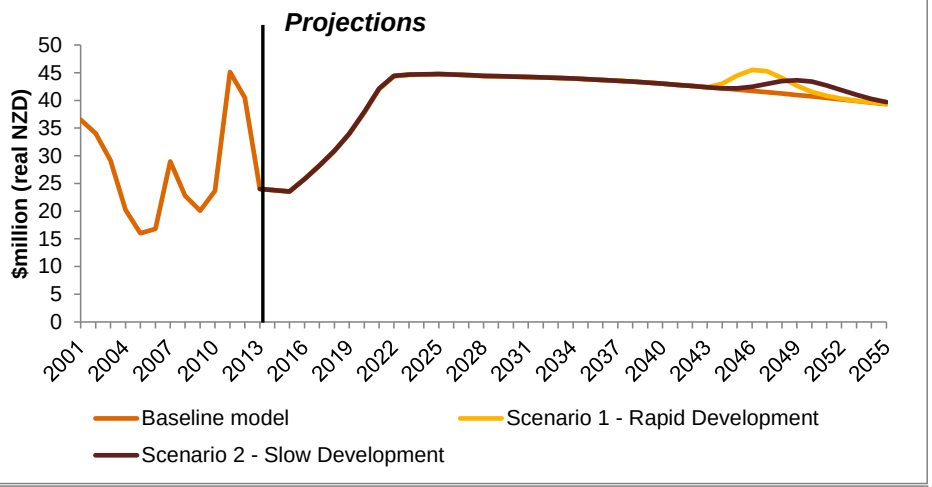

Employment, Sheep & Beef Sector, Southland Region
2002-2025
Projections
FTEs (000s)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development


Investment, Sheep & Beef Sector, Southland Region
2002-2025
Projections
$million (real NZD)
120
100
80
60
40
20
0
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Baseline model
Scenario 1 - Rapid Development
Scenario 2 - Slow development

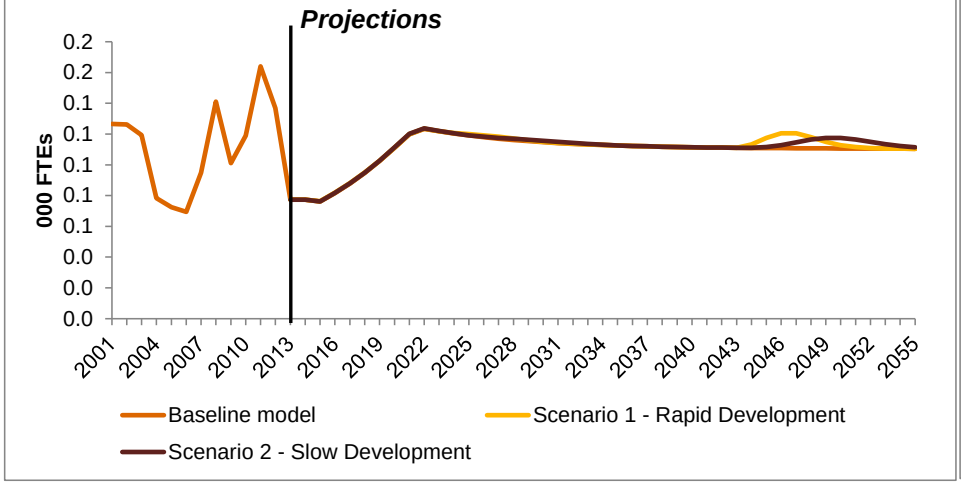
Gross Output, Forestry Sector, Southland Region 2001-2055



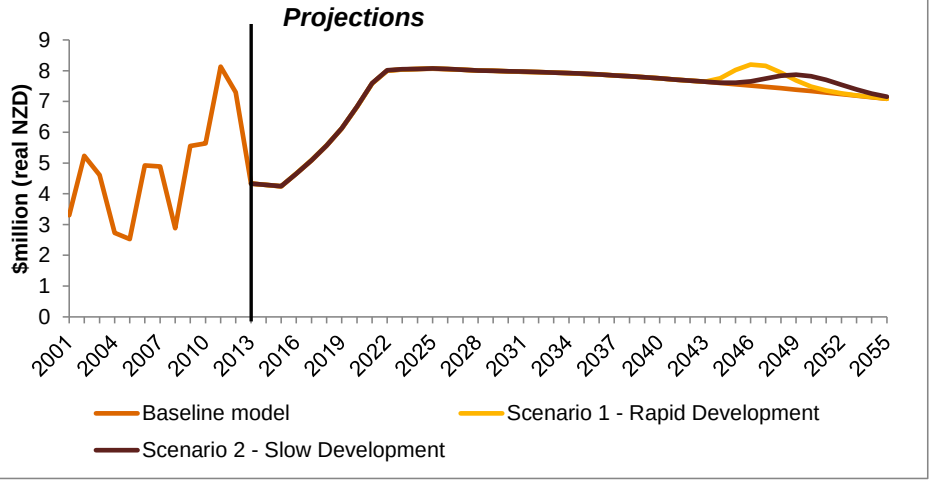
Value added, Forestry Sector, Southland Region 2001-2055



Employment, Forestry Sector, Southland Region 2001-2055



Investment, Forestry Sector, Southland Region 2001-2055



Appendix D - Restrictions

Restrictions

1 This report into the development and application of an economic framework for assessing the impact of bringing Māori land into production was prepared for the Ministry for Primary Industries. This report has been prepared solely for this purpose and should not be relied upon for any other purpose.

2 To the fullest extent permitted by law, PwC accepts no duty of care to any third party in connection with the provision of this report and/or any related information or explanation (together, the "Information"). Accordingly, regardless of the form of action, whether in contract, tort (including without limitation, negligence) or otherwise, and to the extent permitted by applicable law, PwC accepts no liability of any kind to any third party and disclaims all responsibility for the consequences of any third party acting or refraining to act in reliance on the Information.

3 Our report has been prepared with care and diligence and the statements and opinions in the report are given in good faith and in the belief on reasonable grounds that such statements and opinions are not false or misleading. In preparing our report, we have relied on the data and information provided by MPI as being complete and accurate at the time it was given. The views expressed in this report represent our independent consideration and assessment of the information provided.

4 No responsibility arising in any way for errors or omissions (including responsibility to any person for negligence) is assumed by us or any of our partners or employees for the preparation of the report to the extent that such errors or omissions result from our reasonable reliance on information provided by others or assumptions disclosed in the report or assumptions reasonably taken as implicit.

5 We reserve the right, but are under no obligation, to revise or amend our report if any additional information (particularly as regards the assumptions we have relied upon) which exists at the date of our report, but was not drawn to our attention during its preparation, subsequently comes to light.

6 This report is issued pursuant to the terms and conditions set out in the Contract for Services agreed on 2 October 2013.

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