



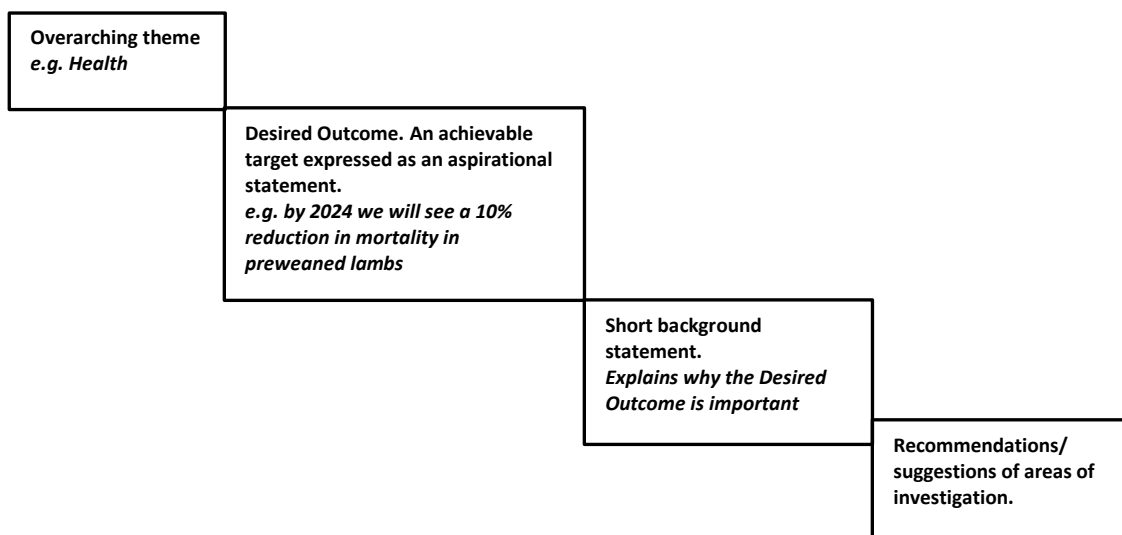
## 2019 Consolidated Livestock Sector Research Priorities

## Livestock Sector Research Priorities Update 2019

### Background:

Between November 2018 and May 2019 LRIC conducted a survey of industry organizations requesting their sector priorities for the coming year. As expected many sectors stated that there was no change from the previous (2017/18) year and this is captured in the table below. Individuals who responded were either Board members, research committee members or senior staff from our member organizations.

Throughout late 2018 and into early 2019 LRIC worked specifically with the Ontario Aquaculture Association, Ontario Sheep and various representatives from the Equine sector to build comprehensive strategies to guide sector investment for the coming 5 years. Comprehensive notes taken at the meeting are distilled in subsequent meetings and through an iterative process used to create strategies that are structured (where possible) in a similar manner to a business plan as follows:



Where LRIC has had recent engagement with the sectors on priorities we tailor the comments to that recent engagement plus any previous work or subsequent work that LRIC has undertaken with the sector. The research strategy documents are available for reference at: <http://www.livestockresearch.ca/current-sector-priorities/> with highlights and priorities from the documents incorporated in the table below.

We received information from Dairy, Pork, Layers, Chicken, Hatching Egg, Turkeys, Beef, Veal, Aquaculture and Sheep.

We have preserved the goat priorities from the previous year as there is currently no goat sector representative body, the 'One Voice' recommended by the Goat Round table group in December 2018, with whom we can connect. There was also little mention of research at that December 2018 meeting.

A few of the sectors also have sector specific issues that they would like to see explicitly addressed/captured in the OMAFRA priorities in 2019 – these are:

1. Layer Industry: An investigation into mechanisms to mitigate the impact of Infectious Bronchitis Virus (IBV) – Egg producers in Ontario are very keen not to have a repeat the problem that was encountered in 2016/2017 with the Delmarva strain of IBV.
2. Broiler Hatching Egg Industry would like to emphasize that ammonia control is a major issue for them and would like to see this explicitly captured in the poultry priorities.
3. 2018 Mycotoxin load has proved difficult for industry. The work that LRIC undertook with the feed industry in 2017 which continued throughout 2018 is used to provide priority areas for research that address this important issue.

Areas highlighted in yellow represent new priorities or those which are of major significance to the sector or sectors concerned.

### **Carry over and newly identified common issues of importance for multiple sectors:**

As with previous years we investigated and discussed priority areas where there is apparent overlap between sectors that potentially could be the stimulus for collective funding of research aimed at addressing common issues e.g. AMR/AMU.

#### **1. Mycotoxins - new**

All sectors that are predominantly grain fed, are looking for mechanisms that will alleviate the negative health and nutrition effects of feeding grain that is contaminated with mycotoxins

#### **2. Human and Ecosystem health outcomes related to livestock production – new**

Whilst not explicit as a main priority for the sectors, we are seeing a clear and relatively new interest from some of the livestock sectors to investigate research that will demonstrate the positive impact they could potentially have on the environment. This is particularly true for the grazing livestock sectors. The sheep sector is a good case in point in recognizing, for example, that wool is potentially a carbon sink and a replacement for synthetic fibres and that well managed rotational grazing can be beneficial for the ecosystem, particularly flora (which subsequently benefits insect and bird life), soil health and nutrient cycling.

Research in this area is unlikely to ever be the number 1 priority for the sectors as they have enough production related issues to contend with on an ongoing basis. However, it should be included in the overarching priorities as it is important for many sectors and definitely ‘fits’ with the Provincial priorities related to undertaking research that will create improved environmental outcomes for Ontario.

There is a burgeoning body of literature emerging about the positive benefits of livestock production and meat protein consumption related to human and ecosystem health benefits. LRICs recommendation is for the Provincial priorities to consider modifying the language in its priorities document from, “*Reduce the environmental impacts of livestock sectors*” to, for example, *research that enables the livestock sectors to demonstrate environmental benefits*. This is a very positive endeavour that we suggest the sectors will be more inclined to support as psychologically, it is always easier to support something that will create something positive than something designed to fix an existing problem.

#### **3. Anti-microbial Use and Reduction - ongoing**

All sectors are looking for alternatives to antibiotics. Alternatives are not necessarily restricted to the development of alternative products prebiotics and probiotics and vaccines for example but could also include management strategies. This is directly related to point 4.

#### **4. Drug residue depletion studies and information that will inform the delivery of off-label prescriptions.**

This is still seen as a key area for the majority of sectors and support for the research undertaken by the Canadian Global Food Animal Residue Avoidance Database (CgFARAD) to be included as a priority under the Production Systems theme as it was in 2018, is clear, particularly from the poultry and the small ruminant sectors. This is particularly true for the milk producing small ruminant sector as the dairy processors are now requiring accurate recording of pharmaceutical use for quality assurance and audit purposes – this move on their part is new in 2019

#### **5. Management during early life - ongoing.**

This continues to be a potential Achilles heel for many sectors. Specifically, the management of day old chicks in the broiler industry, lambs and kids in the small ruminant sectors and veal calves in the dairy sector. Some of these issues are directly related to the reduction in prophylactic antibiotic use (poultry), some to the lack of available treatments (sheep and goats) and some are management/economically driven (veal).

## Individual priorities/researchable issues for the Ontario sectors:

### Sheep 2019 - newly published strategies and priorities.

2017	2018	2019
<p><b>Animal health (vaccine development)</b> – some work already ongoing and on lameness and parasites;</p>	<p><b>Managing animal health</b> – this includes pneumonia and finding alternative means of managing animal health (outside of antibiotics i.e., genetic resistance, vaccine development), with a focus on prevention Economics – getting a better understanding of the economic impact of the sheep industry to Ontario and Canada</p>	<p><b>Animal Health</b></p> <ul style="list-style-type: none"> <li>• Cost effective tests for identification of parasite loads</li> <li>• Methods including grazing systems to improve control of parasites</li> <li>• Management and nutritional methods to manage gastrointestinal parasitism</li> </ul>
	<p>CgFARAD – As so few drugs are registered for use in sheep, work done by CgFARAD on setting appropriate drug withdrawal times is critical in ensuring food safety and maintaining public confidence in our product.</p>	<p>CgFARAD – As so few drugs are registered for use in sheep, work done by CgFARAD on setting appropriate drug withdrawal times is critical in ensuring food safety and maintaining public confidence in our product.</p>
		<p><b>Health and Nutrition:</b></p> <ul style="list-style-type: none"> <li>• Maternal Nutrition: Identify nutritional strategies that will reduce variations and optimize ewe body condition score in accelerated rearing systems</li> <li>• Vaccinating ewes to reduce mortality and morbidity of lambs</li> <li>• Assessment of passive immunity and the factors that determine its efficacy</li> </ul>
Wool - quality		<p><b>Wool</b></p> <ul style="list-style-type: none"> <li>• Determine the cost and environmental benefits of wool as a replacement for synthetic fibers.</li> </ul>
Climate change adaptation and mitigation (this includes alternative feeds)	Environment – how to adapt to and minimize impact on Productivity, product quality and profitability	<p><b>Environment</b></p> <ul style="list-style-type: none"> <li>• A literature review of existing data to determine its applicability to sheep production, the landscapes and climatic conditions in Ontario</li> <li>• Identifying methods for improving whole farm water use efficiency</li> <li>• Work to demonstrate the environmental benefits of sheep production in Ontario.</li> </ul>
		<p><b>Nutrition</b></p> <ul style="list-style-type: none"> <li>• Could winter wheat or rye be grazed with a minimal impact and/or improvement to the crop yield?</li> <li>• The impact of dietary ingredients on meat quality</li> <li>• Options and methods for forage and grass grazing during drought conditions</li> <li>• Assessment of feed sources and their impact on the gut microbiome</li> </ul>

## Dairy

2017	2018	2019 continuation from 2018
<p><b>Healing time of animal injury.</b> Comments: We need studies to show that producers are making animal safety decisions correctly and that we can monitor health issues with their animals and recovery time from injury. This is important as we implement the animal care component of Pro Action.</p>	<ol style="list-style-type: none"> <li>1) the effect that feeding palm oil has on milk quality, milk nutrition and animal health;</li> <li>2) the value of the dairy matrix on non-communicable diseases (diabetes, cardiovascular disease, stroke), (Food-based recommendations are more practical for the general public than a nutrient-based dietary advice);</li> <li>3) distinguish the qualities of dairy products from plant-based alternatives;</li> <li>4) risk assessment to of animal-free (in-vitro) protein alternatives;</li> </ol>	<ol style="list-style-type: none"> <li>1. Euthanasia methods and training for our producers</li> <li>2. Antimicrobial stewardship especially pertaining to blanket dry cow treatment.</li> <li>3. Carryover from 2018: the value of the dairy matrix on non-communicable diseases (diabetes, cardiovascular disease, stroke), (Food-based recommendations are more practical for the general public than a nutrient-based dietary advice);</li> <li>4. Carryover from 2018: distinguish the qualities of</li> </ol>

	5) impact of a reduction of dairy recommendations on economic/social, nutrition and environment; and 6) the measurement and resolution processes for ground current.	dairy products from plant-based alternatives; 5. Carryover from 2018: impact of a reduction of dairy recommendations on economic/social, nutrition and environment; and 6. Carryover from 2018: the measurement and resolution processes for ground current
<b>Stray Voltage.</b> Any information that can be attained will be important to try to stop the injury inflicted on animals because of stray voltage		
<b>Antimicrobial resistance.</b> An ongoing issue that our industry has to stay ahead of.		
2017		
<b>Milk foaming</b> Retailers are complaining about the lack of foaming ability of some milk. We need to determine why this problem is occurring and what to do about it. <i>(latterly taken off the list as work is ongoing between Ontario and BC on this issue)</i>		
<b>Traceability.</b> With the traceability component of Pro-Action supposed to come into effect by Sept 2017 we need to get a program in place very soon.		

### Poultry Layer

2017	2018	2019 continuation from 2018
Feed-utilization of by-products & new precision technologies	Feed-utilization of by-products & new precision technologies	Feed-utilization of by-products & new precision technologies
Energy Use Why? hydro going up & carbon pricing	Energy Use Why? hydro going up & carbon pricing	Energy Use Why? hydro going up & carbon pricing
Sustainability Cost? Possible lower total costs of production	Sustainability Cost? Possible lower total costs of production	Sustainability Cost? Possible lower total costs of production
Economics of Right size & Scale of Operation	Economics of Right size & Scale of Operation	Economics of Right size & Scale of Operation
Housing System Innovation	Housing System Innovation	Housing System Innovation
Growth promotants & antibiotic use	Growth promotants & antibiotic use	Growth promotants & antibiotic use
Live Bird Transportation	Live Bird Transportation	Live Bird Transportation
		Investigate how to prevent future outbreaks of Infections Bronchitis becoming so widespread.
		Work on reducing or negating impact of mycotoxins

### Poultry Chicken (Broiler)

2017 – provided by PIC – however heavy emphasis on reducing AMU	2018	2019 continuation from 2018
AMR/AMU	AMR/AMU	AMR/AMU
Live bird transport	Chick Quality	Chick Quality
Lowering cost of production	Mitigating REO spread	Mitigating REO spread and control of emerging disease.
		Effective barn cleaning
		Animal welfare
		Food safety – links to CgFARAD

## Poultry Turkey

2018	2019 continuation from 2018
Support for CgFARAD research	Support for CgFARAD research
Emerging diseases	Emerging diseases
Animal welfare – elimination of toe, beak and snood conditioning and the impact on production	Animal welfare – elimination of toe, beak and snood conditioning and the impact on production
Poult Quality	Poult Quality
Reduced antimicrobial use and its impact on primary production	Reduced antimicrobial use and its impact on primary production

## Poultry OBHECC

2018: CgFARAD drug depletion studies for drugs that have no approval in poultry. OBHECC requests that LRIC conveys to OMAFRA on behalf of the industry the need to continue funding academic studies to provide veterinarians and producers with the relevant drug withdrawal period guidelines.	2019: CgFARAD research to be supported in order continue drug depletion studies for drugs that have no approval/withdrawal times in poultry. OBHECC requests that LRIC conveys to OMAFRA on behalf of the industry the need to continue funding academic studies to provide veterinarians and producers with the relevant drug withdrawal period guidelines.
Animal Health (field research on diseases – addressing the resurgence of REO)	Animal Health (field research on diseases – addressing the resurgence of REO)
Production based research – e.g. addressing fertility	Production based research – e.g. addressing fertility
Food safety (drug depletion periods – specifically in chickens)	Food safety (drug depletion periods – specifically in chickens)
Environmental research – e.g. Ammonia concentrations.	Ammonia control is a major issue for broiler breeder farmers – OBHECC would like to see this explicitly captured in the poultry priorities.

## Pork

2017	2018:	2019 continuation of 2018
<p>Investigate and mitigate or control:</p> <ul style="list-style-type: none"> <li>Phosphorus , soil / water movement;</li> <li>Pork production without antibiotics to meet current consumer needs</li> <li>Requirements of the new code of practice pain reduction ...pain meds, including mixing, loose housing issues – injury.</li> <li>Innovation, <u>how</u> can technology help our industry, now and going forward</li> </ul>	<p>The committee identified an overarching research objective:  <b>“Test potential improvements to swine industry practices”</b>  All research projects that align with this overarching objective will be considered by Ontario Pork, including, but not limited to; <b>swine health, swine welfare, swine nutrition, swine husbandry, swine reproduction, barn design and management, employee health and safety, meat quality and safety, marketing and consumer trends and environmental and economic sustainability.</b>  Ontario Pork will only support projects that demonstrate:</p> <ul style="list-style-type: none"> <li>Demonstrated economic return to the Ontario industry, e.g. Specific calculations on savings are required.</li> <li>Impact to the sector – a cost: benefit analyses outside of economic impact, e.g. productivity, resiliency, increased market share, etc.</li> <li>Demonstrated collaboration between academia and industry (does not have to be financial, discussions of feasibility, practicality, letters of support from those the research would impact)</li> <li>Investing in human resources for the Ontario swine industry, e.g. grad students</li> <li>Other cash and in-kind, leveraging Ontario Pork’s research funding</li> <li>Link to societal concerns and issues</li> <li>Past performance record of the research team</li> </ul>	<p>Overarching research objective:  <b>“Test potential improvements to swine industry practices”</b>  All research projects that align with this overarching objective will be considered by Ontario Pork, including, but not limited to; <b>swine health, swine welfare, swine nutrition, swine husbandry, swine reproduction, barn design and management, employee health and safety, meat quality and safety, marketing and consumer trends and environmental and economic sustainability.</b>  Ontario Pork <u>will only</u> support projects that demonstrate:</p> <ul style="list-style-type: none"> <li>Economic return to the Ontario industry, - Specific calculations on savings are required.</li> <li>Impact to the sector – a cost: benefit analyses outside of economic impact, e.g. productivity, resiliency, increased market share, etc.</li> <li>Demonstrated collaboration between academia and industry (does not have to be financial, discussions of feasibility, practicality, letters of support from those the research would impact)</li> <li>Investing in human resources for the Ontario swine industry, e.g. grad students</li> <li>Other cash and in-kind, leveraging Ontario Pork’s research funding</li> <li>Link to societal concerns and issues</li> <li>Past performance record of the research team</li> <li>Knowledge translation and transfer (KTT) and a communication plan</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Knowledge translation and transfer (KTT) and a communication plan</li> <li>▪ Multi-species applicability</li> <li>▪ Innovation component</li> </ul>	<ul style="list-style-type: none"> <li>▪ Multi-species applicability</li> <li>▪ Innovation component</li> </ul>
		Research that will reduce Mycotoxin problems in feed
		Investigate mechanisms to reduce the potential impact of and protect industry from, African Swine Fever

## Beef

2017	2018	2019 continuation from 2018
<p>How to produce highly marbled <u>and</u> high yielding carcasses Why important: Efficiency has dropped in past decade as feedlots chased yield through feeding</p>	<p>To <b>enhance industry competitiveness and reduce production costs</b>, priority outcomes are to enhance feed and forage productivity, increase feed efficiency, and decrease the impact of animal health and welfare issues and production limiting diseases,</p> <p>To <b>improve public confidence in Canadian beef</b>, priority outcomes are to improve food safety, strengthen the surveillance of antimicrobial use and resistance, develop effective antimicrobial and growth promotant alternatives, improve animal care through an evaluation of various management systems, demonstrate the safety and efficacy of new production technologies, improve environmental sustainability and the environmental footprint of beef production, and measure the beef industry's environmental benefits. In addition, research should conduct a targeted evaluation of phosphorous risks under different cattle management systems and evaluate/develop mitigation tools and techniques.</p>	<p><b>Enhance industry competitiveness and reduce production costs</b>, priority outcomes are to enhance feed and forage productivity, increase feed efficiency, and decrease the impact of animal health and welfare issues and production limiting diseases,</p> <p>To <b>improve public confidence in Canadian beef</b>, priority outcomes are to improve food safety, strengthen the surveillance of antimicrobial use and resistance, develop effective antimicrobial and growth promotant alternatives, improve animal care through an evaluation of various management systems, demonstrate the safety and efficacy of new production technologies, improve environmental sustainability and the environmental footprint of beef production, and measure the beef industry's environmental benefits. In addition, research should conduct a targeted evaluation of phosphorous risks under different cattle management systems and evaluate/develop mitigation tools and techniques.</p>
Identifying SNP's of benefit by breed or across breeds		
New Tech: Feasibility/effectiveness of virtual fences.		
Evaluation of phosphorous risks for the Ontario beef industry under different management systems Investigate P in feed that leads to future run off.		
Comparison of animal health/welfare impacts for cattle transported long distances. Is there an ideal timeframe or threshold (i.e. less than 8 hours to final destination)		
Highest quality meats attributes and how producers might produce them, select them, process for them etc.	<b>Building on 2017:</b> To <b>improve beef demand and quality</b> , priority outcomes are to reduce food safety incidences, improve beef quality through primary production improvements and the development and application of technologies to optimize cutout values and beef demand.	<b>Building on 2017/18:</b> To <b>improve beef demand and quality</b> , priority outcomes are to reduce food safety incidences, improve beef quality through primary production improvements and the development and application of technologies to optimize cutout values and beef demand.
Cost effective proof of location of origin. Moving beyond RFID's.		
Breeding and feeding strategies that would reduce the use of anti-microbials	<b>Building on 2017:</b> Strengthen the surveillance of antimicrobial use and resistance, develop effective antimicrobial and growth promotant alternatives,	<b>Building on 2017/18:</b> Strengthen the surveillance of antimicrobial use and resistance, develop effective antimicrobial and growth promotant alternatives,
Opportunities for groups to reduce the cost of data collection		
	<b>New:</b> including an evaluation of stray current prevalence and mitigation techniques, and the impact that stray current may have on human and animal health and welfare.	Evaluation of stray current prevalence and mitigation techniques, and the impact that stray current may have on human and animal health and welfare.

	<b>New:</b> To <i>evaluate the efficacy and demand of alternative proteins</i> , priority outcomes are to evaluate consumer perceptions, health attributes and the environmental sustainability of plant and lab (in vitro/synthetic) based protein in comparison to traditional animal based proteins. An evaluation of the impact that substituting animal with plant and lab based protein production and the impact on human and environmental health is needed, including an assessment of the production resource requirements (land, water, and other inputs) between different protein production	<b>Evaluate the efficacy and demand of alternative proteins</b> , priority outcomes are to evaluate consumer perceptions, health attributes and the environmental sustainability of plant and lab (in vitro/synthetic) based protein in comparison to traditional animal based proteins. An evaluation of the impact that substituting animal with plant and lab based protein production and the impact on human and environmental health is needed, including an assessment of the production resource requirements (land, water, and other inputs) between different protein production
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## Veal

<b>2017</b>	<b>2018:</b> VFO's focus is supporting research with the overarching goal of reducing anti-microbial usage in veal production through the following research priorities:	<b>2019:</b> VFO's focus is supporting research with the overarching goal of reducing anti-microbial usage in veal production through the following research priorities:
Animal health Investigate, identify and prioritize the diseases that most adversely affect the health and production of veal in Ontario	<ol style="list-style-type: none"> <li>1. Calf Transport - Age, stress, transfer from farm origin to all points</li> <li>2. Housing - Benchmarking cleaning disinfection and measuring impact</li> <li>3. Management Practices - Benchmarking current management practices and investigating ways in which to improve</li> <li>4. Co-mingling calves - Reducing disease transfer in co-mingled calves in various production systems</li> </ol>	<ol style="list-style-type: none"> <li>5. Calf Transport - Age, stress, transfer from farm origin to all points</li> <li>6. Housing - Benchmarking cleaning disinfection and measuring impact</li> <li>7. Management Practices - Benchmarking current management practices and investigating ways in which to improve</li> <li>8. Co-mingling calves - Reducing disease transfer in co-mingled calves in various production systems</li> </ol>
Nutrition  Determine the optimum feeding and nutrition management practices determine the optimal weaning period for calves based on rumen development.		
Animal welfare Comparative assessment on the types of individual and group housing of veal in Ontario. <i>Design and carry out research that will inform producers of the best practices for individual and group housing.</i>  Develop a research project that evaluates different types of flooring and recommend the most appropriate options that ensure proper growth and development.  Benchmark average age of transport of veal calves in Ontario. Investigate the optimum time for calves to be shipped considering calf health and the economic benefits for both the buyer and seller.	<b><i>This theme is continued in 2018 and is related to group housing priority from 2017: Co-mingling calves - Reducing disease transfer in co-mingled calves in various production systems</i></b>	<b><i>This theme is continued in 2019 and is related to group housing priority from 2017: Co-mingling calves - Reducing disease transfer in co-mingled calves in various production systems</i></b>
Food safety Benchmark antimicrobial usage in calves and reduce the use of antibiotics by using alternative products and improving management practices.	2017 and CgFARAD related: Drug Labelling & Approvals/Depletion Studies/Metabolism of calves	2017 and CgFARAD related: Drug Labelling & Approvals/Depletion Studies/Metabolism of calves



## Aquaculture 2019 – newly published strategies and priorities.

Ranking	2018 Key Area of Focus	<b>2019 Overarching outcome: To grow the net pen industry in Lake Huron and Lake Superior to between 30,000 and 50,000 MT in the next ten years.</b>
1 <sup>st</sup> Genetics and Reproduction	Ontario continues to be very reliant on imported rainbow trout eggs for growout, with genetics that are sub-optimal for Ontario growing conditions. Most of the actions under this theme are still extremely relevant and require continued effort. As a result, it maintains the highest research ranking.	Aspiration: Develop a formal breeding program for Ontario rainbow trout through a partnership between industry and government. Research Challenge: Assess the amount of genetic diversity in existing lines of rainbow trout and then using new and existing tools and techniques initiate a family-based breeding program.
2 <sup>nd</sup> Environmental Interactions & Wild Fishery	These two themes are very closely linked and combined would have been the highest rated research need in the 2014 research priority setting. There has been some research completed in the last several years regarding the impacts of net pen aquaculture and native fish populations. This topic remains one of the central issues raised by Indigenous communities when they are deciding whether to invest in open water net pen aquaculture of rainbow trout or whitefish. More research needs to be done investigating the impacts of large open water net pens on the environment and wild fishes. Many of the actions identified still remain to be completed.	Develop and implement of a science-based benthos and sediment monitoring protocol for freshwater net pen systems.  Develop phosphorus binding and effluent control and/or divergence of waste products to usable resources for any/all types of aquaculture systems (engineering solution recommended)  Develop alternative usages for systems waste components (engineering solution recommended)  Develop a model for assimilative capacity and mass balance for off-property (stream) discharge of land-based farms that regulators will recognize for licensing and monitoring.  Update discharge standards for RAS that distinguish between mass loading and concentration with the ability to incorporate alternative waste usages.
3 <sup>rd</sup> Fish Health	Emerging issues in fish health, especially coldwater disease, continue to require leading edge research to find solutions to reduce the economic impact of disease. Communication to producers to disseminate information on aquatic animal health has greatly improved over the last year from the Fish Expert Network of the Ontario Animal Health Network.	
4 <sup>th</sup> Fish Nutrition	Most of the trout feed used in the province currently comes from the west coast (Ewos – hatcheries and Taplow Feeds – organic) and the East Coast (Skretting – trout grower diets). Recently, Bluewater Feeds has started domestic production of specialty aquaculture diets. There continues to be a need to investigate new dietary ingredients that may have nutraceutical benefits to improving fish health and immune response. One of the research actions that requires renewed attention is performance benchmarking. This was also identified in the Economics research theme.	Develop cost effective, sustainable, nutritional diets that have nutraceutical properties, and improve immunity for all of the technology systems employed in aquaculture in Ontario. Preference that the formulations use local (Ontario or Canadian sourced) and/or novel components. Preference that the formulations do not displace anything used for human consumption.
5 <sup>th</sup> Economics and Industry Benchmarking	An industry wide benchmarking system has not been implemented.	Development of best practices and protocols for the humane culture, euthanasia, slaughter and shipping of fish livestock

		<p><b>Engineering solutions:</b></p> <p>Using engineering and multidisciplinary technologies develop:</p> <ul style="list-style-type: none"> <li>• recirculating aquaculture systems, multi-trophic aqua and aquaponics that can be developed into commercially scalable and economical systems, creating opportunities for expansion in Ontario.</li> <li>• Systems for offshore operations to handle severe weather and mitigate climate change impacts by moving to cooler water environments.</li> </ul>
		<p>OAA to communicate:</p> <p>Environmental Impact – Science based information</p> <p>Industry Transparency</p> <p>Industry Successes</p> <p>Positive impact on local ecosystem/wild fish</p> <p>Knowledge Translation and Transfer (KTT) - Research results shared</p> <p>Media friendly/open</p> <p>How people perceive aqua story</p> <p>Government to message the benefits of aquaculture</p> <p>Next generation – benefits of fish farming</p> <p>Strategy</p> <p>Positive messaging to farmed fish opposition</p>

**Equine 2019 - newly published strategies and priorities.**

Theme	Research Area
Health	<p>Physiological stress – regenerative medicine/therapies, tissue damage</p> <ul style="list-style-type: none"> <li>• Regenerative medicine therapies Horses as models of human disease –value to society</li> <li>• Real-time assessment of impacts of physiological stress (e.g. under high performance conditions)</li> <li>• Management practices that fit the ethology of the horse. Grazing and movement effects on performance</li> <li>• Traction and broad force reactions, issues in soft tissue damage (could tie into environment)</li> <li>• Animal welfare – fracture prevention, compare CT scans with death registry, DNA studies</li> <li>• Cardio research</li> <li>• Characterize bioactivity of nutraceuticals for equine arthritis</li> <li>• Statistics related to conformation issues and relation to specific lameness types in performance/racehorses</li> </ul>
Health	<p>Respiratory issues – allergens, stabled vs pasture and other.</p> <ul style="list-style-type: none"> <li>• Transportation – develop best practices related to stress and health</li> <li>• Transport manufacturing standards related to behaviour and health concerns</li> <li>• Respiratory research – pasture 24/7 versus stabled and low turnout horses</li> <li>• Emergency response at temporary locations (shows, fairs, etc.)</li> </ul>
Health	<p>Analytical testing and diagnostics</p> <p><b>Analytical testing and diagnostics</b></p> <ul style="list-style-type: none"> <li>• Vaccination use is very varied, research is needed to understand owner attitudes and choices related to vaccinating.</li> <li>• Rapid stall-side testing (e.g. respiratory, GI)</li> <li>• Emergency management of herd disease</li> <li>• Animal health/welfare – sudden death (A/F), further work on Holter monitor (mobile ECG machine)</li> <li>• Glucose levels as indicators of equine metabolic syndrome and related issues</li> <li>• Basis of and treatment of heritable diseases using equine models (e.g. PSSM)</li> <li>• Colic-preventative measures</li> <li>• Respiratory disease research</li> <li>• Traceability - future – microchip technology &amp; data management</li> </ul>
Nutrition & Health	<p>Diet, microbiome, nutraceuticals</p> <ul style="list-style-type: none"> <li>• What is the effect of high protein diets on acid/base balance in performance horses?</li> <li>• What is the effect of dietary antioxidants on post-exercise inflammation resolution?</li> <li>• Evidence-based research to support nutrition practices</li> <li>• What is the impact of high intensity exercise on gut microbiome?</li> <li>• Over-feeding and under-work and the effects on overall health and behaviour.</li> <li>• Increased precipitation and paddock conditions on feed health – BMPs</li> <li>• Forage production and hay harvest (small bales vs large bales vs cubes) and respiratory conditions</li> <li>• Senior Horse needs</li> </ul>
Nutrition & Environment	<p>Feed quality and quantity – climate change, environmental impact</p> <p><b>Climate Change Impact</b></p> <ul style="list-style-type: none"> <li>• Emergency preparation including disease, but also beyond disease to include weather</li> <li>• Need a baseline understanding of historical disease trends in order to inform surveillance programs. Under a climate change scenario,</li> </ul>

trends may change. We won't know we have a problem if we don't have data (e.g. vector-borne diseases)

#### Related environmental questions

- Weather – cold vs. hot/humid conditions, need evidence-based information for management guidelines
- Safety – fire risk, assessing current practices and how to improve safety
- Impact of horse operations on environment (manure, watershed, pasture care, etc.)
- What is the environmental footprint of the industry?
- Forage – drought issues – increase production
- Opportunities to link forage coverage with environmental sustainability and climate change, soil health, etc. Weather – increased precipitation affects hay quantity that will impact availability for Ontario and export markets (impact on economy).

## Goat Priorities 2019

In the absence of a central body with whom to discuss priorities for the sector the following is a carry-over from last years priorities. The dairy goat roundtable in 2017 elicited the issues of Herd Management, Production, and Co-ordination of Genetic Improvement as priorities. Production systems research has in the past regarded Genetic improvement as an enabler rather than a research subject in and of itself. Herd management and production are too broad for LRIC to be able to recommend specifics from this area for the research priorities document. The priorities immediately below are drawn from research priority discussions with industry held in (2016). As these have not been addressed through research to our knowledge, LRIC believes these priorities will still stand in 2019.

## Dairy Goats

### 2 big Industry Challenges (from 2016):

1. **How to rapidly increase herd size** – comment: In 2019 this is less of an immediate issue as alternative sources of goat milk have been sought by processors and goat milk is now being imported from USA. However this remains in the document as industry would undoubtedly like to displace imports and also be ready to supply the Kingston milk plant once it is commissioned.
2. **Traceability and its benefits:**
  - Are there drug or bacterial residues in the milk– brought forward to Ontario priorities as a traceability issue .
  - Investigate and advise producers on the rationale behind withdrawal times for all drug treatments.
  - Investigate the incidence of foodborne pathogen contamination in raw milk cheeses and develop food-handling protocols for their elimination.
  - Research the producer benefits to encourage adoption of the full traceability system being implemented through the National Goat Identification Program.

### From 2016:

#### Goat Health Priorities

- **Kid Health**
  - Why aren't kids surviving – **Comment:** *this is currently being addressed in one (1) project only.*
- **Respiratory Disease**
  - What are the main organisms causing respiratory diseases and the risk factors that predispose animals to succumb to those organisms?
- **Chronic Wasting Disease (CAE, Johnes, Caseous Lymphadenitis)**
  - Are there effective vaccines in other jurisdictions? E.g. Australian / Spanish Johnes vaccine that reduces clinical signs and shedding. If effective, is vaccinating for Johnes a good option for Ontario producers?

#### Goat Welfare Research Priorities

1. Lameness and Hoof-care
  - a. What are the practices farmers needs to follow for hoof-care to prevent lameness?
2. Housing and Handling Equipment
  - a. What are the optimum housing and stocking density conditions for goats of various ages and stages in Ontario?
  - b. How does floor type and bedding affect milk quality and welfare?
3. Post farm gate – Transportation and Slaughter at Unlicensed Facilities

Because there is no traceability in the goat industry, no one knows how long a goat stays in transport and where the goat ends up. This is a welfare concern as some animals aren't able to withstand long or multiple trips.

#### Goat Nutrition Research Priorities

##### Primary Nutrition

What are the appropriate ration formulations for Ontario dairy goats at different stages: kids, doelings, early pregnancy, late pregnancy, first pregnancy vs. later pregnancies, carrying singles vs. twins or high multiples, transition period, milking, breeding, dry period? Are nutrition requirements different for pregnant goats in the summer vs. the winter? If different feeding regimes require changes to handling and housing, how does that affect the producer economically?