



# ANNUAL REPORT

FOR 1 JULY 2018 – 30 JUNE 2019

# FROM THE CHAIRMAN



DEEResearch has continued to commission research to improve deer industry profitability and sustainability. In doing so, we've prioritised research that is supported by industry and grounded in commercial reality (whether current or likely future state). We've described the highlights later in this report. A new feature of our direction this year has been to encourage scientists to undertake early-stage exploratory work (called a "learning phase") before starting large new projects. These learning phases, developed in partnership with the industry, are intended to identify the most impactful opportunities for larger-scale work.



## DEERESEARCH'S LEGACY

This will be the last annual review of DEEResearch's work, as the shareholders, DINZ and AgResearch have decided to refresh the model by which research is commissioned and delivered.

As a Board we're proud to have led a partnership research model in which a young industry with its partner Crown Research Institute has had the confidence and vision to invest a significant proportion of funding in fundamental research of broad application. It has always been tempting to invest the majority of funds in short, sharp, low-risk studies that are easy to explain and simple to apply. We've taken a steady, long-haul route in which many projects have been multi-year, broad in scope, high risk and not always of immediate practical application. While these projects, majority AgResearch funded, haven't always made obvious front-page material, they have laid a comprehensive foundation for a raft of specialist, implementable and enduring work that is underway, such as genetic and genomic breeding values for traits of real, economic value.

## THE FUTURE

DINZ and AgResearch will be retaining and amplifying the best bit of the DEEResearch model: encouraging scientists to work with industry to identify farming, processing or supply chain problems or opportunities that research could address.

The main differences going forward will be to-

- Remove the separate bodies and commissioning processes for velvet research versus venison and farm systems research;
- Ensure all aspects of deer industry research have joint industry and scientist input and support, through the creation of four "innovation steering groups" whose scientist and industry members will shape the research programme;
- Use industry and scientists to design research delivery; and

- Commit at the start of a project to delivery of outputs, should results be useful to industry.

All these things make good sense, especially both partners' commitment to research delivery.

These steering groups will maintain the pipeline of research ideas. The strengthened industry-scientist engagement model will renew the funders' trust and confidence in how research can achieve impact for our sector. The scene is set for current and future industry participants to become as enthusiastic for science as were the deer industry pioneers. I'm confident that the deer industry and AgResearch, with their balance of wisdom, passion, and innovation will succeed.

## PEOPLE

Extending the partnership theme, there have been several multi-year projects in the programme that have depended on the contributions of commercial farms (e.g. Long-term impacts of deer on waterways, Life Cycle of Parasites, DEERselect and Tomorrow's Deer) and a deer slaughter plant (e.g. Incidence and Causes of Deep Muscle Bruising). These contributions - such as sample collection, record keeping, semen donations, carcase inspection and recording - have been significant. We thank them wholeheartedly for their contributions.

I've enjoyed the perspectives and good humour of all the directors I've worked with over the years as chair. I thank DINZ and AgResearch for their long-term commitment to DEEResearch. I've appreciated the chance to work with New Zealand's brightest and most dedicated pastoral scientists. Above all, I have appreciated research being undertaken as a 'team sport' with a focus on the industry being the winner.

Collier Isaacs, Chair





# DEERESEARCH PERFORMANCE

In this section we assess how well DEEResearch has operated against our key performance indicators (agreed by DEEResearch in 2013) in table 1. We acknowledge that their achievement depends on factors inside and outside DEEResearch’s control.

KPI	Met?
<p><b>A profitable, productive (in terms of increased output per unit of input) and sustainable deer industry</b></p> <p>Noting there are a number of responsible factors - weather and the market environment being just two - by 30 June 2019, the average carcass weight increased by 2% (58.6 kg, up from 57.3.kg the year before). Venison export volumes were down 10%, but the value down only 5%.</p>	✓
<p><b>More deer, heavier, earlier and better</b></p> <p><i>More:</i> deer numbers are not yet available for the year ending 30 June 2019. DEERselect does not yet include a fertility module - which would facilitate lower wastage - but it is a work-in-progress.</p> <p><i>Heavier:</i> our deer were more productive (see box above) by 1.3kg a head. Moreover, by 2018 (the most recent year in which data is available) for deer recorded on DEERselect, carcass weight had increased genetically on average 6.76kg (reds) and 3kg (Elk/Wapiti) per head since the year 2000. These trends (plus other weights of relevance) are shown in figure 1 (Reds) and figure 2 (Elk/Wapiti).</p>	✓

Figure 1: Red Deer Genetic Trends by birth year for Weaning Weight, Autumn Weight, and 12month Weight and Mature Weight Breeding Values

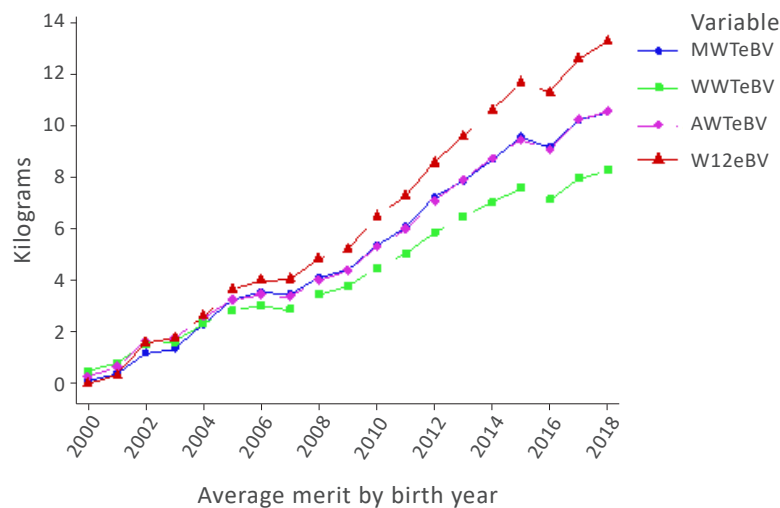
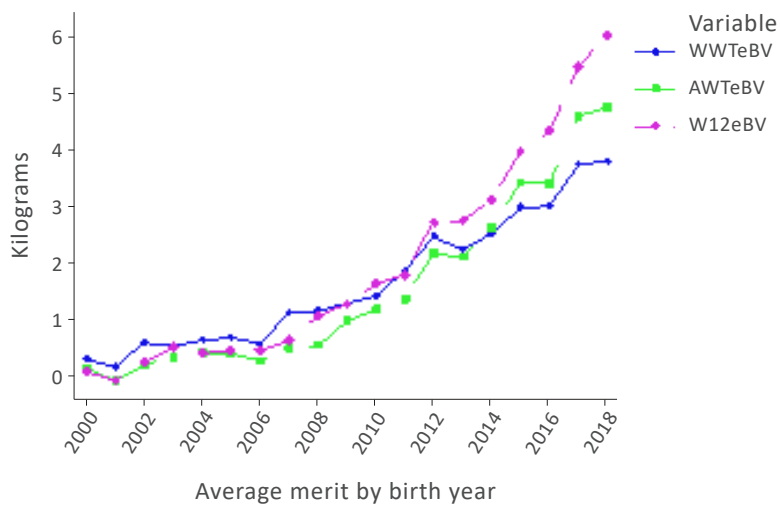


Figure 2: Elk/Wapiti Genetic Trends by birth year for Weaning Weight, Autumn Weight and 12month Weight Breeding Values



<sup>1</sup> 836,300 on 30 June 2017; 851,000 on 30 June 2018 (the provisional number on 30 June 2018 referred to in the FY18 annual report was 892,900, now revised down); Source: StatisticsNZ

*Earlier:* Since 2000, the mean conception date - which correlates closely to earlier birth date - of DEERSelect-recorded venison Red deer (and most have been breeding for growth, not earlier conception) has shifted to 2.29 days earlier and the DPT project indicated that hinds with higher breeding values for earlier conception were also associated with better fertility. Studs actively breeding for earlier conception have achieved much higher breeding values (11 days earlier).

*Better:* Since breeders began systematically recording for Carla (a trait indicative of improved resilience to parasites and thereby better growth) in 2010, the mean Carla breeding value has improved dramatically from 2 to 19 (Red) and 10 to 30 (Wapiti), such that our deer are improving in fitness. Further, Wapiti breeders have managed to improve eye muscle area breeding values. This trait is strongly linked to venison tenderness and a high value ensures that fast growing animals can produce premium eating quality venison.

A detailed progress report on the more, earlier, heavier, and better outcomes of the DEERSelect programme is available on request to Catharine Sayer at DINZ ([catharine.sayer@deernz.org](mailto:catharine.sayer@deernz.org)).

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#### Innovation being applied across industry

✓

We do not have any additional survey data on uptake of innovations since that presented in the last annual report. Nevertheless, we know that deer farmers are interested in innovation. 205 people attended Tech Expos, demand being significant following previous events in 2017 and 2018 (80 attendees each). Advance Party activity was up, with 360 people participating in 29 groups compared with 2018 (330 people in 27 groups).

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#### Relevant capability in research, development and practice change being sustained by growing sector demand

✓

Hitting Targets drew on 30 AgResearch researchers from 10 different teams across all four campuses as well as researchers from Lincoln University and the Invermay-based Disease Research Ltd. Most of those researchers were involved in research for the sheep, beef and dairy sectors, thereby contributing to valuable knowledge exchange within the pastoral sector.

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#### A regained presence of the deer industry in the agriculture sector

✓

144 non-farmer rural professionals attended deer industry introductory workshops run by DINZ during the year (2018 - 129; 2017 - 34), demonstrating renewed interest in the sector.

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#### Strengthened freedom to operate

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Consent to farm deer is still not a nationwide requirement nor is the pastoral sector yet required to fully participate in the Emissions Trading Scheme. However, this will occur if the sector does not achieve significant emissions reductions voluntarily. In the deer industry's environmental plan feeding into this voluntary approach (He Waka eke Noa), it is relying heavily on DEERResearch-sponsored environmental research covering both data about the industry's environmental performance and tools to sustain and improve water and soil quality.

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## DIRECTORS

As at 30 June 2019 the Board of DEERResearch Ltd was comprised of:

Collier Isaacs (*appointed by the shareholder-appointed directors; Chairperson*)

Dan Coup (*Deer Industry New Zealand*) (*I Moffat from 1 October 2019*)

Andrew Greer (*Tertiary Education Institutions*)

Glyn Francis (*AgResearch*)

Danny Hailes (*Venison Processors, Exporters and Marketers*)

Megan Skiffington (*AgResearch*)

Ian Walker (*Deer Industry New Zealand*)



## RESEARCH PROGRAMME HIGHLIGHTS

A major breakthrough in DEEResearch's parasite control suite of work in FY19 was the delivery of a new DEERSelect module introducing Carla as a research trait. Carla is a surface carbohydrate on particular antibodies that enhances deer's immune response to internal parasites. Our Carla module development drew on our Deer Progeny Test projects and later Carla-specific studies under Hitting Targets that validated the correlation between measured high Carla values and improved growth. The Carla module in DEERSelect predicts a deer's relative amount of Carla expression and therefore parasitic resilience. Provided breeders continue to test new sires for actual Carla expression, and commercial farmers factor in high Carla expression to their selection decisions, the module will improve industry resilience to parasites.

Consistent with the deer industry's aspiration to improve profitability through genetic selection, DEEResearch supported complex and technical work to upgrade DEERSelect

through more accurate predictions, better functionality (new traits) and revised economic weightings assigned to traits in each index. This has been a major body of work for which delivery is planned for the 2020 mating season.

On a related topic and in a major breakthrough, Hitting Targets ascertained that genomic breeding values could be determined for all 5 selected traits of interest. Testing of research genomic breeding values is being done on volunteer commercial farms in FY20. The use of genomic breeding values will increase the rate of genetic improvement as an animal's worth for a trait of interest can be predicted from analysis of a DNA sample taken at weaning, rather than after waiting for physical phenotypes to be observed. This is exciting work that would also reduce trait recording burdens on breeders.



# SUMMARY OF DEERRESEARCH RESEARCH INVESTMENTS

IN 2018/19

Investment type	Project title	Period of project	Funding p.a. (\$K)			Continuing in 2019/20
			Total	DINZ Funding	AgR	
Pan-sector consortia	Methane mitigation <i>through Pastoral Greenhouse Gas Research Consortium</i>	2002 - 2020	5,478	35	800	Yes
Industry-led productivity	Hitting Targets ( <i>project content described in detail below</i> )	2013-2019	1,791 <sup>3</sup>	408	1,333	Yes
<b>Total</b>			<b>7,269</b>	<b>443</b>	<b>2,133</b>	

## RESEARCH PROGRAMME PROGRESS

IN 2018/19

Sub-project Title	Achievements by year end
<b>4.2: DEERSelect</b>	<p>Actual or anticipated completion year 2021</p> <p>See Research programme highlights</p>
<b>4.7: Tomorrow's Deer: Genetics for the Future</b>	<p>Actual or anticipated completion year 2020</p> <p>Deer continued to be bred for targeted phenotypes for various research projects using AI with very high weaning rates. By use of commercially sourced semen, this research herd also maintained key linkages between stud herds necessary for ongoing robustness of DEERSelect breeding values.</p>
<b>4.8: Genotyping by Sequencing &amp; Genomic Prediction</b>	<p>Actual or anticipated completion year 2018</p> <ol style="list-style-type: none"> <li>The optimal statistical methodologies for making genomic predictions was determined (the method being trait-specific). A bonus to this strand of work was identification of a strong candidate gene for Calving Date.</li> <li>A commercial dataset of 14,000 genotyped animals that were also recorded in DEERSelect was collated. Genomic breeding values were estimated with moderate to high individual accuracies except that low accuracies eventuated for velvet weight, which was a very small dataset (&lt;300 animals). The genomic breeding values were highly correlated with DEERSelect estimated breeding values.</li> <li>A strategy was developed and implemented for additional sequencing and annotation of the deer genome with recommendations for a combination of technologies to improve sequence coverage.</li> </ol> <p>The next steps are to validate a cross-breed analysis in the large commercial dataset and to investigate the feasibility and merits of combining EBVs and GBVs in a single step analysis as per the NZ sheep industry.</p>
<b>4.10: Seasonal Growth Pathways</b>	<p>Actual or anticipated completion year 2018</p> <p>The year concluded work to determine the optimal research tools for detecting different responses (in terms of dry matter intake, digestibility and faecal output) between individual deer when grazing to different dietary treatments. Paddock-based assessments can now be undertaken with considerable confidence in the accuracy of the results.</p>

GROWING DEER

**2.5: Relationship between behaviour, stress and productivity****Actual or anticipated completion year 2019**

Our study to assess the relationship between temperament, paddock behaviour and stress revealed that improved data capture methodologies are needed to assess some of these relationships. Nevertheless,-

- there were no significant differences in stress levels between drenched and undrenched deer exposed to the same parasite challenge;
- high weaning stress correlated with slower growth; and
- temperament at yarding did not influence weaning stress.

**3.8 Understanding the life cycle of lungworm and GI nematodes in deer****Actual or anticipated completion year 2020**

This project examines the *Strongyle egg* and *Dictyocaulus eckerti* larval output from deer on commercial deer farms with a view to-

- establishing the seasonal biology of *D. eckerti* and *Strongyle* infection in red and wapiti deer;
- improving understanding of the environmental stages of key parasite species, and how they differ between mobs; and
- enabling development of a more effective strategic drenching programme.

Two low or drench-free farms were added to the study, which ensured an excellent balance in the range of deer types, deer ages, farming and drenching practices. Interesting interim indications (not validated) are that:-

- fawning/lactation does not seem to trigger any rise in egg/larvae outputs;
- a proportion of hinds and stags of all ages are passing low numbers of eggs and larvae onto pasture all year round; and
- the drench regime employed has no bearing on egg and lungworm larval output.

**4.9: Genomic Solutions for Health and Well-being (Biomarkers)****Actual or anticipated completion year 2019**

This year the responses of deer with different biomarker-predicted Johne's Disease (JD) resilience phenotypes were compared for their antibody responses to commercial vaccines, to understand whether there is an underlying inheritable basis for disease resilience. Interestingly, the immune responses to Leptospirosis and Clostridia vaccination challenges corresponded to the predicted JD resilience phenotypes, but the response to JD was not measurable by ELISA within the blood testing window. The immune response to mycobacterial antigens will be repeated under a longer assessment timeframe to see if there is a delayed but distinct response dependent on the predicted JD resilient/susceptible phenotype; T-cell-mediated responses will also be compared.



#### 7.4: Long-term monitoring of deer impacts on waterways in hill and high-country systems

##### Actual or anticipated completion year 2021

Two rounds of detailed catchment surveys were completed. All data were logged and individual reports were drafted for each property summarising the findings from the autumn surveys.

Monthly samples continued to be submitted on a regular basis from all properties. FY20 will see the introduction of invertebrate testing at the monthly sample site during each catchment survey, to contribute towards overall stream health assessment. In addition, annual interviews with each farm manager on farm management practices will be instituted to better capture potential causes of observed changes. An online interactive map for participating properties will also be produced.

#### Methane and Nitrous oxide mitigation (through PGGRC)

##### Actual or anticipated completion year 2020

New Zealand's pastoral livestock industries formed the PGGRC in 2002 to develop options for reducing methane and nitrous oxide emissions from New Zealand livestock. Since 2012 its work has been focused on developing technologies for methane reduction. Its major accomplishment in FY19 was to prove the concept of selection for low methane emitting sheep which has been implemented by Beef+Lamb Genetics. Its work on methane inhibitors and vaccines against methanogens has continued. In the deer space, PGGRC has been planning trials to monitor the effect of a candidate methane inhibitor molecule.

#### 5.1 Incidences and causes of deep muscle bruising in deer carcasses

##### Actual or anticipated completion year 2019

A full season of data recording pertaining to deep muscle bruising was captured by the volunteer deer slaughter plant but was pending assessment in relation to incidence and causation by AgResearch by the end of the financial year. This study has now been completed during FY20 and has ruled out transport or slaughter plant factors as causes of the issue. The industry-wide incidence and impact have been estimated.

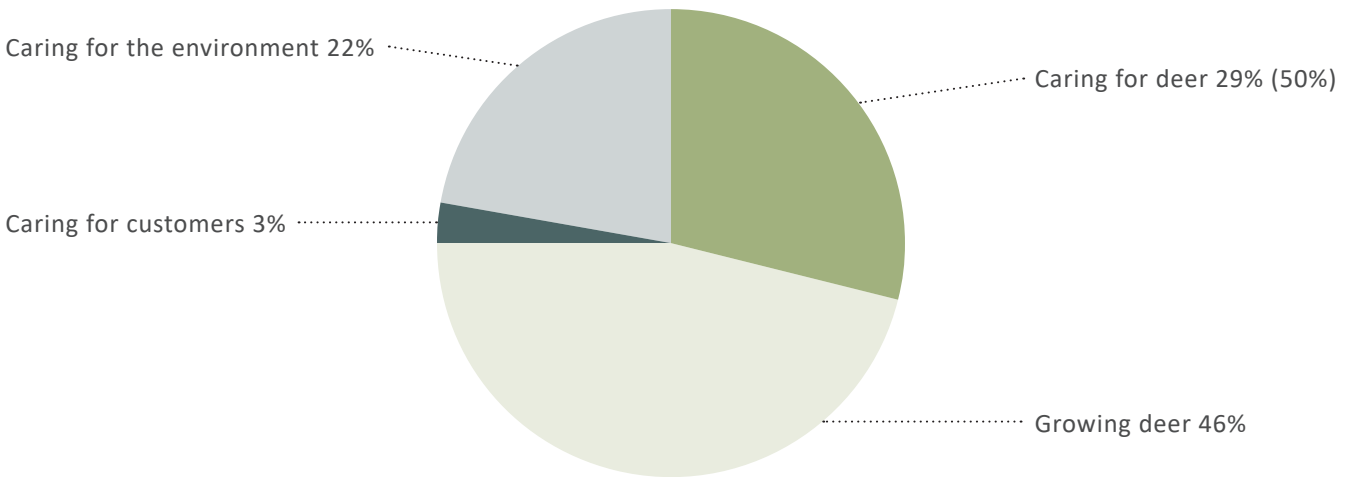
Full project or sub-project descriptions are available on any study of interest, from Catharine Sayer of DINZ<sup>4</sup>, on request.

<sup>4</sup> [catharine.sayer@deernz.org](mailto:catharine.sayer@deernz.org); 04 471 6116



# DEEResearch investment by research theme

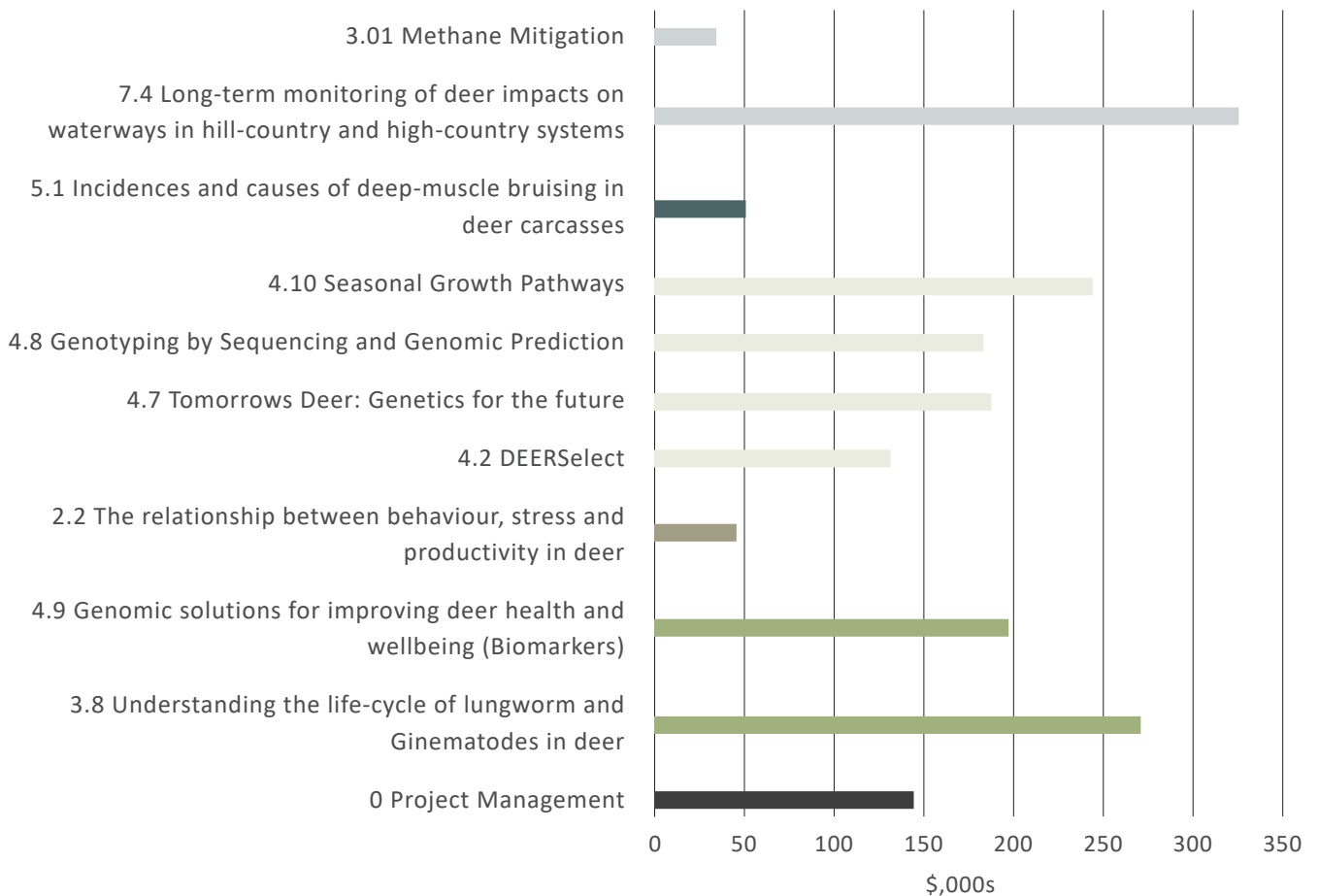
IN 2018/19



\*Percentages in brackets are the proportions of investment into the theme envisaged by the DEEResearch Science Strategy

# DEEResearch investment by project/subproject title

IN 2018/19



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# LOOKING FORWARD: HITTING TARGETS SUB-PROJECTS

IN 2019/20

Theme	Sub-Project Title
Caring for deer	3.8 Understanding the life-cycle of lungworm and GI nematodes in deer
	3.9 Effect of Carla on herd infectivity
	3.10 Penside diagnostic for lungworm infection (Learning Phase)
	4.9 Genomic solutions for improving deer health and wellbeing (Biomarkers)
Growing deer	4.2 DEERSelect
	4.7 Tomorrow's Deer: genetics for the future
	4.8 Genotyping by Sequencing and Genomic Prediction
	4.10 Seasonal Growth Pathways
Caring for customers	5.2 Capturing more value from skins (Learning Phase)
Caring for the environment	7.4 Long-term monitoring of deer impacts on waterways in hill-country and high-country systems



## ACCOUNTS

This report includes an extract from the financial statements of DEEResearch Limited for the year ending 30 June 2019 for general information purposes only. A full set of audited financial statements and the accompanying audit report are available on request to Catharine Sayer (catharine.sayer@deernz.org).

The complete set of audited Financial Statements were approved and signed on 27 November 2019 on behalf of the Board of Directors by C Isaacs and I Moffat (Directors).

## SUMMARY OF DEERESEARCH'S 2018/19 AUDITED ACCOUNTS

DEEResearch Limited  
Summary Statement of Comprehensive Revenue and Expense  
For the year ended 30 June 2019

	2019 \$,000	2018 \$,000
<b>Total Revenue</b>	<b>1,891</b>	<b>1,865</b>
<b>Less Expenditure</b>		
Research Expenditure	1,881	1,820
Administration Expenditure	26	35
<b>Total Expenditure</b>	<b>1,907</b>	<b>1,855</b>
<b>Total Comprehensive Revenue and Expenses before taxation and Interests in Joint Ventures</b>	<b>(16)</b>	<b>10</b>
Change in Proportionate Share in Consortium Net Assets	7	8
<b>Total Comprehensive Revenue and Expenses before taxation</b>	<b>(9)</b>	<b>18</b>
<b>Taxation</b>	<b>2</b>	<b>-</b>
<b>Total Comprehensive Revenue and Expenses after taxation</b>	<b>(11)</b>	<b>18</b>

DEEResearch Limited  
Summary Statement of Changes in Equity  
For the year ended 30 June 2019

	2019 \$,000	2018 \$,000
<b>Opening Accumulated Funds</b>	<b>43</b>	<b>25</b>
Total Comprehensive Revenue and Expenses after taxation	(11)	18
<b>Closing Accumulated Funds</b>	<b>32</b>	<b>43</b>

DEEResearch Limited  
Summary Statement of Financial Position  
For the year ended 30 June 2019

	2019 \$,000	2018 \$,000
Share Capital	0	0
Retained Earnings	32	43
<b>Accumulated Funds</b>	<b>32</b>	<b>43</b>
<i>Represented by:</i>		
<b>Current Assets</b>	267	232
<b>Current Liabilities</b>	235	189
<b>Net Assets</b>	<b>32</b>	<b>43</b>

*These Financial Statements should be read in conjunction with the notes to the Financial Statements*

DEEResearch Limited  
Summary Statement of Cash Flows  
For the year ended 30 June 2019

	2019 \$,000	2018 \$,000
Net cash inflow/(outflow) from Operating Activities	(21)	12
Net cash outflow from Investing Activities	40	(21)
Net cashflow from Financing Activities	-	-
<b>Net Increase/(decrease) in cash and cash equivalents</b>	<b>19</b>	<b>(9)</b>

## NOTES TO SUMMARY FINANCIAL STATEMENTS

The specific disclosures included in this summary financial report have been extracted from the full financial report which was authorised for issue on 27 November 2019.

The financial statements have been prepared in accordance with Tier 2 PBE accounting standards. The full financial statements have been audited and an unmodified audit opinion has been issued. These summary financial statements comply with PBE FRS 43. Figures are in New Zealand dollars. All summary financial information has

been rounded to the nearest thousand dollars.

The summary financial report cannot be expected to provide as complete an understanding as provided by the full financial report of the Company.

If you require a full set of accounts, please contact Catharine Sayer at Deer Industry New Zealand<sup>2</sup> and we will forward a copy to you.

<sup>2</sup> [catharine.sayer@deernz.org](mailto:catharine.sayer@deernz.org); 04 471 6116