Low Carbon Story:
McCreary Land & Livestock

McCreary Land & Livestock business plan goals:

- To make a good living (return on investment)
- To have a good lifestyle
- To leave the environment in as good or better condition than what we found it

Summary

- Continuous cropping helps to buffer temperature variation, reduce moisture loss, protect against erosion, reduce weed competition, and provide habitat for soil microorganisms
- Sweet clover included in crop rotations to remediate saline areas, improve soil biology and nitrogen content
- Integrating animal waste supports soil microbiology and ability to sequester carbon
- Preserving wetland and bush supports carbon sequestration
- 16.9 kilowatt solar array provides all of the farm's electrical needs

Meet Ian McCreary and Mary Smilie

From the time they took over the family farm in the mid-1990s, Ian McCreary and Mary Smillie worked hard to fulfill their farm goal of leaving the environment in as good as or better condition than that in which they found it. Then in 2017, Ian, an Agricultural Economist, was asked by Darrin Qualman to act as a reviewer for his book: "Civilization Critical: Energy, Food, Nature and the Future."[1] Ian now jokingly refers to that book as DDB – Darrin's D**n Book. Ian and Mary had long understood the science of climate change, but the book's content convinced them that it was time to step up their actions to reduce their carbon footprint. As a result, they decided to install a solar array on the farm.

The farm's original owner, Ian's grandfather, established a legacy of working with nature to build a good life. Ian says his grandfather was very disciplined about not being wasteful: he set garbage out in visible places so it was easy to identify the waste the farm was producing; tin cans were left in a pile as a reminder that tin would eventually run out; nails were straightened and reused. On the land, trees were left standing and wetlands were not drained or filled in.

Carrying on the tradition, Ian's mother and father also valued their farm's wetlands and biodiversity. Ian remembers his father seeing a killdeer in the field and stopping to locate its nest so that he could avoid it with his equipment. When Ian and Mary took over the farm, it was important to them to honour that legacy and integrate it into their farm business plan goals.

The couple uses these goals as the gauge against which they evaluate all decisions about their farming operation and against which they measure their success.

In addition to using the goals to evaluate those decisions that impact the environment, their goals related to their economic and social wellbeing are critical. Both gave up well-paying jobs to return to the farm and did not want to sacrifice the benefits that those jobs had provided.

Leave the Environment in as Good or Better Condition

The McCreary farm is a 3,000-acre mixed-use farm, 2,000 of which are cropped. About 170 acres are pasture, 300 acres are wetlands and 600 acres are for hay and forage. The farm includes between 80 and 120 head of cattle, depending on the time of year, and about 100 goats. Continuous cropping and protecting bush and wetland are integral to their approach to farming.

CONTINUOUS CROPPING

According to Ian, having something growing on as much of the land as possible is critical to their farming operation. Covered soil buffers temperature variation, reduces moisture loss, protects against erosion, reduces weed competition and provides habitat for soil microorganisms. Living roots also protect the soil from water and wind erosion and increase soil organic matter which improves water holding capacity. As well, continuous cropping helps soil sequester more carbon.[2]

Of their 3000 acres, 600 are planted in hay and forage, either continuously or semi-permanently (7-25 years). Their most marginal lands are permanent pasture.

SWEET CLOVER IN CROP ROTATION

Mary and Ian use sweet clover as part of their crop rotation in areas with high salinity, a strategy which helps to manage salts, improve tilth[3] and soil biology, and improve nitrogen content.[4]

Of their 2000 cropped acres, the couple uses a

[1] fernwoodpublishing.ca/book/civilization-critical
[2] publications.gc.ca/collections/Collection-R/LoPBdP/BP/prb0038-e.htm
[3] Tilth refers to the physical condition of soil, especially as it relates to suitability for growing crops.
[4] www.sare.org/Learning-Center/Books/Managing-Cover-Crops-Profitably-3rd-Edition/Text-Version/Legume-Cover-Crops/Sweet-Clovers

crop rotation based on pulses in year one, cereals in year two, and oilseeds in year three. In those areas that are very saline and do not support many crops, biennial sweet clover is planted. Sweet clover's long roots pull water and salts down. The sweet clover is left standing through the second year. In year three, the sweet clover is cut and baled in late June. It then regrows and is harrowed the following spring and oil seeds are planted. If it is dry, harrowing isn't needed before seeding. Soil testing has proven this approach to dealing with salinity to be successful on their farm.

While improving the soil, the strategy also improves nitrogen content, as sweet clover is a nitrogen fixer. The legumes used in their regular rotation similarly help to improve soil nitrogen content. Improving soil nitrogen content helps to reduce the use of nitrogen fertilizer. Nitrogen fertilizers contribute to emissions of nitrous oxide, a powerful greenhouse gas.

NUTRIENT CYCLING THROUGH ANIMAL WASTE

Especially in the temperate grasslands, animal waste is critical to supporting the soil's microbiology and biomass, which in turn supports the soil's ability to sequester carbon. The economic and environmental costs of hauling manure presents challenges, but the couple is committed to using its livestock manure as extensively as possible.

They spread manure on three areas of their land, about 400 to 500 acres in total. In any given year, the manure they spread completely replaces synthetic phosphorous fertilizer on about 160 acres. The following couple of years when the manure is spread in different areas, the spread manure maintains a residual effect. Reducing or eliminating the application of phosphorous reduces the potential impact of phosphorus run-off on water quality.

Their cattle graze on cropland, typically fields far from the yard, from late October through January and occasionally into February. On the grazed fields, the benefit of the manure is not enough to completely replace synthetic fertilizer, but helps to reduce its use.

If they had life to live over again, Ian and Mary would choose to have a better balance of livestock and grain. Having more livestock would allow more of their land to benefits from the added nutrients that livestock provides.

PRESERVING WETLANDS AND BUSH

Carrying on the tradition of Ian's grandfather, the couple protects about 300 acres of wetland. They see this as critical to not only supporting biodiversity, but also as a way to sequester carbon. The couple is concerned about the rate at which wetlands continue to be drained. Across the prairies, wetland loss exceeds 70%, making wetlands one of the most threatened ecosystems in North America.

Scientists have identified that wetland restoration in the prairie provinces could make a significant contribution to greenhouse gas sequestration.[5]

Similarly, the couple also chooses to leave significant areas of bush and tree areas untouched. They sequester carbon. Trees like willows are very good at managing saline soil conditions.

Stepping It Up

Motivated by content of Darrin Qualman's book, Mary and Ian decided to install a 16.9 kilowatt solar array to provide all of the farm's electrical needs. In fact, they installed 15% more capacity than they require to allow for future expansion into electrical vehicles. They already use an electrical golf cart during the summer months to check on the goats that are strategically moved around the farm to add nutrients to the soil and help with weed control.

Next, they hope to invest in an electrical run-around truck for other uses around the farm.

Although they were able to have their array installed very quickly, delays in connecting it to the grid[6] meant they lost several months of benefits from it. Nevertheless, they are happy with their solar panels and contend that solar panels should be a 'slam-dunk' for any Saskatchewan farm.

Assessing the Impacts

Mary and Ian say that it is difficult for them to quantify the impact of their farming practices, but they feel that they are based on best practice and they continue to look for ways to improve on them. For instance, now that the price of variable rate technology[7] in crop production has come down, it has become feasible for use on even small farms. In the near future, they hope to have their fields mapped to facilitate variable fertilizer application. This

[5] cbmjournal.biomedcentral.com/articles/10.1186/s13021-018-0094-4 and www.globenewswire.com/news-release/2019/01/31/1708736/0/en/Making-the-connection-between-wetlands-and-climate-change.html

[6] The electrical meter for grid-tied installations effectively runs in two directions, depending on whether you are putting electricity into the grid or pulling electricity out. SaskPower allows credit and debits to be carried over from month to month for up to three years.

[7] www.agr.gc.ca/eng/science-and-innovation/agricultural-practices/soil-and-land/soil-nutrients/variable-rate-nutrient-application-should-i-consider-it-for-my-farm/?id=1368026127650

will help them limit nitrogen fertilizer application to those areas where it is needed, reducing nitrous oxide emissions.

In terms of their solar installation, they are happy with it. It is performing as expected. They appreciate SaskPower's incentives to get into solar, but feel that to truly support a transition to solar the province needs to consider issues of power storage as actively as issues of generation. According to Ian, a provincial storage strategy could open the door to small solar producers, like farmers, providing power to neighboring villages during power outages to maintain key functions like water treatment or emergency centres.

By employing strategies that help to boost their soil's nitrogen content, Mary and Ian have reduced their use of nitrogen fertilizers, thus reducing associated greenhouse gas emissions. Soil microbes convert nitrogen fertilizers into nitrous oxide, a greenhouse gas with 300 times as much heat trapping power as carbon dioxide.[8] Calculating these emissions is difficult because it depends on many factors, including soil type, soil microbial activity, moisture, temperature, season, crop type, fertilization rates, and other agricultural practices. Researchers have pegged the microbial conversion of fertilizer to gas at somewhere between 1.75 and 5 percent.

In addition, approximately 50% of the greenhouse gas (GHG) emissions associated with fertilizers are attributable to their production.[9] Any reduction in the use of synthetic fertilizers represents a drop in the greenhouse gas emissions associated in the production of those fertilizers, before even considering emissions associated with transporting them.

The Saskatchewan Soil Conservation Association states that Canadian cropland could sequester about 22 million tonnes of atmospheric CO_2 per year.[10] Best practices to support CO_2 sequestration include increasing biomass and continuous cropping, both of which are used on the McCreary farm.

Conserving wetlands is a recognized asset in carbon sequestration. Ducks Unlimited Canada estimates that Canada's wetlands store approximately 150 billion tonnes of carbon.[11] At the same time, however, we've lost in excess of 90% of our wetlands and continue to lose more. It is critical to protect those we still have, something that Ian and Mary take to heart on their farm.

[8] www.sciencenews.org/article/fertilizer-produces-far-more-greenhouse-gas-expected
[9] www.farmcarbontoolkit.org.uk/toolkit/fertiliser-production
[10] ssca.ca/soil-carbon-sequestration
[11] https://www.globenewswire.com/news-release/2019/01/31/1708736/0/en/Making-the-connection-between-wetlands-and-climate-change.html

By the Numbers

Their solar array will produce enough electricity to offset all of their electrical use. The solar array will save an average of $4,228 a year over the next ten years. Assuming a price on carbon[12] and annual SaskPower rate increases of 5%, the solar array will pay for itself in about 10 years. About 12.7 tonnes of greenhouse gases (carbon dioxide equivalent) will be avoided annually which, based on the current carbon pricing, will save them $63.50 in carbon levies in 2019, growing to $158.75 in 2022.

	Electricity $ Saved	GHGs Avoided (Tonnes CO_2e)	Electricity (kWh) Not Purchased	Simple Payback	Return
2018 (four months solar, actuals)	$1,559	5.55	11,000	10.1 years	9.9 %
2019 (full solar, calculated)	$2,867	12.7	20,400		

Moving Forward

Ian and Mary are happy with the choices they have made and continue to look for ways to run the farm to benefit both the environment and their bottom line. Their advice to others is "get on with it." They feel that everyone must recognize that the atmosphere is a shared resource and a shared concern. While it is tempting to wait for someone else to fix the problem, we all have to figure out how to do our part. Especially farmers need to acknowledge the privilege of their access to the bounty of land and nature and need to figure out how to give back to the society that affords them that privilege.

Agriculture will disproportionally be affected by the impacts of the climate crisis. Saskatchewan farmers have always been vulnerable to the weather extremes. As climate change amplifies these extremes, farmers will become increasingly vulnerable to flooding, droughts and changing pest and disease ranges.

Agriculture is a difficult sector in which to reduce greenhouse gas emissions, but McCreary Land and Livestock demonstrates that farms can do their part to reduce greenhouse gas emissions without negatively impacting their financial viability.

For Your Information

Darrin Qualman, *Civilization Critical: Energy, Food, Nature and the Future*: fernwoodpublishing.ca/book/civilization-critical
Saskatchewan Soil Conservation Association: ssca.ca
Ducks Unlimited: www.ducks.ca/places/saskatchewan/
SaskPower Net Metering Program: www.saskpower.com/about-us/media-information/news-releases/saskpower-updates-net-metering-program

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[12] This will start at $20/tonne in 2019 and grow to $50/tonne by 2022. SaskPower is not charged on its full emissions; rather, it is only charged on those above a natural gas generation standard, so only on about 25% of its overall emissions.