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AGRICULTURAL SCHOLARSHIPS

A Global System for On Farm Innovation

Ken Coles

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Nuffield Canada Agricultural Scholarships

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3. Achieve personal development through travel and study; and
4. Deliver long-term benefits to Canadian farmers and growers, and to the whole industry.

Applications are due annually. Visit Nuffield.ca for more information.

Scholar Profile

M.Sc., B.Sc., P.Ag, Certified Crop Advisor (CCA), Certified Pesticide Applicator



I was attracted to agriculture innovation at a young age and educated myself for the job with a chemistry degree from University of Lethbridge and a Master of Science, Environment and Management from Royal Roads University. I then began a career by taking on greater responsibility with every new opportunity.

Through Monsanto Canada Inc., Lethbridge Research Centre, Alberta Pool Research and Development, and Agriculture and Agri-food Canada, I became an excellent research manager and organizational leader. I joined the Southern Applied Research Association and created Farming Smarter - Alberta's leading crop research institution.

For the past 17 years, I've led the regional, farm focused, non-profit called Farming Smarter. I brought my passion for the practical application of science in production agriculture and applied it to science and critical thinking, effective leadership, communication and dialogue, strategic relationships and having a little fun along the way.

I'm proud of the way Farming Smarter supports crop production in southern Alberta through its research and knowledge transfer. I also farm mixed grains with irrigation near Coaldale, AB with my young family on the ancestral farm.

Acknowledgments

I jumped into this experience on a whim, and I am exceedingly gratified and grateful for this truly enriching experience. I would like to thank Nuffield Canada for accepting my application and supporting me throughout. I am very pleased that Alberta Grains sponsored my scholarship. This is particularly special to me as I have been involved with the organization since its inception (as the Alberta Wheat Commission) and gave presentations at all its inaugural meetings across the province.

I would also like to thank everyone at Farming Smarter as I couldn't have done this without you. Thanks to the Board for allowing me to take the time to travel and for financial support. The investment will pay dividends for years to come. Thanks to the staff for picking up the slack and creating space for me to truly enjoy the time with no worries as everything was in good hands. A special thanks to Jamie Puchinger for her leadership and Claudette Lacombe for encouraging me to apply and editing my application and report.

The most impactful part of this experience and most cherished is getting to know so many wonderful people along the way. Nuffield is like joining a new global family. Thanks to all of you for your kindness, hospitality, and mind-bending conversations. I'd be remiss if I didn't highlight one hell of a trip to Zimbabwe.

Finally, thank you to my family. It's so difficult to be away but your love kept me going. I'm so happy we shared some of the experience and thoroughly enjoy it when Nuffield visitors come to see us.

Sponsorship

The following sponsors made my Nuffield Scholarship possible: Nuffield Canada Alumni, Alberta Grains and Farming Smarter



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Executive Summary

In Canada, governments continue to back away from field research and extension. In Alberta, the region I know best, the government retreated from directly supporting on-farm innovation, practice changes and adaptation to the social, economic, and marketplace environments of today.

Farming Smarter tries to fill that growing gap. However, it is increasingly difficult to overcome the challenges of running a farm-focused, non-profit without secure funding.

My goal was to seek out exceptional research and knowledge transfer agricultural organizations around the world that are clearly improving agricultural practices and outcomes in the regions they serve.

I wanted to study their operations, funding models, governance, quantifiable impacts, and client communications. Unfortunately, I found quickly that very few non-profit organizations are successfully doing this so I pivoted my efforts to look at how agricultural innovation systems are functioning and how Ag based non-profits can help fill the voids. As is often the case, I set off around the world looking for one thing and found something quite different.

In this study report, I will share my learning that led me to the following four revelations.

1. Current government and post-secondary agricultural research institutions, while doing good work, are challenged to effectively reach local farmers. Grassroots organizations are better at this. Wherever I travelled, farmers faced local challenges pertaining to on farm innovation. There seems to be a disconnect between innovative farms and the institutions meant to support them.
2. It appears that more innovation takes place on private farms than through government-run programs mostly because they are often too far removed from what's happening on farms. The farm voice supported by practical science is often lost in a noisy world with an abundance of misinformation.
3. Allowing agriculture policy to be too heavily influenced by social trends or other government mandates risks writing policy that farmers cannot adopt and remain viable businesses. Public perceptions regarding climate change and sustainability influence politics and policies in ways that are dramatically impacting the farm and society.
4. It's the people. Everywhere I travelled, people innovated not because of policy or scholarly research, but because of their intimate knowledge of the challenge interfering with production and profit. They found answers that work for them, where they are and within the system they practice. These innovators need sharing platforms, financial support, and a bridge to bring their ideas and innovations to a broader audience.

People are at the core of the solution, and it will require a conscious effort to tap into the innovative strengths of the new breed of farmer. We all need to maintain the courage to act, build relationships and sometimes fight for an industry we love. Throughout this report, pay close attention to the people who make the story.



Figure 1 2022 Nuffield Zimbabwe Agriculture Visit

Introduction

Agriculture extension was once a big thing. North America was largely built on agriculture as European settlers were attracted by free or cheap land while most didn't know how to farm in a new climate. Our governments built extensive innovation systems including the dominion experimental farms in Canada (Anderson, 2017) and the land grant university system in the United States (Croft, 2019). Throughout my study, I sought to better understand the history of agriculture innovation, the systems and institutions involved, the trends and mechanisms that connect with farmers and the people that make it all work. As Nuffield's roots bear a strong British influence, it was apparent that colonialism played a significant role in shaping global agriculture. However, each situation took its own divergent path. I visited Europe, Africa, and New Zealand, which all had stark differences compared to Canada. The key organizations that I visited included non-profits, government institutions, crown organizations, levy-based farm organizations, private companies, and universities (Table 1):

Name	Country	Type	Focus
Innovative Farmers	Scotland, UK	Non-profit	Farmer
Norwich Research Park	Norwich, UK	Government	Public
Teagasc	Carlow, Ireland	Government	Farmer / Public
Hometree	Ireland	Non-profit	Farmer / Environment
ISA University	Lille, France	University	Students
Arvalis	France	Non-profit checkoff	Farmer
Groupe Carre	France	Private retail	Farmer
Eco-Phyt	France	Association	Farmer
Plant and Food	New Zealand	Crown Research	Farmer / Public
FAR	New Zealand	Non-profit checkoff	Farmer
Vineland Research and Innovation Centre	Canada	Non-profit	Farmer / Industry
Alan Savory's ACHM	Zimbabwe	For-profit	Farmer
Agriculture Research Trust	Zimbabwe	Non-profit	Farmer

Table 1 Nuffield study subjects

While holding true to my experience in extension, my report attempts to translate my experiences and learnings through a series of stories that includes information about myself. Earning trust with readers is important and includes understanding my own biases developed through my history, education, and experience.

My Roots in Agriculture

My family's roots in Alberta and agriculture epitomize the opening of western Canada. My great grandparents immigrated from the Ukraine in the early 1900s looking for a better life.

My great-grandfather Guido worked in coal mines before working for the Canadian Pacific Railroad (CPR) and helped build the landmark high-level viaduct bridge so much a part of Lethbridge's identity.

The CPR received huge land grants from the federal government as partial payment for building the transcontinental railway. They were actively recruiting immigrants from Europe to both work for the CPR and to purchase farmland. My great-grandfather Guido purchased land and started farming north of Coaldale in the late 1920s.

These ancestors persevered through the Dirty 30s, the Dustbowl and the Second World War that drew my grandpa, Steve Slemko, away to serve. Grandpa returned, married, and bought land from his father. He raised his family of six, including my mother, during the 50s and 60s. He lived on the farm until 2014, aged 95, when my wife and I purchased it.

I fell in love with agriculture because of Grandpa Steve.

Our history and roots in agriculture fuel our passion to protect and do better with our land. Farm focused non-profits are at an impasse and need continual transformation to best serve farmers and the public.



Figure 2: Sam and Pearl Slemko with new tractor (left) and nice wheat crop circa 1935.

My father was a Royal Canadian Mounted Police (RCMP) officer that answered a call one night about a vehicle accident. He found a car in an irrigation canal on my grandparents' farm where my mother was hosting a party. Perhaps he was dazzled by her because he had to return the next day to retrieve his forgotten briefcase and the rest is history.

RCMP officers move often, so I spent my childhood moving from town to town. Grandpa's farm remained our home base and I loved spending summers working, exploring, and playing there. I moved to the farm when I began my studies in science at the University of Lethbridge.

My first jobs were on a crop farm, a feedlot and then a term with the Alberta Wheat Pool Research and Development where I found my calling that blended my love for science and agriculture. I completed my degree in chemistry with a strong background in agriculture and started my career with Monsanto Canada Research and Development, which I loved.

Part of my role was to connect with farmers, farm-groups, and government researchers to help them understand and solve the many challenges associated with the adoption of conservation and zero-tillage. Roundup herbicide played a large role in enabling the transition from tillage to direct seeding systems.

I found the public was interested to learn more about genetically modified crops and valued the benefits contrary to the fear portrayed in the media.

Monsanto began its shift away from an herbicide company to a seed technology company as the Roundup patents expired. With these changes, the research farm shut down and I moved to Agriculture and Agri-Food Canada (AAFC) to work as a technician in the cereal agronomy program. I also pursued a master's degree in Environment and Management with Royal Roads University in Victoria, British Columbia.



Figure 3: A direct seeding field into wheat stubble (photo by Morton Molyneaux)

I chose this path with the expectation that sustainable agriculture would endure and grow. The current global situation supports my vision! My thesis compared the sustainability of three cropping systems in semi-arid southern Alberta. I employed a farm model approach to evaluate the economics, nutrient balances, and energy balances of typical conventional, organic and zero tillage farms under the tutelage of Dr. Henry Janzen.

I enjoyed the work with the government but missed the direct relationship with farmers. I jumped at an opportunity to manage a non-profit, producer-focused organization called the Southern Applied Research Association (SARA). It came with a small capital grant and a solid opportunity to work with farmers to support on farm innovation.

Over 16 years, SARA evolved from one full-time employee at a small non-profit to the amalgamated Farming Smarter with 10 full-time staff and a complement of 25 in the growing season. Our budget grew from under \$100,000 per year to almost \$3 million and Farming Smarter acquired over \$2.5 million worth of top-end field research equipment. Our work involves hundreds of companies and thousands of research trials that help farmers and farm businesses with various challenges and opportunities including the adoption of zero tillage, continuous cropping with pulse crops and oilseeds, the use of integrated pest management (IPM) and the reduction of fallow. We helped develop the use of precision agriculture and on-farm research, irrigation management, and understanding of herbicide tolerant weeds. Farming Smarter helped the development of novel crops such as corn, hemp and camelina and the use of precision planters in small grain crops. We built a brand as a trusted agriculture innovation hub.

The culture of innovation we built, and channel is one of practical, unbiased information that helps people change the way they farm. We are generalists and try to bridge science and its practical application in a real and meaningful way. We lead and partner with experts across Canada on scientific small plot projects through our Agronomy Research program. We work with businesses interested in developing products, practices and technologies through our Commercial Innovation program and we scale, adapt, and verify at the farm level through our Field-Tested program.

The results must reach farmers to adopt and see value from research. This is the main goal of our Knowledge and Network program that focuses on information exchange through various traditional and novel extension tools.

All this history led me to my Nuffield adventure. Running a non-profit has its pros and cons and despite the tremendous growth in our organization, I feel we have reached an impasse. Today, secure operational and core funding is non-existent and, since we're not a check-off or levy supported organization, it's up to the staff to generate all the funding. The board is strong and diverse but, like many non-profits, unable to volunteer too much time. Board governance is also at an impasse. Despite the efforts of many well-paid governance coaches and consultants, governance models need reinvention to meet the needs of a changing world.

According to An Overview of the Canadian Agricultural Innovation System report from the Agri-Food Innovation Council, "Key funders of agricultural research appear to either under-invest or decrease their investments in agriculture R&D." Private industry-led research will only invest where clear profits can be captured. Public good research that addresses environmental and agronomic practices such as reduced tillage, introduction of pulse crops and care for marginal lands are often not well funded despite their tremendous impact. With increased competition for scarce funding, collaboration becomes more difficult as each organization struggles to meet its operational needs. This is particularly challenging for smaller non-profits competing with preferred post-secondaries. In my experience, a big picture leadership void grows, and in Alberta as government divests capacity, they lose touch with farmers. My aspiration with the Nuffield experience was to get a better feel for what's happening in other parts of the world and possibly bring new ideas and energy to a weary fight that can be thankless and discouraging. This experience reignited my passion to support this industry I fell in love with thanks to my farming ancestors.

The Culture of Agriculture Innovation

I am intrigued with the concept, processes, and culture of innovation. It's not just a flashy and trendy word, it's a core value to build a culture. The meaning of innovation can be ambiguous, and most equate it to something new.

Wikipedia says, "Innovation is the practical implementation of ideas that result in the introduction of new goods or services or improvement in offering goods or services." I like that it points to the implementation of ideas that produce something new. I'd take it even one step further and say that it should add value. And I'd probably also qualify that it doesn't have to be something new. I

think we get so obsessed with something new that we forget that an old idea applied in the right way might be incredibly valuable. So that's why I like the premise of implementing something new or old in a way that adds value as a simple yet profound concept. Successful innovation requires a certain level of creativity, ingenuity and understanding of the system. We tend to think about groundbreaking or transformative technological innovation, but I think

innovation can live on a broad range of activities and subjects if it adds value. Sometimes, the most elegant solutions, like crop rotations, the electric fence or stripper headers are simple and widely adoptable. I feel innovation must first start with people. There must be a desire and commitment to change. That doesn't mean that we must change everything,

A farmer centric innovation system is crucial for continued growth and success. The Canadian agriculture system is politically driven, under supported and no longer farmer centric. We need to reinvest in a working system that enables all stakeholders while providing oversight, leadership, and vision for Canadian agriculture.



Figure 4: Crop rotation is a simple, yet valuable innovation as seen in the foothills of the Rocky Mountains in southern Alberta (photo by Morton Molyneaux)

especially when the approach or item is often a result of years of learning and experience. But we must be willing to look at, evaluate and test new ideas and approaches. And we can't be afraid to fail. This is where it starts to become a culture, a culture of innovation.

Farming Smarter is an organization wanting not only a culture of innovation within but to help build a culture of innovation for farmers, agronomists, businesses, and government. We chose to define our own brand around the concept of innovation as an organization.

Farming Smarter's Foundational Values

"Innovation drives us, not profit. This makes us a trusted source for regional adaptation of profitable and resilient crops, cropping systems and agronomic practices. Farming Smarter instills a culture of innovation and takes a bottom-up approach that is gritty, practical, and achievable. As a flexible and responsive organization, we take chances, break the rules, and encourage failure so we can learn. We excel at innovation, development, and adoption. This is crucial to keep farmers competitive and viable in a complex and dynamic environment.

Innovators can rest easy knowing we scan the world for new and old ideas that may apply locally. When they turn to us, they are confident our information is grounded and relevant. We love agriculture and offer our community informative, safe, and enjoyable experiences. They feel part of a diverse community who enjoy learning, networking, and bouncing ideas off each other.

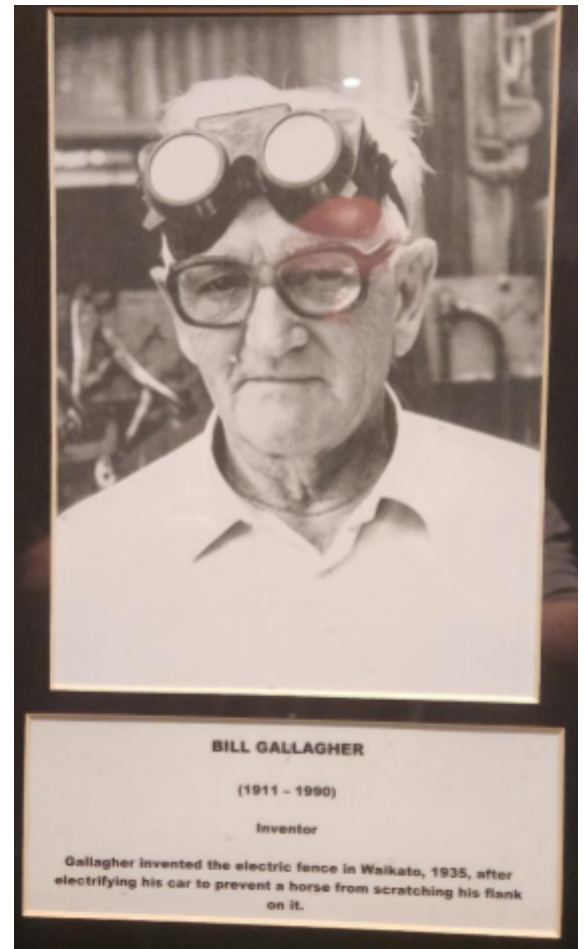


Figure 5 Inventor of the electric fence - A farmer from Waikato, New Zealand. The innovation was realized around the world to manage livestock.

Innovation is hard and about long-term results. We invite anyone interested in agriculture innovation to work with us and together we can change the way people farm.”

To build culture, we end with an invitation to work with us. This invitation aims to build a community effort that will pull the entire industry forward.

As Canadians, we take pride in being innovative and proclaim to be global leaders in agriculture. I hope this means more than simply having vast amounts of land for farming. Canadian farmers are creative, responsible stewards, employing the best practices and technologies producing the highest quality products. I think in many ways we can still claim this, but I fear our approach to innovation and investment into research and development is dwindling to a point where we may not be able to stake this claim forever. While farmers and industry chug ahead, I fear our public policy and research shift away from production and toward issues of climate change and perceived new opportunities such as big data, genomics, and artificial intelligence. From what I have observed, there is a growing disconnect between science and those in the field. This is not just in Canada but wherever I travelled and creates a dangerous and wasteful gap. On the one hand, funders get frustrated with the lack of science and innovation adoption and, on the other, farmers that can adopt are not part of the process and do not know an innovation exists. In my view, this is not true innovation, and we need strategies to build a functioning system.

As a student of science, I appreciate the scientific method. It is designed to manage bias while testing hypotheses. Science is also deliberately slow and can fall short in dealing with the tremendous variation, uncertainty, and chaos when working in a biological system. Applied research is described as research that attempts to solve real problems. In agriculture this means ensuring that we produce enough data to account for variations across time and space before we state anything with a certain level of confidence. Adaptive research tends to be more iterative and lends itself better to implementation of new ideas ensuring true innovation. This is where the idea of an innovation system is very powerful. It attempts to look at all the aspects needed for successful innovation rather than look at an idea

Regional Farm focused not for profit organizations will need to play a bigger role to meet local innovation opportunities.

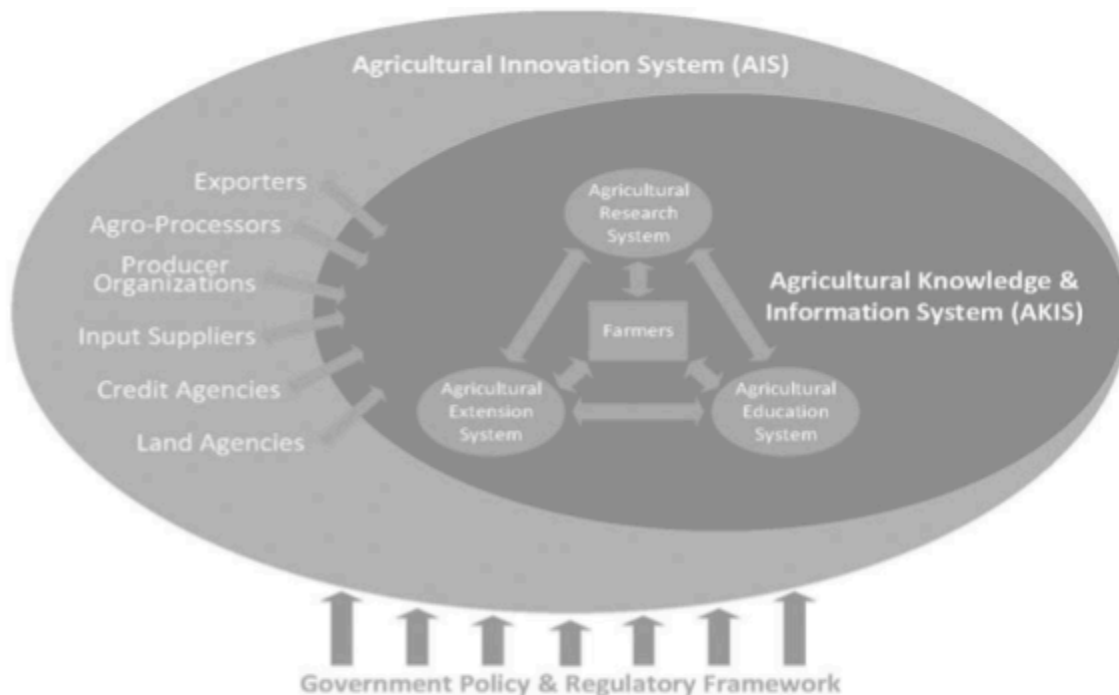


Figure 6 An innovation system (AIS) as depicted from: Triumph, Rajalahti (2013)

or invention in isolation. Figure 6 is a good example of an innovation system that displays most of the major components.

This system places farmers at the centre. In Canada, our agriculture extension system is all but decimated and our education system is small and fragmented. Even at the farm level, extension tends to be commodity specific and struggles to represent the whole farm. Government policy and regulatory framework support the entire system and are relatively strong in Canada but threatened by restrictive policies such as nitrogen fertilizer limits. Government leadership needs strengthening as potential overseers of the system. The role of non-profits, especially non-levy-based organizations, remains relatively undefined in this model. It seems clear that in Canada, and in many other countries, philanthropic organizations with mandates in sustainability, soil health and climate change will continue to play a bigger role by funding sustainability initiatives such as the Weston Foundation and RBC Tech for Nature..



Figure 7 A group of French farmers meet in the loft of an old barn before a field tour (photo by Ken Coles)

We need new approaches. Our organization essentially operates as a living lab. Agriculture and Agri-Food Canada is deploying several mission-based (Larrue, 2021) living labs (Beaudoin et. al., 2022) across the country targeting practices that sequester carbon and reduce greenhouse gases. While I'm keenly watching the progress, I'm concerned that it will fail mainly because it's primarily focused on carbon and greenhouse gas emissions and not necessarily on the needs of the farmer. I'm a big proponent of the concept but like many great ideas and plans, implementation and buy-in will be critical for success.

I believe that innovation is a system that begins with passionate, creative, and fearless people with courage, determination and persistence with a need or a vision. This is the **culture**. Next, a **process** must be efficiently implemented that includes building a knowledge network, exploring, designing, and testing ideas with feedback and iterative **adaptation**. Evaluating, tweaking, or even starting over all while considering risk, costs, and revenue. Success comes with relentless effort and value accrues through **adoption**. Innovation is about culture, process, adaptation, and adoption.

The challenges

1. Disregard for on-farm realities in agricultural policy development

Agriculture policy can dramatically influence the way people farm, which impacts economic, environment and food security (Byerlee, 2009; Dethier, 2012; Norton, 2004). Policy development drivers often are not aligned with the diverse logistical challenges and risky nature of running a farm business (Huber et. al. 2014). As climate change policy continues to surge, farmers are increasingly weary, yet interested in adapting practices to ensure agriculture is part of the solution. My travels exposed me to a new and interesting world of agriculture policy that is increasingly surpassing the weather as the greatest risk in farm management strategies. (Findlater et al, 2019).

The French (lack of) Connection

The French Connection is a film from 1971 starring Gene Hackman that won five academy awards. It has nothing to do with this section other than popularizing the term so I could use it in the title. Maybe I'll watch it someday if it shows up on Netflix. It does, however, help highlight something I saw in France and quite frankly everywhere I went, including at home. It is a growing lack of connection between innovative farmers and efforts put into scientific research.

France is a fabulous place to visit and was a great opportunity to polish up on my grade school immersion French. I was able to visit past exchange students that worked at Farming Smarter. France's post-secondary agriculture programs require international internships to help broaden students' experience and foreign languages. I'm a huge supporter of this concept and visited ISA (www.junia.com), an agriculture engineering university in Lille. I couldn't help but wonder why only students do this and the potential value of professional work exchanges as well.

On the research front, France has various government and producer focused organizations. INRAE (www.inrae.fr) is the national agriculture research institute that includes 19 research centres with a budget of 877.6 million EUR per year. It covers a wide range of topics and extension practices including knowledge transfer and training. One of the centres in the north of France is situated within an innovation park as seen in various parts of the world.



Figure 9 A French farmer discusses a plant disease at Arvalis research plots. (photo by Ken Coles)

Within this park, I spent some time visiting Arvalis (www.arvalis.fr), a farmer-led applied research institute that focuses on crop production. It attempts to work directly with farmers and includes 400 farmer members, 450 employees over 27 research sites with an annual budget of 55 million EUR. It is focused on crop development in cereals including corn, sorghum, potatoes, forage, flax, and tobacco. Farmers and contributing member associations created and funded it. Its sister organization, Terres Inovia (www.terresinovia.fr) is another producer association that focuses on pulse crops, oil seeds, sunflowers, and hemp also with a budget of close to 55 million



Figure 8 A visit to a French agriculture University where foreign experiences are mandatory (photo by Ken Coles)

EUR per year. Overall, an impressive effort and surprisingly after visiting dozens of local farmers, none of them had any involvement or knowledge of these organizations' activities. In some instances, the farms were only miles away from a rather large research facility. This is hugely concerning to me as Europe seems to be investing much more into agriculture research compared to Canada, but it appears that it still isn't reaching the farms. As we look to improve our innovation system, it's glaringly obvious that we need to invest in strategies that increase our relationship with farmers and find better ways to capture and grow on farm innovation.

From Feudal to Freedom - UK & Ireland

Agriculture in the UK is highly influenced by its history, wealth, and environmental altruism. We should be careful not to let history shape future policy to a degree that it makes us choose or influence unwisely.

Visiting England and Ireland while focused on agriculture helped me better understand the history that shaped what we see today in how the land is farmed and supported.

My heart is in the field but it's also important for those in the field to appreciate and support the great minds in real laboratories. I experienced a superb example of truly world class proportions at the Norwich Research Park at the University of East Anglia in England. Its lofty goals are apparent in its vision to "change lives and to rethink society so that our world is a better place for those who come after us." . This multidisciplinary, multi-plex and perplexing facility is home to the John Innes Centre, Quadram Institute, Norfolk and Norwich University Hospital, John Innes Foundation, Norwich Institute, The Sainsbury Laboratory, The Earlham Institute, the University of East Anglia, Biotechnology and Biological Sciences Research Council and the Tyndall Centre for Climate Change Research - all in one fun park. This amazing innovation park employs 12,000 people including 3,000 scientists and clinicians. It also has 17,000 students and 115 companies aimed at commercializing the findings of all the great work.

A little overwhelming to say the least, but a fascinating example of commitment to agriculture, the environment, and its connection to health. The first John Innes Centre Director coined the term 'Genetics' and it has a 100-year history of fundamental research. Each organization focused on different areas of research including plant health, microbes, biotechnology, engineering, plant pathology, meteorology, big data and more. There was also a clear effort to attract and train invaluable human capital as well as an eye to supporting business development. There is clearly a lot of pride in agriculture in the UK including a long history strongly influenced by historic wealth and power.

I found that the one health approach, attempting to connect human health to food and agriculture, was much more prevalent and focused when compared to agriculture research centres in Canada. There are growing attempts to work with developing businesses and Public-Private-Producer Partnerships (P4), but they are largely missing the mark and much more effort, consideration and collaboration is required in this area.



Figure 10 Thomas Edward Coke, The Earl of Leicester discusses the history of the bowler hat being used as a measure of a good wheat crop. If you threw it up in the air and it landed on top of the canopy it was a bountiful crop

Further study of Norwich Research Park is warranted. Despite obvious success in integrating tremendous research and educational efforts, it was difficult to see a meaningful focus or connection with farms and farmers. The one health approach attempts to bridge agriculture with human and environmental health. This noble and intriguing approach is worth pursuing but would benefit by considering the realities and pressures associated with running a farm business. However, English farms operate quite differently from those in Canada.

Out in the fields, there are still many large estates complete with castles owned by lords and earls reminiscent of feudal times. These estate farms are diverse and managed carefully to meet the goals set by the heads of the estates. There was usually an altruistic environmental tone to the aspirations of these ventures through their presentations and goals. A large and famous estate at Holkham Hall in Norfolk (www.holkham.ca.uk) manages a diverse farming venture with the tagline “Where farming and conservation go hand in hand.”



Figure 11 Holkham Hall, Norfolk, England (photo by Ken Coles)

2. Influence of social trends on agricultural policy

In a world with instant access to millions of people around the world, social trends surge through media platforms at the speed of consumption. People can share opinions, facts, and misinformation with the click of a button. It cascades by reposting, repurposing along with the targeted use of artificial intelligence, and bots. This free and ever flowing torrent of information can have a tremendous impact on the public's opinion of agriculture and significantly influences agriculture policy (Baker, Irani, 2014). The public and special interest groups pressure elected policy makers while science is often muted or challenged. A voice for Farmers is more faint than ever (Stockdale, J.D., 2019) . There are distinct differences around the world creating drastically different policy environments for agriculture (Primdahl, Swaffield, 2010).

Agriculture in Zimbabwe, Africa

Zimbabwe! Has a nice ring to it, right? I've liked saying this country's name since I learned about Africa in grade school. For years, I used to say it for no reason at all. I'd hold the "Zimmmmm" for a bit and let out the "babwe" quickly, raising the tone on the "we". I'm still shocked that I actually got to go there and experience something so different and amazing. Then, the very first person I met at our Contemporary Scholars Conference in England was a crocodile farmer from, you guessed it, Zimbabwe! How cool is that!

Zimbabwe was once known as the breadbasket or jewel of Africa. Desertification, mis-guided policies, and political strife crashed the economy and decimated agriculture production. Nevertheless, the potential for recovery and even regeneration is tremendous. Canadian assistance would be hugely impactful especially toward soil conservation, irrigation management, and mechanization.



Figure 12 Making new friends in Alice Springs, Zimbabwe (photo by Ken Coles)



Figure 13 Learning about mob grazing at Alan Savory's Africa Center for Holistic Management, Zimbabwe. (photo by Ken Coles)

The first two days were spent at Alan Savory's Africa Centre for Holistic Management. As a naïve crop farmer, I didn't even know who Alan Savory was and here I was enjoying some barbecued kudu, a species of antelope, around a campfire with him and his wife. People credit this agrarian celebrity for developing holistic grazing management to help reverse desertification in Africa. Alan's 2013 TED Talk titled '*How to fight desertification and reverse climate change*' has close to 9 million views and skyrocketed his popularity. He has a strong following and various adaptations of his methods exist all over the world. However, right under the video, there is a disclaimer that statements in his talk have been challenged by scientists. As we went through a two-day seminar taught by a barefooted Savory disciple named Etienne, my critical thinking muscle worked overtime. There was an obvious anti-science tone that I've heard all too often within the regenerative agriculture movement. While there is certainly some logic to certain processes and claims, there was little to no empirical evidence presented but rather great visual stories. We were asked to compare a recharge area to a 'poorly' managed national park many miles away. The main theory we saw demonstrated was periodic mob cattle grazing. This is an attempt to mimic the natural herds of grazing animals that were often bunched up by predators. We watched several African shepherds wearing coveralls move the cattle on foot from grazing all day into the nightly shelter. They used dogs to help warn them of predators such as lions and leopards while sleeping in tents. When the dogs started barking the men would use flashlights to spot the predators eyes and only had their loud voices as weapons to scare them away. This rather terrifying job came with a monthly salary of thirty American dollars.

Farm labour is plentiful in Zimbabwe, which has a major impact on farming practices. Alan's claim is that along with a good grazing plan this trampling of residue, urine and manure would increase regrowth while sequestering carbon. An advocate for the idea that more intensive periodic grazing on half the grasslands in the world would bring atmospheric carbon down to pre-industrialized times. A great story filled with hope but one that might seem too good to be true. As with anything, it was clear that the story itself and the training services are products in addition to the beef. The regenerative agricultural enthusiasts in the group were surprisingly quiet after experiencing their idol up front and in detail.

I'll have to admit that I've never really been a fad follower and am skeptical by nature. I believe in the Sagan standard, the aphorism that "extraordinary claims require extraordinary evidence." Savory's simple approach with an extraordinary claim appealed to the public and to ranchers interested in low input grazing methods. Regenerative agriculture is often used synonymously with Savory's "holistic" management, a term that has gained popularity globally despite not having a clear definition. As with extraordinary claims, regenerative agriculture must prove itself both practically and scientifically. This is not to say that we shouldn't continue to try new approaches, to innovate or be afraid to fail. We should be cautious and think critically, especially of ourselves when promoting practices to others. Decisions don't need to be made purely on instinct. As Ford CEO Alan Mulally so aptly exclaimed, "the data will set you free."

The Savory's were amazing hosts and our group bonded tremendously and started to learn the enthralling stories of Zimbabwe's history and people.

After a walk along Victoria falls and a sunset cruise on the mystic Zambezi, we all experienced the true beauty and magic of Africa. It is an extraordinary place, and our euphoric feelings were weighted with deep empathy as we learned of the hardship, strife and pain the residents experienced.

Carrots or Sticks, Schemes and Dreams

Farmers are known to put their heads down and get the job done. This salt of the earth persona is an admirable and learned behaviour. They are attuned to the fact that they can only control certain things and stay focused on the job at hand. Despite a perfect effort, things don't always go well. Usually it's the weather: drought, flood, fire, frost, hail, wind and sometimes it's varmints, weeds, insects, bacteria, fungus, virus, invasive species... To compound this further, throw in market volatility, input and labour costs and shortages, pandemics and even war. Despite this long list of challenges, there's an emerging and potentially greater threat - government agriculture policies. Or more accurately flawed, or misguided policies.

Like most farmers, I'm pretty good at keeping my head down and getting the work done. I tend to focus on southern Alberta and what matters most to crop production agronomy, research, and



Figure 14 Victoria Falls, Zimbabwe (photo by Ken Coles)

There is a growing global interest in sustainable agriculture policy especially pertaining to climate change. It's imperative that agri-environmental policy is well researched, flexible, science based, regionally specific and farmer centric. Ideologically based policies pose drastic threats to farms, markets, food security and overall environmental quality.

extension. My abiding passions are science, agriculture, and the environment. My limited interest in politics focuses on securing sufficient funds and land to do the work. We've been spoiled with relatively good agricultural policies and freedom to operate. For a long time, agriculture was part of the fabric of society, well understood and appreciated. I wouldn't say that it's not appreciated anymore but we don't have the same connection to the public and thus government priorities tend to focus on the economy, education, and health care. It's easy to blame this on the growing urban – rural divide but it might ultimately be because of farmers' tendency to keep our heads down. It's great to be hard working and focused but we can no longer afford to bury our heads in the sand when it comes to agriculture policy. I think the best solution to this is to get involved in any way you can. For example, I joined the Lethbridge County Agriculture Service Board, I meet regularly with provincial and federal elected officials and joined the Farmers for Climate Solutions board of directors. While policy has never been a priority for me, I feel compelled to share my perspectives, which I feel are grounded in science and connected to the farm.



Figure 15 A very damaged Canola plot without neonicotinoid seed treatments at Arvalis, France (photo by Ken Coles)

A closer look at European agriculture policy shows a very different policy environment. There are many more restrictive policies that dictate what farmers can and can't do. For example, there is a ban on genetically modified organisms (GMOs), neonicotinoid seed treatments in the EU and plans for strong restriction on herbicides including glyphosate by certain countries such as Austria, Germany, and France (Finger, R., Möhring, N. & Kudsk P., 2023). There are also many environmental schemes (subsidies) that have become a significant contributor to a farmer's net income. In the UK and Ireland, these schemes can represent up to 60% of a farm's profit (Marshall, J., Mills-Sheehy, 2021).

While many would argue that they'd prefer a carrot to a stick, I fear the repercussions of a false or forced market where the farmers' main crop is an environmental incentive or subsidy. I certainly buy into the concept of compensation for farm practices that predominantly provide social benefit, but I recoil at the risk associated with an accurate and true measurement of these benefits and whether there is sufficient science to support them (Bonnen J., T., 2019; Dinesh, D., et. al., 2021). Common examples include the banning of GMOs that can dramatically decrease the use of harmful insecticides and restrictions on glyphosate that encourage energy intensive and soil damaging tillage. My experience in agriculture research and extension taught me that when operating in a biological system certainty is about as reliable as the weather. I fear the inherent bias in all values-based policy decisions that fail to consider the full economic and environmental consequences.

This does not mean that I don't advocate for sustainable agriculture. I'd just like it to be based on science with 95% confidence levels and be regionally specific. In many cases, I don't think we have the scientific capacity to effectively support hugely influential farm policies such as the European Union Common Agricultural Policy. The European Green Deal with its Farm to Fork strategy means to improve legislation on pesticides, nutrition labelling and animal welfare from 2019-2024. The core targets of the plan were to use 25% of the land for organic farming, reduce sales of antibiotics for animal breeding by 50%, reduce fertilizer use by 20% and reduce pesticide use by 50% (European Commission, 2023).

These rather drastic targets claim to support food security, reduce environmental and climate footprint, and create new economic opportunities. I would never claim to be a policy expert, but I fail to see how these targets could fall into the realm of sanity and be even close to achievable without farmer buy in and massive reduction in productivity (Reinhardt and Tilman, 2023; Wesseler and Justus, 2022; Beckman, et.al., 2020). Sure, we can say fortune favours the bold but come on. This reeks of environmental elitism and naivety to the global community and the ecosystem. Sure, you can pay farmers to grow less but that comes at a cost, too, and it's usually born by poor and developing countries. Then throw in the unexpected to really put your policies to the test such as COVID 19, the Russia – Ukraine war, Brexit, Avian Influenza, and a breakdown in global logistics resulting in huge increases in input costs, fuel, and food prices.



Figure 16 Intensive tillage is common in the north of France as glyphosate use is restricted (photo by Ken Coles)

When it comes to agriculture policies, the best strategy that resonates with me is from the Organization for Economic Co-operation and Development (OECD) that suggests a three-pronged approach for countries to follow:

1. Phase out price interventions and market distorting producer support.
2. Target income support to farm households most in need, and, where possible, incorporate such support into economy-wide social policies and safety-nets.
3. Re-orient public expenditures towards investments in public goods – in particular innovation systems.

“Opposing paths have been selected in the EU and Canada. The evidence to date confirms that it is Canadian agricultural production that is increasingly sustainable. The government must learn the right lessons from Europe’s mistakes when adopting strategies for reducing emissions from our agricultural sector. Canada should continue to improve sustainability through innovation. Canada should not follow Europe’s failed attempts to reduce emissions by producing less food.”

Stuart J. Smyth Professor & Agri-Food Innovation & Sustainability Enhancement Chair at the University of Saskatchewan.

While this may not capture the intricacies of a policy framework, it is a thoughtful strategy that might work well with more adoption. The extremes of poor policy can have devastating consequences and there are several recent examples such as in Sri Lanka and Zimbabwe that resulted in poverty, hunger, mass migration, death, and the destruction of economies. We need to be balanced and consider the global implications of our altruistic efforts.

Canada’s role in global food security will continue to grow. Our policy strategies need to consider the importance of sustainable innovations that increase yields and optimize the use of inputs. Foundational efforts must continue in the fields of breeding, agronomy, cropping systems, technology, and storage that take into consideration climate change adaptation. Extension and farm level innovation needs significant rebuilding as does the innovation system. Value added industries will continue to be important economic drivers as will the necessary infrastructure to support trade.

The Carbon Craze

Carbon dynamics are complex, spatially, and temporally variable, and difficult and expensive to measure. The impact from practice change requires long periods of time and can easily be reversed. Efforts should maintain the course of sustainable production and be cautious with the carbon craze.

Climate change, soil health, carbon sequestration and greenhouse gas mitigation are a global priority. You'd have to be under a rock to miss the flocking of people, companies, institutions, and governments to the business of climate change. It has taken nearly 40 years to gain the political will to seriously address climate change (Hensel et.al, 2022). While there is still a wide range of opinions, the general approach has been to create a carbon economy. However, some feel this may not be a viable approach (Rosenbloom et. al., 2020). While agriculture is often presented as a major emitter, many would prefer to see the opportunities as a solution or carbon sink. And like it is with so many complex issues, the cliché "the devil is in the details" is all too fitting.

It's clear that science alone cannot solve the climate change challenge but should remain a core foundation for analysis. Agriculture science is particularly challenging because of the negative impacts of climate change and the potential to compromise production by the promotion of value-based production systems (Betts et.al 2010). In my opinion, the political pendulum may have swung too far and it's time for some sober second thought.

In my professional experience, nearly all agriculture grants and funding initiatives now target climate change in agriculture and no longer try to solve real problems or advance our knowledge of systems. It also seems to focus on mitigation over adaptation. Accurate measurement of practice change is often confounded by spatial and temporal variation and depends on many assumptions including where we choose to draw the boundaries in the system. Ground truthing is highly sporadic and models are only as good as the data we put into them. Compliance with practice change is costly and likely not enforceable, especially in the long term. We seem to have created an agricultural Schrodinger's cat where both answers might be right at the same time. There are certainly some truths that are reputable. We know that we've mined our soil for years and that we can sequester carbon by using fertilizers, reducing fallow, minimizing tillage, using perennial forages, pulse crops and keeping the ground covered. Most farmers are already doing this. Are we asking how we can help them do it better without bankrupting them? We can't simply stop farming or even grow less intensively without major consequences.

A wise soil scientist described trying to measure carbon fluxes in soil as measuring the water displacement of a cat by placing it on a super tanker. Yes, another cat! This is an incredibly important point to consider as we're trying to use carbon as a currency. It is critical that we hear what the best scientists say through all the noise generated in this global dialogue rather than simply allowing political agendas to push agri-environmental policies that don't make sense.

We need to watch out for great stories that tend to oversimplify things. This reductive approach is tantalizing as we're often overloaded with information and choice. Agronomy, the study of energy and water efficiency in crop production, is our best solution but, as a country, we do not support this field appropriately. Let's take



Figure 17 A young farmer in France works hard to build soil health by experimenting with cover crops. (photo by Ken Coles)

advantage of the carbon craze too and rebuild our human capital in agronomic science and extension and truly help farmers continue to innovate. Carbon neutral or not.

3. The need for direct farmer involvement in research and policy implementation

Farm size and composition continue to change around the globe (Lowder et. al., 2016). While rural populations diminish, farm sizes increase in the developed world resulting in a decreased farmer voice and involvement in agriculture policy. In addition to this, policy makers are less connected and knowledgeable about agriculture systems and fail to consider the importance of economic sustainability of farms (Guth et. al., 2020). Innovation systems and research tend to focus on government priorities and cause frustration that adoption and return on investment for research is relatively slow and lagging (Moschitz, Home, 2014; Long et. al., 2016). One of the best things we can do is to continue to explore and implement strategies that facilitate farmer-led research and feed farmer knowledge into policy development (Ochieng et. al., 2022; Waters-Bayer et. al., 2015). The following stories explore some highlights of efforts taking place in various places I visited.

Innovative Farmers of Scotland

The irony of my 10 weeks of Nuffield travel is that I met a kindred spirit on my very first day in a quaint little coffee shop in Edinburgh, Scotland. This was probably the most relevant visit related to my chosen study topic. I was honestly a little nervous to embark on this Nuffield adventure. I don't love travelling and I find it uncomfortable meeting new people. But, as soon as I met Ana Allamand, I was thrilled to find someone with so much in common and we hardly took a breath after four hours of straight talking. All my fears and apprehension disappeared as fast as my fancy European coffee.



Figure 18 Ana Allamand of Innovative Farmers shares stories with Ken Coles (photo by Ken Coles)

At Innovative Farmers, farmer-led research means just that - actual farmers receive support by pairing relevant scientists with farmers to help solve their problems. Flexible funding secured from philanthropic foundations support this endeavour. Canada should emulate this model.

We shared a common passion and experience. Ana works with the Soil Association and Innovative Farmers

(www.innovativefarmers.org). This group just celebrated its 10-year anniversary, and it was refreshing to hear about the success of its approach. The group's main premise is to put innovation into the hands of farmers and thus guide the research. It focuses on what it calls Field Labs or on-farm trials. The association receives a grant that allows them to pair innovative farmers with relevant scientists to co-design and implement research trials. Flexible funding is critical to its success to be responsive and timely. The program is so well received that she said it was very trendy and having no problems securing financial support mainly through charitable trust funds.

This truly farmer-led research brings investment to the local level rather than a single desk or centralized approach. According to its website, the community and regional efforts boast many benefits with over half of the farmers making practice changes because of the field labs, 84% learned something new and 99% recommended the program to others.

Farming Smarter and many other groups across Canada are currently conducting on-farm trials with varying success and impact. Farming Smarter's Field Tested Program conducts scientifically rigorous field scale trials using spatial statistics, geo-referenced data and traditional agronomic approaches including replication and randomization. This is a challenging endeavour versus common strip trials, is costly and requires more technical knowledge and experience.

One element of acute importance to the approach at Innovative Farmers is that they have access to a pool of flexible funding that gives freedom to act and pairs farmers with appropriate scientists. This would be of tremendous benefit for Farming Smarter as we are constrained by tedious funding applications, required matching funding and a slow decision-making process.

Groupe Carré, France



Large investments in institutional science and innovation seem to occur in isolation from the general farm population. Agriculture policy can have massive hinderances to the adoption of proven conservation practices such as zero-tillage. Farm retail companies can play a bigger role in screening products and promoting soil conservation and best management practices. Student and professional work exchanges could help share knowledge and accelerate adoption of new practices.

I spent a day with a group of farmers who work together to test and share innovative ideas facilitated by a local retail agronomist that works for Groupe Carré - a grain buyer and input retail distributor. Groupe Carré opened a research farm, La Ferme Pilote, in 2015 to help advance ecological farming practices and support training for clients. Another big motivation for the farm was to test and verify the many products available from wholesalers and sold to farmers. Often tempted by attractive margins, the culture of this company was to ensure that whatever they sell would or could help their clients. This long-term vision recognizes that the company's success is tied to the success of its client base. This is a refreshing attitude given the tremendous push for biological and alternative products available in the marketplace. Some companies in Canada are moving in this direction and have hired Farming Smarter to test products and help educate their agronomists with local data. Farmers should always ask for local data because it might help encourage more regional testing from suppliers.

Groupe Carré also placed a large emphasis on soil health and offered extension services that encourage reduced tillage. I found this very interesting as I couldn't believe the vast amount of intensive tillage in France. I live in an area where zero tillage is commonplace and have seen firsthand the immense benefits to soil health, productivity, and resilience. In France, conservation tillage means one less pass with a plow. I watched a sales-based field demonstration of a Lemkin high speed disk pulverising the soil into a powder as a soil conservation practice. In all honesty, every field I saw was powder. That created an emotional reaction in me. Farmers do their best in a policy environment that demonizes

glyphosate. I'm all for reducing pesticides when we can, but what I saw in France was a huge overuse of tillage with an unnoticed or unrecognized negative environmental impact. It is straight up environmental hypocrisy on the carbon neutral front due to a clear bias.

In many cases, the idea of work exchanges could benefit both France and Canada. Our knowledge of zero-tillage systems could be hugely impactful to their conservation practices as we could gain from ecological practices with reduced inputs.

Hometree – Making Ireland Even Greener

Most people recognize the unique landscape of Ireland’s rolling hills, green grass, neatly trimmed hedges, and stone walls galore. Despite all this beauty, it might surprise you that after centuries of human activity, there’s very little natural rainforest remaining.

A noble non-profit organization called Hometree (www.hometree.ie) in Claire County hopes to restore part of the natural ecosystem through the ambitious Wild Atlantic Rainforest Project. This organization started as a community garden and soon realized the importance of nature. Much of the ancient forests were removed for farming and other land uses but pockets remain, teeming with biodiversity. I joined fellow Nuffield Scholar and Project Lead Ray O Foghlu on a walk through a bog filled with petrified stumps of an ancient forest into a mystical deep ravine with trees covered in moss. Ray’s obvious passion came to light as he described just about every plant, lichen, and creature. He discussed threats and ways to allow the natural regeneration of these fragile and beautiful areas. The opportunity, as they see it, is to create a healthy ecosystem, build climate resilience and repair a connection with nature. The current project aims to restore 4,000 acres over 4 years (Phase 1) at 8 sites with an average project size of 250 acres.

The goal is to work with landowners to preserve and plant trees. The common denominator for all organizations, especially smaller non-profits, is the people with passion, vision and relentless effort doing something they love. Their passion is contagious and is sometimes all it takes to help a farmer think differently about their approach, to preserve unique ecosystems or simply plant a few trees. Hometree raises funds by selling acres or rehabilitated land and rainforest memberships. They align values and include supporting organizations on their board. Throughout my visits and regardless of the size of the organization, the people within inspired me.

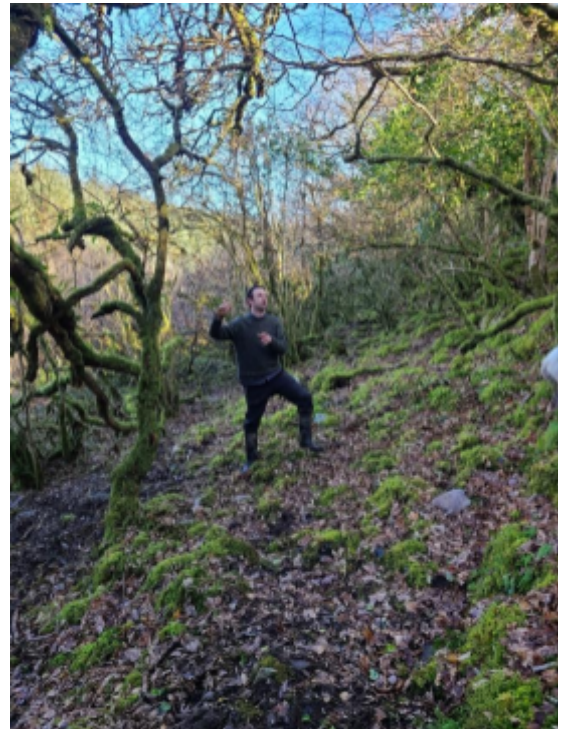


Figure 19 Ray O Foghlu, Hometree Farm Programs Coordinator explains the Atlantic Rain Forest Ecosystem (photo by Ken Coles)

A New Breed of Farmer

The agricultural innovation system that grew our successful industry is broken. Provincial and federal governments cut the personnel and programs dedicated to direct contact with farmers on the land. To fix it, we need to connect and develop meaningful relationships with a new breed of innovative farmer, one selected over generations of survival and adaptation. They are the best source of agricultural innovation.

Farmers are masters of innovation. During the agrarian settlement of North America, it was innovate or die. Early farmers and settlers faced wild and empty land on a homesteading expedition. Many had little to no farming experience with minimal access to technology and seed developed for a completely different environment. Many did fail and only those who were able to adapt – to innovate – survived on the farm.

There were no air-conditioned tractors with GPS autosteer, no fertilizer, no herbicides, no cell phones, or internet. But they found a way to make it work. They adapted to the conditions and came together as communities. Those who could innovate, survived, and thrived. Farmers themselves have gone through a natural selection process over generations resulting in a new breed of farmer

complete with rugged independence, resistance to pests, deep roots, and resilience. They have tremendous capacity to innovate in real, practical, and life-giving ways.

However, they didn't do it alone as it takes a community to raise a barn. Well, at least metaphorically these days. Farm failures plagued the nation, so the US government created the land grant university and cooperative extension services to help extend scientific and cultural knowledge to farmers. A youth program called 4H also started as a mechanism to transfer practical knowledge to the next generation. Other countries developed similar supporting organizations to conduct experiments and help farmers succeed. Our nation can attribute a large amount of our agricultural success to a collective effort.

These human centric programs helped enable innovation and build a thriving agriculture industry. However, too much of a good thing may have resulted in its own demise. Farm size continued to grow along with private industry and the rural populations shifted to urban centres. Agriculture dwindled as a top priority as economies diversified and farmers are alone again to survive on the depopulated landscape. The big question is, are farms ready to take on these new challenges in different world? This time, more connected and more alone than ever before. Moving faster, constantly pushed, and pulled by changing climate, markets, government policies and more. If history is any indication, then I'd say heck ya! I have every faith in farmers rising to the challenge, but it will require a well-oiled and functioning agricultural innovation system. And frankly it needs some serious work. It will require more investment, more leadership, more accountability, real collaboration, and more focus on the new breed of farmer.

4. The Need for Better Governance Models

Non-profit organizations continue to play a targeted and impactful role in agriculture. There is however a need to build capacity and play a larger role as governments continue to reduce both internal and external support for primary agriculture. Improved governance models will be critical to allow for growth and efficiencies (Bruni-Bossio, Kaczur, 2022; Bradshaw et. al., 2007). Board governance can often be a limiting factor in success. While I was challenged to locate many truly successful non-levy farm focused organizations, I was able to visit some truly interesting groups involved in agriculture innovation.

Canada's Golden Innovation Centre - Vineland Research & Innovation Centre

Based in the Niagara Region of Ontario, just south of Hamilton along the shores of Lake Ontario, this progressive non-profit organization leads Canada's horticulture innovation. With a keen eye for commercialization, this team collaborates across the country with targeted science and business-oriented efforts for impact and sustained revenue. Its



Figure 20: Coles Barn – Circa 1930 (Photo by Ken Coles)



Figure 21: A young French farmer visits his grandmother on a 10th generation farm. (photo by Ken Coles)

annual budget of approximately \$11.5 million has diverse funding sources anchored with a 5-year agreement through the Canadian Agriculture Partnership that represents nearly half of the budget (www.vinelandresearch.com).



Figure 22 Vineland Research and Innovation Centre (photo by Ken Coles)

Vineland Research and Innovation is a great example of the potential impact and effectiveness of a non-profit.

Effective Leadership is critical and enabled with a modern advisory based governance model. A significant anchoring grant of approximately 50% of their budget is crucial to manage operational risk and enable sector, academic and government participation.

A dynamic staff understands the culture of innovation, are well organized and strategic in developing and maintaining relationships with partners, industry, and government. They employ 81 full-time staff, including 19 scientists, and have a very high grant success rate of 88%. Its core goals are to diversify and enhance horticultural products for domestic and export markets; ensure new technologies get optimized for future production environments; and improve the connectivity of products and processes across supply and value chains.

Perhaps most interesting for the governance buffs, Vineland operates with a unique model for a non-profit. Dr. Ian Potter, holds the position of President and CEO, is a member of the board of directors and Chairs the Innovation Advisory Council. Karen Belaire chairs the policy-based advisory board comprised of a diverse group of high performing and experienced members from within and outside the horticulture industry. The board has two other teams including the Stakeholder Advisory Council and a Business Development Committee. Board members, external stakeholders, national and international innovation advisors, and government observers comprise the innovation and stakeholder councils.

Teagasc, Ireland

Across the North Channel into Ireland, the farming environment is notably different. My first stop was at another remarkable agriculture organization called Teagasc (www.teagasc.ie). It took me about 20 tries to say and remember this word that is roughly pronounced ‘chaigus’, a Gaelic word

Figure 24 An ancient wall separating fields at the Teagasc research farm in Carlow, Ireland (photo by Ken Coles)



meaning ‘instruction.’

While the estates were still in place in England, the Irish fought for independence against British rule and the head office is housed in an old British castle with the land used as a research farm in Carlow. This rather complete organization is the national body that conducts research, and advises and trains farmers, industry, and communities. It comprises 7 research centres, 7 colleges, 12 advisory regions and 52 advisory offices.



Figure 23 Stan Lalor, Director of Knowledge Transfer, Teagasc, Ireland

Considering that Ireland has about 22% of the farmland of Alberta, its investment of nearly 160 million EUR per year makes me question our agriculture investment at home. The organization is well diversified with strong research efforts coupled with considerable extension capacity and services. They even offer master's degrees in agricultural innovation support and agriculture extension. There is clear evidence of impact as they can easily see a dramatic difference in farm practices when comparing farms on either side of the border with Northern Ireland which is part of the United Kingdom (Hennessy, M., 2022). We can learn from Teagasc's well-coordinated and thorough efforts.

Foundation for Arable Research (FAR)

New Zealand's radical policy to remove all subsidies in the late 1980's shaped their agriculture to their global comparative advantage. Canadian agriculture efforts should build on its comparative advantage including vast amounts of land, innovative farmers and high-quality products coupled with sustainable practices.

New Zealand established science and innovation institutes at universities, Crown Research Institutes and producer funded levy organizations. The most relevant crop production oriented organizations I visited were Plant and Food Research (www.plantandfood.com) and the Foundation for Arable Research (FAR, www.far.org.nz). I also visited with John Foley, a production agronomist with PGG Wright Seeds who recently completed his Nuffield Scholarship, conveniently on science and innovation in New Zealand Agriculture.

The well-respected Plant and Food Research Institute has 1000 employees focused on horticulture, arable crops, and aquaculture. Its diversified strengths include genetic development along with creative value capture initiatives for work outside of New Zealand.

FAR is more relevant to my study topic and closer to the farm. This organization collects mandatory levies from anything that runs through a combine. It supports the industry through applied research and extension. An interesting component of its governance model is that every 6 years it holds a referendum with growers to decide if the organization will continue to operate. It attempts to keep growers involved at all levels and has a skills-based board of eight with five growers and three independent members. They partner and co-fund projects with available government grants and lead the technology transfer efforts which include field tours, fact sheets and podcasts. The arable crop industry is relatively small in New Zealand and its approaches are not all that dissimilar from ours given its level of investment. Its research themes include maximizing productivity and value, environmental and social best practices, and resilient cropping in farming systems.



Figure 25 Visiting a Kiwi nursery, Coromandel, New Zealand (photo by Ken Coles)

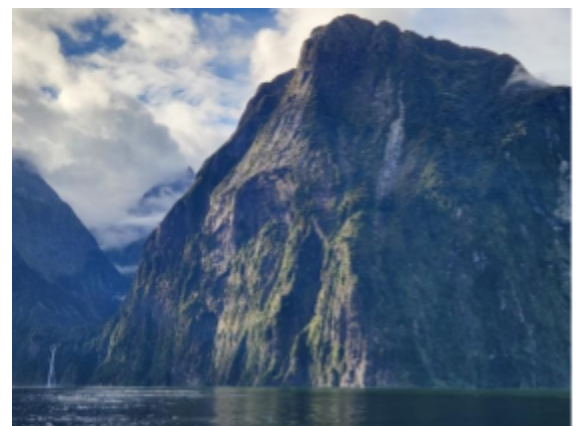


Figure 26 Steep cliffs of Milford Sound (South Rivendell), New Zealand (photo by Ken Coles)

5. Innovation Success with Bold Approaches

Innovation occurs with or without intentional structure. This is because innovative people drive it. Nevertheless, there is clear value in designing innovation ecosystems that encourage and enable innovation (Berthet et. al., 2018; Somers, Stapleton, 2014; de Boon et.al., 2022)

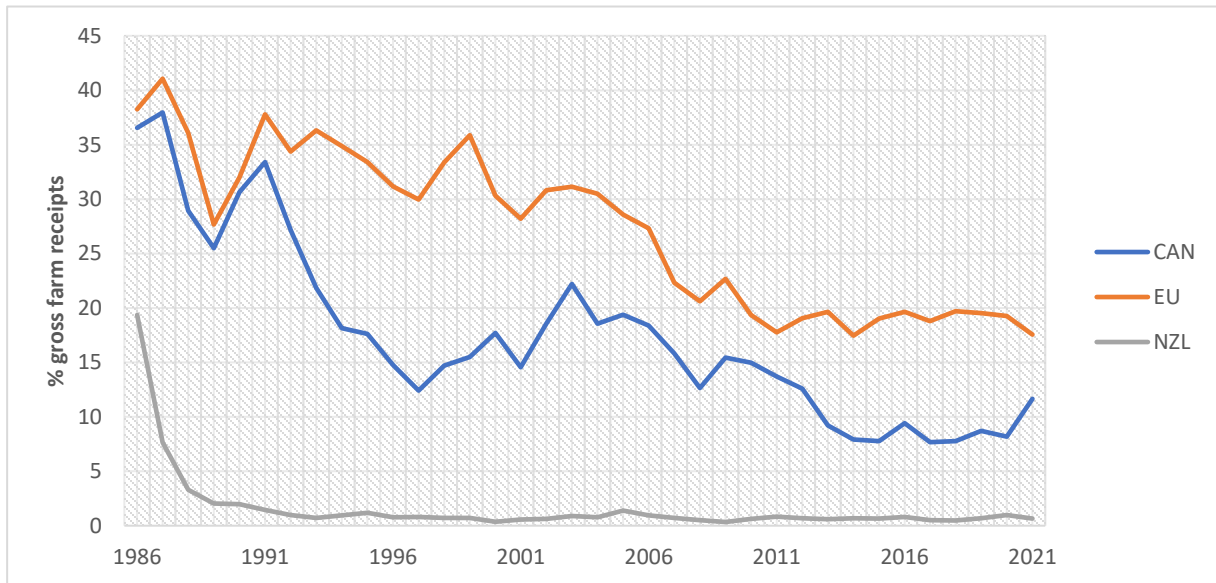


Figure 27 Agriculture Producer support as a % of gross farm receipts from 1986-2021 -(OECD (2023), Agricultural support (indicator). doi: 10.1787/6ea85c58-en (Accessed on 13 October 2023)

A Bold Agriculture Policy Experiment in New Zealand

New Zealand's wild and captive beauty, well presented in the Lord of The Rings, is crisp and breathtaking. I've never

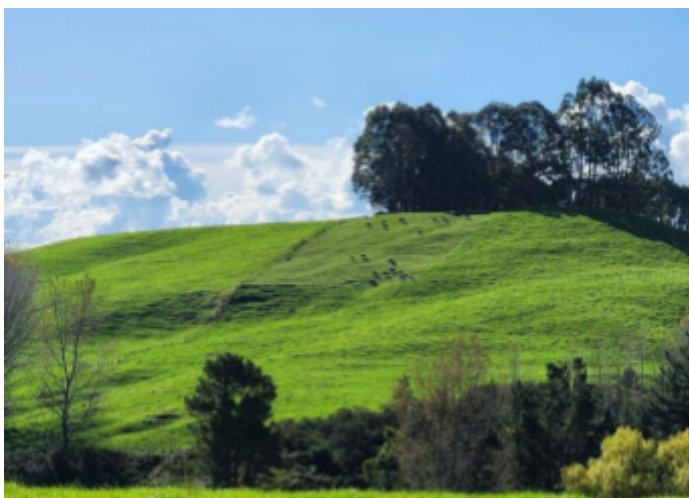


Figure 28 typical dairy farm near Reporoa, New Zealand. Dairy cows are grass fed using rotational grazing paddocks (photo by Ken Coles)

heard anyone complain they hadn't enjoyed visiting. I was excited to spend my final Nuffield destination there for a few reasons and not just the touristy ones.

First, I was able to attend Nuffield's Triennial Conference and tour—a well-organized event that assembled scholars from all over the world, both young and old. It is also similar to Alberta in both agricultural land and population. I was keen to spend a significant amount of time (one month) to truly experience the country and witness the impacts of a country-wide agriculture policy experiment that removed all forms of subsidies and price protections on agricultural products in the 1980s. This is a stark contrast to Europe. Heavily influenced by a maritime environment, it was much cooler, further south and far more isolated than I expected. There's even a fair amount of isolation between the north and south islands with ferries in poor repair often docked

due to rough seas in the Cook Strait. On the global map, it looks to be Australia's closest neighbour but is over 1600 km away at its closest point. The next closest place to the southernmost tip is Antarctica and it is one of the most southerly populated communities in the world aside from southern Chile. It is a very long way from markets, yet agriculture is still the largest sector in its economy.

Even though farmers went through a rather tough time when the government removed subsidies exposing them to international markets, it forced them to design a system built to its comparative advantages. Like Ireland, it is very good at growing grass with dairy, sheep, and cattle as major outputs. The dairy industry is highly developed, and New Zealand is the largest global exporter of milk solids. A large farmer cooperative, Fonterra, maintains approximately 83% of the market with massive drying facilities to help optimize the high cost of transport to importing nations.

There is also a well-developed arable cropping sector, particularly in the Canterbury Plains of the South Island. A relatively new irrigation industry increased by 91% between 2002 and 2019 despite a high average rainfall (www.stats.govt.nz). This helped growers to intensify dairy, sheep, and beef production and to diversify high value crop options including floriculture, fruit, berries, and hybrid seed production. Small grain production is limited in acres but produces world record breaking yields with appropriate management. Certain areas are well suited to grape production and are world-renowned wine producers. It has well-established horticulture crops including the famous kiwi, which now come in green, yellow, and red varieties.

The Elephant in the Room – Africa's Potential

British colonization significantly influenced agriculture around the world. It's interesting to see the divergence of agriculture paths when comparing the United Kingdom to Ireland, Australia, USA, New Zealand, Canada, and Zimbabwe. Zimbabwe's history has been particularly chaotic since British colonization. Early colonizers, including Cecil Rhodes, arrived in the late 1800s forming Northern and Southern Rhodesia, named in his honour, which are now Zambia and Zimbabwe (Wikipedia contributors 2023). The UK annexed Southern Rhodesia in 1923 until Ian Smith declared independence in 1965, the first since the US colony did the same in 1776. The UK and UN imposed economic sanctions while African nationalist groups, including Robert Mugabe, commenced guerilla warfare with support from communists and neighbouring countries.



Figure 29 A wild African elephant grazing along the shores of the Zambezi River, Chirundu, Zimbabwe (photo by Ken Coles)

Southern Rhodesia became the Independent Republic of Zimbabwe on April 18, 1980.

An election brought Robert Mugabe and the ZANU party into power of the independent nation of Zimbabwe in 1980. At this time, many people of European descent left the country, but many farmers stayed. The country was experiencing some growth in the 1990s and the Europeans representing only 0.6% of the population still held 70% of the agricultural land. In the year 2000, the government introduced a rapid land reform initiative that effectively transferred land



Figure 30 Subsistence farming in Zimbabwe. Burning crop residues is common as a farming technique and to hunt rodents. (photo by Ken Coles)

ownership from white farmers to the African population. Once the breadbasket of Africa, there was a massive reduction in productivity dramatically impacting the economy resulting in the emigration of 11 million people.

The UK suspended commonwealth status and the US froze credit. From 2000 on, the Zim economy crashed and experienced hyper-inflation to such an extreme that the central bank issued a \$100 trillion note. The currency was frozen, and the economy improved with the use of more stable foreign currencies including the US dollar. Twelve zeros



Figure SEQ Figure * ARABIC 21 An aerial image of once irrigated land divided into small parcels since the land reform. (photo google earth image)

Seemingly uncontrollable situations can be navigated using business intelligence, value chain capture, innovation development and most importantly with qualified, knowledgeable, and passionate people. Zimbabwe's history is filled with strife and trauma yet possesses the resources and people to become the breadbasket of Africa again.

were removed before the Zim currency was reinstated and the economy continues to operate with a formal and informal market system (Odendaal P. 2022). Mugabe is no longer in power and while some white farmers are still losing land, there seems to be a changing attitude towards the white Zim farmers and some opportunity for growth. White farmers can't own land, access loans through banks, and operate in a dynamic and corrupt environment that takes risk management to a nearly unimaginable level. Despite this environment, we visited many agriculture operations that have had incredible growth in only two to three years. In Canada we work very hard to achieve incremental increases in yield and efficiencies. Given the right policy environment, Zim has the potential to become an agriculture powerhouse. I never could have imagined that there exists this much potential in a world as developed as ours.

Much of the redistributed land was broken up into 6-hectare parcels for subsistence farming. The government sometimes provides seed and fertilizers to persuade votes and advance political agendas (Zimbabwe residents 2022). There was minimal transfer of knowledge for farming techniques and the farmers do their best with limited technology. Fields are hand seeded, hoed, and harvested. Residues are burned and soil erodes. Profitable tobacco crops are particularly challenging as they require drying, so trees are cut down resulting in large scale deforestation. Despite all this, a large portion of the previously farmed land is abandoned. Talks of 99-year leases continue but haven't come to fruition. Those who managed to keep their farms have done so through varying means rarely discussed. There is a clear distinction between older farmers who experienced the land reform and the younger generation who are more eager to make a go of new opportunities.

Tobacco is also a very important crop for white Zim farmers. With no access to capital, tobacco companies are the only source of cash and contracts support entire farm operations. Some older farmers don't want to be 'owned' by the tobacco companies and opted to take on low input farming practices to maintain independence. Farm labour is a huge factor and it's common to see labour forces of 400 plus employees. In these situations, the farms build communities, including schools, and provide healthcare. Mechanization of operations means putting people out of work, which stifles innovation when considering a staggeringly high unemployment rate and no safety nets or welfare programs. However, the labour was largely untrained and possessed little to no education.

We toured several large and successful farms that tended to operate within the entire value chain. For example, Kefalos (www.kefalosfood.com), a dairy produce company, partnered with a Danish farmer who provides nearly all the milk to a high-tech processing factory that produces a wide variety of products sold in Zimbabwe and other African countries. This Danish family eventually bought Kefalos and they do exceedingly well. They



Figure 32 A farm-based Zim community complete with soccer field (photo by Ken Coles)



Figure 33 CEO of Red Dane Farming explains a bush dairy that milks cows out in fields. (photo by Ken Coles)

discovered the perfect breed of cow that performs well in the savannah by crossing European breeds with more adapted species to the African climate. They continue to innovate by attempting a new method of milking cows with mobile systems (figure 33) out in the pasture. The main driver for this approach is that there's plentiful access to grazeable land and is seen as ecologically beneficial. It hasn't really caught on - it is labour intensive - but is a great example of people trying to innovate even in extreme situations when opportunities present themselves. Core revenue from their traditional barns and high value capture creates space and freedom to take on the risk associated with innovation. While visiting the Red Dane Farm (www.reddanefarming.com), we discussed the challenges of operating in such an environment. They too don't own the land yet have plans to invest in a new barn. When asked how he could justify such an investment when he could lose it tomorrow, he calmly answered, "well, I could lose the farm, or I could lose the farm and one new barn. Either way it would be gone." We were all amazed at his attitude and perspective on risk.

A tour of Colcolm CCC Pigs (www.colcom.co.zw) was eye opening as this one operation is responsible for 70% of the pork production in the country (Odendaal P. 2022). It manages four farms with one feed mill, no bigger than a single farm in Canada. It's hard to believe that one average sized farm in Canada could feed an entire country. They have over 500 employees and haul feed in 50-pound bags by hand without an auger in sight. They import almost all the feed as it is more reliable than what's produced locally. They own the abattoirs, butchers and even retail outlets. Forty per cent of the business is whole hogs. The mill, barns, abattoirs, and shops are well run and appear to produce a high-quality product. On a visit to a retail store the power went out. This shocked us, but to them it was a daily standard and the generators kicked in. It's hard to believe what they manage to accomplish in a place that doesn't have reliable infrastructure, a testament to the hard-working people. The CEO, Dino Tumazos, explained the daily process to evaluate the business and produced a booklet an inch thick filled with inflation calculations and currency conversions critical for informed decisions. We could all learn from this level of effort, analysis, and accountability. We heard a consistent message that success depends highly on having the right people on the job. People that understand the dynamics, act when necessary and take the time to understand.



Figure 34 A pork retail outlet sells butchered meat and whole hogs. (photo by Ken Coles)

A visit to PHI Commodities' (www.phizim.com), Goromonzi Farm showed us again that one large farm handled/contracted most of the crops in the country. These small monopolies were distinctly different from the level of competition in North America. At this farm, President Mugabe's cousin owns the land. She lives in the US and shows up occasionally for a paycheck (Murdoch G. 2022). Under the table deals were so common that no one even tried to hide them.

They use comparable pivot irrigation technologies to Canada but slightly older seeding and harvesting equipment. They are well diversified and operate within the entire value chain. They contract with other farms, grow various crops including continuous potatoes and raise beef cattle. The potatoes are very profitable because they are sold in the informal (black) markets directly to consumers where taxes are avoided. Expanding the market for them means finding ways to grow more and they are looking to build potato storage so they can sell year-round. Competition in Zimbabwe isn't between people or farms, but against a chaotic environment.



Figure 35 A group of school aged children in Harare, Zimbabwe. (photo by Amy Cronin)

Overall, Zimbabwe was a testament to the farming spirit. There's nothing like a developing world experience to put your problems into perspective. It certainly highlights the importance of agriculture to a nation. Regardless of who farms, food and water security should always be a top priority and carefully supported. In Zimbabwe, the European descendants have completely lost their voice and power. Some are still trying to receive compensation for land they owned for generations. Yet, many still stay and find ways to survive and adapt in a corrupt and chaotic environment. Despite all the trauma, they love their country and call it home. It truly is a magical place. Their resolve and ability to find purpose, prosperity and contentment should be an inspiration to all.

Canadians are so blessed to live in such a wonderful country where the opportunities are endless. We need to draw on our passions with the same perseverance of the Zim farmers and find ways to build our farms into great successes and to never stop changing.



Figure 36 Philip (Wors) Odendall and Ken Coles at Victoria Falls, Zimbabwe (Photo by Ken Coles)

The People, The People, The People

Understanding, accepting, and using vulnerability as a strength is at the core of successful people. Creating alliances, that support, challenge and develop groups of people with clear goals will always achieve greatness.

If you have ever seen a Māori haka performed either at a cultural event or by the All Blacks Rugby team, you will have felt its power, ferocity, and intimidation. These traditional ceremonial dances are performed at various events and social gatherings to welcome guests and acknowledge accomplishment, as a sign of strength, pride, unity, and respect. Fittingly, during my last Nuffield trip, at the Triennial Conference in New Zealand, an uncanny number of presenters recited an impactful message from a Māori proverb: ‘He aha te mea ui tea o? He tangata, he tangata, hetanga!’ In English this means: “What is the most important thing in the world? It is the people, it is the people, it is the people.” This very

Figure 37 Martin and Elisse Gosse De Gorre and Ken Coles visit the shores of Dieppe, France. (photo by Ken Coles)



Figure 38 Ken Coles and John Foley visit in Lincoln, NZ (photo by Ken Coles)



Figure 39 Shawn Moen, Ralph Goodale and Ken Coles meet in Westminster Hall, UK (photo by Ken Coles)



Figure 40 Ana Carolina Zimmermann, Ken Coles and 2021,2022 Nuffield Scholars at Holkham Hall, England. (photo by Ken Coles)

simple message succinctly summarizes the most important takeaway from my scholarship. It should seem obvious, but it's often forgotten and rarely given the priority that it deserves. Maybe that's why it's repeated three times? As we all seek solutions to our problems whether it's finding purpose, a new technology or approach, a scientific breakthrough, it always comes down to people. The simple truth is that *we* are the solution.

I hope to find better ways to support farm innovation. I am the solution. It might seem a little arrogant, but the intent is to be confident. It starts with us and flows through others. Progress and success will only come with buy in, cooperation, passion, ingenuity, and effort.

I experienced many examples of triumph over adversity that I came to see adversity and vulnerability as a powerful motivator. I found that the people of Nuffield all had significant adversity to overcome and that seemed to fuel their passion. They are all amazing. It gives me hope for the people in Zimbabwe whose tremendous adversity will make them great.

We're not always right but what Nuffield brings is an environment that supports, challenges, encourages, and creates meaningful connections with others. It develops leadership, self-awareness, and perspective. It's really a group of innovative change agents that form a family of daring enthusiasts. It builds confidence and fuels passion.

We, in the agriculture community, are cut from the same cloth no matter where we live in the world. We need to feed our culture of innovation, support each other in solidarity and dance the haka in front of all our battles. We need to raise our voices and connect science to policy. We need to protect our soil and improve all that we do. We need to think critically and raise our heads to the world when the time is right. We need to grow and feed the most important thing in the world, the people, the people, the people.



Figure 41 The Coles family visiting the beautiful New Zealand coast near Dunedin. (photo by a passerby)

Summary

Agriculture Innovation is at the core of our civilization. Much of the development of modern human civilization can be attributed to the practice of agriculture: the continual development of crops, practices and techniques that help produce abundant, healthy, and affordable food, fuel, and fibre. Nevertheless, governments and markets continue to fail (Alston, J., M., 2021) at providing support for the right kinds of innovation and are constantly challenged with proving return on investment.

With the growing movement towards sustainable production, and political and public pressures for net zero or carbon neutral, it's more imperative than ever that our agriculture innovation systems are grounded in science, are farmer centric and functional.

Despite many examples of tremendous efforts made in scientific research, in production and in business, it is clear that we need more effort to connect all the actors into a more cohesive innovation ecosystem (Pigford et.al., 2018).

Now I know that every place, every agriculture community needs people to build, innovate and push forward everywhere, always, and all ways. There is not, nor ever will be, a map, formula or cookie cutter system that will fit everywhere. The good news is that fierce, tenacious people live all over the globe.

Do we need a system for innovation? You bet we do, but it must be a system that attracts, supports, enables people and is inclusive (Rose, Chilvers, 2018). It needs a prairie flat structure that keeps researchers, farmers, policy makers, public and industry collaborating. It needs a broad scope, serious flexibility, and room for error.

Agriculture changes all the time and is subject to many forces. Any time a civilization forgets that agriculture takes investment, they suffer dire consequences. Let's not do that in Canada.

Recommendations

Please note that any recommendation I make comes from the totality of my experience working in agriculture. It encompasses my boyhood on great Guido's farm, my career path that put me amongst some of Canada's top agricultural researchers and my years in direct contact with southern Alberta farmers making valiant efforts to innovate on the farm. These experiences shaped the innovation hub my team and I continue to nurture in Lethbridge, Alberta.

When a person travels as a Nuffield Scholar, we each bring our own perspective along. One of my convictions is that in Canada both researchers and farmers question why our innovation system does not include them. Researchers have valuable information for farmers. Farmers have pressing questions. And yet, they seem to stand on opposite sides of a great divide. They need a bridge – a sturdy, wide and open road from the science to the farm gate receipts.

Definition of Agriculture Innovation

"I believe that innovation is a **system** that begins with passionate, creative, and fearless people with courage, determination and persistence with a need or a vision. This is the **culture**. Next, a **process** must be succinctly and efficiently implemented that includes building a knowledge network, exploring, designing, and testing ideas with feedback and iterative **adaptation**. Evaluating, tweaking, or even starting over all while considering risk, costs, and revenue. Success comes with relentless effort and value accrues through **adoption**. Innovation is about **culture, process, adaptation, and adoption.**"

Ken Coles 2023

Actions

1. Dedicate a portion of the federal/provincial agriculture policy funds to strengthening Canada's innovation system – currently called Sustainable Canadian Agriculture Partnership (SCAP)
 - a. Begin with a revamp of the agriculture innovation system and strategy
 - b. Actively seek out grassroots regional innovation hubs in every province
 - c. Empower and invest in grassroots regional innovation hubs
 - d. Reconnect with farmers needs through collaborative innovation models
 - e. Attract, train, and encourage agriculture leaders to focus on the public good
2. Modernize governance models that enable effective management
3. De-politicize innovation and genuinely collaborate on shared objectives
4. Take advantage of growing support from charitable foundations

Specific Recommendations for Non-Profits

1. Invest in passionate people to lead the organization
2. Allocate funds for efficient administration
3. Gather a competency based advisory board
4. Operate with a modernized governance model
5. Establish a focused plan/mission and revisit often
6. Measure program impact annually
7. Set growth targets
8. Foster innovation internally and externally
9. Explore and pursue diverse revenue sources
10. Engage with like-minded organizations and build together

Policy

I've grown to respect the impact policy can have on organizations, research directions and the lives of Canadians whether they know the policy exists or not. I appreciate the importance of well-worded, simple policies to ensure they are effective and do the least unintentional harm.

I believe that we need to encourage broad civic engagement from the whole industry and attract a diverse knowledge base into designing Canadian agri-environmental policies.

Therefore, my recommendation is that Canadian agri-environmental policies be:

1. Science based
2. Regionally specific
3. Outcome driven

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