# DEERresearch

# ANNUAL REPORT

## FOR 1 JULY 2017 – 30 JUNE 2018

# FROM THE CHAIRMAN

## OVERVIEW

DEEResearch has had an excellent year in which scientists have made solid progress in investigating a range of opportunities for increased deer industry profitability and sustainability. We've described the highlights later in this report.

## INDUSTRY INPUT

As a Board, we're heartened by the extent to which industry groups have become more involved in steering the direction of projects. This gives us confidence that there is demand for our research and helps us deliver knowledge in a form suitable for adoption.

The groups I'm thinking of here are the Venison Processors' Technical Committee, the Deer Select Reference Group and the Deer Industry Parasitology Group. Their input is greatly valued by us. We hope to strengthen the roles of these groups after work with our shareholders Deer Industry New Zealand ("DINZ") and AgResearch to refresh how the research commissioning, monitoring and adoption pipeline works for venison, velvet and co-product research.

## UPCOMING STRATEGIC ISSUES

Whether DEEResearch should maintain a diverse research programme or concentrate resource on fewer projects is a strategic question we will consider. We're aware that DINZ intends to identify which of its strategic objectives it expects research to contribute towards; this will greatly assist us in our task.

Most of our programme is deer-specific, but DEEResearch has also invested for many years in research of relevance to the whole pastoral sector: pastoral greenhouse gas mitigation. Through this investment, the deer industry has had a role in steering the development of mitigation technologies suited to New Zealand farming systems at the lowest access cost.

With the research consortium's funding cycle coming to an end shortly and the regulatory treatment of livestock emissions under review by the Government, DEEResearch will take a close look with the other investors at whether and how that research should continue. We'll work closely with DINZ to ensure that our investment decisions are aligned with DINZ's strategy of sustainable on-farm value creation.

## DEERESEARCH PERFORMANCE

We assess how well DEEResearch has operated against our key performance indicators (agreed by DEEResearch in 2013) in *table 1*. We recognise that achievement of these KPIs depends on many factors outside DEEResearch's control, so they're under review. In the meantime, they're nevertheless outcomes that our work can influence.

## DIRECTORS

As at 30 June 2018 the Board of DEEResearch Ltd. comprised:

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

**Dan Coup** (Deer Industry New Zealand)

**Andrew Greer** (Tertiary Education Institutions)

**Glyn Francis** (AgResearch)

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

**Megan Skiffington** (AgResearch) (Mark O'Connor until 20 February 2018)

**Ian Walker** (Deer Industry New Zealand)

# DEEResearch progress against Key Performance Indicators

## Table 1

| KPI | Whether met | Commentary |
|-----|-------------|------------|
| **A profitable, productive (in terms of increased output per unit of input) and sustainable deer industry** | ✓ | Noting there are a number of responsible factors - weather and the market environment being just two - by 30 June 2018, the average carcass weight reached 57.34kg, up from 56.99kg the year before. DINZ attributes one of the three causes of bigger carcasses as "increased growth rates due to improved genetics, reduced stocking rates and better feeding".[1] With respect to improved genetics, *Figure 1* reveals continued increases in the Deer Select carcass weight breeding values in the last 12 months. This trend is due to breeders making mating decisions informed by Deer Select and demonstrates the value of DEEResearch's significant investment into improving its accuracy and relevance. |
| **More deer, heavier, earlier and better** | ✓ | **More:** deer numbers have increased 7% on the previous year[2]. <br><br>**Heavier:** our deer were more productive (see box above) by 348g a head, representing, at a conservative $10/kg farmgate value, an additional $3.48 a head. <br><br>**Earlier:** the proportion of the annual kill reaching slaughter in the Sep-Nov and Dec-Feb quarters was similar between 2017 and 2018. DEEResearch anticipates that owing to improvements in conception date in the elite stud herds[3], the proportion of the national kill reaching slaughter in the Sep-Nov quarter should increase over the next few years as those genetics filter down to the commercial herds. See *Figure 2* Change (in days) in conception date with respect to 1990 average conception date of animals then recorded on Deer Select. Negative numbers indicate days earlier and positive numbers days later. <br><br>**Better:** we have no information on the qualitative improvement in live deer or venison. |
| **Innovation being applied across industry** | ✓ | In a 2017 Practice Change Survey of deer farmers, 50% of farmers reported having adopted a new technology or significantly different practice compared with 47% of farmers interviewed in 2011. More specifically, in 2017, 49% of those interviewed reported using breeding values for stag selection, compared with 36% of those surveyed in 2011. With more recording of more traits by breeders (CARLA trait recording has gained traction), improvements in the genetics trends amongst the breeders and uptake of those genetics by commercial farmers, DEEResearch is confident that innovation in genetics is being applied by industry. |
| **Relevant capability in research, development and practice change being sustained by growing sector demand** | ✓ | DEEResearch has maintained the value of its investments. However, we are pleased to note increasing demand for additional deer research by DINZ: projects on the effect of non-traditional supplement finishing on venison quality, the development of new non-invasive meat quality assessment technologies (both through AgResearch) and the development of a multi-active liquid oral anthelmintic are underway. We are also aware of commercial and industry-good research being undertaken into deer milk and deer hides, respectively. All of these projects will sustain deer research and adoption capability. |
| **A regained presence of the deer industry in the agriculture sector** | ✓ | We're satisfied with the improved profile of the deer industry in the New Zealand primary sector, and this has been noted in the business and rural media and by government. Other consequences were investment into deer industry infrastructure (e.g. Alliance Group's new deer slaughter plant in Southland) and keen interest from the banking and rural support sector in the industry as evidenced by 202 people registering for attendance at 7 sector introductory workshops run by DINZ during the year. |
| **Strengthened freedom to operate** | – | New Zealand farmers are facing more, not fewer, restrictions on their freedom to operate, mainly owing to more environmental regulations. However, assisted by DINZ and the New Zealand Deer Farmers' Association, who have referred to previous DEEResearch environmental research, most regional councils have issued regulations that take into account the relatively lighter impact of hill country farming systems on water quality. DEEResearch is active in this research area with the objective of informing best practice and regulatory policy. |

[1] Source: DINZ annual report, 2016/17

[2] 836,300 on 30 June 2017; 892,900 on 30 June 2018; Source: StatisticsNZ

[3] The conception date trend for animals recorded on Deer Select showed pronounced improvement from being 1.5 days earlier than the average in 2016 to 2.2 days earlier than the average in 2017, 'average' being the average conception date of deer in 1990
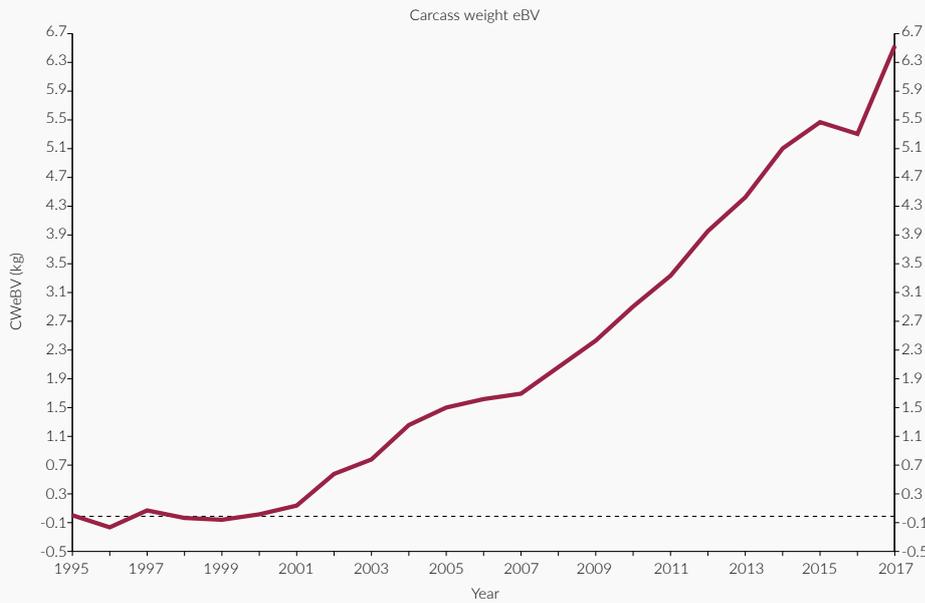
# GENETIC IMPROVEMENTS FACILITATED BY DEERESEARCH

Carcass weight eBV



**Figure 1**
Change in breeding value for carcass weight for all Deer Select recorded deer 1990 - 2017
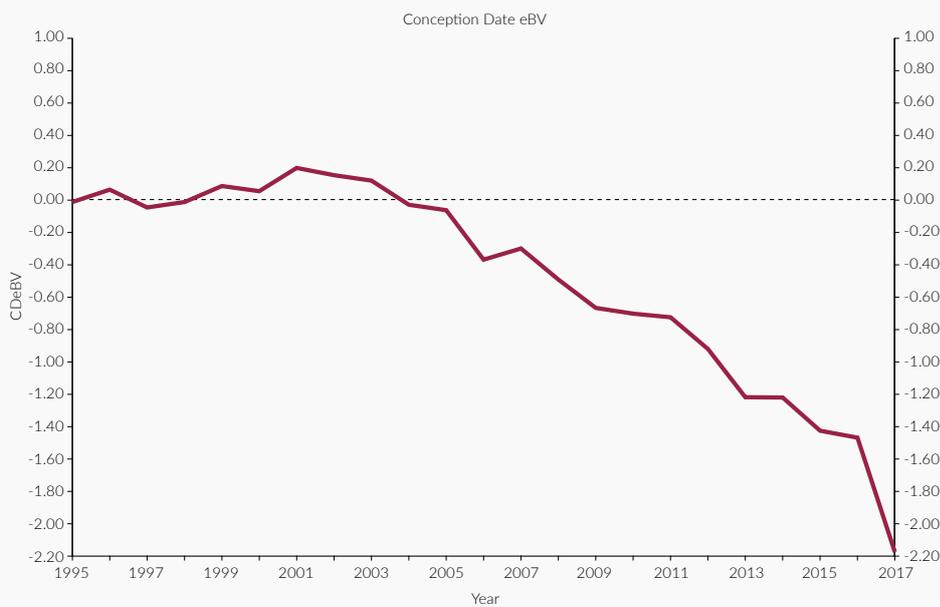
Conception Date eBV



**Figure 2**
Change (in days) in conception date with respect to 1990 average conception date of animals then recorded on Deer Select. Negative numbers indicate days earlier and positive numbers days later.

## ACKNOWLEDGMENT

Lastly, we thank wholeheartedly the farmers and processors who have volunteered their participation in our research projects, some of which are multi-year. Their commitment to our studies and willingness to disrupt their own operations is invaluable to industry progress.

**Collier Isaacs, Chair**

# RESEARCH PROGRAMME HIGHLIGHTS

Highlights from 2017/18 arise from the Hitting Targets project led by AgResearch. The year has seen the successful completion of two long-standing genetics sub-projects, the Deer Progeny Test (DPT) and DEERLink. Both sub-projects have been demonstrated to be responsible for improved rates of genetic gain within the deer industry particularly for growth rates (see *Figure 1* and *Figure 2*), but have also facilitated the adoption of new commercially important traits around carcass/venison quality and host parasite resistance.

FY18 also saw the initiation of several high-profile, multi-year studies whose learnings will be vital to improving industry profitability. These are all projects supported and promoted by stakeholder groups within the deer industry.

> The first is a fundamental research project into the life-cycle of farmed deer's principal parasites of the lungs and gastro-intestinal tract. This involves a newly-appointed post-doctoral parasitologist examining the precise relationships between climate, seasonality, parasite development, parasite numbers on pasture in the herd, parasite speciation and deer growth. Our objective is to obtain information from which effective deer-focussed parasite management regimes can be developed.
>
> The second is an in-depth study on seasonal growth of young deer, focussed on the physiological and genetic mechanisms controlling feed intake and involving collaboration with Lincoln University. This study will inform us with more precision than ever before of the levers available to adjust the deer farming system in response to variances in system inputs as well as customer preferences, such as timing of product demand.
>
> The third new major project is a 6-year study on deer impacts on waterway health in hill and high country deer systems. This project will quantify the amount of nutrient losses to water causes by deer farming, by taking a range of deer farming systems and land types and regularly monitoring waterway pollution over 6 years. This should be of immense value to policy makers and regulators. It will also devise a visual tool by which the appearance of waterway banks will identify water pollution hotspots, thereby indicating to farmers where waterway protection measures are required.

The Hitting Targets Project continues to draw upon science capability throughout all four AgResearch campuses. It supports a growth in capability in parasitology and environmental sciences to underpin new studies in these areas. The project also draws upon capability in the fields of health/immunology through Otago University and ruminant nutrition through Lincoln University, including support for students to undertake post-graduate degrees.

# ACCOUNTS

This report includes an extract from the financial statements of DEEResearch Limited for the year ending 30 June 2018 for general information purposes only. A full set of audited financial statements and the accompanying audit report are available on the DEEResearch Limited website (www.deeresearch.org.nz).

The complete set of audited Financial Statements were approved and signed on 1 November 2018 on behalf of the Board of Directors by C Isaacs and D Coup (Directors)

# SUMMARY OF DEERESEARCH'S 2017/18 AUDITED ACCOUNTS

**Summary Statement of Comprehensive Revenue and Expense**
For the year ended 30 June 2018

| | 2018 $'000 | 2017 $'000 |
|---|---|---|
| **Total Revenue** | **1,865** | **1,892** |
| **Less Expenditure** | | |
| Research Expenditure | 1,820 | 1,860 |
| Administration Expenditure | 35 | 28 |
| **Total Expenditure** | **1,855** | **1,888** |
| **Total Comprehensive Revenue and Expenses Before Taxation and Interests in Joint Ventures** | **10** | **4** |
| Change in Proportionate Share in Consortium Net Assets | 8 | (3) |
| **Total Comprehensive Revenue and Expenses Before Taxation** | **18** | **1** |
| **Taxation** | **-** | **-** |
| **Total Comprehensive Revenue and Expenses After Taxation** | **18** | **1** |

DEERESEARCH LIMITED

**Summary Statement of Changes in Equity**
For the year ended 30 June 2018

| | 2018 $'000 | 2017 $'000 |
|---|---|---|
| **Opening Accumulated Funds** | **25** | **24** |
| Total Comprehensive Revenue and Expenses after taxation | 18 | 1 |
| **Closing Accumulated Funds** | **43** | **25** |

**Summary Statement of Financial Position**
As at 30 June 2018

|  | 2018 $'000 | 2017 $'000 |
|---|---|---|
| Share Capital | 0 | 0 |
| Retained Earnings | 43 | 25 |
| **Accumulated Funds** | **43** | **25** |
| *Represented by:* | | |
| **Current Assets** | 232 | 251 |
| **Current Liabilities** | 189 | 226 |
| **Net Assets** | **43** | **25** |

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 2018

|  | 2018 $'000 | 2017 $'000 |
|---|---|---|
| Net cash inflow/(outflow) from Operating Activities | 12 | (81) |
| Net cash outflow from Investing Activities | (21) | (19) |
| Net cashflows from Financing Activities | | |
| **Net decrease in cash and cash equivalents** | **43** | **(100)** |

## 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 1 November 2018.

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 (DINZ Science and Policy Manager) and we will forward a copy to you.

# SUMMARY OF DEERESEARCH RESEARCH INVESTMENTS IN 2017/18

| Investment type | Project title | Period of project | Funding p.a. ($K) | | | Continuing in 2018/19 |
| | | | Total | DINZ Funding | AgR | |
|---|---|---|---|---|---|---|
| Pan-sector consortia | Methane mitigation *through Pastoral Greenhouse Gas Research Consortium* | 2002 - 2019 | 5,478 | 35 | 800 | Yes |
| Industry-led productivity | Hitting Targets *(project content described in detail below)* | 2013-2019 | 1,791[4] | 408 | 1,333 | Yes |
| **Total** | | | **7,269** | **443** | **2,133** | |

# RESEARCH PROGRAMME PROGRESS IN 2017/18

| Theme | Sub-project Title | Actual or anticipated year of completion | Achievements by year end |
|---|---|---|---|
| Growing deer | 4.1 Deer Progeny Test | 2018 | Final maternal traits uploaded into Deer Select. |
| | 4.2: DEERSelect | 2021 | Carla module (parasite resistance) devised and implemented as research trait; Meat module revised, to be implemented when technical amendments to related modules have been re-aligned. Extensive work on cross-breed growth analyses and some work on maternal module development. 2-monthly breeding value evaluations undertaken. |
| | 4.4: Deerlink | 2018 | Continued phenotypic trait recording from matings necessary to maintain sufficient linkage for reliable breeding values on DEERSelect; all pedigree and trait data relating to progeny uploaded onto DEERSelect. |
| | 4.7: Tomorrow's Deer: Genetics for the Future | 2020 | DNA profiles on all progeny obtained from 2017 AI programme. Annual AI programme completed to breed progeny for assessment of novel, potentially valuable traits in other sub-projects of Hitting Targets. 83% success at pregnancy scanning from Carla sires and 78% success from Jd resistance/susceptibility sires. |
| | 4.8: Genotyping by Sequencing & Genomic Prediction | 2018 | Genome-by-sequencing method used on 1,000 DNA-recorded deer to demonstrate parentage, assign breed/species, locate major genes using genome-wide association studies, and perform genomic prediction. Accuracies for genomic prediction of commercial farm traits were determined. Genomic predictions made using these methods sufficiently accurate to proceed to further testing on recorded deer of selected breeders. Recommendations made on how genomic predictions can be accommodated within Deer Select, which is currently a phenotype-based genetic prediction tool. A candidate gene for yearling weight was also identified. |
| | 4.10: Seasonal Growth Pathways | 2018 | See Research programme highlights. |
| Growing deer/ caring for deer | 2.5: Relationship between behaviour, stress and productivity | 2019 | Almost all fieldwork (apart from ongoing growth monitoring) completed. Full data analysis to take place in 2019. |

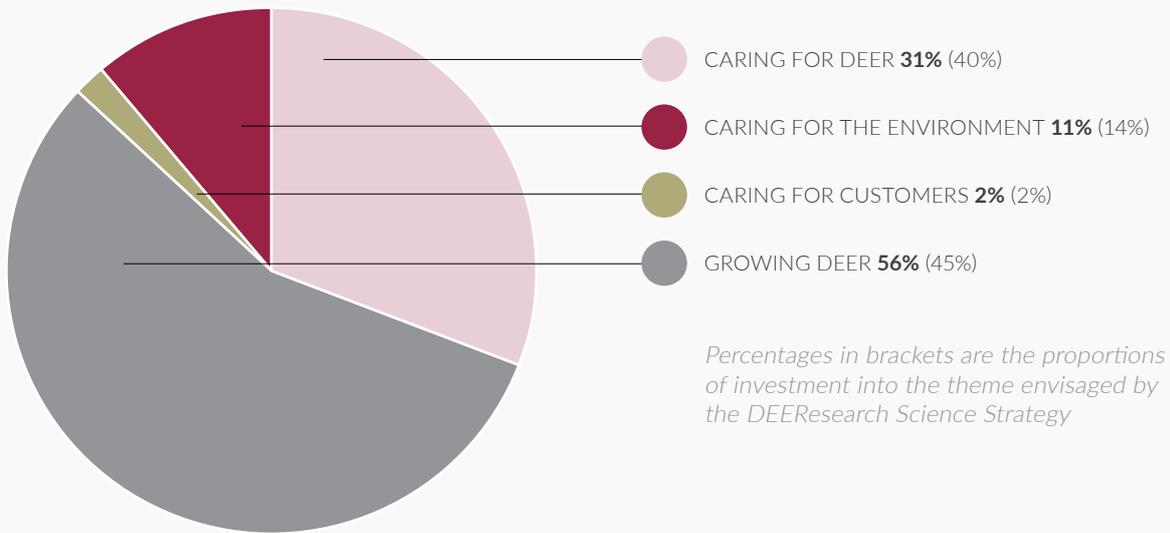[4] Includes $50K from Landcorp Farming Ltd

| Theme | Sub-project Title | Actual or anticipated year of completion | Achievements by year end |
|---|---|---|---|
| Caring for deer | 3.6: Effective mini-bolus anthelmintic for deer | 2019 | After strong performance of the first dual active mini-bolus formulation, new formulation prepared for a repeat efficacy trial, in which efficacy against liver fluke also to be assessed. Trial start delayed until very end of year until parasite challenge at minimum levels. |
| | 3.7: Does Carla Influence Parasitism in Deer? | 2018 | Trial work determined that in rising yearling red deer and Red-Wapiti-crossbred progeny, High CARLA sires' progeny have higher CARLA responses than low CARLA sires at all timepoints, regardless of sex or breed. Further, there is a small positive (+10.2%) relationship between CARLA response and growth response. The mechanism by which CARLA expression exerts its beneficial effect on growth will be examined in follow-up work in 2019. |
| | 3.8 Understanding the life cycle of lungwork and GI nematodes in deer | 2020 | See Research programme highlights. |
| | 4.9: Genomic Solutions for Health and Wellbeing | 2018 | In trials of outbred animals, expression of Johne's disease ("Jd") resilience or susceptibility did not match what was predicted by the expression of biomarker genes, and the genetic predictions were less polarised than in previous trials using purebred sires. Phenotypic responses may have been confounded by the low level of Jd challenge. Fieldwork planned to identify sire differences in the strength of the component of the immune system generally used to fight parasites. |
| Caring for the environment | 7.4: Long-term monitoring of deer impacts on waterways in hill and high country systems | 2021 | See Research programme highlights. |
| | Methane and Nitrous oxide mitigation (through PGGRC) | 2019 | 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 and its achievements on the various workstreams is as follows: |
| | | | **Genetics selection:** Have confirmed that methane emissions are genetically influenced for which heritability is 0.19. The work has been largely completed in sheep and is being rolled out to breeders in 2019-20. Selection mechanisms in cattle and deer are still being developed. |
| | | | **Feeds:** Some brassica cultivars have been demonstrated to reduce methane by 30% compared with other brassica cultivars with their nitrous oxide impacts currently under investigation. The maximum contribution brassicas can make to the ruminant diet is limited for various reasons so low GHG-emitting feeds cannot be the sole solution. |
| | | | **Methane inhibitor:** Being developed for delivery through feed or in a slow-release capsule. A promising compound found that reduces methane by 30% in limited animal trials for an extended 6 week period. Still have substantial technical, cost of delivery and consumer risks to be addressed, meaning that delivery is 7-8 years away. |
| | | | **Methane vaccine:** Approach based on using the immune system to target methane-producing microbes in the rumen. Has potential to be widely used in all species but is proving technically very challenging. Still considered achievable hence work to demonstrate proof of concept of measured reduction in methane continues; delivery of solution would take a further 5-7 years thereafter. |
| Caring for customers | 5.1 Incidences and causes of deep muscle bruising in deer carcasses | 2019 | Initial scoping of data of interest and data recording possibilities undertaken with a deer slaughter plant by way of small-scale pilot trial; full-scale data recording planned for 2018/19. |

*Full project or sub-project descriptions are available on any study of interest, from Catharine Sayer (DINZ Science and Policy Manager[5]), on request.*
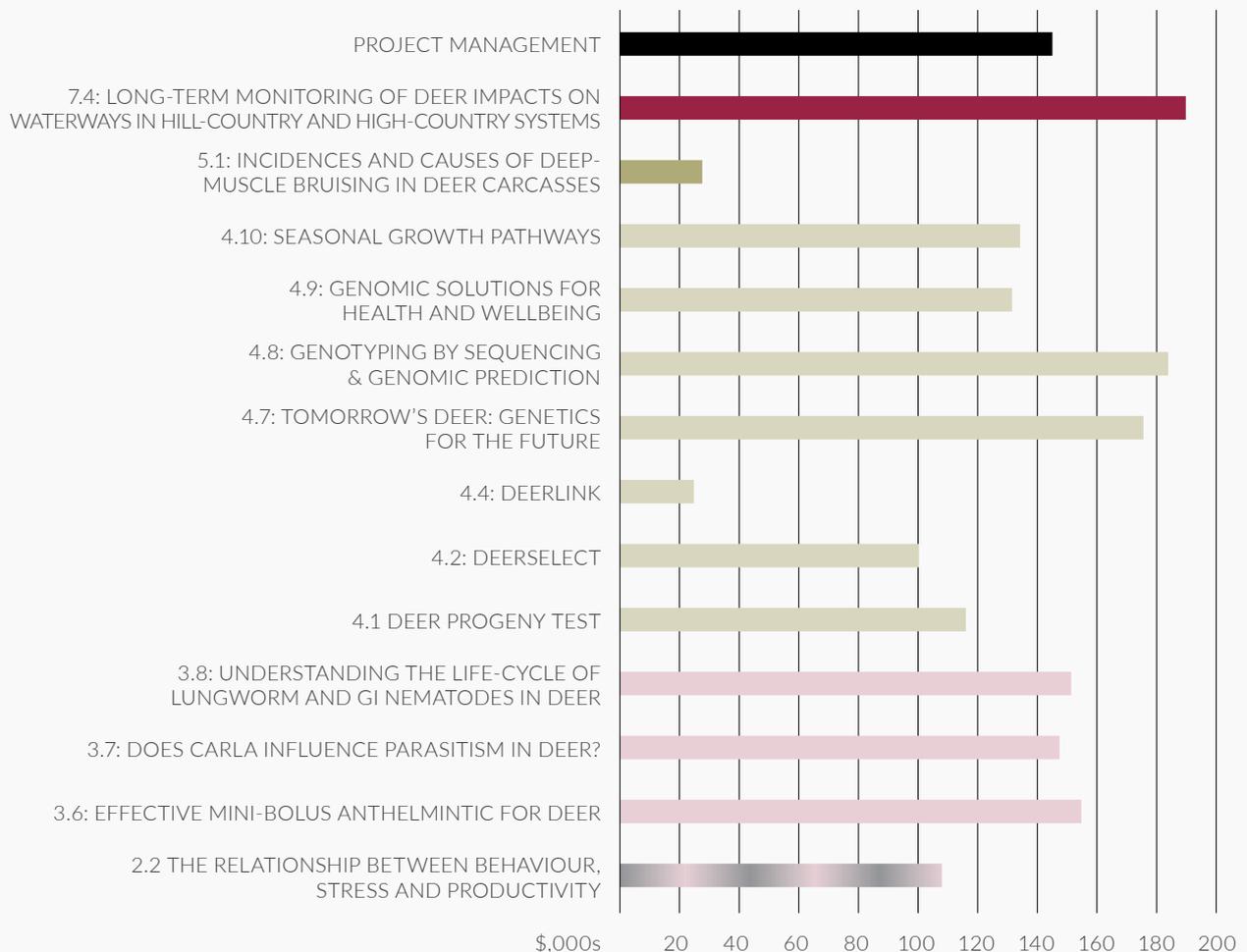
# DEEResearch investment 2017/18 by research theme



- ● CARING FOR DEER **31%** (40%)
- ● CARING FOR THE ENVIRONMENT **11%** (14%)
- ● CARING FOR CUSTOMERS **2%** (2%)
- ● GROWING DEER **56%** (45%)

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

# Hitting Targets investment in 2017/18 by sub-project



- PROJECT MANAGEMENT
- 7.4: LONG-TERM MONITORING OF DEER IMPACTS ON WATERWAYS IN HILL-COUNTRY AND HIGH-COUNTRY SYSTEMS
- 5.1: INCIDENCES AND CAUSES OF DEEP-MUSCLE BRUISING IN DEER CARCASSES
- 4.10: SEASONAL GROWTH PATHWAYS
- 4.9: GENOMIC SOLUTIONS FOR HEALTH AND WELLBEING
- 4.8: GENOTYPING BY SEQUENCING & GENOMIC PREDICTION
- 4.7: TOMORROW'S DEER: GENETICS FOR THE FUTURE
- 4.4: DEERLINK
- 4.2: DEERSELECT
- 4.1 DEER PROGENY TEST
- 3.8: UNDERSTANDING THE LIFE-CYCLE OF LUNGWORM AND GI NEMATODES IN DEER
- 3.7: DOES CARLA INFLUENCE PARASITISM IN DEER?
- 3.6: EFFECTIVE MINI-BOLUS ANTHELMINTIC FOR DEER
- 2.2 THE RELATIONSHIP BETWEEN BEHAVIOUR, STRESS AND PRODUCTIVITY

$,000s   20   40   60   80   100   120   140   160   180   200

# HITTING TARGETS SUB-PROJECTS IN 2018/19

| Theme | Sub-project Title |
|---|---|
| Caring for deer | 3.8: Understanding the life-cycle of lungworm and GI nematodes in deer |
| | 4.9: Genomic solutions for improving deer health and wellbeing (Biomarkers) |
| **Caring for deer/Growing deer** | **2.2: The relationship between behaviour, stress and productivity in deer** |
| 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** | **5.1: Incidences and causes of deep-muscle bruising in deer carcasses** |
| **Caring for the environment** | **7.4: Long-term monitoring of deer impacts on waterways in hill-country and high-country systems** |

DEEResearch

**Website:** deeresearch.org.nz
**Email:** info@deeresearch.org.nz
**Phone:** (04) 473 4500
**Postal Address:**
c/o PO Box 10702, Wellington