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REVIEW OF AGRI-ENVIRONMENTAL ASSESSMENT TOOLS

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EXECUTIVE SUMMARY

Agri-environmental assessment tools enable the agriculture and agri-food sector to assess, monitor, and reduce the environmental impact of the sector. From a producer's perspective, tools must accomplish these objectives in a cost-effective manner. While tools have historically focused on agri-environmental assessment, they are now moving towards decision-support outputs to assist producers to move beyond initial assessment and identification of problem areas.

To date, these tools have not been compiled, compared or assessed for Ontario conditions or users. Thus, there is a need to better understand what agri-environmental assessment tools exist and what the sector sees as essential components. Ultimately, this will reduce duplication of efforts with respect to the development of tools and ensure that tools available to farmers will truly enhance adoption of effective best management practices.

The scan identifies 103 agri-environmental assessment tools. Tools identified were primarily developed and/or used in Ontario. Tools were most commonly developed for the purposes of nutrient management, pest management, disease management, weather forecasting, and soil health. Tools are primarily available on mobile apps or online. Regional tools are generally targeted for watershed management. An overwhelming number of tools were associated with on-farm decision making. Agri-environmental assessment tools largely target producers and are predominantly intended for grain and oilseed production.

To better understand the tools being used, alongside strengths and challenges, key stakeholders from a number of agricultural sector organizations were engaged. Stakeholders indicated a number of agri-environmental initiatives their members are prioritizing, such as 4R nutrient stewardship, precision agriculture, soil health, nutrient management, and greenhouse gas reduction among others.

A number of characteristics are considered beneficial in agri-environmental assessment tools. Stakeholders emphasized the importance of:

- engaging producers;
- ensuring ease of access and use;
- developing tools as mobile apps;
- improved benchmarking, baseline, and site-specific data;
- improving decision-support outputs and incorporating financial aspects of decision making and;
- developing tools under a whole-farm approach while incorporating commodity specific initiatives.

Key recommendations in order to improve integration of agri-environmental assessment tools, improve tool accessibility, and reduce duplication of efforts have been highlighted as a result of this project.

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1.0 INTRODUCTION

Agri-environmental assessment tools enable the agriculture and agri-food sector to assess, monitor, and improve soil health, water quality, and greenhouse gas emissions among other aspects to reduce the environmental impact of the sector and respond to existing and emerging environmental and sustainability requirements. For the purpose of this project, an agri-environmental assessment 'tool' is defined as any instrument/software that produces outputs that can be used to inform decisions to reduce environmental impact. While tools have historically focused on agri-environmental assessment, these are now moving towards decision-support outputs to assist producers to move beyond initial assessment and identification of problem areas. This project includes both assessment only tools as well as those that include explicit decision-making or decision-support mechanisms.

To date, these tools have not been compiled, compared, or assessed for Ontario conditions or users. Therefore, there is a need to better understand what agri-environmental assessment tools exist and what the sector sees as essential components and formats. Improving agri-environmental assessment tools requires the input of progressive producers and stakeholders in the agriculture and agri-food sector. Ultimately, this will reduce duplication of efforts with respect both to the development and application of tools and ensure that tools available to farmers will truly enhance adoption of best management practices (BMPs), including those identified in the Canada-Ontario Lake Erie Action Plan supporting the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health. For the purpose of this project, tools that focus on on-farm decision making and watershed management at the regional level are assessed.

The Ontario Federation of Agriculture (OFA) represents more than 37,000 farm families across Ontario and has a long-standing history of being the voice and champion for farmers striving to be sustainable in the farm and food sector. This project will support increased knowledge of OFA's membership towards adoption of BMPs relevant to their individual farm operations.

This report outlines the methodology used to identify and search for the agri-environmental assessment tools available, provides a summary of key findings from both the scan and interviews with key influencers, and presents next steps for moving forward.

2.0 METHODOLOGY

The following is an overview of the project methodology.

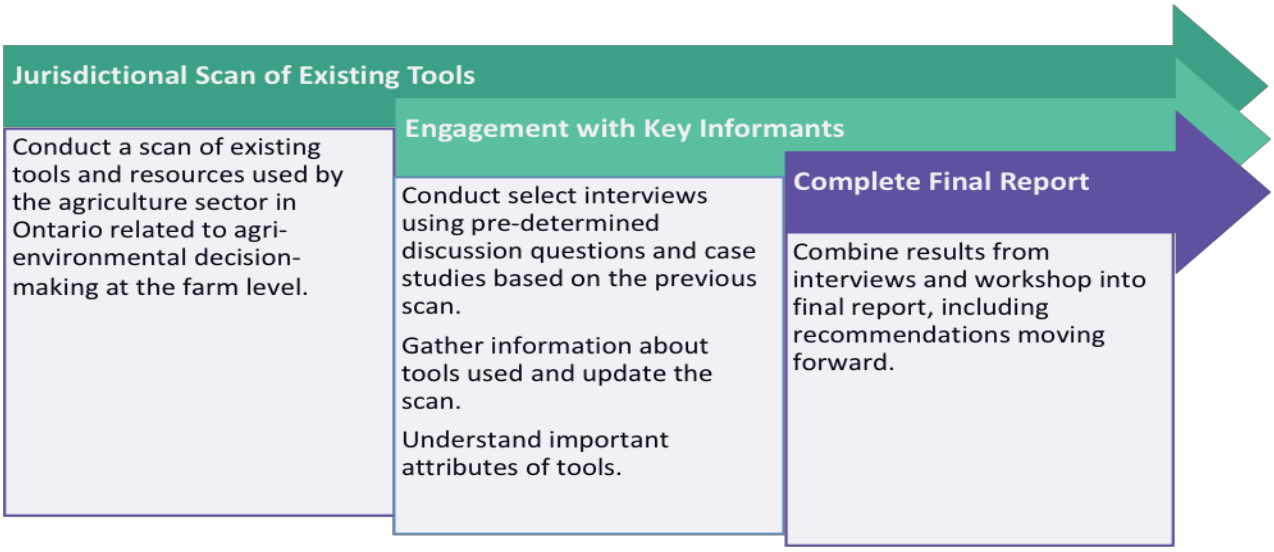

Figure 1. Overview of methodology

2.1 JURISDICTIONAL SCAN

The first step of this project was to conduct a jurisdictional scan of existing agri-environmental assessment tools. Emphasis was placed on tools developed and/or used in Ontario and Canada. Tools were identified through scanning well-known websites (such as OMAFRA and AAFC), Google, and App stores. Search terms can be found in Appendix A. Following this, applicable tools were incorporated into an Excel database and categorized based on key attributes including the jurisdiction of the tool, which agri-environmental component the tool assessed, the type of tool, how it is used, the target audience, and the developers.

2.1.1 Limitations

The information presented in the scan was generated from what is available online. For this reason, the entire scope of some tools may be overstated or understated depending on the quality of its description. It is worth noting that no repository for regional, national, or International agri-environmental assessment tools was found. As a result, there may be tools that were missed and not included in this scan. Additionally, there are a number of tools available alongside proprietary products that cannot be publicly accessed. Accurately identifying the jurisdiction that the tool is used in was also a limitation of this study. While it is generally clear where the tool was developed, the online availability of many tools means that it is possible that users exist across a broader area.

2.2 Engagement With Key Influencers

To better understand the agri-environmental assessment tools being used, key influencers from a number of agricultural sector organizations were engaged. The purpose of these interviews was to gather information on tools that their organizations and members use and to understand the important attributes of tools. The engagement with key influencers also helped to inform the jurisdictional scan and highlighted tools that were important to include if they were not already. Stakeholders from 16 organizations were invited to participate in interviews. A summary of the scan (Appendix A) was provided to interviewees prior to the discussion. A discussion guide was followed during the engagement (Appendix B) and consisted of topics such as tools the interviewee was familiar with or used and key components that would be beneficial for a tool. In order to highlight some of the tools found in the scan and showcase those used across a range of jurisdictions and classifications, five case studies were shared with the interviewees to encourage discussion. Case studies were chosen on an informal basis and highlighted tools that are relatively well known. These case studies included; Canadian ArcView Nutrient and Water Evaluation Tool (CANWET), Canadian Field Print Initiative, Farmland Health Check Up, AgMaps, and Nutrient Management Planning Tool (NMAN) (see Appendix C).

Interviews were conducted with 12 organizations[1]:

- Agri-Food Management Institute, *Ashley Honsberger, Executive Director*
- Agriculture and Agri-Food Canada, *Maxine Kingston (Senior Advisor) and Keith Reid (Soil Specialist)*
- Certified Crop Advisors Ontario, *Deb Campbell, Vice Chair*
- Farms.com, *Joe Dales, Vice President/Co-Founder*
- Grain Farmers of Ontario, *Nicole Mackellar, Manager, Market Development*
- Hensall District Co-Operative, *Steve Redmond, Precision Agriculture Specialist*
- Ontario Agri-Business Association, *Ron Campbell, Operations and Member Service Manager*
- Ontario Fruit and Vegetable Growers Association, *Brian Gilroy, Ex-Officio*
- Ontario Greenhouse Vegetable Growers, *Justine Taylor, Science and Government Relations Manager*
- Ontario Ministry of Agriculture, Food and Rural Affairs
  Mike Cowbrough (Weed Management Field Crops), Kevin McKague (Water Quality Engineer), Jake Munroe (Soil Fertility Specialist-Field Crops), Christine Brown (Field Crops Sustainability Specialist), Anne Verhallen (Soil Management Specialist Horticulture), Christoph Wand (Livestock Sustainability Specialist), Dorienne Cushman (Program Analyst)
- Ontario Pork, *Stefan Larrass, Senior Policy Advisor*
- Ontario Soil and Crop Improvement Association, *Harold Rudy, Executive Officer, Research and Business Development*

As well, an important key influencer throughout the project was the OFA. The OFA received regular updates and summaries of the work completed to provide input and suggestions as the project progressed.

[1]Other stakeholders engaged informally included Farm Credit Canada, A&L Labs, and Climate Field at the London Farm Show.

3.0 FINDINGS – JURISDICTIONAL SCAN

103 agri-environmental assessment tools are identified in the scan. The tools have been organized into a database that captures the following characteristics:

Classification	Characteristics
Tool Name	The tool name as it appears online/in the app store
Jurisdiction	- Regional - Provincial - National - International
Agri-environmental Classification	- Crop management - Livestock management - Greenhouse gas emissions - Nutrient management - Pest management - Disease management - Watershed management - Soil health - Pollinator health - Weather and climate monitoring - Weather forecasting - Water quality - Soil mapping - Whole-farm data management - Whole-farm environmental management
Tool Type	- App - Online software - Hand held device - Spreadsheet - Tractor mounted tool - Workbook/ worksheet
Intended Use	- On-farm decision making - Regional decision making

Other metrics included targeted end user, developers, specific regional information, and a description of the tool. Tools often cover more than one of the above characteristics. Detailed information about the identified agri-environmental assessment tools can be found in Appendix D.

3.1 JURISDICTION OF TOOLS

Many agri-environmental assessment tools were developed and/or used in Ontario (Figure 2). Sixteen tools are national in scope. Most international tools are from the Unites States.

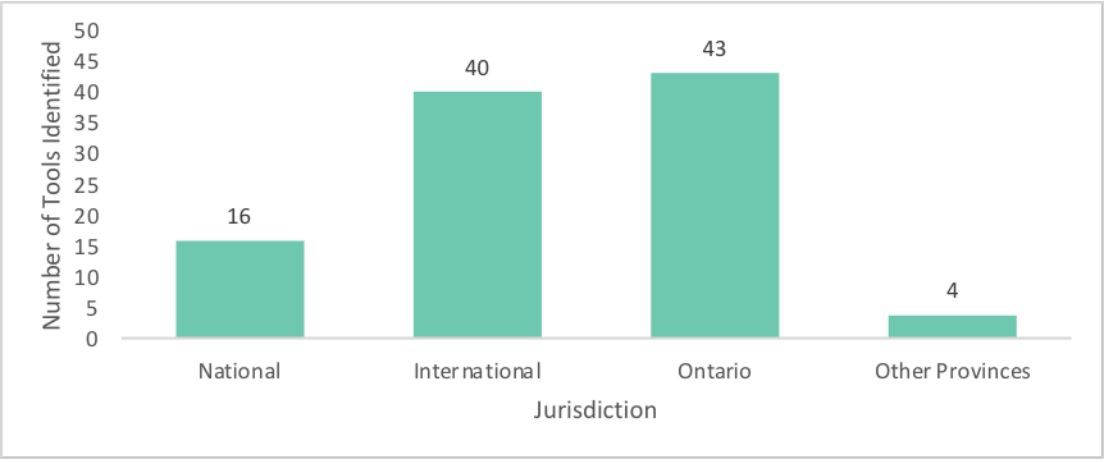

Figure 2. Distribution of tool jurisdiction.

3.2 SUMMARY OF TOOL AGRI-ENVIRONMENTAL CLASSIFICATIONS

Tools were most commonly developed for the purposes of:

- Nutrient management;
- Pest management;
- Disease management;
- Weather forecasting;
- Soil health.

Tools for on-farm assessment or decision-making purposes were primarily available as mobile apps or online. Several tools were included in the scan that are meant for use at the regional level and are generally used for watershed management. Understanding the value watershed management tools bring to the farming community is beyond the scope of this project, but should be explored in future studies. Interestingly, tools are predominantly intended for grain and oilseed producers in particular, with few targeted towards livestock operations. Tools classified as 'whole-farm' in scope are defined as tools that cover multiple agri-environmental initiatives on-farm and contained components that are not classified as agri-environmental in nature (economic or business management components, for example). Notably, there were eleven tools that were whole-farm in scope, however while these addressed multiple agri-environmental initiatives on-farm, most of these were still generally commodity specific.

Site specific risk assessment or management tools include NMAN, the Canadian Field Print Initiative, and the Farm Health Check Up. These are highlighted in the case studies (Appendix C). Other identified tools such as the Canadian Watershed Evaluation Tool (CANWET) are useful at the regional watershed level.

4.0 FINDINGS – KEY INFORMANT INTERVIEWS

The feedback provided from key informants was analyzed for a more comprehensive understanding of which tools they frequently use, potential priority areas for their organization or sector, and key components that would be useful in a tool. As well, a one-page summary of these key findings was developed (Appendix E) and provided to interviewees to ensure the summary was reflective of their key messages.

4.1 TOOLS USED BY MEMBERSHIP

Due to the high number and diversity of tools available, key influencers did not want to speak about which tools individual producers are using specifically. Some stakeholders highlighted producers in their commodity group are using a large number of tools while others indicated that they are primarily only using the mandatory regulatory tools or those required for funding eligibility. There was consensus that there are many more tools that could be used, however key influencers suggested there is a barrier in terms of uptake as producers may not have the time and/or support to learn use a multitude of tools.

Agri-environmental tools or components of tools highlighted in discussions included the Environmental Farm Plan (EFP), simple mapping tools, satellite and drone imagery, business management tools, regulatory tools, and mandated or market driven compliance tools. Those that fall in the scope of agri-environmental decision tools were captured in the scan

4.2 AGRI-ENVIRONMENTAL ASSESSMENT TOOLS –PRIORITY AREAS

Key informants identified environmental priority areas that are important to their members. These priority areas helped to categorize the agri-environmental assessment tools. Priority areas include:

- 4R nutrient stewardship
- Biosecurity and food safety
- Crop rotations
- Pest assessment
- Soil organic matter
- Storm water management
- Biodiversity
- Cover crops
- Greenhouse gas reduction
- Precision agriculture
- Soil pH, P, and N management
- Traceability

A lack of adequate tools to develop field level soil zones as well as current and detailed soil maps is inhibiting progress with precision agriculture. Stakeholders emphasized the need for tools with the ability to measure long-term performance of cover crops in relation to soil health, yield and other important on-farm indicators. As cover crops become more widely accepted and utilized, there is potential to fill this gap. Key criteria to improve the ability to track or measure these priority areas using agri-environmental assessment tools are described below.

4.3 KEY CRITERIA OF EFFECTIVE TOOLS

During the interviews, a general consensus around seven key criteria of effective agri-environmental assessment tools emerged. While there will of course be variability in the types of tools available to producers, it was generally agreed that in order to be as useful as possible, an agri-environment assessment tool should meet the following seven criteria:

- ✓ Engage producers in tool development
- ✓ Be accessible and easy to use
- ✓ Include a mobile app version
- ✓ Include high quality baseline data
- ✓ Include locally relevant data (scale dependent on the purpose of the tool)
- ✓ Produce high quality decision-support outputs
- ✓ Incorporate financial information in the decision-making model

Engage Producers

Stakeholders emphasized that it is important to engage producers in tool development to optimize utility and increase uptake. Producer engagement will help to ensure that the tool is tailored to producers' needs and accessible or easy to use on-farm. It was also noted that historically much of the tool development has been left to the input suppliers, in particular the equipment industry, and this seems to be relatively underserviced and leaves the farmer to figure out how to use available tools.

Ease of Access and Use

Key stakeholders reinforced repeatedly that the most important aspect of tool development or components of individual tools is to ensure they are as easy as possible to access and use. Currently there is no single portal or catalogue of tools that are relevant to Ontario producers, so it can be challenging for people to know where to look for a tool that might be helpful for their operation.

> "Tools need to be as complex as necessary but accessible, transparent, and easy to use - need to prioritize what we really need out of these tools"

In terms of ease of use, tool developers should ensure that questions being asked are considered 'answerable', improve the ease of use, prioritize the most important information is asked, and the required inputs are not too cumbersome on the user. The user interface should be as clear, relevant, and intuitive to use as possible.

It was also mentioned that it would be useful to increase the level of education and training for the use of online and mobile tools. This could be a potential role for public funding to support workshops and other training tools (e.g. webinars) to promote increased uptake and adoption of high quality tools.

Include a mobile app version

Stakeholders noted that while many of the tools are available as online or downloadable software, mobile apps are generally seen as the most convenient. They emphasized that future development should focus on mobile tools to improve in-field accessibility through producers' smart phones or tablets.

Additionally, stakeholders also emphasized that it would be useful if funding was directed towards converting regulatory tools, that producers are mandated to use, from online software to mobile apps. For example, it would be useful if the Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) AgriSuite tools were available and incorporated through a mobile app suite, rather than available as online software only. It is expected that the current online system would need to be maintained for the convenience of some current users, however, the creation of a suite of mobile app versions of the AgriSuite tools would be a useful option for consideration as producers increasingly move towards mobile devices.

Include high quality baseline data

It was noted that current and high-quality baseline data should always be used in the development of tools in order to inform meaningful decision-making. Baseline data that measures current performance would increase the utility of assessment tools for producers as it would better measure improvements at the farm level following adoption of priority areas. Grower associations could also use baseline data to assess whether recommended BMPs are addressing priority areas effectively.

Include locally relevant data

Commodity, industry, and regulatory stakeholders emphasized the importance of site-specific data being incorporated into the tools as well. This could be achieved by incorporating mapping data available at smaller scales or geo-referencing site-specific data in order to account for the localized context. This data, particularly at the scale required for precision agriculture, is either unavailable or dated in many areas in Ontario. There is a perception that Ontario is lagging behind other countries, such as the United States Department of Agriculture or Environmental Protection Agency, who provide better access to public data at these scales. Stakeholders highlighted that better site-specific data could improve comparability with other producers in different regions, as well as provide the ability to incorporate different soil types and zones. By incorporating site-specific data at a local level, the overall context of a broader aggregated data set would be more accurate and meaningful. By including more locally relevant data, which stakeholders recognized requires the potential input of data by them, outputs can be benchmarked with those of regional counterparts to allow users to understand how they perform compared to others.

Produce high quality decision-support outputs

"It shouldn't take 10 days to figure out the next step, but 10 minutes or less"

Stakeholders called for tool outputs in a useable format that can instantly inform decision making in the field with actionable items and not just risk indicators as outputs. It is not enough to show that there is risk, or to give some form of environmental indicator, but agri-environmental practices could be optimized if producers were provided with decision-support outputs or the 'what now' of how to mitigate these identified

issues. Specific decision-support outputs could significantly increase decision-making efficiency and optimize producers' ability to address agri-environmental issues as opposed to the sole purpose of assessment. Future work could look to differentiate between assessment tools and tools that include decision-support outputs.

Incorporate financial information

Stakeholders emphasized the need for incorporation of financial feasibility and business management aspects of agri-environmental decision-making. Because an important caveat is that decisions rendered by the tool be cost effective to implement, it is also important that the tool include a cost-benefit analysis component. The Ontario Environmental Farm Plan[2] and Farmland Health Check-Up tools were criticized for not incorporating economic components. A tool could incorporate profitability whereby you can include your input costs as well as industry standards to resolve whether agri-environmental decisions are also financially viable and/or beneficial.

Although this was not in scope of this project, a number of examples of how this could be incorporated were suggested and have been included here for future consideration.

Examples to Incorporate Financial Feasibility into Tools

- To determine financial feasibility and return of investment of implementing BMPs.
- To enhance collaboration across producers (such as sharing of nutrients/organic amendments), so that the value of these nutrients could be better communicated to cash croppers, rather than a desire for livestock producers to just give nutrients to neighbouring producers.
- To help producers calculate if additional manure storage, to enable optimization of application time, would be cost-effective.
- To give landlords the tools they need (or renters the ability to communicate this to landlords) to assess the value of long-term investments related to soil health, including the implementation of cover crops and increasing soil organic matter.
- To determine the financial feasibility of newer technologies such as on-farm renewable energy and biofuel production.

[2]Every province has its own individual EFP, however, there is a national harmonization process in place.

5.0 IDENTIFIED GAPS

5.1 CENTRAL PORTAL

Agri-environmental assessment tools lack one simple access point. Key influencers emphasized the utility of a central 'portal' or menu-based 'catalogue' that could simplify access to tools. They also highlighted this as a limitation of this study, as it is likely that we have not captured all available tools because of the broad search required to find disparate tools in addition to the large number of tools associated with proprietary products.

"Tools are currently disorganized, difficult to find or inaccessible, repetitive, and lack integration"

5.2 INTEGRATED WHOLE FARM APPROACH

In addition to a central portal or catalogue, there is value in creating an overarching 'umbrella' platform that integrates existing tools to reduce duplication. This platform would help users prioritize the most important agri-environmental issues specific to their individual farm operations. Building on the previous discussion of incorporating financial feasibility, this integrated platform should provide an estimate of how impactful various mitigation strategies or BMPs would be while incorporating the cost of implementation. A whole-farm approach to reduce duplication and incorporate systems thinking is needed. Many farmers produce multiple commodities, and they would rather not have to input repetitive data on a commodity basis. A remedy would involve inputting data once and having the data consolidated and integrated into a whole-farm portal.

An overarching platform could draw on improved use of Application Programming Interfaces (APIs) to allow tools to better 'speak' to each other to reduce duplication. This would allow a user to enter basic farm or field data into the platform and, with the users' permission, allow the portal to feed this information into additional tools that require it.

Such an integrated tool would also provide an opportunity to highlight available cost-share programs available to producers. Stakeholders felt that this could also help to improve the efficiency and accessibility of these cost-share programs.

An overarching tool should ultimately:

- ✓ **Include agri-environmental and sustainability initiatives**
- ✓ **Include business management platforms**
- ✓ **Include available funding programs**
- ✓ **Inform decision making by indicating priority issues and risks**
- ✓ **Propose BMPs or mitigation strategies**

The private sector is already developing a number of tools based on this model of an over-arching tool. A number of key informants discussed proprietary initiatives that are integrating GPS, soil sampling, flow meters, manure sampling, soil and yield mapping.

OMAFRA's AgriSuite could be incorporated into this platform to integrate information, reduce repetition, and layer AgMaps and weather data. For example, the required inputs for NMAN and MDS tools are repetitive and time consuming.

Who would host such a platform?

A host external to government entities with national reach is ideal. Key influencers expressed concern for producers' lack of trust if a regulatory agency were to host the central tool. While a number of stakeholders suggested OFA could be an ideal arms-length host, others felt it should be developed with a group national in scope. Suggestions were made that Farm Credit Canada is generally trusted across the sector and could host such a national tool. Data security will still be an important factor to consider when looking for an appropriate host for this platform.

Data Quality

Accuracy of tool outputs is a key concern. Key influencers expressed confidence in the science or the models themselves, however noted issues with a lack of understanding, training, or ability to accurately measure data collected on the farm that are required for these models. Many models require the input of on-farm sampling or knowledge of field-specific characteristics such as slope. On-farm sampling is highlighted as potentially lacking rigor. To improve the accuracy of data inputs, stakeholders called for training or on-farm assistance to help producers more rigorously sample and measure farm or field characteristics required for these tools.

6.0 RECOMMENDATIONS AND CONCLUSION

Themes for next steps are evident as a result of this project. Further improvement of understanding of existing tools as well as tool development best practices will reduce duplication of efforts in the market for agri-environmental assessment tools. Increasing accessibility of tools already available will increase uptake of tools that reduce environmental impact. Finally, increasing integration between tools will increase efficiency, particularly for mandatory regulatory tools currently being used. Recommended next steps to be considered are summarized in detail below.

1. Improved development of decision-support tools	- Engage producers in tool development to optimize utility, increase uptake, ensure it is tailored to producers' needs, and accessible or easy to use on-farm - Develop tools to include decision-support outputs in addition to assessments indicators - Include cost-benefit analysis and aspects of financial feasibility to inform the viability of proposed next steps highlighted in these decision-support outputs
2. Tool assessment and validation	- Examine tools in greater depth to better assess utility and ease of use - Evaluate available tools with field tests to validate the accuracy of assessment and decision-support outputs - Develop a mechanism for producers to provide feedback on available tools (for example to indicate a tool's utility across geographies). This would also help to inform producers' choice between seemingly similar tools. - Explore a certification mechanism for future tool evaluation and validation
3. Improve understanding	- Engage producers directly with a survey and commodity specific workshops to better understand the specific tools they are using as well and their reasons for not adopting certain initiatives or using select tools - Examine key tools being used in jurisdictions outside Ontario to examine utility and potential for development/adaptation to be used in Ontario - Ensure that outputs include next steps for users to determine the 'what now' actions associated with outputs

4. Increase accessibility	- Convert mandatory regulatory tools from online software to mobile apps. I.e. Making AgriSuite tools available and incorporated through a mobile app suite, rather than only available as online software - Develop and pilot an integrated, whole-farm portal and/or catalogue of agri-environmental assessment tools
5. Increase integration of agri-environmental assessment tools	- Improve integration/layering of OMAFRA suite of tools to incorporate AgriSuite, AgMaps, and weather data - Integrate information regarding available cost-share programs into decision-support outputs - Examine how existing data can be better incorporated and how key players, including private partners, can be brought together to collaborate to optimize decision-making - Provide opportunities for producers, certified crop advisors, industry experts, and OMAFRA staff to network in order to improve awareness, training, and uptake of available tools as well as incorporate feedback to update tools

Stakeholders emphasized that industry is moving forward with tool development at a rapid rate. Public funding cannot compete with the private sector. Many non-government stakeholders suggested future public research could work to better understand OMAFRA's strengths so that they can improve uptake and optimization in specific areas and leave other areas to private sector development. These areas of focus for OMAFRA could include nutrient management and crop removal data (perceived as their strength) while integrating scouting, soil mapping, weather, and business management tools. A long-term goal may be to develop and pilot such an integrated overarching tool in Ontario with the potential for expansion nationally.

This project helps develop an understanding of (1) the variety of on-farm and watershed agri-environmental assessment tools available in regional, national, and international contexts; (2) an understanding of the need for a mechanism to assess the validity and efficacy of existing and future agri-environmental decision-support tools available to the farm community (3) the components of agri-environmental assessment tools that are beneficial for user experience and; (4) key recommendations for improving tool integration, accessibility, and reducing duplication.

APPENDIX A: SUMMARY OF JURISDICTIONAL SCAN

Search Terms:

Google search terms used to identify additional available agri-environmental assessment tools:

- Agri-environmental assessment tools
- Agri-environmental online assessment
- Agri-environmental assessment
- Agri-environment tool
- Agricultur* environment* assessment tool
- Agricultur* environment* online assessment
- Agricultur* environment* assessment
- Agricultur* environment* tool
- Agricultur* online assessment tool
- Agricultur* online assessment
- Agricultur* assessment
- Agricultur* tool

Much of these variants of the search term had overlapping results but we still used all to ensure we had not missed any tools. Attention was particularly paid to tools developed and/or used in Ontario and Canadian jurisdictions for the purposes of this scan.

JURISDICTIONAL SCAN OF AGRI-ENVIRONMENTAL DECISION-MAKING TOOLS

PROJECT PURPOSE

- Reducing environmental impacts remains a provincial priority
- Agri-environmental assessment tools help producers assess impacts and support decision-making
- Need to ensure decision support systems are relevant to Ontario agricultural systems and are progressive for farmers
- Input of progressive producers and key stakeholders can help to enable improvement and optimization of the tools and technology available
- This can help producers, processors and commodity groups respond to increasingly stringent environment and sustainability indicators alongside heightened consumer demands

A better understanding is required:

- What tools exist?
- How they are being used?
- How to meet the needs of the sector?
- How to maximize adoption and implementation of the tools?

OUR APPROACH

Initial scan of government websites → Broader scan using search terms → Search of mobile App stores → Developed a database and categorized tools.

Tools have been classified by the following criteria

- Tool name
- Abbreviation
- Jurisdiction
- (Regional, Provincial, National, International)
- Specific Jurisdiction
- Agri-environmental classification
- Type
- Access
- Intended use
- Targeted end user
- Developer
- Description of Tool

KEY FINDINGS

103 identified tools (regional, provincial, national, and international)

PRIMARY CHARACTERISTICS OF TOOLS

Category
nutrient management, pest management, disease management, weather forecasting, and soil health

Type
Online or Mobile App

Audience
Producers (mostly grain and oilseed)

Use
On-farm decision making

NEXT STEPS

Stakeholder Engagement

- Engage with key influencers from Ontario agriculture sector organizations to collect information on what type and format of assessment tool is useful to Ontario's agriculture sector.

Inform Future Development

- Increase the accessibility of available tools.
- Enhance users' experiences and uptake.
- Optimize interaction between tools, and differing management areas.

Project Lead: OFA Ontario Federation of Agriculture

Consulting services offered by: WILTON CONSULTING GROUP

This project is funded by the Ontario Ministry of Agriculture, Food and Rural Affairs

APPENDIX B: DISCUSSION GUIDE FOR KEY INFORMANT INTERVIEWS

EMB Decision Tools Engagement Strategy – Interview/Discussion Guide

Company/Organization	
Name / Title	
Contact	

Intro:

[provide a brief overview of the project and very high-level scan results]

Questions:

1. What agri-environmental practices initiatives or objectives is your organization undertaking? (ie. Precision Ag tools, cover crop strategy, 4R Nutrient Stewardship, etc.)
2. How is your organization measuring the performance of these initiatives or objectives?
3. Which agri-environmental assessment tools are you and your members generally using?
    a. How they are being used? For ex. regulatory compliance, private sector products, voluntary adoption to increase profitability, voluntary adoption of sustainability measures for public good, etc.?
4. Which tools do you find really work? (ie. *Public vs. proprietary tools?)*
5. Which tools do you find to be less relevant or less useful?
6. Given your experience with agri-environmental tools, what are the key components and details that are beneficial for a tool?
7. Have you been involved in the development of any tools?
8. Are any tools being used for the purposes of benchmarking performance of farm/ field actions?
9. Are tools employing a whole-farm approach of more or less value than those using a commodity-specific approach? Is there a role for both approaches?
10. Where do you go to find or access available tools?
11. Do you think it be helpful to have available tools housed in a central 'portal' or 'app store', and if so who do you think should host this?
12. What challenges do you or your members experiencing with existing tools? (ie. *overlap/repetition? Integration?)*
13. Any final comments or questions?

APPENDIX C: CASE STUDIES

1. CANADIAN FIELD PRINT INITIATIVE

http://fieldprint.ca/

The Canadian Field Print Initiative focuses on the development of market-driven, science and outcomes-based metrics and tools measuring the environmental performance of Canadian crop production.

Canadian Field Print Calculator

The Canadian Field Print Calculator is an excel-based farm-level measurement tool that allows growers to assess environmental performance based on primary indicators – land use efficiency, soil erosion risk, energy use, climate impact and soil carbon release – and compare performance against national and regional benchmarks. Growers input farm-level, field-level and individual crop data into an online-excel based tool that is relatively easy to use. Growers input basic information on farming practices, soils, and climate and a model is used to estimate individual crop's sustainability on five indicators.

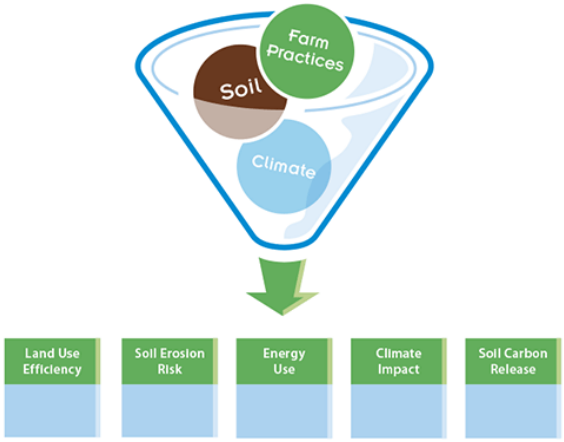

Figure 1 Canadian Field Print Calculator (Retrieved from http://fieldprint.ca/why-participate/what-is-it/)

Since 2012, the calculator has been piloted on 120,000 acres from 500 Western Canadian fields. It is now being used in several regional pilot projects across Canada.

Fertilizer Use Survey

Data on fertilizer management is vital to understanding how Canadian crop production is performing with regards to productivity, greenhouse gas emissions and water quality impacts. However, a national comprehensive data set on fertilizer management practices does not exist. The Canadian Field Print Initiative is surveying Canadian farmers on their fertilizer management practices to capture baseline information for grain, oilseed and pulse crops across the country. The survey seeks to gather information on farmers' adoption of 4R Nutrient Stewardship, quantify impact of current practices, and identify strategies to further improve fertilizer management practices.

National Sustainability Indicator Reports

The Canadian Field Print Initiative is also assessing the progress in sustainable agriculture with three decades of crop data drawing on information on yield improvements, reduced tillage, improved crop rotations and improved nutrient management. The reports outline the environmental sustainability of peas, lentils, spring wheat, winter wheat, durum wheat, canola, oats, flax and soybeans in Western Canada and corn, soybeans and winter wheat in Ontario.

2. CANADIAN ARCVIEW NUTRIENT AND WATER EVALUATION TOOL CANWETTM

http://www.grnland.com/index.php?action=display&cat=17

CANWET™ is a regional GIS-based software suite developed by Greenland Group of Companies designed to inform decision making around river basin and watershed management; water supply and wastewater treatment infrastructure; food security; and, climate change adaptation[3]. CANWET™ is an online tool that features an integrated open source GIS environment and is considered an 'all-in-one' software suite that does not require perquisite additional software.

CANWETTM (v 4.2) offers an extensive range of features and useful tools including:

- Daily time-step simulation engine for hydrology, hydraulics and water quality.
- Integrated and flexible charting and mapping of simulated output.
- Comprehensive Beneficial Management Practice (BMP) routines.
- Integrated hydraulic routing of in-stream water quality concentrations and flows.
- Integrated climate change scenario analysis tools (including climate data).
- Powerful web-based service for retrieval of useful datasets.
- Modules to handle loading estimates from septic system and livestock contributions.
- Link simulated output back to GIS for map creation.
- Routing of point source discharges.
- Resources to transform your CANWETTM GIS layers into Google Earth overlays.
- Detailed Users' Guide and Technical Manual.

The Generalized Watershed Loading Function (GWLF) simulates stream flow, sediment, nutrient (nitrogen and phosphorus) and pathogen loading from catchments given variable-size source areas based on land use categories. BMPs can be incorporated and the tool also estimates typical costs for this. The software also features charting tools and grid outputs to enhance data analysis and improve visualization.

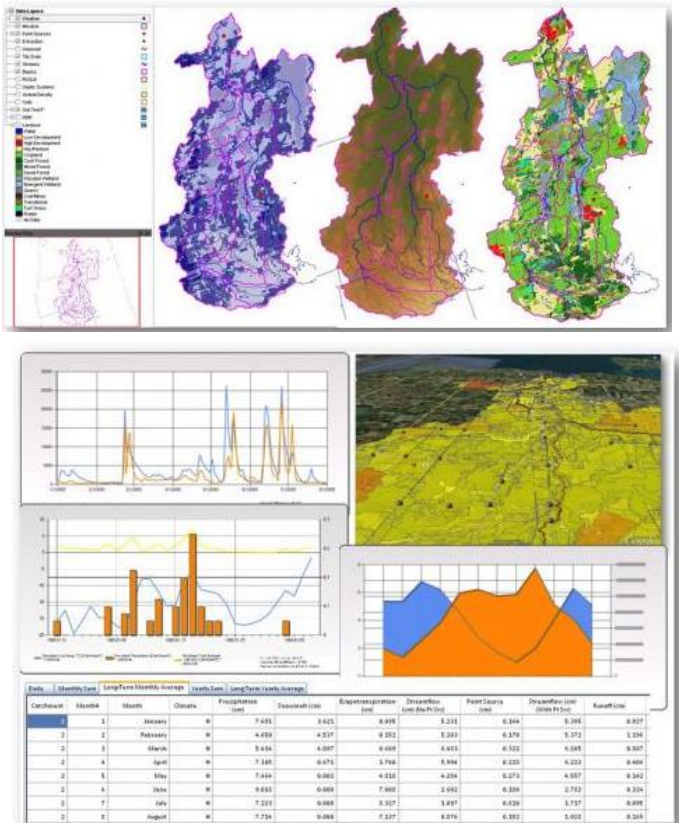

Figure 2 CANWET GIS processing (top) and data analysis (bottom) outputs.
(Retrieved from http://www.grnland.com/index.php?action=display&cat=17)

[3]http://www.grnland.com/index.php?action=display&cat=17

3. FARMLAND HEALTH CHECK UP

https://www.ontariosoilcrop.org/oscia-programs/glasi/farmland-health-check-up/

The Farmland Health Check Up is an on-farm decision making tool developed by OMAFRA in partnership with Ontario's Certified Crop Advisors. The tool is delivered to farmers through the Ontario Soil and Crop Improvement Association. Developed under the Great Lakes Agricultural Stewardship Initiative, this tool is an online worksheet (pdf based) that uses location, soil health, water quality and nutrient management, and pollinator health data to assess challenging areas on-farm and establish baseline and target farm health levels. This tool provides producers with the opportunity to work with Certified Crop Advisors free of charge.

Farm specifics, such as water erosion, wind erosion, tillage erosion, subsurface compaction, organic matter, soil life, soil chemistry, phosphorus and pollinator health, are used to identify best management practices that can be adopted with the aim of improving farm-health.

This tool highlights short BMP facts throughout the worksheet, such as the advantage of cover crops, costs of water and wind erosion and quick tips to reducing compaction. This tool also highlights the value of additional tools such as AgMaps for improving the accuracy of farm-level spatial data inputs.

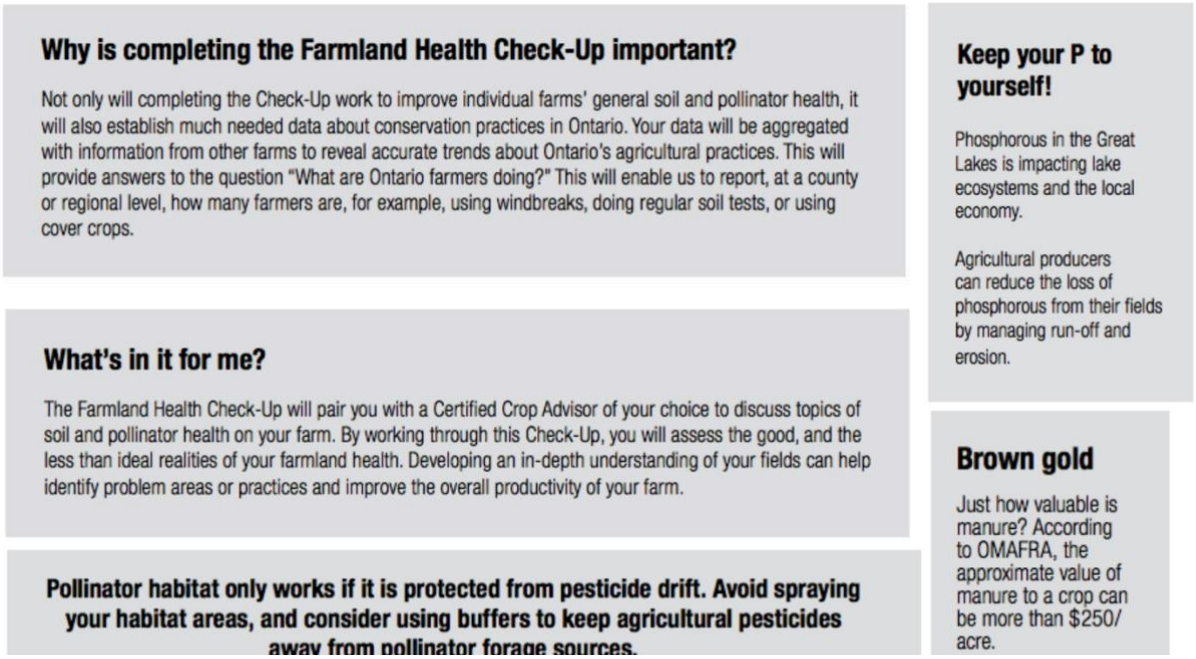

Figure 3 Examples of fact boxes from the Farm Health Check Up worksheet. (Retrieved from http://www.ontariosoilcrop.org/wp-content/uploads/2015/07/Farmland-Health-Check-Up-Workbook-Fillable-PDF.pdf)

4. AgMaps

http://www.omafra.gov.on.ca/english/landuse/gis/portal.htm

AgMaps, or the Agricultural Information Atlas, is an interactive online geographic information portal available through OMAFRA. AgMaps allows users to create custom maps of their farm, customize and label maps, create farm sketches for government programs, research soil information for their land, and identify the local ministry staff representative. More specifically, AgMaps is highlighted for creating maps for tile drainage records, nutrient management strategies and non-agricultural source material plans.

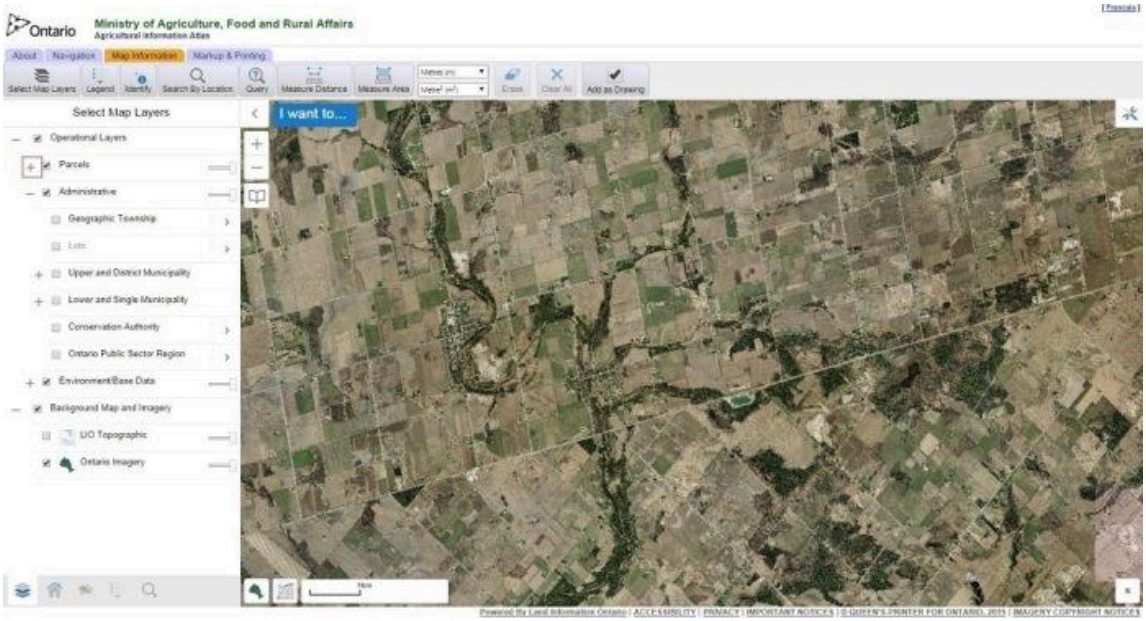

Figure 4 Example of OMAFRA's AgMaps online GIS tool. (Retrieved from http://www.omafra.gov.on.ca/english/landuse/gis/portal.htm)

5. Nutrient Management Planning Tool (NMAN)

http://www.omafra.gov.on.ca/english/nm/nman/nman3.htm

NMAN is an online decision-making tool that informs best management practices that indicate the best way to store, treat and use nutrient materials, such as manure, on-farm. NMAN is often used for regulatory purposes to ensure compliance with the Nutrient Management Act, 2002. This online tool is accessed through OMAFRA's AgriSuite, which includes a selection of available tools.

NMAN worksheets used to help manage on-farm nutrients include:

1. Field Management Plan Worksheet
2. Manure (MSTOR) worksheet
3. Non-agricultural source material (NASM) plan worksheet
4. Nutrient Management Strategy and Plan Worksheet
5. Greenhouse Nutrient Feedwater worksheet

APPENDIX D: ENVIRONMENTAL SCAN AND SUMMARY TABLES

For the full scan, please see the attached database in Excel format with filters and searchable functions. For any questions related to this file, please contact the Ontario Federation of Agriculture.

Agri-environmental_Tool

Table 1. *Identified tools categorized by agri-environmental classification*

Agri-environmental classification	Number of Tools*
Crop management	4
Livestock management	3
Greenhouse gas emissions	4
Nutrient management	36
Pest management	22
Disease management	17
Watershed management	12
Soil health	15
Pollinator health	1
Weather and climate monitoring	5
Weather forecasting	16
Water quality	5
Soil mapping	2
Whole-farm data management	4
Whole-farm environmental risk management	8

*Some tools contain multiple agri-environmental classifications and have been double counted in the above table.

Table 2 *Identified tools categorized by type.*

Delivery Mechanism	Number of tools*
App	27
Online software/	62
Hand held device	2
Spreadsheet	1
Tractor mounted tool	1
Workbook/ worksheet	5
Collaborative management plan development	1
Not identified	7

*Some tools can be used in multiple delivery formats and have therefore been double counted in the above table.

Table 3 *Identified tools categorized by intended use.*

Type of Tool	Number of tools*
On-farm decision making	92
Regional decision making	18

*Some tools are used for on-farm and regional decision making and have therefore been double counted in the above table.

Table 4 *Identified tools categorized by targeted end-user.*

Type of Tool	Number of tools*
Producers	**96**
Crop (total including unspecified crops)	**42**
Crop (fruit and vegetables)	7
Crop (corn)	2
Crop (soybean)	1
Crop (grain, general)	1
Greenhouse	1
Livestock (total including unspecified livestock)	**15**
Livestock (dairy)	4
Livestock (pork)	1
Livestock (beef and sheep)	1
Regional decision makers	**5**
Conservation authorities	**1**
Variety of users	**3**

*Some tools can be intended for multiple end-users and have been double counted in the above table.

APPENDIX E: SUMMARY INFOGRAPHIC OF STAKEHOLDER INTERVIEWS