Sheep and Beef – summary of indicators and method

Land use	Sheep and Beef
Location	New Zealand, intensive land only
Analysis type	Whole farm
Time to commercial yield (years)	1
Specific skills required	Sheep and beef farm management
Critical infrastructure requirements	Woolshed, cattleyards
Market (Export/Domestic)	Export
Volatility of returns	Moderate
Marketing structures	Well developed
Reliability of data	High – best available information on sheep and beef industry
Entrepreneurship required	Low
Source	Derived from industry data

Notes:

- Data derived from industry sources as discussed below. Valid for period 2019 – 2021.

Method

Revenue

The generation of Revenue as an indicator in this dataset uses a novel combination of simulation modelling of pasture growth paired with observed farm performance metrics to generate national predictions of productive potential for sheep and beef farming at the land parcel scale. Data provided by an industry NGO on farm performance were regressed against dryland (no N fertiliser) pasture modelling data in the landuseopportunities.nz data repository[1]. The predictions were restricted to flat and low slope land represented by intensive farming types which match the conditions under which the pasture modelling was undertaken. We were able to account for 34% of the variability for these farm types and thus produce a dataset for farm revenue from the whole country. This is more useful than the expert or average estimates of productivity and economic performance currently used, but still has wide error margins for any individual estimate.

The coefficients from the regression of revenue against pasture production and B+LNZ Farm Class were used to predict revenue nationally using the same modelled pasture dataset. However the pasture data should be truncated at the upper and lower end to ensure the predictions match the industry NGO dataset from which the coefficients were generated. All values more than 10% below the lower pasture production (2353kgDM/ha/year) on farms in the NGO dataset, and all values 10% greater than the highest pasture dataset pasture production (10199)+10% should be wet to that value. This is were applied More detailed information about the method used is provided in Harris et al (2024)[2].

Operating Profit

The equation for estimating Operating Profit(/ha) from revenue and the associated coefficients are shown in Equation 1 and Table 1 below. This model has a residual standard error of 291.5 on 126 degrees of freedom, an adjusted R2 of 0.8958, and a probability of <0.001 of occurring by chance.

Equation 1

$$Operating\ profit = -332.06 + \partial \times Revenue$$

Where ð equals the coefficient shown in Table 2 below and Revenue is the modelled revenue from Harris et al (2024).

Table 1: Coefficients for estimating Operating Profit from Revenue, sheep and beef farms B+LNZ Farm Class 5,6 and 7

Coefficient	Estimate	Std Error
Intercept	-332.06	48.30129
Class5: Revenue	0.53534	0.01658
Class6: Revenue	0.55795	0.03312

[1] Pasture datasets are here Pasture production maps (historical weather) - Datasets - Whitiwhiti Ora: Land Use Opportunities

[2] Harris, S., Cichota, R., Lilburne, L., and Fraser, C. 2024. Predicting the productive potential of land for pastoral sheep and beef farming in New Zealand. Paper submitted to Environmental and Sustainability Indicators, April 2024.

Class7: Revenue	0.49895	0.02477

On Farm Labour/10ha

The equation for estimating On Farm Labour from revenue and the associated Coefficients are shown in Table 1 below. This model has a Residual standard error of 0.002388 on 126 degrees of freedom, an adjusted R2 of 0.2769, and a probability of less than 0.001 of occurring by chance. The estimates generated using these coefficients were multiplied by 10 to give the On Farm Labour per 10 ha.

Equation 2

$$On\ Farm\ Labour/10ha = (2.49\mathrm{E}-03) + \mathrm{A} \times Revenue$$

Where A equals the coefficient shown in Table 3 below and Revenue is the revenue generated from Harris et al (2024).

Table 2: Coefficients for estimating on farm labour from revenue, sheep and beef farms B+LNZ Farm Class 5,6 and 7

Coefficient	Estimate	Std Error
Intercept	2.49E-03	3.96E-04
Class5:Revenue	8.01E-07	1.36E-07
Class6:Revenue	1.44E-06	2.71E-07
Class7: Revenue	1.19E-06	2.03E-07

Flow on economic indicators

Total Gross Domestic Product (GDP), Household Income (HHI) and employment (FTE/10ha): the contribution to regional economic indicators associated with an increase in 1 ha of a land use in a region. The includes the flow on effects of purchases from suppliers and from households associated with the enterprise spending money in the community. These were calculated using the estimates of flow on impacts from regional input-output (IO) tables. Regional IO tables provided by Butcher Partners Ltd based on 2019/20 StatsNZ national IO table (see Table 3). Employment estimates were inflation updated (CPI 11%).

Table 3: Total Value Added, Household income and Employment multipliers for the sheep and beef sector

Region	Total VA Multiplier	Total HHI Multiplier	Total Employment (FTE) Multiplier
Northland	0.77	0.19	5.71
Auckland	0.70	0.18	9.20
Waikato	0.77	0.19	6.36
Bay of Plenty	0.76	0.19	4.61
Taranaki	0.65	0.15	3.80
Manawatu-Wanganui	0.77	0.19	5.71
Wellington	0.65	0.15	4.06
Nelson	0.63	0.15	8.91
Tasman	0.70	0.16	7.43
Marlborough	0.72	0.17	3.65
Canterbury	0.88	0.23	4.87
Otago	0.80	0.20	4.97
Southland	0.72	0.17	4.19
West Coast	0.00	0.00	0.00
Hawke's Bay	0.80	0.20	4.53
Gisborne	0.71	0.17	5.32

References

Harris, S., Cichota, R., Lilburne, L., and Fraser, C. 2024. Predicting the productive potential of land for pastoral sheep and beef farming in New Zealand. Submitted May 2024 – preprint available from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4827752.