APPLIED AGRICULTURAL RESEARCH

Collaborative Foundation for Northern Ontario

Northern Ontario Farm Innovation Alliance

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List of Acronyms

ARIO - Agricultural Research Institute of Ontario

BFO – Beef Farmers of Ontario

EARS - Emo Agricultural Research Station

EFAO - Ecological Farmers Association of Ontario

GFO – Grain Farmers of Ontario

LU – Lakehead University

LUARS - Lakehead University Agricultural Research Station

NeCN – Northeast Community Network

NLARS - New Liskeard Agricultural Research Station

NOFIA – Northern Ontario Farm Innovation Alliance

NOHFC – Northern Ontario Heritage Fund Corporation

OMAFRA – Ontario Ministry of Agriculture, Food & Rural Affairs

OSCIA – Ontario Soil & Crop Improvement Association

UQAT - Université du Québec en Abitibi-Témiscamingue

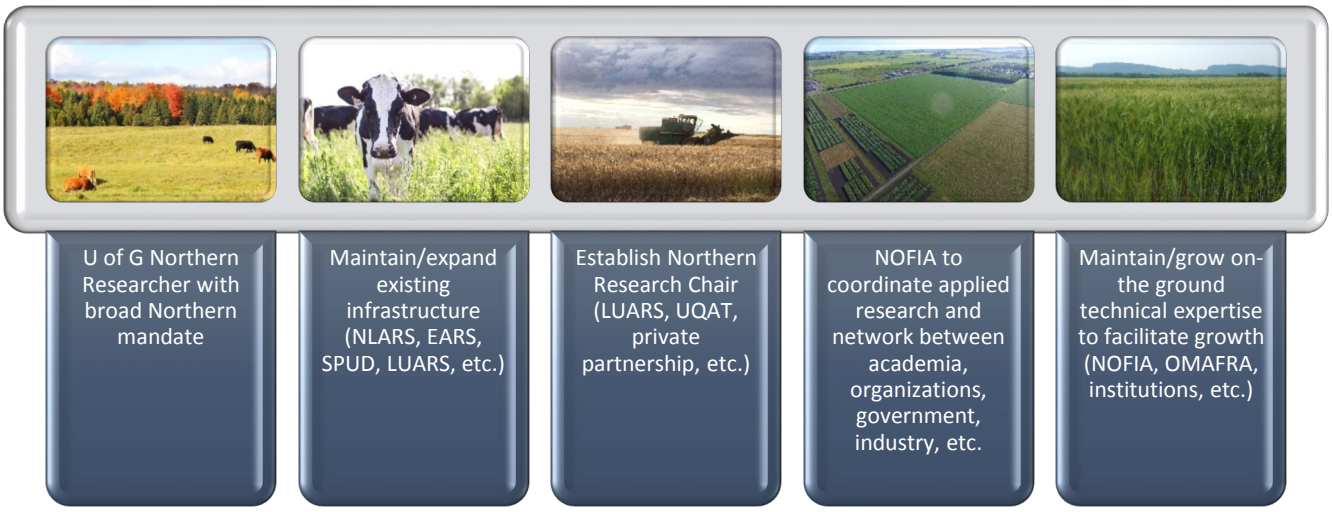
RAIN - Rural-Agri Innovation Network

2 EXECUTIVE SUMMARY

Northern Ontario agriculture is growing and has the potential and opportunity for growth due to a warming climate, agri-tech advances and available, affordable farmland. Due to site and climatic differences, it is critical that farmers have the access to information that is relevant for their farming operation. There are currently several organizations and institutions across Northern Ontario who are completing agricultural research – two summits were held in January 2018 to identify how further collaboration could be developed amongst partners to ensure that resources are effectively leveraged while meeting regional needs.

The need for sustainable, stable, long-term funding support and a coordinating body that is positioned to establish stakeholder priorities, coordinate research and compile, communicate and report on Northern results were identified as summit priorities that could have lasting impacts on the delivery of agricultural research in Northern Ontario. The Northern Ontario Farm Innovation Alliance (NOFIA) has been identified as having the capacity to coordinate research. To fully facilitate this, NOFIA proposes working with the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), the Northern Ontario Heritage Fund Corporation (NOHFC) and FedNor to secure long-term stable funding, with OMAFRA as the lead funder. This funding would be most effective as programming based funding, which would support NOFIA in its efforts to coordinate industry research call submissions, work with academic institutions to share their results, collect and disseminate research and potentially develop Northern-centric applied research funding and delivery models.

This component of agricultural research is one of many that can work collectively together to ensure the needs of the industry are successfully met.



This project was funded in part through Growing Forward 2 (GF2), a federal-provincial-territorial initiative. The Agricultural Adaptation Council assists in the delivery of GF2 in Ontario.

Growing Forward 2 AAC agricultural adaptation council Ontario Canada

The content of this report does not necessarily reflect the views of the GoC and Ontario government funding partners.

3 INTRODUCTION

The Northern Ontario Farm Innovation Alliance (NOFIA) is a non-profit organization, established in 2013 to support the continuation of agricultural research in the North and provide a unified voice for Northern Ontario Agriculture. NOFIA's overall mandate is to advance agriculture in Northern Ontario. NOFIA coordinates many research projects and technology transfer activities, facilitates the disbursement of funding for many industry partners and collaborates with its Advisory Council, farmers and industry partners to provide a central source of information gathering and dissemination. To date, NOFIA has managed a three-year study on the rapid development of forest to farmland (and associated land clearing reference guide); completed agronomy projects on intensive oat management, yellow mustard, malting barley, canola & flax; facilitated a project on industrial hemp variety development and led a pan-northern strategic assessment for the Northern Ontario dairy processing sector. NOFIA also developed and manages FarmNorth, an online hub for information related to agriculture in Northern Ontario. This also includes a compilation of agricultural research completed in Northern Ontario.

In 2014, NOFIA held a roundtable in Sudbury with numerous agricultural stakeholders to begin compiling a list of stakeholders needs and priorities and to identify mechanisms to complete projects that would support farmers in their commercial operations. In 2017, the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) identified that NOFIA has demonstrated capacity to coordinate agri-food research across the North and partnered with NOFIA on a project to reinforce NOFIA as a leading research and innovation organization for the agri-food sector in Northern Ontario. This multifaceted project built upon the Sudbury round table, and included seven specific agricultural deliverables, two summits in Sudbury and Thunder Bay and a report that focused on:

Developing a collaborative foundation for applied research, innovation and technology transfer that is reflective of sub-regional interests, directions and needs, focused on the start of the value-chain with an outcome driven by economic development

Identifying key themes and priorities
Identifying opportunities to coordinate research and innovation across the region
Outlining preliminary plans to achieve that coordination

The need for sustainable, stable, long-term funding support and a coordinating body that is positioned to establish stakeholder priorities, coordinate research and compile, communicate and report on Northern results were identified as summit priorities that could have lasting impacts on the delivery of agricultural research in Northern Ontario. Additionally, several specific and broad themes for future Northern agricultural research were identified during the summits. Though several avenues of agricultural research are touched upon in this report, much of the focus of this report is on the potential themes and plans to support a coordinated approach to applied research.

4 OMAFRA/NOFIA PROJECT SUMMARY

The following projects were completed within the overall scope of this broader project:

1. *Plastics Disposal Assessment* – NOFIA worked with Envise Consulting to conduct an inventory of the current and usage of agricultural plastic in Northern Ontario, assessed several end-use options and provided suggestions for options to sustainably dispose of used agricultural plastic.
2. *Deadstock Disposal Assessment* – NOFIA worked with a farmer in Thunder Bay and a specialist in OMAFRA to design the research protocol and install two deadstock disposal vessels. This will enable farmers to sustainably dispose of their deadstock and if the vessels are sufficiently viable, could offer a future alternative to emergency livestock disposal.
3. *Medicinal Plants Opportunity Analysis* – NOFIA worked with the Rainy River Futures Development Corporation to assess the market viability of several medicinal plants native to the Rainy River District. Plants that were deemed economically viable can be trialed at the Emo Agricultural Research Station (EARS) to evaluate growth potential.
4. *Non-timber Forest Products in Northeastern Ontario* – NOFIA worked with the Temiskaming First Nation to evaluate the economic uses of many non-timber forest products. Educational information for several products was compiled to support the sharing of traditional knowledge and improved market access to products.
5. *Development of a Hops Yard* – NOFIA supported the development of a hops plantation at EARS – this will be used to demonstrate the viability of hops in Northern Ontario and assess economic impacts, break-even points, etc.
6. *Beekeeping Course* – NOFIA worked with a Northern beekeeper to develop and deliver a 10-week course on beekeeping. This course was delivered in two locations in Rainy River, with approximately 25 people in each course, and will be further adapted into a two-day workshop.
7. Crop & Forage Trials – NOFIA worked with the New Liskeard Agricultural Research Station (NLARS) to complete three trials, including oats as a cover crop, a corn variety trial and a forage digestibility trial.

5 SUMMIT SUMMARY

A Northern Ontario Agricultural Research Summit was held on January 16 & 17 in Sudbury, ON and January 19, in Thunder Bay, ON. The summits were facilitated by Bryan Boyle of Bryan Boyle & Associates, who is a private consultant with expertise in facilitation and agriculture after a career as a lead facilitator with OMAFRA. The summits focused on assessing the current state of agricultural research in the North and how this could be further coordinated and built upon with current and future partners and stakeholders. The feedback generated from the summits has been incorporated into this report and a summit participant list and the two summit reports exist as a supplemental report.

Overall, participants in both summits indicated that more can be done with respect to agricultural research in Northern Ontario and collaboration within this research infrastructure – participants in Thunder Bay had higher scores for both categories than those in Sudbury, likely due to the geographic nature of participants attending the summits.

Merits for collaborative, coordinated, sustainable and successful agricultural research include a degree of stable funding, existing organizational framework, strong physical infrastructure, unique Northern features and opportunities for growth, stakeholder interest, engagement and community strength, innovative approaches and positive existing collaboration.

Challenges identified in delivering agricultural research in Northern Ontario include a lack of sustainable funding, lack of structural coordination, lack of research infrastructure, communication barriers, knowledge translation and transfer, changing demographics, administrative and logistical issues, farm viability, production and economic challenges and Northern Ontario realities.

The need for sustainable, stable, long-term funding support and a coordinating body that is positioned to establish stakeholder priorities, coordinate research and compile, communicate and report on Northern results were identified as priorities that could have lasting impacts on the delivery of agricultural research in Northern Ontario.

6 CURRENT STATE OF AGRICULTURAL RESEARCH IN ONTARIO

The Agricultural Research Institute of Ontario (ARIO) is a corporate body which reports directly to the Minister of Agriculture, Food and Rural Affairs and advocates for areas of research for the betterment of agriculture, veterinary medicine and consumer studies and increases the production efficiency and marketing of agricultural products by stimulating interest in research. ARIO owns fifteen research stations across Ontario. These facilities provide the capacity for research on a wide variety of agri-food issues. The stations are managed by the University of Guelph (U of G) with oversight from OMAFRA's Research and Innovation branch. Each station has a livestock, food or crop focus or is representative of unique farming areas, such as Northern Ontario. The stations develop research solutions for local farmers and participate in and inform research of provincial significance, including the work of other ARIO research stations. For example, the beef, dairy and aquaculture research stations near Guelph generate research that is directly applicable to northern livestock and aquaculture production.

OMAFRA also provides funding for theme based research programs under the OMAFRA – U of G Partnership. These programs address several themes and the principal investigator must be faculty from the U of G. Other open, competitive programs such as Food Safety and New Directions address various combinations of themes and address emerging issues and short-term priorities.

6.1 STATE OF NORTHERN RESEARCH

Of the stations owned by ARIO, two are in Northern Ontario – the New Liskeard Agricultural Research Station (NLARS) in the Northeast and the Emo Agricultural Research Station (EARS) in the Northwest. The two stations have built up a body of intelligence on applied research about crop, forage, horticulture and beef production and work with local farmers to address local and regional needs. The U of G is currently in the process of hiring a Northern Researcher, who will coordinate the research at EARS and NLARS and will strengthen the connection between the U of G and Northern Ontario and provide a point of contact for NOFIA and others to better work with the stations.

In addition, the Lakehead University Agricultural Research Station (LUARS) in Thunder Bay, undertakes research at the local level benefitting regional producers in Northwestern Ontario and contributes important data and knowledge which benefits the entire province. LUARS is managed by Lakehead University (LU) through a partnership agreement with OMAFRA. This new partnership presents an opportunity for a more recognized, formalized aspect to Northern agricultural research as a Northern university is now directly tied to applied research.

The Université du Québec en Abitibi-Témiscamingue (UQAT), with a campus in Notre-Dame-du-Nord, has been extensively involved in beef research in Northern Ontario, both at NLARS and in Kapuskasing when the federal government funded a research station there. UQAT has researchers that focus on beef, grazing and carbon sequestration. Other academic institutions, including Laurentian University, Nipissing University, Algoma University and l'Université de Hearst have completed research relevant to agriculture but are not directly involved in the delivery of long-term agricultural research.

The capacity for academic involvement in agricultural research could be strengthened and further support the applied research needs of farmers by:

- Potentially developing a Northern Research Chair, either with LU, U of G, UQAT or a combination of institutions and organizations. A Northern Research Chair at UQAT could focus on forages, grazing and pasture management and a Research Chair at LU or U of G could focus on agronomy or horticulture.
- Ensuring the Northern Researcher position at the U of G has the mandate to work throughout the North, connect with Northern stakeholders and foster connections between other organizations and institutions, such as the University of Manitoba. Northwestern Ontario often shares more similarities with Western Canada than it does with the rest of Ontario and a large amount of potential exists for Western-based research at EARS. To leverage these opportunities, personal connection and trust needs to be established between institutions and organizations within the two provinces.
- Potentially developing a Centre of Agriculture at LU, in accordance with its other Centre's, that would support innovative interdisciplinary research and scholarly activities in agriculture while leveraging existing researchers and staff.

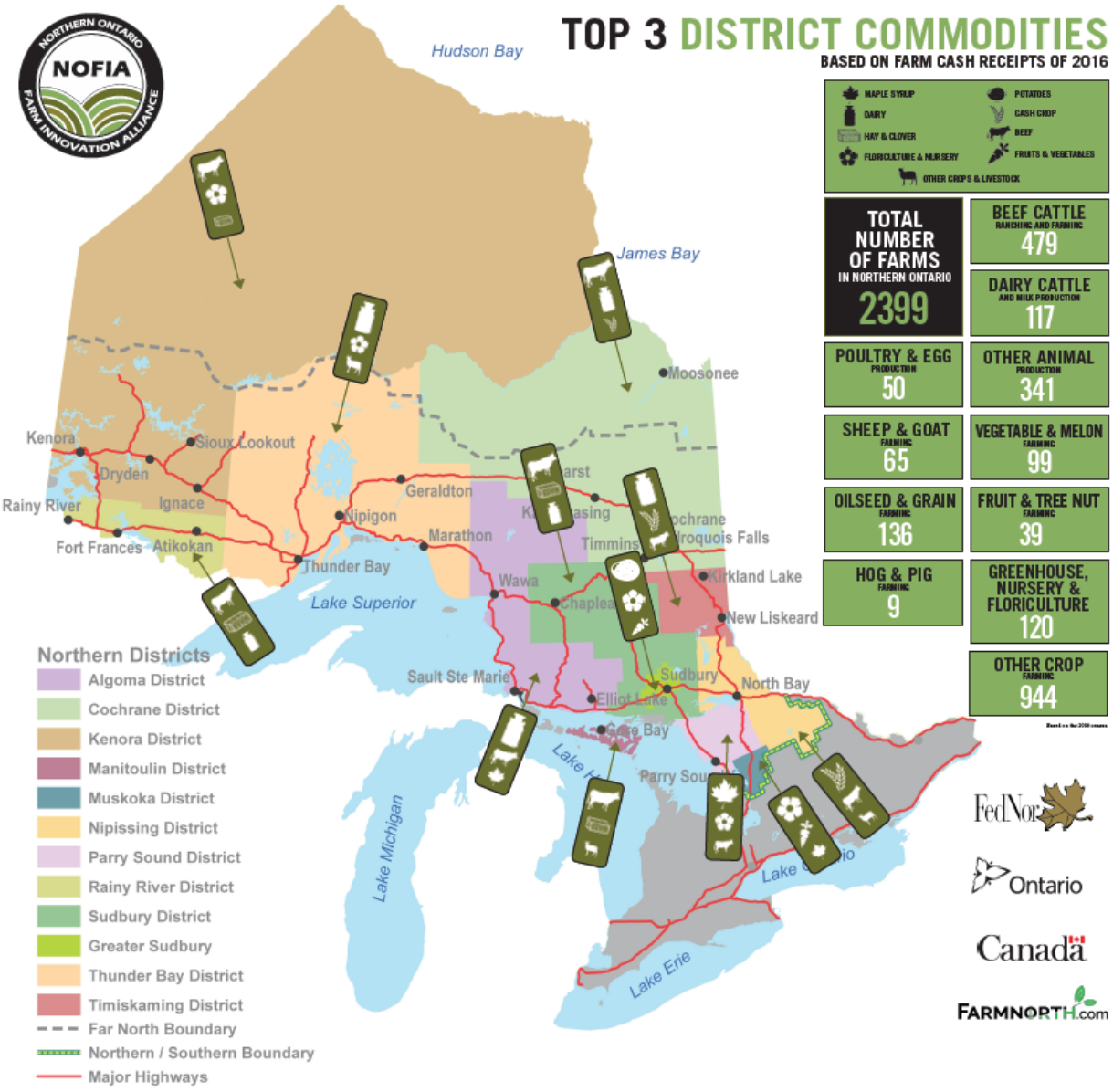
It is also critical to at minimum maintain existing infrastructure and provide transparency in long-term operational commitments. The OMAFRA agreement with LU allows for five years of funding for LUARS, which supports industry in their commitments for long-term research at LUARS. The recent OMAFRA agreement with U of G, effective April 1, 2018, offers a 10-year funding commitment, but until commitments are made specifically for the continued operation of NLARS (including SPUD) and EARS, it can be difficult for industry to commit to long-term projects. The overall vision of the U of G/OMAFRA agreement includes the growth of Ontario's capacity to produce food and the support of a globally and domestically competitive agri-food sector while maximizing the use of research infrastructure to provide benefit to all of Ontario, all of which can be accomplished through the existing infrastructure in Northern Ontario.

With the renewed academic focus on agriculture in the North and the potential to strengthen this with improved collaboration between institutions and organizations, a strong academic network exists to meet the needs of the North. This can and should exist in tandem with an improved network and structure for applied research, demonstration and technology transfer to ensure that relevant information is shared in a meaningful way with farmers, that on-farm needs are met in a timely manner and that district specific needs that exist are met on a local level. There are currently several organizations who are involved in applied and on-farm agricultural research in Northern Ontario, including the Rural-Agri Innovation Network (RAIN), the Northeast Community Network (NeCN), the Kapuskasing Experimental Farm and NOFIA.

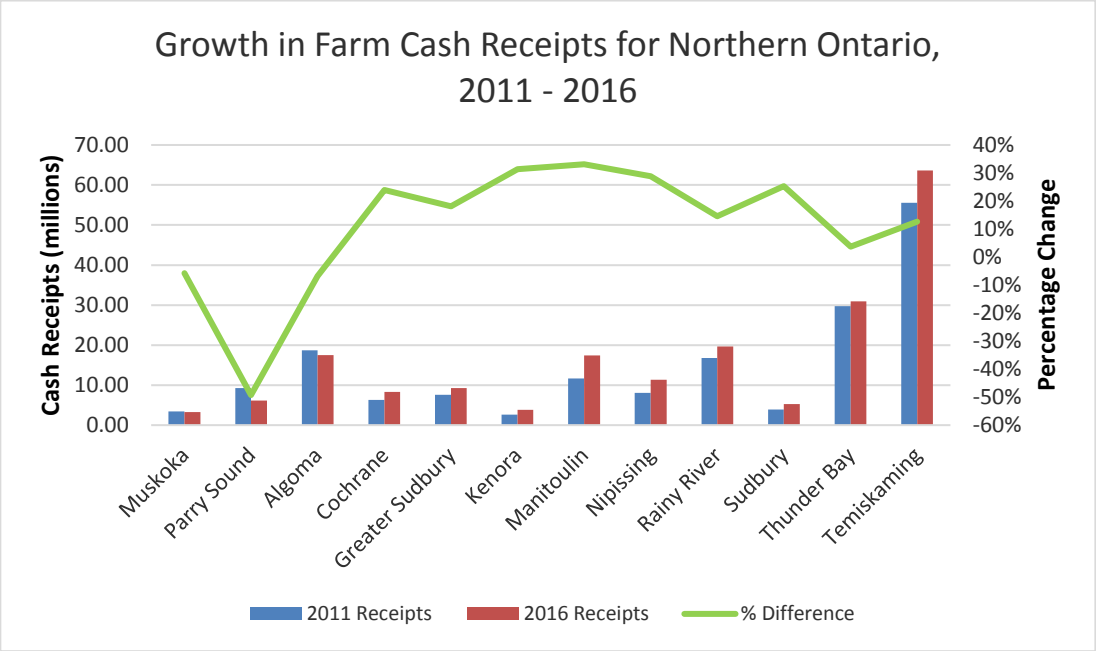
Innovation is critical to success in today's competitive agri-food marketplace. On-farm demonstrations, applied research and technology transfer projects show how innovative technologies can be applied to livestock and aquaculture production and how new crops can be adapted for use in the various northern regions. While some of the work completed in Southern Ontario is relevant, including some management trials, crop rotation strategies, livestock handling, etc. there are many needs that cannot be met in the South and must be trialed in the North. Much of the agricultural production in the rest of Canada occurs at similar latitudes to Northern Ontario and research on crops for those areas can often be adapted for production and demonstrated in Northern Ontario. Alternatively, a strong research framework in Northern Ontario could produce strategies and research that can be used in the rest of Canada, expanding the breadth and scope of Northern agricultural research facilities.

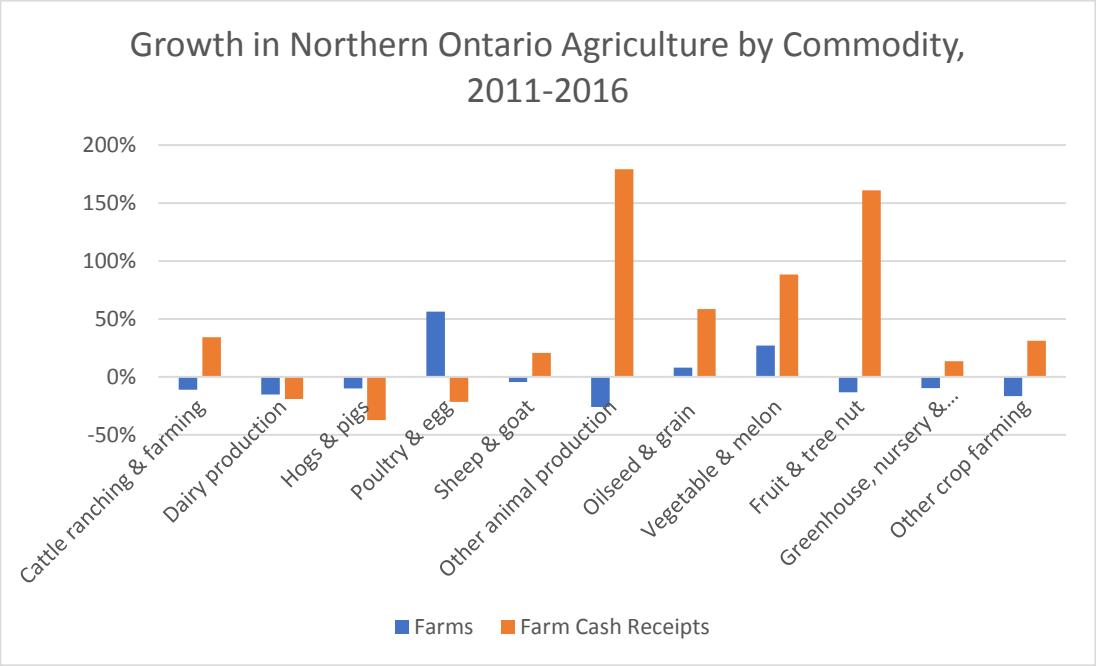
7 NORTHERN ONTARIO AGRICULTURE

According to the 2016 census, Northern Ontario agriculture generated $209 million in gross farm cash receipts, an increase of 9% since the 2011 census. The total area of the 2,399 farms encompasses over 900,000 acres, with 368,000 acres in crop production, 73,000 acres in seeded pasture and 194,0000 in natural pasture across the 11 Northern districts. While aquaculture production is not captured in the census of agriculture, 2016 northern lake based rainbow trout production generated an additional $23 million in cash receipts. The food and beverage processing sector in Northern Ontario employs more than 1,000 people in 129 locations producing baked goods, beverages, meat and dairy products. Northern Ontario has a beef industry that is comparable in size to that of New Brunswick, the biggest maple syrup producer in Ontario and is the site of more rainbow trout production than the rest of Canada combined. The spin-off from agri-food activities like these contributes to the economic health of many northern communities.

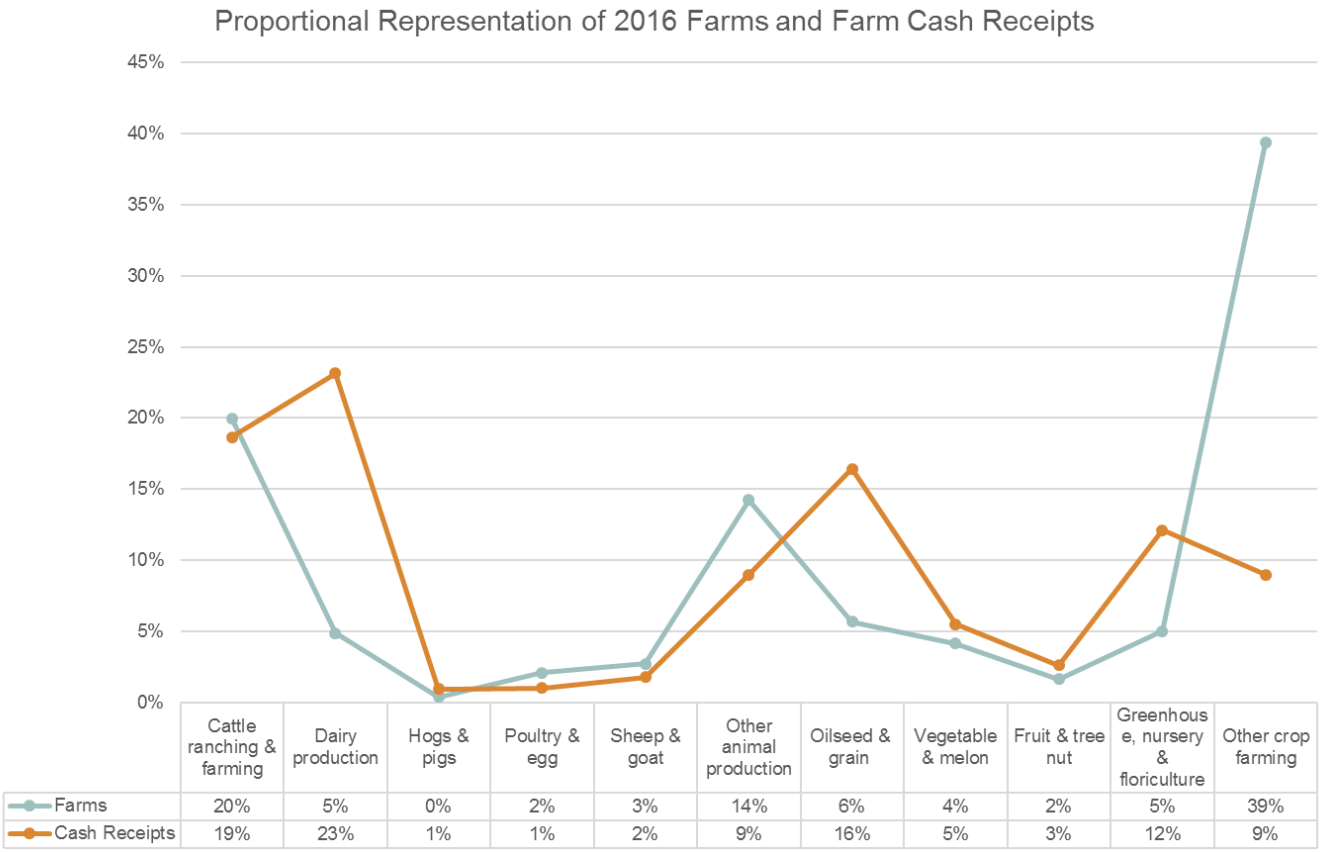


Except for Muskoka, Parry Sound and Algoma, each district across Northern Ontario has seen an increase in farm cash receipts between 2011-2016. With respect to growth within specific commodities, animal production, horticulture, oilseed & grain farming and cattle farming have seen the largest overall increase in farm cash receipts; in some cases, this is due to an increase in the number of farms of that commodity type and in other cases, this may be due to market conditions.





The Northern dairy production sector is the largest contributor to overall farm cash receipts, followed by beef farming and oilseed & grain farming. Both dairy and oilseed & grain farming have a disproportionate impact on farm cash receipts compared to the number of farms.



	Cattle ranching & farming	Dairy production	Hogs & pigs	Poultry & egg	Sheep & goat	Other animal production	Oilseed & grain	Vegetable & melon	Fruit & tree nut	Greenhouse, nursery & floriculture	Other crop farming
Farms	20%	5%	0%	2%	3%	14%	6%	4%	2%	5%	39%
Cash Receipts	19%	23%	1%	1%	2%	9%	16%	5%	3%	12%	9%

Northern Ontario agriculture is poised for expansion, with affordable, available land; funding to improve the productivity of the land and a concerted effort and focus from commodity associations such as the Beef Farmers of Ontario to showcase the potential for agriculture in the North. Idled acres across the North can be reintroduced to agriculture relatively quickly and at a low cost, but farmers need to have the information and the tools necessary to farm in a viable manner, which includes applied research and hands-on technical expertise.

7.1 District Differences in Agriculture

Districts across the North have unique agricultural characteristics and needs. To generate a general overview of agricultural specializations within each district, the Location Quotient (LQ) has been used. The LQ is a tool that determines which sector of an economy is more specialized than others – in the following chart, the LQ is assessing the relative size of a commodity group in a district compared to the region of Northern Ontario. The LQ is calculated as:

$$\frac{number\ of\ dairy\ farms\ in\ the\ District}{total\ number\ of\ farms\ in\ the\ District} \div \frac{number\ of\ dairy\ farms\ in\ Northern\ Ontario}{total\ number\ of\ farms\ in\ Northern\ Ontario}$$

The LQ has a base value of one – if the LQ is greater than one, the region has more specialization within that commodity group than Northern Ontario as a whole. It is important to note that these values indicate specialization relative to the rest of the North – if there are a low number of farms in that commodity type across the North, a district may specialize in that commodity even if it doesn't contribute significantly to that district's number of farms or farm cash receipts. However, the LQ provides a visual of the differences in agriculture across the North and the importance of meeting district needs and interests.

	Algoma	Cochrane	Greater Sud	Kenora	Manitoulin	Nipissing	Rainy River	Sudbury	Thunder Bay	Temiskaming
Beef cattle ranching and farming	0.7	0.9	0.3	0.5	**2.1**	0.8	**2.2**	0.9	0.3	0.8
Dairy cattle and milk production	0.6	0.4	0.0	0.0	0.3	0.6	0.6	1.0	**2.4**	**2.3**
Hog and pig farming	0.0	0.0	1.8	0.0	1.1	1.0	0.0	0.0	**4.4**	1.2
Poultry and egg production	0.4	1.1	**2.9**	**1.7**	0.9	1.1	0.3	0.9	**2.1**	0.5
Sheep and goat farming	0.8	1.2	0.9	1.1	0.2	1.2	0.6	0.6	1.1	1.7
Other animal production	1.3	0.8	1.7	0.5	0.7	1.2	0.8	**1.1**	1.3	0.7
Oilseed and grain farming	0.3	1.0	0.6	0.0	0.5	**1.5**	0.4	0.4	0.4	**2.8**
Vegetable and melon farming	1.2	**1.9**	**2.8**	1.3	0.5	1.0	0.2	0.8	1.5	0.5
Fruit and tree nut farming	**2.7**	0.8	2.1	0.0	1.3	0.6	0.3	0.5	1.3	0.2
Greenhouse, nursery and floriculture	1.3	1.6	**2.5**	2.0	0.5	0.3	0.4	0.4	**2.5**	0.2
Other crop farming	1.2	1.1	0.9	**1.7**	0.8	1.1	0.9	**1.2**	0.8	0.9

NOTE: The value for hog & pig production in Thunder Bay is skewed due to the small number of pig farms overall – of the 9 that exist in the North, 4 are in Thunder Bay. Compared to the rest of the North, Thunder Bay is more specialized in pig farming, but pig farming is a small component of Thunder Bay's agriculture

NOTE: Parry Sound & Muskoka were not included in the calculations as they are included in the 2016 Central Ontario census summary, not the Northern Ontario summary.

Based on the LQ, districts such as Rainy River and Manitoulin might need additional beef research, while districts such as Temiskaming and Nipissing might need additional crop research. Increased horticultural research may be necessary in Algoma, Cochrane, Sudbury and Thunder Bay. Though the entire Northern region will benefit from this district-specific research, ensuring trials and demonstration sites are in the districts that will most benefit will strengthen the capacity for district research.

Due to the size of the North, different areas also experience different climates, soil types and growing season conditions. The average length of the growing season is lower in Northern Ontario compared to the rest of the province, with a wide variation across the North from 87 days in Kapuskasing to 130 days in Sudbury. For example, the southern part of Temiskaming features a micro-climate influenced by Lake Temiskaming, resulting in a more temperate climate than other Northern areas – various lake effect weather trends also exist in Algoma, Manitoulin, etc. As a result, the success of crops grown in certain areas may require further on-farm trials and demonstrations in other areas of the North to assess and ensure viability.

8 THEMES OF FOCUS FOR NORTHERN RESEARCH

Five specific themes and two broad themes for Northern Ontario agricultural research have been outlined below – each theme is important for sustainable agriculture in Northern Ontario and include research opportunities that are directed at addressing farmer needs. The two broad themes include research needs and opportunities that are essential for the expansion of the industry, but projects and findings within these themes can be less relevant initially to the individual farmer without further research. As farmers use the tools and information gained through applied research, they will be able to implement efficiencies or improve production practices and associated yields. This will result in continued economic growth, strengthening the sector overall.

THEMES FOR NORTHERN RESEARCH

Crop Management with a focus on new crop varieties and innovative management strategies
Livestock with a focus on high-value feed and housing conditions reflective of a Northern climate
Specialty and emerging markets with a focus on improving production, accessing markets and expanding sectors
Horticulture with a focus on new varieties and innovative technology to expand markets
Indigenous Agriculture with a focus on diversified economic development & the sharing of traditional knowledge and values

8.1 CROP MANAGEMENT…WITH A FOCUS ON NEW CROP VARIETIES AND INNOVATIVE MANAGEMENT STRATEGIES

Crop production is an important component within Northern Ontario's agricultural industry. Oilseed & grain production accounted for 16% of total farm cash receipts in 2016, experiencing a 58% increase compared to 2011. With the influx of tile and cleared land resulting from the Northern Ontario Heritage Fund Corporation (NOHFC) funding, cropping will continue to be an important component of the overall sector. Though grain crops have traditionally thrived in Northern Ontario, there has been a substantial increase in production acreage of soybeans, field peas, white beans and corn due to a warming climate and agri-tech advances. The average annual temperature in Ontario has increased by 1.4C over the last 60 years and could increase by an additional 2.5C to 3.7C by 2050; crop heat units in Kapuskasing have already increased by 26% from 1961-1970 to 2001-2010. As the climate warms, farmers will be able to diversify their crop holdings with new crops and varieties but will also be faced with new disease and insect varieties.

8.1.1 Current & Past Projects

- Three-year malting barley variety and management trial (2018-2021), managed by NOFIA & funded by Grain Farmers of Ontario, with pan-northern collaborators with LUARS, EARS, NLARS & RAIN
- Effect of phosphorous and bio-ag products on soybean grain yield at LUARS
- Rapid development of forest to farmland and associated crop potential, managed by NOFIA, funded by Ontario Soil & Crop Improvement Association, with the Temiskaming Crops Coalition and the Cochrane Soil & Crop Improvement Association
- Various agronomy trials at EARS, NLARS & LUARS

8.1.2 Research Opportunities

Specific research opportunities include:

- crop rotation demonstrations and economic analysis
- cover crops and conservation tillage for Northern climates
- management options including split nitrogen applications, combing buckwheat, etc.
- wildlife damage abatement
- forage and cereal research aligned with livestock utilization across the North
- mixed land use options between forestry/farming and livestock/cropping.

Opportunities could also exist with crops within the bio-economy, including camelina and carinata. In many cases, research opportunities lie within the technology transfer and demonstration spectrum, as existing research from cold climate areas can be adapted to Northern Ontario. For example, as agriculture in the Rainy River district transitions to increased crop production, a long-term crop rotation plot and an economic analysis of crop rotations in Rainy River would be highly relevant and educational to farmers in the area.

8.1.3 Opportunities for Coordination

Many organizations and institutions are well-positioned to support northern crop management research. Detailed variety trials and management strategies can be completed at NLARS, EARS and LUARS, with further on-farm work supported by RAIN in Algoma, NECN in Cochrane and NOFIA. The infrastructure and expertise at the stations is important to complete certain complex and technical trials and manage variability. Successful varieties & management strategies can then be moved on-farm to assess economic viability and on-farm variables. Opportunities also exist to complete on-farm work at the Kapuskasing Experimental Farm. Additional industry-led research can be undertaken by local Soil & Crop Improvement Associations, ensuring that on-farm applied research and demonstration can be completed in each district and meet local needs in local conditions. Large-scale demonstration sites could also be developed and managed by local commodity associations, etc. to

illustrate existing management practices. Farmers who currently have specific management questions related to the operation of their farm can also work with their local colleges to complete one-time specific projects. Partnerships can also be established with Laurentian University, Nipissing University and Algoma University, who have been involved in soil research and research on insect/disease pressure. With Lakehead University's involvement in the LUARS and with the hiring process for a Northern Researcher at the University of Guelph underway, organizations and industry in Northern Ontario can leverage academic knowledge and credibility with farmer needs to develop strong projects and access industry dollars.

OMAFRA/NOFIA Crop Management Project Profile

Two trials were completed at NLARS – project reports can be found at www.nofia-agri.com.
Oats as a cover crop – identified oat cultivars that were most suitable as cover crops and assessed traits of a superior oat cultivar for cover crops.
Corn variety trial – assessed the growth of corn with different heat units

8.2 LIVESTOCK...WITH A FOCUS ON WITH A FOCUS ON HIGH-VALUE FEED AND HOUSING CONDITIONS REFLECTIVE OF A NORTHERN CLIMATE

There has been a prolonged focus on expanding livestock production in Northern Ontario – with the current beef industry accounting for 19% of Northern Ontario farm cash receipts in 2016, the current and future Northern cattle sector has room to grow. With the launch of the Artisanal Chicken Program in 2015, 23 chicken farms in Northern Ontario are currently producing up to 3,000 chickens annually. With a warming climate, changes to feed crop & forage quality, livestock diseases and reproduction necessitate the need for applied research to further develop adaptive management strategies and maintain current benchmarks. Additionally, the distinct nature of livestock production in northern climates, with different feeding and housing strategies than other areas, necessitates the need for further on-farm exploration and demonstration. Northern Ontario open water cage aquaculture accounts for over 85% of provincial rainbow trout production, valued at over $26 million. Aquaculture producers face challenges and opportunities to expansion and could benefit from additional northern aquaculture research and extension.

8.2.1 Current and Past Projects

- Comparative performance of alfalfa & galega at LUARS
- Comparative forage production potential of different forage crops at LUARS
- Keyline plowing for improved forage production with RAIN
- Cross-seeding forages to assess economic viability, coordinated by RAIN with sites at LUARS & EARS
- Effects of winter grazing on performance of gestating beef cows in Northern Ontario with UQAT
- Performance of forage mixtures under a beef grazing management system in Northern latitudes with UQAT
- Surface applied lime on pasture with NOFIA, the Temiskaming Community Pasture & the Temiskaming Crops Coalition

8.2.2 Research Opportunities

Specific research opportunities include:

- expanding aquaculture production with new fish species
- aquaculture research based on the current production model of open net pens
- assessing effective fees ratios and active pasture management strategies to support growing markets (ie. Grass fed cheese & butter)
- forage adaptive management strategies suited to a changing climate
- feed trials with new forage mixes (ie. Galega)
- range pasture research for brood cows and development of best practices and feed & housing strategies for the broiler sector
- Crop residues/cover crops as forages

Livestock research can be expensive so future research could look towards inventive, innovative ways that use existing resources. For example, a group of beef farmers in Temiskaming participated in an industry-driven one-year on-farm feed benchmarking study that generated feed metrics and associated ideas for improving local feed efficiencies. Though the data generated isn't as rigorous as data generated from academic studies, it provided information useful for the participating farmers at a fraction of the cost. Localized projects of this nature could generate district specific information based on farmer needs and input and provide an opportunity to adapt livestock research completed in other areas.

8.2.3 Opportunities for Coordination

Pasture management and grazing research will continue at NLARS, with the involvement of the University of Guelph and the Université du Québec en Abitibi-Témiscamingue. This can be supplemented with on-farm livestock research (beef & sheep) at the Kapuskasing Experimental Farm. Depending on the nature of the project, it may also be possible to complete trials using existing community pastures. The Northern Producer Animal Health Network is a strong industry partner that can be an information conduit. College Boreal is currently undertaking aquaculture research (such as farmed whitefish production and associated management strategies) and will continue to be a strong partner in this endeavour, along with private aquaculture operations. Lakehead University also has the capacity for aquaculture research. There currently exists a large amount of livestock research conducted by institutions in colder climates, such as the University of Minnesota, which can be condensed into meaningful information that Northern farmers can use and demonstrate.

OMAFRA/NOFIA Livestock Project Profile

A forage digestibility trial was completed at NLARS that identified forage varieties that have good winter survivability and assessed the yields of these forages throughout the growing season.

Two deadstock vessels were installed in Thunder Bay, starting a two-year monitoring project that will assess the viability of deadstock vessels for Northern farmers.

8.3 SPECIALTY AND EMERGING MARKETS WITH A FOCUS ON IMPROVING PRODUCTION, ACCESSING MARKETS AND EXPANDING SECTORS

The support for farmers producing specialty, niche and emerging commodities, is important to ensure that Northern farmers can remain innovative and ahead of the curve. In 2016, Northern Ontario had 11% more maple syrup producers and 3% more maple taps than in 2011. There exists significant maple forest and birth forest potential for expansion within the sector. Aquaculture is a significant sector within Northern Ontario agriculture. Honey production, small and large scale, is gaining interest and momentum in the North and offers a positive partnership between bee and crop production. Haskap plantations exist in various districts for export to Asia and value-added development. New crops, such as quinoa, faba beans, edible peas, etc. are in production in Northern Ontario for export markets. Canada's first verified grass-fed butter and cheese are now being produced by Thornloe Cheese. These commodities and products may be captured in other themes but a dedicated focus on specialty and emerging markets will ensure that commodities that may not currently contribute significant economic benefits aren't overlooked. Some of these commodities offer great opportunity for growth and will drive interest and expansion in other agricultural areas. As this theme is a new and emerging focus, a list of dedicated past and current projects isn't included.

8.3.1 Research Opportunities

Specific research opportunities include:

- Honey production in northern crops, including new and emerging varieties
- Crop potential and economic viability of new crops
- Potential for lime application on maple bushes

8.3.2 Opportunities for Coordination

The Northern Ontario Aquaculture Association has coordinated and supported many freshwater research projects in Northern Ontario, including a full lake experiment at the International Institute for Sustainable Development Experimental Lakes Area, a natural laboratory of 58 small lakes and watershed in Northern Ontario. Past aquaculture research has also included the installation of an aquaculture cage with high density rainbow trout to assess changes within the lake ecosystem. College Boreal and Lakehead University have also been involved in past aquaculture research. The Ontario Soil & Crop Improvement Association, through its local associations, has completed projects in haskap management. The Great Lakes Forestry Research Centre, the Centre ACER, the Ontario Forest Research Institute, the Ontario Beekeepers Association (and existing local associations) are all well positioned to support Northern specific research in speciality and emerging markets.

OMAFRA/NOFIA Specialty Markets Project Profile

A beekeeping course specific to Northern production was developed and delivered in the Rainy River district to support the continued growth and expansion within the apiary industry. This 10-week workshop was held in two locations, with approximately 25 attendees in each. The course content will be compiled into a two-day workshop that can be used across the North.

8.4 HORTICULTURE.... WITH A FOCUS ON NEW VARIETIES AND INNOVATIVE TECHNOLOGY TO EXPAND MARKETS

Horticulture, including vegetables & melons, fruit & tree nut and greenhouse, nursery and floriculture collectively accounts for ~20% of Northern Ontario's 2016 farm cash receipts, with a 200% increase in farm cash receipts between 2011 and 2016. There has also been an increase in the number of acres under production across Northern Ontario between 2011 and 2016. With a consumer focus on locally produced food, the potential for the isolation of the North to limit pest and disease and with new market opportunities, there exists the potential for the continued growth in the horticultural sector in Northern Ontario. However, with the climate sensitivities of horticultural production and the high initial investment, technological needs and expertise necessary for many production systems, Northern-centric horticultural research is necessary to offset initial risk and improve efficiency and economic viability.

8.4.1 Current & Past Projects

- RAIN's sulphur fertilization project to assess economic rates of sulphur application on vegetables
- RAIN's market garden assessment of organic fertilizers
- Haskap evaluation and management strategies in Northern Ontario, managed by the Northeastern Ontario Soil & Crop Improvement Association with on-farm sites across Northern Ontario

8.4.2 Research Opportunities

Opportunities for research in horticulture include the further demonstration of northern hardy fruits, vegetables and nuts with season extension infrastructure and projects that assess the viability of new types and varieties of horticultural crops and management strategies suitable for a northern climate. These projects could include hazelnut production, cold hardy cherries, grapes, etc. for value-added production, hydroponic and aquaponic systems, etc.

8.4.3 Opportunities for Coordination

The SPUD Unit at NLARS propagates first generation potato plantlets for seed potato producers and strawberry and raspberry plantlets for the Ontario Plant Propagation Program. SPUD also conducts other tissue culturing that involves the establishment in-vitro, heat treatment and production of virus-tested plantlets for crop breeders. The isolation in northern Ontario is beneficial for any "seed" program since they are away from commercial crops and virus insect vectors so it ensures high quality. This work is high-level and extremely technical but the SPUD unit is well-positioned to undertake farm-level research, including management trials in its greenhouses and field trials in outdoor plots. The SPUD unit is well-known for its current and past work and this existing infrastructure and expertise should be leveraged for additional northern horticultural research. Hazelnut trials are scheduled for 2018. College Boreal has greenhouse infrastructure that also supports industry drive research, has the capacity to complete research on the impact of climate zones on potential crops and can develop research projects with individual farmers. In the past, College Boreal has worked with a potato farm in the Sudbury area to assess the effectiveness of fungicide on plant growth and health. Lakehead University, with LUARS, also has the potential capacity to undertake cutting edge technological research on season extension technology and will be able to demonstrate various horticultural crops and their potential. This can be further demonstrated through existing industry partners who have horticultural operations or with infrastructure at Sioux Lookout, Thessalon First Nation or forest research institutes, such as those in Sault Ste. Marie. The University of Michigan conducts a great deal of horticultural research and many of its results are directly relevant to nearby areas that share similar climate patterns. Stronger collaboration and partnerships can be developed with these organizations to better meet the needs of local farmers.

OMAFRA/NOFIA Horticultural Project Profile

The development of a hops demonstration plot at EARS in Rainy River was supported to assess the economic viability and management strategies of hops production in Northern Ontario. This will be supplemented with findings from private hops growers in the North.

8.5 INDIGENOUS AGRICULTURE ... WITH A FOCUS ON DIVERSIFIED ECONOMIC DEVELOPMENT & THE SHARING OF TRADITIONAL KNOWLEDGE AND VALUES

There is interest in the expansion of agriculture, aquaculture and food processing to grow indigenous economies and create jobs. Opportunities exist in the production of fish and maple syrup, with potential for other sectors such as livestock, crops and horticulture. Developing the agricultural sector could result in increased food production and improved food security. However, this growth will be driven by the needs and interests of communities who wish to expand into agriculture and opportunities will likely be identified and developed with traditional knowledge of the land, resources and sustainable development. Research opportunities could include aquaculture, maple syrup production, non-timber forest harvesting and continued growth in traditional crops and medicines and though some opportunities fall within other themes, the framing and focus of indigenous based research projects will likely be different.

8.5.1 Opportunities for Coordination

There are communities in the Far North who are implementing projects to improve access to food – Sioux Lookout is developing a regional distribution centre, which will improve food distribution and connect with livestock and produce farmers in Northwestern Ontario. This project also includes proposed greenhouse developments within the community. The Moose Cree community is assessing the feasibility of an aquaponics demonstration site, with the potential to develop a large-scale aquaponics system for local food production. These projects, initiated and driven by the local communities, can be supported with technical expertise and can potentially build upon existing and future horticultural research. Based upon the commercial opportunity analysis completed by NOFIA and the Rainy River Futures Development Corporation, Senega Snakeroot and Yarrow are native plants that could have commercial potential and could be viable crop alternatives in the Rainy River district.

OMAFRA/NOFIA Indigenous Project Profile

A commercial opportunity analysis of medicinal plants in the Rainy River district was completed to assess the economic viability of indigenous food & medicinal plants to be grown as crops. Of five possibilities, two native plants were identified to have commercial viability. On-farm trials at EARS are possible for 2018 to assess growth potential.

The potential for non-timber forest harvesting in the territory of the Temiskaming First Nations was assessed and information was compiled to support educational and marketing efforts of specific harvestable products.

8.6 Climate Change & Environmental Sustainability

The environmental and climate considerations of agricultural production are two-fold. Changing climate, soil health, etc. will drive future research needs and creates the need for evolving benchmarks, production practices, disease vectors, etc. However, agricultural production also contributes to a changing climate, impacts soil health, etc. and will need to be proactive in assessing its impact and relevant mitigation measures. Additionally, a changing climate and environmental considerations apply broadly to all sectors and themes. For example, crop management practices directly impact soil health and soil loss, carbon sequestration, the intensity of inputs, etc. Livestock production is a major contributor to greenhouse gas emissions and production practices, when coupled with crop management, could be mutually beneficial to both sectors. The expansion of the agricultural sector should be done in an environmentally responsible way, which can directly benefit the farmer's economic viability as well.

The involvement of LU, U of G, UQAT, Laurentian and Nipissing, along with the historical work completed at the three northern stations, could position Northern Ontario for leading edge climate and carbon sequestration research that would be relevant to the province and to the country. Work is already underway at UQAT that examines the implications of crop management practices and varieties of crops in carbon sequestration. The Ontario Centre for Climate Impacts and Adaptation Resources at Laurentian University developed a Climate and Agricultural Assessment Framework that characterized the risks and opportunities associated with forage based beef production in the Great Clay Belt under a range of climate conditions. This research is essential in supporting the Northern Ontario agricultural industry and some of the learnings can be directly applied to farmers. For example, suggested management strategies can be adapted from UQAT's work, supplemented with an economic assessment, to provide the farmers with the information they need.

Further, typical Northern Ontario production practices have included forages in crop rotations – the negative implications of crop on crop rotations are now evident in other areas of the province. Northern Ontario agriculture should continue to demonstrate the importance of proper crop rotation and further research should be done on agricultural management practices that conserve soil and maintain organic matter. These practices must be economically viable for Northern farmers and exist within the constrained planting and harvesting windows that exist, so Southern tillage practices can be difficult to incorporate. Soil research and soil science currently underway at universities like Laurentian, UQAT and Algoma should continue since soil health forms the basis for all agricultural production.

OMAFRA/NOFIA Livestock Project Profile

A disposal assessment for used agricultural plastic was completed to determine the current and future level of plastic generated and assess several sustainable disposal options for Northern farmers.

8.7 Agricultural Infrastructure and Asset Measurement

The type and scale of existing agricultural infrastructure that services a district will impact the type of applied research that is relevant to farmers in that district. For example, access to transportation or storage may limit the potential of a specific crop, which could limit the need for specific research in a district. However, research also needs to be undertaken to support further agricultural infrastructure development and the lack of this research and associated expansion could limit overall sector growth in areas. For example, an increase in corn and soybean production in Rainy River and an existing soybean roaster in Thunder Bay provide the opportunity to reduce animal finishing costs in Northwestern Ontario through locally produced animal feed. This transition is supported by the two research stations in the Northwest that can complete complementary feed grain trials. Additionally, Rainy River could expand production of malting barley and access the malting barley market in Thunder Bay if the district had rail access – research could be done on the viability of growing malting barley but research needs to be done to support the development of the infrastructure itself first.

It is also critical to understand what capacity exists within various sectors and the industry itself, what opportunities for growth exist and where this could occur, what gaps and barriers exist, etc. Measuring assets enables the industry to sustainable plan for growth and provides a measure to benchmark change and success. Many organizations and projects are currently underway or have been completed in this regard, including:

- The Thunder Bay and Area Food and Agricultural Market Study, to better understand the local market and the potential market share of local food to encourage increased local food production and local food processing
- The Cloverbelt Local Food Coop and the Local Food and Farms Co-ops are completing regional trade routes for Northern Ontario to facilitate market access and identify opportunities for growth
- RAIN is completing a regional study of the local and wild food market supply and demand with the goal of diversifying traditional industries and increasing access to markets for new value-added products
- NOFIA is completing an assessment of the distribution capacity of Temiskaming and surrounding districts to access new markets through rail
- NOFIA completed the Northern Ontario Dairy Processing Strategy, which assessed the current capacity of the dairy processing sector in the North and generated recommendations to grow and expand it
- OMAFRA is assessing crop storage and handling capacity and potential and abattoir and meat processing capacity for the industry across the North
- The Greenbelt Fund initiated a working group to support the agricultural distribution system across Northern Ontario

Understanding what assets, infrastructure, opportunities and gaps exist is necessary across all sectors, as is the need to complete research on the potential for expansion and growth in these sectors. This information gathering also supports further networking and collaboration and enables both industry and government to plan for long-term, strategic growth. Before major research projects are completed in the North, at minimum an assessment of existing infrastructure and assets as well as market potential should be considered to ensure the project outcomes are viable and useful for farmers in that district and to identify what further information needs to be gathered and studied to ensure future growth in that area.

9 COORDINATED RESEARCH INFRASTRUCTURE

There are several organizations and institutions currently involved in academic and applied research in Northern Ontario agriculture. The size of Northern Ontario, the different types of organizations involved and competition for limited funding can hinder the collaborative efforts of these organizations and limit the ability to leverage the resources and expertise available for Northern agricultural research. The need for a coordinating body was the top priority identified at both summits as this will facilitate improved communication and foster stronger networks across the North, which will address several issues currently facing agricultural research in the North.

Creating a new organization to coordinate research across the North is an ineffective use of resources and will merely add another layer to the existing framework. In addition, creating a Centre of Excellence based out of an academic facility will strengthen the North's capacity to complete academic-based research, but does not bridge the gap between academic and applied research, nor does it support technology transfer and extension to meet the needs of an individual farmer. Instead, developing an academic Centre of Excellence or a Northern Research Chair should be done *with* further facilitation of applied research across the North. These two streams of research and knowledge acquisition should exist together, support each other and work collectively, not exclusively.

NOFIA is an existing non-profit organization that has a mandate to advance agriculture across Northern Ontario. NOFIA is in a strong position to coordinate research across the North given its involvement with the agricultural community, its history of projects, its existing networks and its Advisory Council. This coordination and collaboration is occurring more frequently, but NOFIA's capacity to deliver applied research could be improved with dedicated programming funding. NOFIA currently receives programming funding from FedNor, which provides for NOFIA's general operating costs in pursuit of initiatives that support FedNor's mandate and mission. This is supplemented with the administration fees generated from the management of NOHFC's Tile Drainage/Land Clearing Funding program. Though NOFIA keeps its organizational structure as lean as possible, these costs can be significant and can be difficult to offset with revenue-based initiatives. The greater focus NOFIA places on revenue-generation, the less focus can be placed on initiatives such as applied research. While some of NOFIA's current mandate directly aligns with the delivery of applied research in Northern Ontario, stable, long-term programming funding directly tied to the delivery of applied research will position NOFIA to better establish stakeholder priorities, coordinate research and compile, communicate and report on Northern results, priorities that were established in the summit.

Project-based funding is typically secured on a project-specific basis, depending on the needs of the industry partner, the needs of the project and the best fit between project and funder. This ensures that industry drives research, participates in project development, project funding and results sharing. However, most existing project based funders do not include provisions for existing operating costs. A dedicated project-based fund for Northern Ontario applied agricultural research would support the greater involvement of individual farms and allow for Northern research that may not fit within the existing priorities of funders. However, if the choice must be made between providing dedicated programming funding or project funding, programming funding will likely result in greater, wide-ranging impacts, additional leveraging of resources, more credible, valuable research and a cohesive approach to compiling and reporting results. It can be difficult for a farmer to complete an applied research project on their own – they may know the question they need an answer too, but can't structure a project to provide an answer. To apply for dedicated project funding, they will need the support of an organization such as NOFIA. This is also true at the association level – individual districts can facilitate on-

farm research through local Soil & Crop Associations, etc. but coordinated research across the North, with reportable results, are driven by organizations like NOFIA. If NOFIA doesn't have the capacity to support individual farmers or coordinate larger projects, dedicated project funding will not be effectively leveraged.

During this exploratory stage, definitive outcomes, activities and objectives associated with programming funding are difficult to determine, as they are predicated on funding partners and will be decided upon in further discussion. Prior to secured funding for Northern Ontario research, NOFIA proposes that the following activities could support the coordination of applied research in Northern Ontario.

9.1.1 Collaboration with academic institutions

The U of G, LU and UQAT have the expertise, technical knowledge and infrastructure to conduct highly detailed, credible and technical research on crop management, horticulture, grazing and pasture management, aquaculture, etc. These assets can be strengthened with the establishment of Northern Research Chairs, which will further support the dedicated academic support of agricultural research. The challenge in the past has been to share the research done by institutions and at the stations with farmers and to ensure that some of the research completed by these institutions is done for the farmers, rather than to fill gaps in existing literature. A strong collaboration between these institutions and NOFIA can leverage these resources and allow NOFIA to deliver applied research in a cost-effective way.

There are components of each agricultural academic study that can be extracted and shared with farmers. For example, as UQAT completes research on the ability of roots to sequester carbon, they will assess several management strategies for Northern crops with metrics including yields. NOFIA will be working with UQAT to ensure that these management strategies are tied to profits/acre and return on investment – the highly technical carbon sequestration research is necessary but may not be as relevant to the individual farmer. With associated management strategies and costing, farmers will be able to make direct decisions that impact their farm. Crop management trials at NLARS do not include economics as the objective of the trial is to assess general impact on crops. Providing several management strategies to farmers is only useful if the farmer knows which management strategies will have a positive return on investment. NOFIA has been compiling trial summaries for NLARS for the last few years and is incorporating economic indicators within the 2018 trial summary. A Centre of Excellence for agriculture established at a university or the establishment of Northern Research Chairs at a university or in partnership with industry works in tandem with the strengthening of applied research capacity and stronger connections with industry and stakeholders.

For station trials that require further verification within other districts, NOFIA can partner with local Soil & Crop Improvement Associations, other district organizations and interested farmers to complete on-field trials and large-scale demonstration sites. Large-scale demonstration sites could be as simple as monitoring management practices on a farmer's field, assessing soil heath and crop yields and publishing results in an annual summary, leveraging existing land and equipment.

9.1.2 Coordinate long-term projects with industry research calls

There are several industry research calls that target specific priorities, including those from the Grain Farmers of Ontario (GFO), Beef Farmers of Ontario (BFO), the Ontario Soil & Crop Improvement Association (OSCIA) and OMAFRA. In the past, agricultural research in Northern Ontario has lacked recognizable researchers as the sector currently only has one PhD researcher currently working in the North. This has been a barrier to successfully applying for some of these research calls. However, with time and the development of a broader research network, NOFIA has seen successes in coordinating industry funded projects. A three-year project that

assessed the crop potential after clearing and the development of a reference document for land clearing was recently completed. This project was funded by OSCIA and managed by NOFIA, in partnership with the Cochrane Soil & Crop Improvement Association, the Temiskaming Crops Coalition and the Northeastern Ontario Soil & Crop Improvement Association. A three-year pan-northern research project on malting barley management strategies with sites at LUARS, EARS, NLARS and on-farm with RAIN in Algoma was recently awarded funding by the Grain Farmers of Ontario. This project, coordinated by NOFIA over the next three years, was a strong submission partly due to the research credibility and involvement of several academic researchers across Ontario. A tentative project has also been submitted to OSCIA, examining application strategies on potatoes and cereals in Sudbury, Nipissing and Thunder Bay.

These collaborations will enable Northern agricultural research to access additional industry dollars for long-term projects. These collaborations and the networks necessary to support them take time to develop but as NOFIA expands its networks, these collaborations have been easier to facilitate. As NOFIA expands its networks, future collaborations on other sectoral/commodity projects could be facilitated. Additionally, as academic capacity for agriculture grows, there will be improved access to researchers who understand the agricultural landscape in Northern Ontario, which will further strengthen future applications.

9.1.3 Develop program to support farmer-led research & clustering opportunities

To enable farmers to answer questions related to their specific farm and to create a culture of curiosity of questioning and research, a farmer-led research program could be piloted in Northern Ontario. This could be modeled after the Cooperators Program from the Practical Farmers of Iowa, which has supported over 240 farmers with 1,100 research trials since its inception in 1987. Results are shared through reports, quarterly newsletters, agricultural magazines, at field days and workshops and at annual conferences. Recently, the Ecological Farmers Association of Ontario (EFAO) developed a farmer-led research program, modeled after the Cooperators Program. Under this program, on-farm research is completed using the scientific method in a way that is compatible with individual farms and equipment. Farmers submit a research question, challenge or curiosity about their farm, EFAO member-farmers assess the feasibility and practicality of the project and if accepted, the farmer receives support from EFAO to conduct research and a stipend upon completion. This will support farmer-led research across all commodity groups and across all districts, will develop a database of on-farm trial methods and will feed into NOFIA's 'Agricultural Advances for Northern Ontario'. This type of program could be extended to support cluster based research, which could allow a group of farmers to collaborate to complete a project, such as the beef benchmarking study from Temiskaming. This type of program could further be adapted to support industry driven research by matching industry dollars for on-farm and on-station trials. A significant challenge with this type of program is the length of time it takes to foster a culture of research – the first few years may prove difficult in generating accurate results if farmers can't complete the work per protocol.

As farmers approach NOFIA to participate in research projects, there is an opportunity to identify broad needs but also re-direct and work with other organizations (ie. College Boreal, IION, etc.) if the farmers research question would be better served in a different way. For example, a farmer with a complex question might benefit from a one year applied research project with College Boreal. As farmers approach NOFIA with their questions, NOFIA can match them with relevant funding and expertise sources.

The project-based dollars of this program would need to leverage additional funding, so the existence of this type of research funding would be dependant on external funding sources. However, if appetite for a program of this nature exists, a delivery model could be developed. The funding and potential delivery of this program

could model SNAPP, which is coordinated by RAIN and delivered locally by several partner organizations to great success.

9.1.4 Extension and Outreach

With farmers dispersed across a great distance, they need access to relevant information that is disseminated in a way that is useful to their operation. NOFIA currently uses several tools, including Breaking Ground, www.farmnorth.com, www.nofia-agri.com, Twitter and Facebook to share information about research, events, etc. NOFIA also attends meetings where and when possible – a concerted effort needs to be made to visit each district more often to connect with the farmers and businesses in the area, but this would be contingent on the ability to source funding since this travel is expensive.

NOFIA is currently working on improving the searchability and associated metrics for FarmNorth to ensure that people can find the information they are looking for. Research results from various organizations and institutions are uploaded into the research database. NOFIA has been compiling a series of factsheets relevant to farmers in Northern Ontario and will compile an annual 'Agricultural Advances for Northern Ontario' report that will provide relevant information in one package. Semi-annual updates will be shared with Northern Commodity Directors, local association presidents, etc. to ensure that farmers across the North are aware of the work underway. An annual report will also be shared with Northern Commodity Directors for them to share at their relevant AGM's. Finally, it would be valuable to host an annual or bi-annual summit to present Northern research results and address future stakeholder priorities. This will facilitate strategic research across the North and continue to connect stakeholders across the region.

Given the dispersal of farmers across the North, extension and demonstration is important. The value of having people on the ground to support the agricultural industry cannot be understated. OMAFRA's agricultural development advisors in the North consult with producers, processors and entrepreneurs on ways to innovate and grow their businesses. The advisors bring specialized knowledge and technical expertise to projects supporting expansion of the sector. They also facilitate access to OMAFRA specialists - such as field crop, horticulture, business management and livestock experts - and to government programs that can help. OMAFRA's current involvement in extension and technical agricultural support is shifting and as increased focus is placed on business and rural development, there will be a larger gap to fill with respect to agricultural expertise and technical support. Further, while OMAFRA specialists can offer expertise, their focus is on other areas of the province and do not always meet the needs of some districts/sectors. This gap can be filled with mobile Northern specialists, part-time district staff, etc. employed with NOFIA, but funding capacity currently does not exist to do so. With further extension and outreach, stronger collaborations can be build with organizations and institutions outside of the province, potentially developing projects with the University of Michigan or the University of Manitoba.

9.2 Stable, Long-Term Funding

Improved focus on applied agricultural research and a concerted effort to coordinate research across the North requires funding, specifically to cover programming costs, including overhead. Long-term funding for agricultural research will support strategic, visionary research, and will enable NOFIA to commit to long-term applied research projects that meet the needs of Northern farmers. Stability in research is important to attract industry investment – organizations like NOFIA, NLARS & SPUD, LUARS, etc. must be able to offer long-term project capacity so industry partners can complete more than one year of research to ensure credible results.

Stable, long-term funding could also be dedicated to project based funding, however, organizations like NOFIA are essential in accessing project based funding. As previously mentioned, accessing project based research funding on an individual farmer level is unique and difficult as a farmer may know what question they need answered, but will need guidance and support in finding an answer. Organizations like NOFIA build applications, complete literature reviews, complete projects and publish results so farmers can benefit and it will likely be organizations like NOFIA that either apply for project based funding or support farmers in their applications for project based funding. If a dedicated project based funding model is developed for Northern Ontario agriculture and administered by NOFIA (such as a farmer-led research program or a Northern research call), a working committee could be established to vet proposals, provide recommendations, etc. to ensure transparency and equity and that projects are selected based on merit and impact to the sector. This working committee could include a NOFIA board member, a NOFIA Advisory Council member, representatives from funding agencies, academic institutions, Northern commodity directors and industry experts.

An ideal funding scenario would include programming funding for NOFIA to coordinate research across the North and operational dollars for demonstration sites in areas/sectors not currently represented, research calls, farmer-led research and personnel to work across the North in extension and technology transfer. However, this may not be conducive within current funding climates. Programming funding to support a collaborative applied research mandate at minimum is necessary.

Agricultural research must be industry driven and publicly supported. Industry funding can potentially be sourced through several mechanisms, some of which are already being accessed by NOFIA and others. Long-term, stable industry funding may be possible through check-offs, etc. but this will be challenging as it involves several commodities, some of which currently re-invest more in Northern Ontario than they receive for check-offs. Industry funding will most likely be sourced on a project by project basis, as this will justify the need for specific projects and will enable the direct involvement of many industry partners.

Both the NOHFC and FedNor have been involved in funding the Northern agricultural industry in general and certain agricultural research projects, specifically those tied to market development, job creation and economic growth. Growing Forward 2, and the newly released Canadian Agricultural Partnership, have been used extensively by organizations in the North to access project funding. However, this funding partner has little to no provisions for overhead costs. There is potential for FedNor and NOHFC to invest in agricultural research, but this effort needs to be led by OMAFRA as the government ministry with the agricultural mandate. If OMAFRA, NOHFC and FedNor support program/project funding to offer long-term stability for NOFIA and the Northern ag industry, metrics for measurement and success will be discussed to ensure that NOFIA is accountable to the funding partners and to the agricultural sector in general.

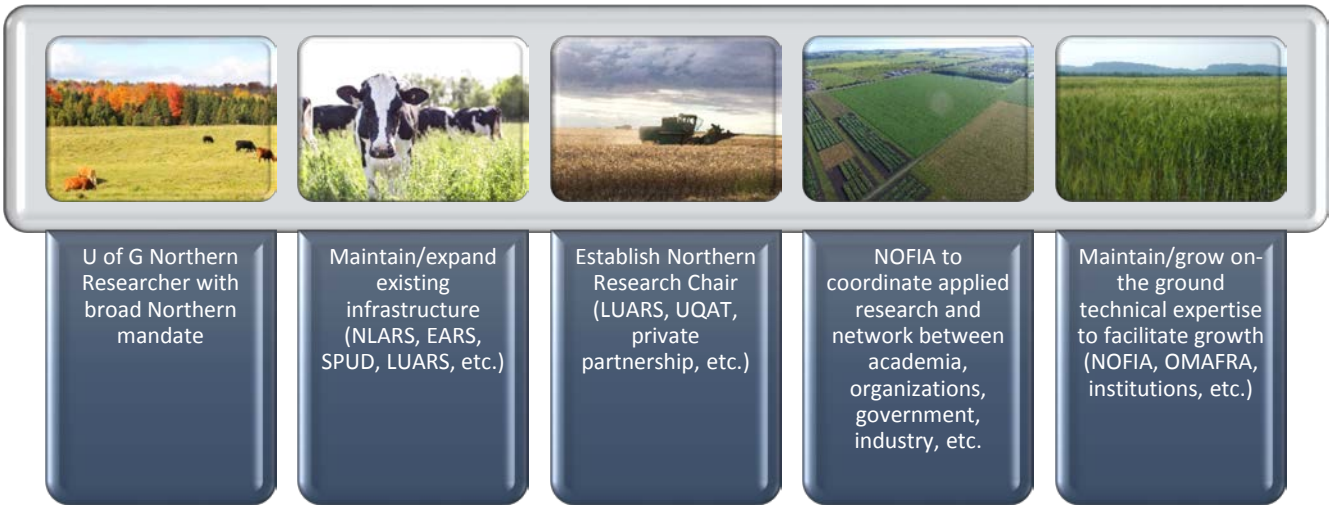
10 CONCLUSION

A strong collaboration between government, academia and industry will support the applied research needs of Northern Ontario farmers. NOFIA can connect government and academia to industry and support continued networking between stakeholders. NOFIA can also exist as a mechanism for funding partners and the government to gauge the potential of projects, as the Advisory Council can provide feedback based on real-farm needs. Communication between stakeholders is key to ensuring that existing and future resources are leveraged. This communication cannot be NOFIA's responsibility alone – government, industry, academia and organizations need to share what is underway, what is planned, what is needed, what follow-up is necessary, etc.

NOFIA's applied research mandate will focus on connecting academic research to farmer needs, coordinating and managing long-term research projects through industry calls and pilot a farmer-led research program. Additionally, NOFIA will concentrate on extension and outreach, sharing results broadly with farmers across the North and connecting them to the funding and expertise they need to facilitate further research. However, NOFIA's capacity to deliver coordinated applied research across Northern Ontario is limited by a lack of long-term programming funding. NOFIA is currently working within its FedNor mandate, which has partial overlap with the delivery of applied research.

Sustainable, stable, long-term funding support and a coordinating body that is positioned to establish stakeholder priorities, coordinate research and compile, communicate and report on Northern results could have lasting impacts on the delivery of agricultural research in Northern Ontario. Excellent capacity to deliver agricultural research exists across Northern Ontario, as well as industry engagement and desire to expand the industry itself. With increased coordination and communication, Northern Ontario agricultural research could meet the needs of Northern farmers and more broadly, provide information to other farmers in cooler climate areas.

Components of Northern Ontario Agricultural Research Framework



Northern Ontario Farm Innovation Alliance

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Past Projects:

Rapid Development of Boreal Forest to Farmland

Land Clearing Reference Guide

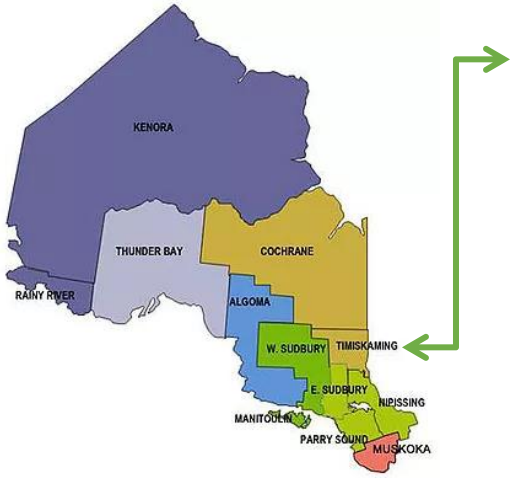
Northern Ontario Dairy Processing Strategy

Intensive Oat Management

Yellow Mustard, Malting Barley, Canola, Wheat & Flax

Oat Cover Crop

Industrial Hemp Variety Development



NOFIA is a non-profit organization that works to advance agriculture across Northern Ontario through applied research, technology transfer and business development. This is accomplished by working with partners in industry, government & academia to complete projects that provide the information farmers need to success in Northern Ontario.

Current Projects:

Surface Applied Lime on Pasture to examine the potential of surface applied lime to improve soil pH and pasture growth

Deadstock Disposal Vessel Assessment to examine the use of deadstock disposal vessels in Northern Ontario

Plastics Disposal Assessment to develop an inventory of agricultural plastic waste generated in Northern Ontario and assessing end use options

Rail Infrastructure Assessment to assess the current & potential distribution capacity of the Hwy 11 corridor from Nipissing to Cochrane and develop a modular plan for a rail siding facility to service the area

Economics of Hops in Northern Ontario to assess the potential and economics of hops varieties in the North

Indigenous Foods & Medicines to assess foods & medicines used by Indigenous communities in Rainy River and potential for further on-farm development

Developing Non-Timber Forest Products in NEO to assess the state of agro-foresty & NTFP and educate the public on NTFP's

Technology Transfer:

Agricultural Advances for Northern Ontario – compilation of information relevant to needs in Northern agriculture, shared in a useful way for farmers

FarmNorth – online 'hub' that connects people with the information they need about agriculture in Northern Ontario

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Past Research Projects

Keyline plowing for improved forage production and climate change resilience

Nutritional value and integration of hybrid will and poplar as fodder for sheep

Diversification strategy of Thessalon First Nation Biocentre

Soybean variety strip demonstration trial

Economic comparison of growing canola and horse hay

Market garden assessment of organic fertilizers

Pasture improvement demonstration and assessment

Bobolink habitat and hay nutrition

Season extension forage production – fodder corn & forage sorghum

Crop variety trials -flax, camelina

Soybean response to sulphur, potassium and phosphorous applications

Agricultural Biomass – economic analysis & field trials

Late season no-till winter crops

Quinoa variety trial

Crop rotation options for canola production in Algoma

Speckled alder regeneration study

RAIN builds a resilient farm and food sector in northern Ontario through innovative research and agriculture development projects by:

- Encouraging business growth and improved capacity for farmers and food businesses;
- Collaborating with industry, government and communities to develop initiatives that meet the needs of farmers and agri-food businesses;
- Providing a network of support that enhances the industry

Current Projects:

Cross-seeding Forages to determine if cross-seeding is an economically viable practice for establishing pasture and hay crops in northern Ontario

Algoma District Sulphur Fertilization Project to assess economic rates of sulphur application on vegetables, canola and forage brassica mix

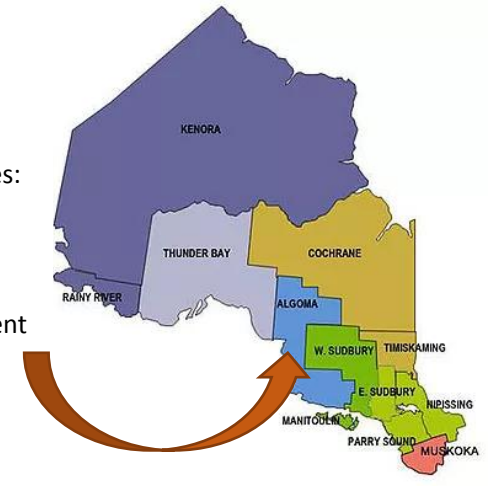
Assessing the Nitrogen Requirements of Sorghum Crops to assess whether there are significant yield losses associated with lower-than-recommended N applications on sorghum-sudangrass grown in northern Ontario.

RAIN Research Priorities:

Forage Improvement

Novel Crop Studies

Value Chain Development



RAIN
RURAL AGRI-INNOVATION NETWORK

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Northeast Community Network

c/o North Claybelt DFCD
6 Ash St., Kapuskasing ON P5N 2C8
www.necn-rcne.ca

The Northeast Community Network (NeCN) promotes collaborative economic development, applied research, and support for regional development. Through the establishment of committees who are responsible for overseeing various industry related projects, the NeCN works to grow and strengthen all economic sectors within the region. The purpose of the NeCN Agriculture Steering Committee is to guide, mentor and oversee the enhancement and development of farming and agri-business growth within the NeCN catchment area.

Past & Current Projects:

Food Security Research Network Case Study

Current & Future Opportunities for Agricultural Development in Northeast Ontario: A Regional Development Perspective

Strategic Direction for Agricultural Development in Northeastern Ontario

Mining Local Food in Northern Ontario in collaboration with the University of Guelph

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New Liskeard Agricultural Research Station
Emo Agricultural Research Station

https://www.uoguelph.ca/omafra_partnership/research-facilities/research-stations/crop-research-facilities/new-liskeard-agricultural-research

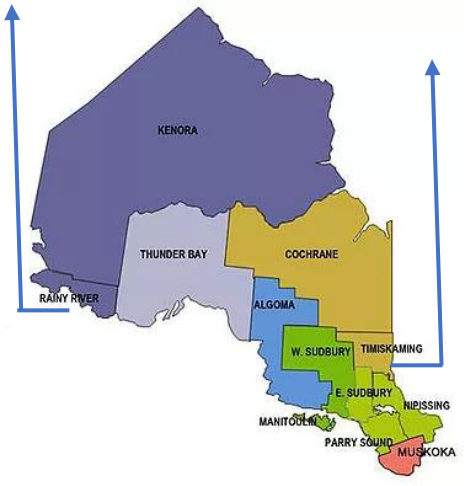
Research Units operated from NLARS:

Agronomy – focuses on adapted crop species, cultivar evaluation, crop nutrition and new species evaluation

Horticulture/SPUD – management and production of fruit and vegetables

Beef – focuses on production systems, fall grazing, controlled breeding and pasture management

Emo Agricultural Research Station - focuses on adapted crop species including spring wheat, barley, oats, canola, soybeans, flax and perennial forages such as alfalfa, clovers and grasses. Research areas include cultivar evaluation, crop nutrition and new species evaluation.



The NLARS is managed by the University of Guelph through the OMAFRA – U of G Partnership Agreement. The NLARS also operates the Verner Test Site, which facilitates field crop projects.

Current Projects:

Variety Trials – OCCC Barley, Oats & Spring Wheat Performance; 2 & 6 Row Barley Orthogonal; Spring Wheat Orthogonal; Spring Wheat Screening; Ottawa Oat Covered Registration; Ottawa Oat Preliminary; Corn; Soybean; Manitoba spring wheat, oat, barley, canola

Corn N-Rate Nitrogen Response Trial

Buckwheat Combing Pollination Trial

Ottawa Oat Yield Trial

NL Forage Digestibility and Biomass Yield

White Bean Row Spacing Trial

Oat Cover Crop, variety and seeding rate impact on biomass

Hops Yard

Dry Bean Trial

Oilseed radish & compaction

Galega vs. Alfalfa

Strawberries, raspberries, potatoes, garlic, asparagus, sweet potato, haskap and hazelnut

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NLARS: Nathan Mountain
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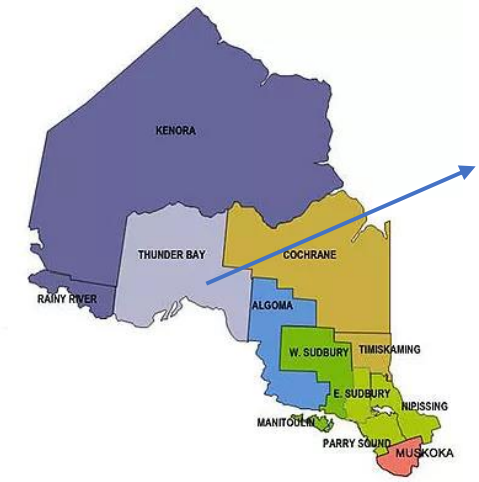
Annual results and summaries can be found at:
FARMNORTH.com

Lakehead University Agricultural Research Station

(formerly the Thunder Bay Agricultural Research Station)
5790 Little Norway Road, Thunder Bay ON

The LUARS uses small-plot research to introduce and assess crop varieties and agricultural management practices – with a new partnership between Lakehead University and OMAFRA, further leading research can be completed at LUARS.



Dr. Tarlok Singh Sahota CCA
Director of Research & Business
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Current Projects:

Variety Trials – wheat, barley, malting barley, oats, winter wheat, winter rye, grain corn, soybeans, edible beans, peas, flax, canola, mustard, forages

Comparative Performance of Alfalfa and Galega

Effect of P and Bio-ag products on soybean grain yield

Maximizing canola yield with nitrogen & other nutrients

Evaluation of ammonium sulphate and gypsum as sources of sulphur for canola production

Evaluation of gypsum and ammonium sulphate as sources of sulphur for barley, canola and pea production

Effects of nitrogen & growth regulator, P & K and sulphur on flax seed yield

Mid June seeding options

MasterGraze corn seeding and harvest management

Comparative forage production potential of different forage crops

Cross Seeding Grasses

Optimum Seeding Rate of Quinoa

Find summary results & extension articles at www.tbars.net

Univeristé du Québec en Abitibi-Témisamingue

Centre du Témiscamingue
79, rue Côté Notre-Dame-du-Nord, QC J0Z 3B0
www.uqat.ca

UQAT, as vast an institution as its areas of coverage, chiefly offers services in the Abitibi-Témiscamingue and Nord-du-Québec regions as well as in the MRC Antoine-Labelle. Serving all the communities in those areas is an important part of its mission. Besides going beyond its borders, UQAT has solidly anchored itself to its home region through its three campuses and six regional centres.

The Centre at Ville-Marie has a research niche focused on agriculture and agri-food. Research themes are focused on plant production systems, carbon sequestration, beef production, forage & silage.

Current Agriculture Projects:
-how complex mixtures and pasture management influence plant roots & carbon sequestration
-relationship between root function traits & carbon sequestration in Mediterranean soil mechanisms
-carbon sequestration in forest plantation established to provide energy, wood & restore degraded land
-assessing feed value & ensilability of replacing timothy with alfalfa in binary mixes for dairy cows
-management practices for stockpiling complex mixtures
-Quebec & Ontario beef production benchmarking with a focus on sustainable production in Northern conditions
-feeding strategies to finish steers with three different mixes

Potential Agriculture Projects:
-roles of root traints & soil properties in carbon sequestration in different soil horizons (2018-2023)
-quantify and reduce CO2 emissions from agricultural soils under current & future climate conditions (2018-2021)
-how roots of bioenergy crops influence soil carbon sequestration mechanisms
-how complete mixes & soil drainage status influence pasture performance & below ground processes
-effects of soil drainage & pasture botanical composition on carbon sequestration, soil heath & forage productivity
-high quality silage production for dairy farms
-sustaining the legume component of grazed pasture mixes for summer grazing & stockpiling complex mixes for Eastern Canada

Past Projects:
-Effects of Winter Grazing on Performance of Gestating Beef Cows in Northern Ontario
-Improving utilization of forages by yearling beef cattle in Northern Ontario
-Performance of Forage Mixtures under a Beef Grazing Management System in the Northern Latitudes
-Pasture mixtures and forage legumes for the long-term sustainability of beef production

UQAT
UNIVERSITÉ DU QUÉBEC
EN ABITIBI-TÉMISCAMINGUE

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Université de Hearst

http://www.uhearst.ca/english

Innovar is a research institute affiliated to l'Université de Hearst that focuses first and foremost on economic and community development. Through *Innovar* and in partnership with the University of Guelph, the Université de Hearst are currently working on "Understanding the Barriers to Livestock Production in the Clay Belt: An Economic, Social and Political Analysis". This project will seek to identify the economic and social barriers associated with agriculture in the north, more precisely with livestock production, and to understand how these barriers impact youth retention, farm creation and farm expansion.

Pending potential funding, l'Université de Hearst may also construct a 1,000 square foot greenhouse as a research facility and hire a research chair to study growing new varieties of fruits and vegetables suitable to Northern climates.

UNIVERSITÉ DE HEARST

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Additional Relevant Research

Thunder Bay and Area Food and Agriculture Market Study, http://tbfoodstrategy.com

2017 Trade Routes Report, Local Food & Farm Cooperative

Ontario Soil & Crop Improvement Association

https://www.ontariosoilcrop.org

The Ontario Soil & Crop Improvement Association facilitates responsible economic management of soil, water, air and crops through the development and communication of innovative farming practices. The OSCIA leads province-wide research initiatives while addressing district needs through research opportunities made available to local and regional associations. Within Northern Ontario, there are 11 local associations and 2 regional associations.

OMAFRA provides annual funding to support on-farm research. In 2015, a new grant structure was introduced that supports a broad array of one year activities and three-year in-depth investigations.

Tier One Grant – supports educational activities, field days, bus tours, in-field trials or demonstration of new equipment or management techniques.

100% cost share up to $1,500 per county/district or region annually

Tier Two Grant – supports large-scale multiple-year projects across focus areas with a competitive, merit based application. Four projects are currently being funded across the province and Tier Two Grant funds are locked until April 1, 2018.

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Tier 2 Project – Rapid Development of Forest to Farmland Temiskaming Crops Coalition, Cochrane Soil & Crop Improvement Association, Northeastern Ontario Soil & Crop Improvement Association, Northern Ontario Farm Innovation Alliance

Three-year project to assess soil & crop implications of mulching for agricultural purposes and to develop a document that provides information on various types of land clearing

Past Projects:

Seeding Rates of Oats in Northeastern Ontario

Sulphur Responses of Crops in Northwestern Ontario

SMART Canola Study

Fertilizer Evaluation on Corn, Barley & Potatoes

Starter Fertilization for Corn

Herbicide Evaluation for Control of Smooth Bedstraw in Forages

Muskoka Lime Trial

Haskap Evaluation and Management Developments in Northern Ontario Growing Regions

OSCIA
Grassroots Innovation
Since 1939

Beef Farmers of Ontario

http://www.ontariobeef.com/

Beef Farmers of Ontario has conducted applied research projects related to beef expansion in Northern Ontario over the past five years. Projects related to agriculture in Northern Ontario have focused on:

- The potential for cow herd expansion in Northern Ontario, looking at economic, environmental and social factors
- Identifying opportunities and challenges for beef expansion in the north
- Crown land policy and land acquisition challenges in the north
- Economic modelling for beef operations in the north
- Demonstration projects for northern beef production, including the topics of dairy beef, lead-follow grazing of sheep and cattle and bale grazing and windbreaks.

Current Project – Pasture mixtures of grasses and legumes for the long-term sustainability of beef production

Developing simple and complex forage mixtures for long-term and low-cost beef grazing management systems, this project will offer a unique opportunity to assess grazing management in northern climates

Past Project – Effects of winter grazing on performance of gestating beef cows in Northern Ontario

Examined different management strategies for wintering beef cows in Northern Ontario. Evaluated winter grazing to determine if stockpiled feedtstuffs can be used to meet the needs of gestating cattle in a harsh winter environment.

Past Project- Improving utilization of forages by yearling beef cattle in Northern Ontario

Examined supplementation strategies to increase performance of beef cattle managed on pasture or fed round bale silage. Goal is to improve utilization of forages for beef cattle production and lower costs of production.

BeefNorth

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Email: info@ontariobeef.com