

Wild Game Monitoring Project

Makarewa Headwaters Catchment Group

October 2023

Version 2

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Thanks

On behalf of the Catchment Group and Lumen Environmental, thank you to the farmers who took the time to complete the survey which assisted in preparing this report.

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Executive Summary

This report outlines the financial and greenhouse gas impact of the wild ungulate population in the Makarewa Headwaters Catchment. The total catchment area is 41,200ha and contains land occupied by primary production, forestry and native bush. The population of wild ungulates has been assessed by Trap and Trigger and supported by answers from the community survey.

Trap and Trigger assessed the catchment for numbers and types of wild ungulates in August 2023. A total of 561 wild ungulates were identified in the catchment which translated to a total population of 7,600 when adjusted for density. The split of the ungulate population was 71% deer, 25% pigs and 4% wild Hokonui sheep. Densities ranged from 5 ungulates per hectare to 1 ungulate per 5 hectares. The density maps can be found in the Trap and Trigger reports.

The community survey was undertaken across the end of August 2023 and early September 2023, from which we received 30 complete responses. Survey questions ranged from culled numbers of ungulates and damage to pasture and crops. This data has been valuable to support the population observed by Trap and Trigger.

The key findings of this report include:

- The total impact on the catchment for both feed consumed, damaged and GHG emissions is estimated to be \$2,048,560 per year.
- The financial burden to the farmland area (28,100ha) in the catchment from deer, Hokonui sheep, pig feed consumption and pig rooting damage is \$25.60/ha.
- The total cost of feed consumed by the deer population within the catchment is estimated to be \$1,374,942 per year.
- The average consumption by one deer is the equivalent to: 3.8 bales of baleage at 280 kg DM per bale; or the equivalent to 1.5 ewes weighing 68kg lambing 130%.
- The estimated total cost of feed consumed by the pig population within the catchment is \$265,244.
- The financial burden of feed consumed by pigs on farmland in the catchment is estimated to average \$1.20/ha.
- If 17% of a pig's intake comes from farmland that would equate to enough feed for 341 Stock unit equivalents or 633 bales of baleage at 280kg DM per bale.
- The average pig rooting damage per pig is 0.16ha.
- The cost of pig rooting damage to both pasture production lost and the reduction in growth for the remainder of the season equates to \$1,058/ha for the first year.
- The total greenhouse gas emissions cost from ungulates is estimated to be \$14,126 under the HWEN¹ pricing.
- The cost of feed consumed on farmland by wild Hokonui sheep is \$6,800/year. The total impact to the catchment is \$31,312 in feed and GHG emissions.

Defining the point at which the catchment and farming community decide to control wild herbivores is complex. Some farming businesses within the catchment will be disproportionately more affected by wild ungulates than others depending on their location within the catchment. The Trap and Trigger heat maps will assist with understanding the density of the population in relation to

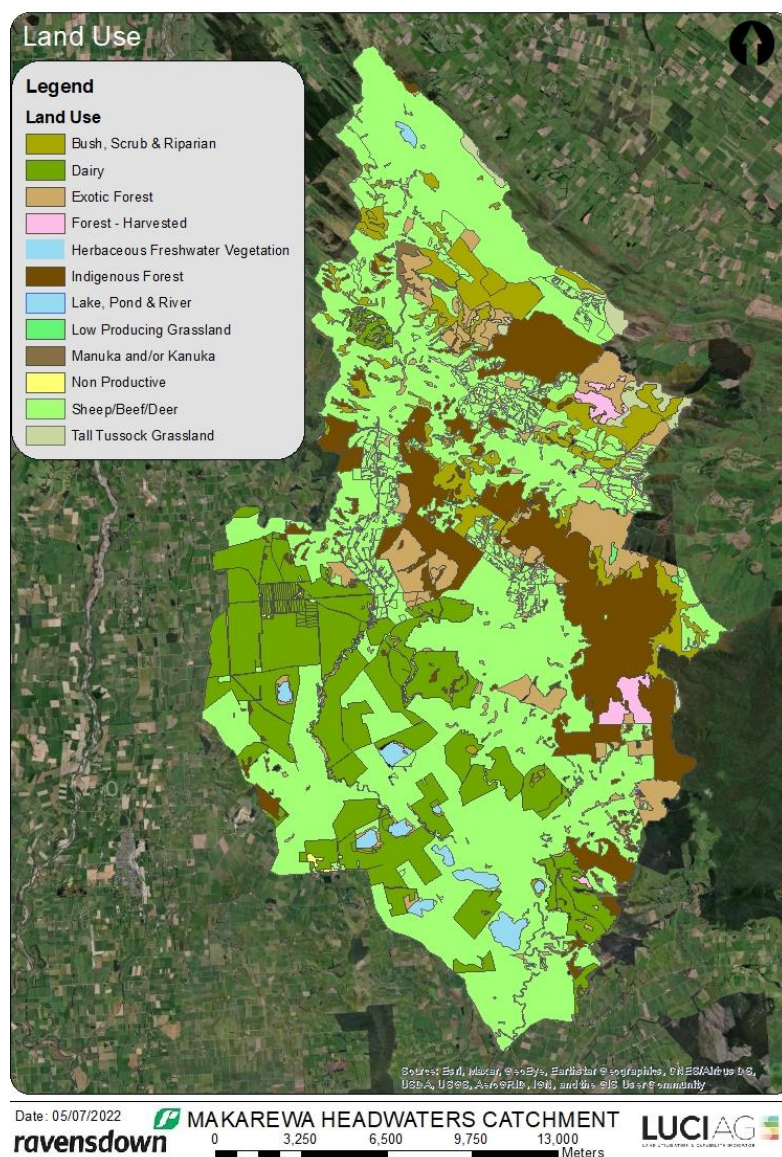
¹ He Waka Eke Noa

individual properties and may assist in making decisions where, when, and how a population control strategy might be implemented.

1. Introduction.

1.1. The Catchment

The Makarewa Headwaters Catchment (The Catchment) area is a total of 41,200 hectares.²



Source: Makarewa Headwaters Luci-Ag project.

There are several land uses within the catchment, the most prominent being sheep, beef and deer farmland which makes up 50% of the catchment area. While the native and exotic forest areas are vital parts of the ecosystem of the catchment, they also provide relatively safe areas for wild ungulates to live and breed. Controlling the wild ungulate population will not only benefit farming landowners but will also have a significant benefit to flora and fauna in the area.

² Ravensdown Luci-Ag Project report 2022

1.2. The Project

Lumen Environmental have been engaged to undertake an analysis of the impact of the wild ungulates in the catchment on farm production. The project assesses both the financial cost to farm production, and the GHG impact of these animals.

2. Assumptions

This section outlines the key baseline assumptions used to calculate the wild ungulate damage and population within the Makarewa Headwaters Catchment. The data for number of animals has been sourced from the Trap and Trigger report as well as the data collected in the farmer survey. All survey results have remained anonymous throughout this report.

2.1. Trap and Trigger Observations

Trap and Trigger undertook an assessment of the wild ungulate population via helicopter in August 2023. The methodology of assessment can be found in the Trap and Trigger report. This report includes maps which outline the density of populations of wild ungulates within the catchment. Please note that in Trap and Triggers report there is a map of their level of confidence to be able to detect the wild ungulate population. The map can be found on page 5 of their report. The density maps have been calculated by Trap and trigger and consider the level of confidence they had in collecting raw data from certain parts of the catchment.

2.2. Community survey

The community survey was sent to catchment landholders between the end of August 2023 and the beginning of September 2023. There was a total of 30 complete response. The data captured from the farmer survey has been used to support the observations from Trap and Trigger. Pasture Production

- Pasture production for the catchment has been sourced from the using a Southland Winton-Otapiri growth curve.³

	July	Aug	Sep	October	Nov	December	January	February	March	April	May	June	
Southland - Winton Otapiri silt loam													
kg DM/day		8	9	10	26	53	54	54	53	51	42	26	13

2.3. Cost

- Cost of feed has been assumed at \$0.20/ kg DM, representing a combination of costs including supplements, winter forages and summer pasture across a range of livestock enterprises.
- Green House Gas (GHG) emission costs are based on the initial He Waka Eke Noa (HWEN) costings which are \$0.11 per kg CH⁴ and \$4.25 per Tonne of N₂O and CO₂.

³ Lincoln University Farm Technical Manual

3. Deer Impact

Each property within the catchment reported having differing experiences with wild deer both in terms on population and feed consumed from their property.

On average, a deer can consume 1,088 kg DM⁴ in a 12-month period. The feed consumed by a deer ranges between a maximum of 1,472 kg DM/head/year and a minimum of 674 kg DM/head/year. The range in feed consumed depends primarily on the age and weight of the animal.

The feed intake of deer has been estimated using Farmax. The average intake of a deer has been used in the calculations preparing this report when determining the financial burden on the catchment.

For context, the average annual consumption of one deer is the equivalent to 3.8 bales of baleage at 280 kg DM/ bale, or the equivalent to 1.5 ewes at a liveweight of 68kg lambing 130%.

Trap and Triggers’ observations estimated 5,405 feral deer within the catchment boundary. Due to parts of the catchment having a low and moderate detection confidence we could assume that only a small portion of the population was identified this has been accounted for in Trap and Triggers’ heat maps. The farmer survey results indicated that about 1,700 deer are being culled by landowners, hunters, and helicopters annually.

3.1. Feed & financial- Catchment

The table below outlines the total number of deer as calculated by the Trap and Trigger observation, and the culled numbers reported in the survey. The annual financial burden to the entire catchment is estimated to be \$1.175 million.

Because the culling occurred over the 12 month period prior to the trap and trigger observation, the information sourced from the community survey is added to the Trap and Trigger numbers. Farmers, local hunters (allowed access to farmland) and helicopter kills are removing approximately 1,700 deer from the catchment per annum. It has been assumed that the deer culled would consume only 6 months’ worth of feed, therefore the cost of the culled animals is \$184,960.

The feed consumed and financial impact of wild deer is outlined in the table below.

	Number of wild Deer	Consumed Kg DM/hd/year	Consumed kg DM /year Total	Catchment Financial Impact of feed eaten
Total observed within catchment <i>(Trap & Trigger)</i>	5,405	1,088	5,877,938	\$1,175,588
Culled by farmers, hunters & helicopter. <i>(source: Catchment group farmer survey)</i>	1,700	544	924,800	\$184,960
Net burden on the catchment	7,105	-	6,805,440	\$1,361,088

**Note assumed that all deer stay within catchment boundary for 12 months.*

⁴ Farmax Red Meat

On the assumption that a wild female population would reproduce at a rate 35%⁵, the estimate population growth of 946 per annum. The current numbers being culled in the catchment is higher than the estimated reproduction rate. Although many factors determine the rate of replacement, like a domestic capital livestock. Some comments from a landholders within the catchment have reported that hinds being culled in the catchment were heavier in carcass weight and condition to a typical wild deer population. This anecdotally could indicate that the population of wild deer in the catchment would have a higher fawning rate than a typical wild deer population. The New Zealand domestic deer industry average is 80-91%⁶. Being conservative for a wild population at a fawning of 80% that would equate to 2,162 fawns born annually. This results in a higher natural increase than what is being culled in the catchment and result in a net increase in wild deer in the catchment.

3.2. Feed and financial - Farmland

Consumed Feed:

The Ravensdown Luci- Ag project determined 50% of the land within the 41,200ha catchment is sheep, beef, and deer farmland. 17.5% of the catchment area is dairy. A total of 28,016 hectares of land is farmed within the catchment area.

Questions were asked in the community survey as to how much time feral deer spent grazing farmland. The average of the survey answers indicated that feral deer spent on average 22% of their time grazing farmland within the catchment.

	Number	22% DM intake	Cost
Per Head	1	239 kg DM	\$48
Catchment Total	5,405 (+ 1700 for 6moths)	1,497,197	\$299,439

Feed consumed from the farms by wild deer can make it challenging for landholders to define their true stocking rate, and the varying population makes it difficult to accurately budget feed.

The feed consumed on farmland equivalent to 2,880 stock units.

The financial burden on farmland in the catchment is estimated to be \$9/ha/year. Some landowners are disproportionately more affected by the loss in production induced by wild deer. The variance of affect is dependent on where individual farms are located relative to the population density.

Crop Losses:

Crop losses to feral deer consumption are significant. The results from the farmer survey indicate there is a total of 83 ha lost within the catchment to wild deer grazing. The 83ha grazed by wild deer equates to an average of 5ha per farm.

Crops grown included swedes, kale, ryecorn and annual ryegrass. Yields varied between type, property location and management. The survey results showed an average yield of 8.5T DM/ha.

⁵ Source: Trap & Trigger- Logan Boyd

⁶ Deer Industry NZ – P2P Reproductive Performance Analysis.

The cost of the yield loss at 8.5T DM/ha equates to \$1,700/ha. On an average farm, 5ha crop lost costs \$8,500/year.



Source: Google Images

3.3. Impact on Greenhouse gas emissions

For ruminant livestock the main greenhouse gas of concern is methane. Although it is a short-lived gas it has a greater potential for warming while it's in the atmosphere. Ruminants produce 22 grams of methane per kilogram of dry matter intake.⁷

Nitrous oxide emissions originate from urine and faecal matter deposition. The nitrogen in urine and faecal matter deposition is defined by nitrogen in the feed livestock consume and the allocation of Nitrogen to meat and milk production. As we don't know whether the animals identified are mature, lactating or growing we have assumed that 80% of N intake is deposited in urine and faeces.

The average emissions of nitrous oxide from deer are 0.00015kg N₂O per kg DM consumed.⁶

Greenhouse gas emissions have only been calculated for the non-farmland component of feed consumed (78% of total) because if the wild population were not present, the farmland forage and pasture would be consumed by domesticated animals which would produce similar GHG emissions per kilogram of dry matter intake.

Deer number	Methane (kg CH ₄)	Methane Cost	Nitrous Oxide (T CO ₂ -e)	Nitrous Oxide Cost	Total cost
1	19	\$2	0.04	\$0.16	\$2.16
7105	116,781	\$12,846	237	\$1,008	\$13,854

**Please note that due to these being a wild population, the emissions of these ungulates will not have to be paid for by the landholder. The cost has been calculated as an exercise of comparison.*

⁷ New Zealand Agricultural Greenhouse Gas Research Centre- Methane

4. Wild Pig Impact

Like deer each property in the catchment will have varying experience with wild pig population as damage caused by them. Feral pigs are omnivorous and opportunistic feeders. Pigs can both consume pasture resulting in loss of feed for primary production livestock within the catchment and root up pasture and crop ground which will result in patches of bare ground and increase introduction of weed and less productive grass species. Depending on location in the catchment some properties will disproportionately be affected by wild pig populations than others.

A pig can consume 550kg DM per year⁸ this varies with age and weight of the animal.

With Trap and Triggers survey being undertaken in August 2023 and the survey culling results being over a 12-month period prior to the survey, the total culled animals have been added to the survey numbers to calculate the total estimated number in the catchment for the past 12 months.

4.1. Feed & Financial- Catchment

Consumed Feed:

The calculation of impact on feed consumed within the catchment from wild pigs has been completed the same as the wild deer. Resulting in a total financial cost of the feed lost at \$265,244.

We have assumed that the culled animals only eat 6 months of feed as an average to reflect culling over a 12-month period.

See table below for feed consumed and financial impact of wild pigs in the catchment.

	Number of wild Pigs	Consumed Kg DM/hd/year	Consumed kg DM/year Total	Financial Impact of feed eaten
Total observed within catchment (<i>Trap & Trigger</i>)	1,900	550	1,042,174	\$209,035
Culled by farmers, hunters & helicopter. <i>(source: Catchment group farmer survey)</i>	1,040	275	285,048	\$57,210
Net burden on the catchment	2,940	-	1,331,221	\$265,244

**Note assumed that all pigs stay within catchment boundary for 12 months.*

⁸ Pasture composition by pigs and wild boar- Cambridge 2017

Like any livestock reproduction and replacement rates of the population are determined by ability to consume enough protein rich feed. Pigs are efficient reproducers and gestation period is 112-114 days equating to 2-3 litters per annum. Pigs in the right environment can have litters of an average of 6 piglets per litter and can start breeding at 5-8months of age. Survival rates of piglets is variable and up to 90% of piglets can die when conditions are poor. However, when conditions are favourable its easy to see why pig populations will recover quickly.⁹

If we were to assume that half of the current population were sows and on average had 6 piglets per annum (2 litters per annum with 3 piglets surviving) this would equate to 5,700 pigs being born and surviving in a year. This assumption would have the pig population increasing y a significant proportion annually.

4.2. Feed & Financial- Farmland

The community survey results estimated the average time a pig would spend grazing on farmland was 17%.

Pigs	Number	17% of total intake	Cost
Per Head	1	94 kg DM	\$19
Total pigs in catchment	2,940	177,680 kg DM	\$35,536

Depending on farm location within the catchment, some landholders will be disproportionately affected by pigs consuming feed from their property. The variation in affect will be defined by the farm location relative to wild pig population density.

On average, the cost of wild pig's consuming farmland feed is estimated to \$1.27/ha.

For context, If 17% of a pig's intake comes from farmland that would equate to enough feed for 341 Stock unit equivalents or 633 bales of baleage at 280kg DM per bale.

Pig rooting damage to farmland:

Results from the farm survey of pig rooting damage varied but equates to an average area of 0.16ha per pig. The damaged area will likely fluctuate depending on density of population and demand for food source.

	Damaged area per pig	Cost
Average	0.16 ha	\$169
Maximum	0.30 ha	\$317
Minimum	0.05 ha	\$53

The damage caused by one pig in the spring to early summer can be as significant as \$221/ha. In addition to lost pasture production, rooted areas often becoming invaded with weeds and less productive grass species. The total cost over the season is \$1,058/ha. The ingress of undesirable

⁹ Feral pigs: A review of monitoring and control techniques, April 2017

species in rooted land results in ongoing losses in pasture production. In many instances the loss in pasture production could be as much as a 50%.

The total loss in feed from a hectare lost to pig damage is estimated to be 5,292 kg DM/ha.

	Kg DM/ha	\$/ha
Cost of total loss of feed in spring	1,108	\$221
Cost of loss in pasture production for the rest of the season	4,184	\$836
Total cost	5,292	\$1,058

If we were to assume that the pigs identified by Trap and trigger caused an average damaged area (0.16ha) per pig and the culled pigs made the minimum damage (0.05ha). This would equate to 356ha of damaged pastoral area across the catchment. Linking this to a lost feed equivalent of 6,728 bales of baleage for a 12month period.



Photo Source: Hamish Elder

4.3. Impact on Greenhouse gas emissions

Pigs are a monogastric and not ruminants therefore have lower emissions per head of any class of livestock. There is little data available for wild pig greenhouse gas emissions. Farmed pigs' emission data has been used in this report. It is unclear from New Zealand research if wild pig greenhouse gas emissions are different to those of domesticated animals. We have assumed in this report that they are indifferent.

Greenhouse gas emissions have only been calculated for the non-farmland component of feed consumed (83% of total) because if the wild population were not present, the farmland forage and pasture would be consumed by domesticated animals.

Pig number	Methane (kg CH ₄)	Nitrous Oxide (T CO ₂ -e)	Total GHG (T CO ₂ – e)	Methane Cost	Nitrous Oxide Cost	Total Cost
1	1.08 kg ¹⁰	0.000175	0.000445	\$0.12	\$0	\$0.12
1,900	2,045kg	0.332	0.8455	\$225	\$1.4	\$272

**Please note that due to these being a wild population the emissions of these ungulates will not have to be paid for by the landholder these ungulates freely graze. The cost has been calculated as an exercise of comparison.*

5. Hokonui Wild Sheep

5.1. Feed and Financial

The population of wild Hokonui sheep as assessed by Trap and Trigger equated to 298 sheep. The consumption of a sheep as calculated by one stock unit (55kg ewe bearing 100% lambing) consumes 520 kg DM/head/year.

Total number of sheep	Kg DM/year	Cost
298	154,980	\$30,996

As there were no culling data recorded of these from the survey, we could assume the population would be relatively stagnant. If we assume that they graze on farmland a similar amount to that of the feral deer population (22% of intake) that equates to 34,000 kg DM or 122 bales of baleage.

5.2. Impact on Greenhouse gas emissions

Sheep	Methane (kg CH ₄)	Methane Cost	Nitrous Oxide (T CO ₂ -e)	Nitrous Oxide Cost	Total cost
1	9	\$1	0.06	\$0.08	\$1.08
298	2659	\$293	5	23	\$316

¹⁰ Ian Kruger, Greg Mills, Patrick Madden- PigGas: Pork industry GHG Calculator Australia.

6. Total Catchment Impact

The estimated total catchment cost of all feed lost to ungulates is 8,136,661 kg DM and the estimated financial cost is \$1,640,458 of both feed and greenhouse gas.

	Number of Animals	Kg DM feed	T GHG (CO ² -e)	Cost		
				Lost feed	HWEN tax	Total
Deer	7,105 <i>(5409 observed & 1700 culled)</i>	6,805,440	3,157	\$1,361,088	\$13,854	\$1,374,942
Pigs	2,940 <i>(1,900 observed & 1,040 culled)</i>	1,331,221	0.845	\$265,244	\$272	\$265,516
Pig damage	2,940	1,883,952	-	\$376,790	-	\$376,790
Hokonui Sheep	298	154,980	71	\$30,996	\$316	\$31,312
Total	10,045	10,020,613	3,158	\$2,003,122	\$14,126	\$2,048,560

**note pig rooting damage is taking the assumptions made in section 4.2*

7. Summary

In summary, the wild ungulate population in the Makarewa Headwaters Catchment comes with significant cost to the not only primary production but also damage to biodiversity and environment.

The total estimated financial cost to the catchment of wild ungulates is \$2,048,560.

The impact to farmland from a feed intake perspective equates to the same amount of feed consumed by 5,082 ewes at a liveweight of 65kg lambing 130%.

The financial impact of wild ungulates in the catchment is estimated to be \$25.57/ha farmland. Directly observable forage crop grazing and pastures damaged by pig rooting is estimated to be up to 235ha per year (1% of farmland area).