GROWING SUSTAINABILITY

A REPORT ON THE APAS PRAIRIE AGRICULTURE CARBON SUMMIT

Saskatoon, Canada
July 13–14, 2017

APAS
Agricultural Producers Association of Saskatchewan

The APAS Prairie Agricultural Carbon Summit was made possible through collaboration with the Global Institute for Food Security.

Agricultural Producers Association of Saskatchewan

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Executive Summary: We have to tell our own story

Our world faces the dual challenges of addressing climate change and providing food security for a growing population. We need to reduce or offset greenhouse gas emissions while producing 70% more food by 2050 to meet growing demand. Agriculture plays a significant role in sequestering carbon on the landscape and has the potential to play an even greater role in providing the solution to carbon and greenhouse gas emissions. As both producers and stewards of the land, we have to tell our own story.

The APAS Prairie Agriculture Carbon Summit brought together agricultural producers, researchers, government policy makers and other members of society to explore and discuss the role that agricultural practices currently play in the greenhouse gas balance, and the exciting potential that new research and technologies can provide. This was the first conference of its kind to be held by an agricultural producer-run organization to provide researchers with a platform to both present their findings and comment directly on policy surrounding agriculture and emissions.

The two-day event featured 14 speakers and panelists with a wide range of involvement in Western Canadian agriculture. The presentations and panels were well received by the 175 attendees who represented a broad cross-section, from individual producers to representatives of various organizations and levels of government. Feedback from both speakers and summit participants has been positive with focus on the importance of ensuring that producer's perspectives are taken into account, giving weight to the proverb that "If you don't have a seat at the table, you're probably on the menu."

HOW WE GOT HERE

Global warming is a serious problem and one that we as a global community are striving to understand. Increasing temperatures are driving forward changes in climate at an accelerated rate that until now were not able to be perceived within as little as one human lifetime. The scientific consensus is that the recent warming is contributed to increasing greenhouse gas (GHG) concentrations in the lower atmosphere of which carbon dioxide (CO_2) concentrations alone have risen by 125ppm since the beginning of the industrial revolution.

In order to address the rise of GHG concentrations, Canada signed The Paris Agreement in April of 2016 with an emissions reduction target of **30% below levels produced in 2005**. The federal government aims to meet this pledge before 2030 by putting a minimum price on equivalent CO_2 emissions of **$10 per tonne in 2018, rising $10 per year to $50 per tonne by 2022**. Provinces have been given the option of implementing their own carbon pricing schemes by following either a carbon tax or cap and trade system that must meet the minimum requirements set out the federal government. The pricing schemes would then allow each province to decide how the money would be used and any exemptions that might be needed by particular sectors. For any province refusing to enact a carbon pricing scheme, a Federal Carbon Pricing Backstop will be imposed upon them that will be collected and returned to the province by the federal government.

THE SUMMIT

The Agricultural Producers Association of Saskatchewan strongly believes that policies to curb emissions must not present potential disincentives to producing food the world needs or place a greater burden on an industry like agriculture that is unable to pass additional costs down the value chain. As a representative of producers, we must also highlight to government decision-makers the research and ongoing efforts to reduce the sector's carbon footprint through emissions reductions and the sequestration taking place in agricultural soils.

The APAS Prairie Agriculture Carbon Summit was designed to provide researchers with a platform to discuss findings and policy recommendations with agricultural producers, government policy makers, and other members of society. As a companion to the summit, this conference summary has been prepared and circulated to highlight the discussions and key take home recommendations from the summit.

APAS would like to acknowledge the contributions of our presenters, and the participation and discussion of all participants.

ACKNOWLEDGEMENTS

The APAS Prairie Agriculture Carbon Summit would not have been possible without the generous support of our partners and sponsors. Our sincere thanks go to:

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Koch Fertilizer Canada ULC
Community Pasture Patrons Association of Saskatchewan

TAKEAWAYS FROM THE SUMMIT

Agriculture has great potential to solve the Greenhouse Gas problem. International researchers have calculated that if all the world's agricultural producers were able to increase the sequestration of carbon in soils by four parts per thousand, we can help halt the increase in atmospheric carbon. We would also help increase soil productivity. All it takes is some bold thinking. As one presenter pointed out, we removed a billon tonnes of carbon from prairie soils when we cultivated them, why don't we find a way to put that carbon back?

Food Comes First

The International Panel for Climate Change agrees that greenhouse gas emissions policies must not present potential disincentives to producing food the world needs.

Canadian Agriculture is Already Producing More While Emitting Less

Canadian agriculture from 1991 to 2012 has produced 25% more in crops while producing 15% less GHG emissions resulting in an improvement in emission intensity of over 30%. These improvements also extend to the livestock sector that have seen improvements in emissions intensities of 14% in broilers and culled layers, 24% in turkeys, 19% in pork, and 27% in beef.

A Greater Understanding of Agriculture is Needed By Policy Makers

Governments and policy makers need to understand that GHG emissions policies must not place a greater burden on an industry like agriculture that is unable to pass additional costs down the value chain. Likewise, environment ministries need to develop a better understanding of how agriculture operates and that business as usual does not apply to producers with the challenges and immense financial risks posed by each growing season.

Additionality is Not Applicable to Agricultural Practices

The additionality baseline for offsets fails to recognize the adoption of climate mitigating technologies and practices prior to 2005. Failing to recognize the work of early adopters of zero till technology could produce a perverse incentive to remove carbon from soil so future sequestration can be assigned an offset.

Protecting Agricultural Carbon Sinks is Paramount

The Paris Agreement recognizes the importance of the conservation and enhancement of sinks and reservoirs of greenhouse gases. Uncultivated grasslands in Western Canada currently hold between two to three billion tonnes of carbon to a depth of 1m and must be protected through incentives to keep them out of crop production despite strong market signals to producers.

Investing in Agriculture Benefits All Canadians

Investment in zero tillage research and development have provided a 60:1 benefit to cost ratio without taking into account the value of the ecological goods and services it has provided to society. The sequestration from zero till is just the beginning of what is possible from investing in agricultural science including recent advancements in root mass, plant yield, and photosynthesis research. Funding must also be allocated to projects working to help quantify sequestration in soils, like the upcoming Prairie Soil Carbon Balance Project 2, which will increase the measurability of verifiable offsets.

DAY 1: OVERVIEW AND ECONOMIC IMPACTS OF CARBON PRICING

Moderator:

Norm Hall,
RM# 277 Emerald Representative, APAS Vice President, and First Vice President of CFA

DAYS PROCEEDINGS IN BRIEF:

The first day of the APAS Prairie Agriculture Carbon Summit was intended to get participants up to speed on the issue of carbon pricing and make the technical talks of Day Two more accessible to those that have not been able to follow the subject in detail. The first goal of the summit was to provide a learning environment that recognizes climate change as a very real problem that will influence the future of agriculture worldwide. Drew Black of the Canadian Federation of Agriculture delivered a comprehensive overview on the current policy framework for carbon pricing and its application to agriculture across Canada and internationally.

The day concluded with a panel that explored the economics and possible impacts carbon pricing might have on the agricultural sector. Also included in the panel was a look at what types of emissions are covered by the International Panel for Climate Change and an examination of the economics behind zero tillage technology including evaluating the benefits it not only provides to producers but society as a whole.

OUTLINING THE ISSUE OF CARBON PRICING

PRESENTER

Drew Black,
Canadian Federation of Agriculture

Drew Black, Director of Environment and Science Policy, CFA

Emissions on the Global Landscape

In 2016, signatories of The Paris Agreement came to a consensus to limit the rise in global temperatures to **less than 2ºC above pre-industrial levels** while increasing the ability to adapt to the adverse impacts of climate change. Participants would also be expected to foster low greenhouse gas emissions and climate-resilient development but **in a manner that does not threaten food production**. Countries that have implemented a carbon price to date account for only 15% of global GHG emissions with larger polluters like China announcing their own pricing schemes coming into effect in late 2017.

Putting a Price on Carbon in Canada

The Canadian government announced its Pan Canadian Framework of Clean Growth and Climate Change in late 2016 of which carbon pricing was a key component. The framework is aimed at meeting Canada's pledge to reduce emissions levels to 30% of 2005 levels by 2030. The government plans to achieve this by introducing a minimum carbon price of $10 per tonne in 2018 that is set to rise $10 per year to $50 per tonne by 2022. This price on carbon represents a cost that is meant to be passed on from emitters to consumers to change purchasing decisions and ultimately influence consumer behaviors.

The Canadian Patchwork

Prior to the Pan Canadian Framework a number of provinces had already adopted their own carbon pricing schemes including a Cap and Trade system in Ontario and Quebec, a Carbon Tax in British Columbia, and a hybrid system of the two in Alberta. The federal government had in turn decided to let each province come up with their own pricing system as long as it meets at least minimum requirements. Those that do not create their own system will be subject to a Federal Carbon Pricing Backstop system. The result of this decision has been a patchwork of pricing systems across the country with varying prices and levels of coverage that will undoubtedly make it difficult for Canada-wide industries.

Agriculture is Part of the Solution to Climate Change

An important proposal outlined in The Paris Agreement is the 4 per 1000 initiative that outlines how a 4% increase of carbon in soils not only creates more fertile soils, but would offset all new carbon released into the atmosphere. The initiative would create a focus on management activities and technological solutions, many of which are already in place in Canada. The program would underline how crucial agricultural soils are for food security and providing a solution to climate change.

Challenges and Opportunities for Agriculture

Proposed policies in the Canadian climate change framework and pricing backstop present a number of challenges for agriculture. Among the most pressing challenges is to ensure recognition of early adopters of technologies and management practices to reduce emissions and sequester carbon prior to the proposed baseline of 2005. The other big challenge is whether or not the time and effort required to get an offset recognized is worth it for the producer considering the lengthy process and how much aggregators currently take. A number of opportunities are beginning to arise for producers as well with companies starting to integrate offsets into their service stream and reducing administrative burden on producers. This is further aided by allowing multiple offsets to be combined through one process and offsets to be available even across borders.

Canadian Agriculture is Producing More and Emitting Less

Research into emissions from Canadian agriculture have revealed that over time producers are supplying more food while generating fewer emissions. When comparing Canada's agriculture from 1991 to 2012, we produced 25% more in crops while producing 15% less GHG emissions resulting in an improvement in emission intensity of over 30%. These improvements also extend to the livestock sector that have seen improvements in emissions intensities of 14% in broilers and culled layers, 24% in turkeys, 19% in pork, and 27% in beef.

CFA Policy Recommendations

The Canadian Federation of Agriculture has a number of important recommendations to governments within their unique carbon pricing systems, starting with by viewing agriculture in terms of carbon intensity rather than absolute emissions. Environment ministries need to develop a better understanding of agriculture and accept that the concept of "business as usual" is different from other industries. Ministries must in turn develop climate policies that do not produce a disincentive for food production and should provide recognition for early adopters of technology and management practices prior to 2005. A number of other policy recommendations include exceptions for on farm fuel use including natural gas and propane in addition to offset systems designed to encourage adoption.

THE ECONOMICS OF CARBON PRICING

PANELISTS

Cecil Nagy, MSc
University of Saskatchewan

Tristan Skolrud, PhD
University of Saskatchewan

Richard Gray, PhD
University of Saskatchewan

Taking Account of Emissions

What Is Covered in Agricultural Emissions Accounting?

Under the International Panel for Climate Change accounting rules, agricultural emissions taken into account under carbon pricing schemes include CO_2 from the burning of fossil fuels, N_2O from fertilizers and manure, methane from manure and ruminants, and other associated minor GHG gases. This leaves aspects like CO_2 emitted from respiration and the breakdown of biomass out of the equation including CO_2 sequestered above-ground in plants. As a result, carbon sequestered by agriculture is only viewed as that held within soil organic carbon mainly as the root mass of plants.

An Interesting Thought Experiment

Also not included in Canadian emissions under IPCC accounting rules are those from coal and other fossil fuels that have been exported and used outside of Canada. Under this same logic, if carbon sequestered in above-ground plant mass were covered under the accounting system, then it would mean any plant mass grown and then exported to be consumed elsewhere would be considered a net sequestration for the exporting country. Since Canadian agriculture is an exporting sector it would also mean that the overall carbon footprint of the sector would be far smaller than under the current accounting system.

The Implications of Carbon Pricing

Fuel Exemptions and Direct Costs

The *Federal Carbon Pricing Backstop* and other pricing schemes have exempted gasoline and diesel used by farms for particular activities with most of those being in-field operations. For gasoline this would be a $0.02 per litre increase in 2018 to fuel costs that would climb to $0.12 per litre in 2022. Diesel would see a 3% increase in cost in 2018 climbing to 15% in 2022. Natural gas would also see a significant increase in cost by 14% in 2018 and escalating to a 70% increase in cost per gigajoule in 2022.

Indirect Costs to Producers

Even with agricultural fuel exemptions for particular activities, indirect costs will still leave producers feeling the significant impacts of carbon pricing. These indirect costs come in many forms including producer activities not covered by exemptions such as grain drying, which could see a 50% increase in costs between 2018 and 2022. Other costs indirectly affecting producers will come from sectors linked to agriculture that are able to pass on the additional costs through their value chain, something producers are unable to do. An increase in transportation costs could mean a 13% increase in trucking costs between 2018 and 2022 where on-rail transport would likely see an adjustment in the MRE through an increase in the Volume-Related Composite Price Index. Potentially the biggest cost increase to producers could come from the fertilizer industry, which is very energy intensive. We will need a better understanding of how international integration will impact potential cost increases.

Left to Right: Richard Gray, Tristan Skolrud, and Cecil Nagy from the Department of Agricultural and Resource Economics at the University of Saskatchewan.

Recommendations on the Path Forward

There exist a number of options to help agriculture remain competitive and reduce any disincentives to food production caused by increased costs. The best way to mitigate these problems is finding ways to help offset indirect costs and simultaneously reduce GHG emissions. Considerations might include a sector-wide refund or payments for the adoption of measurable best management practices. When coupled with the possibility of also accruing offsets for the producer, these strong incentives could result in an even greater shift within agriculture towards emission reductions and sequestration.

The Economics of Zero Tillage Technology

The Benefits of Zero Till on the Canadian Prairies

Extensive research has been conducted to estimate the benefits of both the development and adoption of direct seeding and minimum tillage between 1985-2010 in Western Canada. Producers have benefited in their on-farm operations by making fewer field passes resulting in reduced fuel and equipment use, lower labour costs, and increased land productivity. In turn, society is also benefitting from these changes in technology and management through reduced GHG emission reductions and the sequestration of carbon in agricultural soils. The value of the on-farm benefits during this time frame are estimated at $23.4 billion while the off-farm benefits to society are valued at over $1 billion at a carbon price of $5 per tonne.

Who captures the benefits from the R&D investments?

It is estimated that for every $1 that was invested in zero till technology research, over $60 was generated in returned value, creating a benefit to cost ratio of 60.8:1. Of this returned value, approximately 50% was captured directly by farmers through cost savings and productivity gains with the remaining benefit values going to society for reduced emissions and sequestration while the private sector captured the benefit of the hard technology from the R&D process. The value of these benefits highlights the importance of the soft technologies and extension activities where there is little incentive for the private sector to undertake expenditures that are not tied to a technology.

DAY 2: THE SCIENCE AND FUTURE POSSIBILITIES FOR SEQUESTRATION

Moderators:

Rick Jensen,
RM# 138 Webb Representative and APAS Board Member

Marion McBride,
RM# 121 Moosomin Representative and APAS Board Member

DAYS PROCEEDINGS IN BRIEF:

The second day of the APAS Prairie Agriculture Carbon Summit took a more technical look at the science behind sequestration in addition to the contributions of ecological goods and services to society from both cropland and rangeland. Participants were then able to take this knowledge of sequestration and apply it to the role of pulses and rotations in the carbon balance. The afternoon of Day Two featured a keynote presentation from Dr. Maurice Moloney, Executive Director and CEO of the Global Institute for Food Security. Dr. Moloney advanced the topic of discussion toward avenues of research that are on the cutting edge of increasing both sequestration potential and crop yields. The latter half of the day also included two panel discussions, the first focused on what industry groups in agriculture are doing to meet the challenge posed by climate adaptation and mitigation. The final panel of the day looked at innovations in agricultural research and technology with a focus on how investment in these breakthroughs benefit not only producers but all Canadians.

The Science of Sequestration on Agricultural Lands: Opportunities and Policy Considerations

PRESENTERS

Brian McConkey, PhD
Agriculture and Agri-Food Canada

John Bennett,
Saskatchewan Soil Conservation Association

Building Soil Organic Carbon

Measuring Carbon in Agricultural Soils

With an active system of offsets operating in Alberta and additional ones set to roll out in other jurisdictions, the need to measure and verify changes in the carbon content of soils is paramount. An increase in soil organic carbon (SOC) represents the sequestration of carbon by plants that have removed it from the atmosphere. This soil carbon is generally considered the single best indicator of soil quality and is a very stable form of carbon storage. Even more important than the amount of carbon in the soil is the change in SOC over time as new technologies and land management practices are adopted with sequestration in mind.

The Prairie Soil Carbon Balance Project (PSCB)

To determine how much carbon could be sequestered on agricultural lands, the project was initiated in 1996 with a benchmark network of 143 fields representing numerous combinations

Brian McConkey, Research Scientist at AAFC

of soil and landform types from across Saskatchewan. Additionally, 8 more sites were selected across the province with paired fields to allow for a side by side comparison in SOC while using zero tillage and conventional tillage systems with crop rotations. The study concluded that using zero till is allowing growers to sequester 8.75 million new tons of CO_2 every year on 23 million acres of farmland which equates to 0.38 tons of CO_2 per acre sequestered yearly.

Further research has been planned through the Prairie Soil Carbon Balance Project 2 that will continue to test changes in SOC on cropland and expand measurements to grasslands. The examination of grazing management on grasslands is complex and changes depending on annual situation. Little is also known modern grazing practices with intense grazing followed by recovery periods. Preliminary results have found increases of organic carbon of grasslands soils from 19 to 72kg of carbon per hectare per year when comparing grazing with non-grazed controls.

John Bennett, Former Director and Chair of SSCA

Sequestration and Policy

Carbon Sequestration Potential

The potential for carbon sequestration on the Prairies is estimated using a series of assumptions made in the Century Model. The model predicts that carbon sequestration in the soil under zero or minimum tillage would decline over time and that soil would reach a new sequestration equilibrium after a period of 20 to 30 years. New evidence from the Prairie Soil Carbon Balance Project has found that large changes in SOC are occurring below the top 20cm of soil, something that the Century Model does not take into account. This would significantly increase the amount of time for soil to reach a new sequestration equilibrium which also greatly increases the potential for future sequestration to occur.

The Glaring Problem with Additionality

The *Federal Carbon Pricing Backstop* has set a baseline for creditable changes in the farming practices of 2005. This means that any technology or management practice changes prior to the baseline will not be eligible to receive an offset including the great strides in zero tillage that revolutionized agriculture in the 1990's and early 2000's. This additionality requirement will not only penalize early adopters but it will make quantifying carbon gains before and after the baseline too complicated to discern. There is also the possibility that additionality could create

Recognition and Protection of Carbon Sinks

The Paris Agreement explicitly recognizes the importance of the conservation and enhancement of sinks and reservoirs for greenhouse gases. Included in these sinks are the soils of grasslands that are estimated to contain two to three billion tonnes of carbon to a depth of one metre. As commodity prices rise so does the incentive for owners of marginal soils and grasslands to convert these areas to grow crops, hence there is a recognized need for incentives to maintain these soil sinks.

RANGELAND ECOLOGICAL GOODS AND SERVICES

PRESENTER

Daniel Hewins, PhD
Rhode Island College & University of Alberta

Assessing Ecological Goods and Services

Rangelands provide numerous ecological goods and services including water purification, flood management, biodiversity, habitat, forage production, and carbon storage. To better evaluate these benefits, 114 grassland enclosures were sampled by Alberta Environment and Parks to assess plant biomass, plant diversity, and carbon storage. The effects of grazing were also taken into account by examining areas inside and outside of long-term cattle enclosures under a number of grazing management regimes.

Daniel Hewins, Faculty of Agricultural, Life & Environmental Science at the University of Alberta

Grasslands and Carbon Storage

Grasslands currently store between 10 to 30% of the world's organic carbon with temperate grasslands containing more than 295 Gigatonnes within their soils. These types of perennial rangelands have root to shoot ratios with as much as 7x the plant mass below ground versus what is visible above. Despite the importance of native grasslands as massive carbon sinks, there are no incentives for maintaining them with only 43% Alberta's original native grasslands remaining.

Carbon Loss and Land Use Change

Cultivation and land use conversion can lead to the rapid loss of 30-50% of soil carbon. This is mainly due to the fact that commercial crops and tame forages have less root mass and organic matter than native grassland. Studies have found that efforts to naturally re-vegetate mixed grass prairie failed to recover the loss in root mass soil carbon even after 50 years. This low resilience underlines maintaining the long-term carbon storage within grasslands and offering incentives to avoid land use conversion.

Grazing and Carbon

When compared to monoculture commercial crops, grasslands provide greater difficulty in measuring soil carbon and predicting changes from management types due to a larger variability in species, soil types, and precipitation regimes. Despite these complications, grazing has been found to increase soil carbon concentrations, particularly in the top 15 cm of soils. It is believed that grazing stimulates root production in addition to shoot biomass with the greatest results present in areas with favorable rainfall.

CROP ROTATIONS, PULSES, AND THE GREENHOUSE GAS BALANCE

PRESENTER

Richard Farrell, PhD
University of Saskatchewan

Maximizing Sequestration and Reducing Emissions

The overall goal of increasing sequestration by increasing crop productivity is largely in line with farm management goals to maximize efficiency. Producers are striving to achieve higher sequestration through adoption of low or no-till practices over summer fallow, growing crop rotations with high residue yields, and the efficient use of nutrient inputs and irrigation. The reduction of N_2O emissions is also an area of focus with the best option being more efficient use of nitrogen fertilizer. To reduce N emissions producers are being recommended to follow the 4R nitrogen management strategies that consist of choosing the right source, rate, timing, and placement of nitrogen fertilizer.

Comparing Pulses for N Fixation and Yield Increases

Researchers have made side by side comparisons between peas, lentils, chickpeas and faba beans for their ability to fix nitrogen as part of a rotation. Measurements were also made to determine yield increases and nitrogen uptake in wheat grown after the different pulse crops along with the contributions of above ground

Richard Farrell, Department of Agricultural and Resource Economics at the University of Saskatchewan

and below ground residues from the pulse crops to the nitrogen nutrition of the wheat. The study found that faba beans fixed the most nitrogen follow by lentils and chickpeas evenly and lastly by peas. However examinations of above ground residue yields revealed chickpeas had the most residue followed by lentils and peas evenly then faba beans.

During the wheat year of the rotation, inorganic nitrogen in the soil measured highest where the lentils and peas had been grown followed by the chickpeas and faba beans. This ultimately led to the highest wheat yields coming from the pea and lentil stubbles over the chickpea and faba bean stubbles with the increased yields

resulting in an overall decrease in the emissions intensity. This study was also able to conclude that below ground nitrogen had a greater contribution to the seeds and straw of the wheat than the above ground nitrogen.

Rotation Types and N_2O Emissions

Research was also undertaken to determine the effect of crop sequence and crop type on emissions over the course of a rotation. To determine this a number of rotations were tested using combinations of pulse, cereal, and oilseed. The study was able to conclude that including canola in the crop sequence increases emissions for the overall rotation on both a *per area* and a *yield-scaled* emissions basis where the inclusion of a pulse in the sequence benefited the overall rotation for emissions. The tendency for canola residue to emit significantly more N_2O in a rotation has been selected as a topic of ongoing research.

INDUSTRY RESPONSE TO CARBON

PANELISTS

Ben Voss, P.Eng
Morris Industries Ltd

Karen Haugen-Kozyra, MSc & P.Ag
Viresco Solutions Inc

Reducing Emissions and Adapting to Climate Change

In recent years, producers have experienced rapidly fluctuating conditions from one year to the next resulting in the need for equipment that can keep up with these dynamic situations. Keeping producer needs in mind, manufacturers have been working towards developing equipment that will not only be adaptable but will allow producers to reduce costs and emissions. These types of innovations have led to lighter equipment that uses less fuel to pull while being able to operate under even wet conditions without getting stuck. When coupled with the addition of GPS technology to reduce overlap and better fertilizer placement, on average, producers are able to reduce their input costs by 7 to 10%. The improved designs are in turn giving producers more options when dealing with unique situations such as being able to direct seed into a mat of unharvested crop where in the past it would have needed to be burnt, releasing carbon into the atmosphere.

Meeting Emission Reduction Goals Through Investing in R&D

Even if Canada is able to reach a reasonable mid-range case in GHG emission reductions, it will still fall 91 Megatonnes short of its Paris Agreement commitment by 2030. This underlines the need for investment into R&D focused on emissions reductions like that of the Clean Cow Compound Trials in Alberta. These trials have introduced a feed ingredient to cattle that has made a 30 to 60% reduction in enteric methane emissions with a 5 - 8% boost in animal performance. Additionally, research is also needed to quantify existing ecological goods and services to society. A study of wetlands and grasslands in particular has found that they remove a CO_2 equivalent of 7 million cars off the road every year and that failing to preserve them would result in the equivalent of using up to 90 billion barrels of oil.

What is Needed Going Forward?

In order to make reducing carbon cheaper and easier for Canadians, sustained investment instead of one-time funding is needED for adopting green technologies and management practices in addition to payments for successful increases to sinks and stored carbon. Investing in R&D is also paramount with the need for more measurable science with existing management practices as well as enhanced research to find new reduction and removal opportunities that could create new protocols. This need to build efficient verification systems could also increase the push for less invasive systems with satellites, drones, and robotics as viable options for measuring carbon reductions.

Left to Right: **Ben Voss from Morris Industries Ltd and Karen Haugen-Kozyra from Viresco Solution Inc.**

KEYNOTE PRESENTATION: INNOVATIONS IN BIOLOGICAL CARBON SEQUESTRATION

PRESENTER

Maurice Moloney, PhD
Global Institute For Food Security

A Planet Beyond 400ppm

Carbon dioxide is not a pollutant but rather is essential to life and necessary for terrestrial and oceanic photosynthesis which are major controllers of CO_2 levels. However, the earth could suffer from too much of a good thing and with CO_2 concentrations above 400ppm it poses a very substantial risk. Agriculture and forestry currently sequester massive amounts of carbon offsetting a substantial portion of fossil fuel emissions that could be enhanced through research to improve sequestration potential.

The CO_2 Fertilization Effect

The rise in atmospheric carbon has in turn provided more of the CO_2 needed for photosynthesis in plants resulting in an overall increase in process in plants. Studies have detected that the 14% increase in atmospheric CO_2 between 1982 and 2010 has led to a 5 to 10% increase in green foliage cover in warm, arid environments. Likewise, a 25% to 50% greening has been documented over the global vegetated area with less than 4% of the globe showing a browning effect.

Maurice Moloney, Executive Director and CEO of the Global Institute For Food Security

Global ecosystem models suggest that CO_2 fertilization effects explain 70% of the observed greening trends around the world.

Increasing Root Biomass and Carbon Sequestration

Research had estimated that as much as 22 million tonnes of atmospheric carbon dioxide is sequestered on cropland in Canada per year by using best management practices such as zero tillage. Additionally, improved grass production and grazing management is estimated to sequester over three million tonnes of CO_2 in Canadian grasslands. To further increase these

levels of sequestration, scientists are looking at ways to both increase root biomass and develop broader deep roots. These innovations would lead to improved drought and flooding resistance in addition to greater biomass yields, better soil structure, and increases steady-state carbon sequestration.

Improving Photosynthesis and Crop Productivity

Perhaps the greatest leap forward in recent agricultural science was been the proof of concept to effectively improve photosynthesis and crop productivity. The research was done using tobacco plants due to their ease for modification which has increased the efficiency of photosynthesis in these plant by up to 30%. Additionally, increased yields were reported in the experimental crop by 14 to 20% with plans for applying these same techniques to other agricultural crops.

CARBON AND PRAIRIE AGRICULTURE: A LOOK AHEAD

PANELISTS

Leon Kochian, PhD Global Institute for Food Security	Stuart Smyth, PhD University of Saskatchewan	Michael Raine, The Western Producer

The Root of Carbon Sequestration

Breeding Crops with Carbon Efficient and Climate Resilient Root Systems

Recent advances in root system imaging and phenotyping are opening doors for being able to selectively breed for larger and more efficient root systems with increased water and nutrient acquisition efficiency allowing for increased climate resiliency. Furthermore, breeding for larger root systems that have a positive effect on yields and shoot biomass will increase adoption of the varieties and facilitate increased carbon sequestration in root systems. If breeding can also create more efficient and effective root microbiomes then it will be feasible to enhance mineral nutrient availability to roots and minimize the release of CO_2 and N_2O gases.

Biotechnology: Farm Benefits & Climate Impacts

Farm Impacts of GM Canola

A 2006 farm survey had found a number of economic and environmental benefits to growing

genetically modified canola. An average direct benefit of $15/acre in saved herbicide costs was reported thanks to weed control the year following growing GM canola. The resulting cost – savings produced a cumulative benefit between producers of $350-400 million per year and 15 million fewer kilograms of chemical being applied to field for weed control. An increasing number of producers are also using minimum or zero tillage with canola grown on the Prairies giving rise to better soil moisture and reduced soil erosion. It is estimated that the use of minimum and zero-till by producers is sequestering over 470,000 tonnes of carbon annually.

Federal Funding & Agriculture

Will Producers Get Their Fair Share?

Every year the agricultural sector makes immense contributions to society through the food producers grow and the ecological goods and services they provide. Producers are able to make such a large impact despite only 1% of Canadians earning their living from agriculture. This underrepresentation of agricultural professionals can pose serious problems when trying to effect public opinion and attract research funding. The substantial federal funding on the line to find solution for climate mitigation and adaptation must take into account the vast opportunity presented by agriculture for sequestration through further research into improved technology and management practices. Recently, the Canadian federal government has earmarked agriculture as one of the key economic sectors for growth and has invested in research and transportation to urge producers to grow more product. This has resulted in producers being asked to grow more and to do so while emitting less. Agriculture has already made great strides in reducing emissions intensity and will need the support of federal funding to maintain the balance between economic and environmental demands.

Left to Right: Michael Raine, Managing Editor of The Western Producer; Stuart Smyth, Assistant Professor of Agriculture and Resource Economics at the University of Saskatchewan; Leon Kochian, Canada Excellence Research Chair and Associate Director and the Global Institute For Food Security.

About APAS

What is APAS?

The Agricultural Producers Association of Saskatchewan (APAS) was formed out of a resolution during the Saskatchewan Association of Rural Municipalities (SARM) convention in the Fall of 1999, as an organization that could provide sound farm policy on behalf of Saskatchewan producers. APAS was incorporated in July 2000 under the Non-Profit Corporations Act. In December 2000, the first APAS Board of Directors was elected.

APAS is Saskatchewan's general farm organization – formed to provide farmers and ranchers with a democratically elected, grassroots, non-partisan, producer-run organization based on rural municipal boundaries. As the united voice of thousands of agricultural producers in Saskatchewan, we strive to represent the views of a wide variety of agricultural stakeholders in order to form comprehensive policies that can benefit all sectors of society.

For more information about APAS and our policy work please visit our website at www.apas.ca.

What We Do For Our Members

- APAS, with the input of its members, is instrumental in the development of innovative farm policy to both address many of the issues currently affecting agriculture and with a vision for creating new opportunities for Saskatchewan producers.

Todd Lewis, APAS President and RM# 128 Lajord Representative

- APAS is connected to other provincial farm organizations across Canada and represents Saskatchewan producers at the Canadian Federation of Agriculture.
- APAS uses the strength of its membership to both access and lobby all levels of government on behalf of Saskatchewan producers.
- APAS is continually enhancing our Member Benefits Program to assist producers with their health, insurance, security, telecommunications and equipment needs.

Our Mission

The Agricultural Producers Association of Saskatchewan provides a respected, unified voice that positively influences agricultural and rural communities.

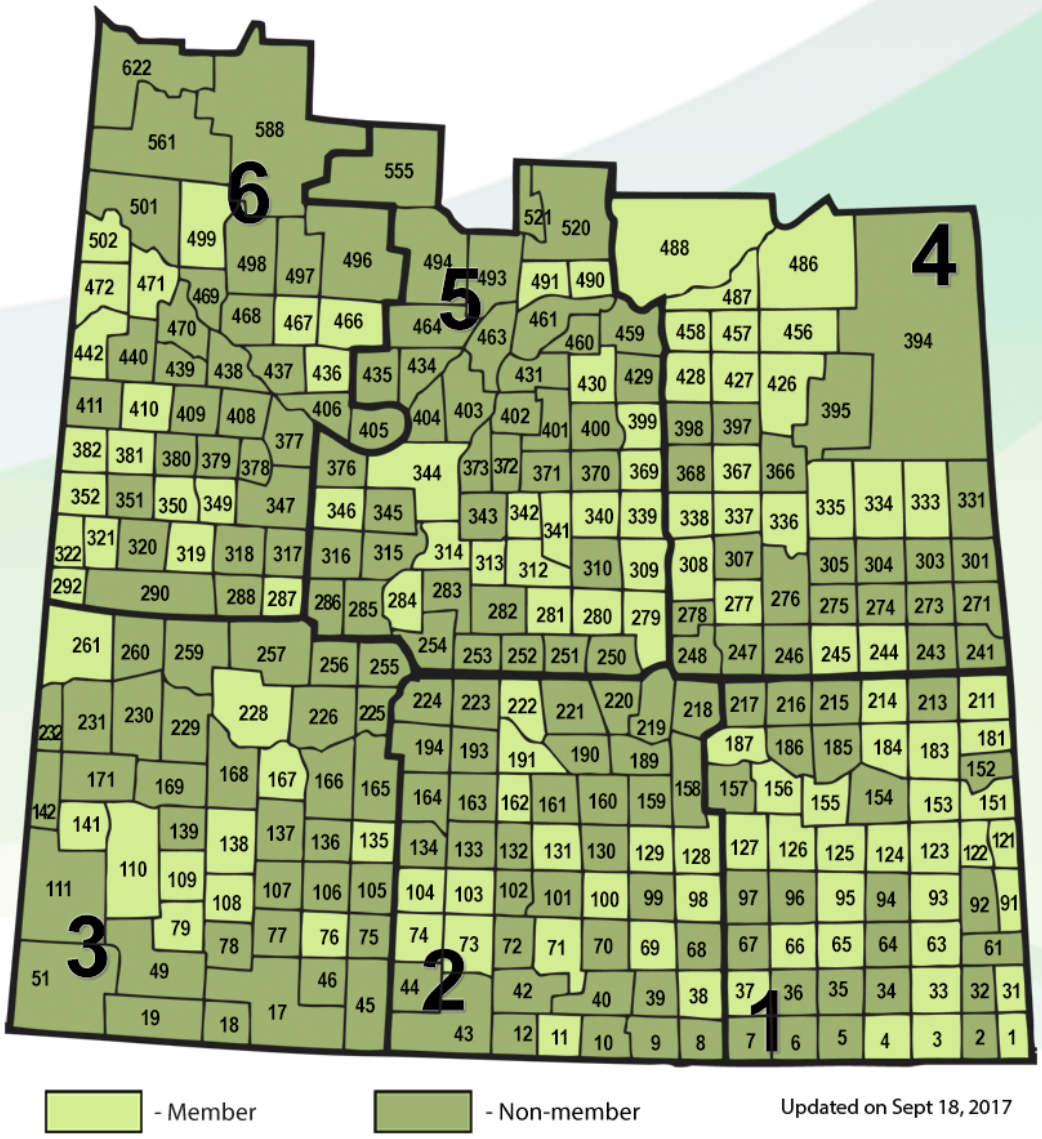
Our Vision

A respected, thriving agricultural sector.

Our Values

In carrying out the work of the organization and in all its relationships, APAS will:

- Demonstrate respect, honesty, integrity, openness and a spirit of collaboration.
- Conduct itself in a professional, inclusive and trustworthy manner that is respectful of diversity.
- Be responsive and accountable to the needs of those it serves.
- Maintain a non-partisan political position.
- Reflect democratic principles and practices in all of its activities.



APAS

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