PRACTICES WITH POTENTIAL FOR ON-FARM GREENHOUSE GAS MITIGATION IN MANITOBA – What's Next?

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Summary: Despite increases in greenhouse gas (GHG) emissions (Fig.1), various indicators suggest a drop in emissions per unit product (e.g. emissions per kg of beef live weight (Fig. 4)) or unit of income (Fig.5). Emissions intensity has fallen due to adoption of Beneficial Management Practices like those listed in Table 1. To bend the Fig. 1 emissions curve downward may require more than incremental adoption of BMPs. The linear production model shown in Fig.2 can be re-imagined as inter-woven, renewable cycles (Fig. 3), as a way toward a sustainable agricultural future.

GREENHOUSE GAS EMISSIONS

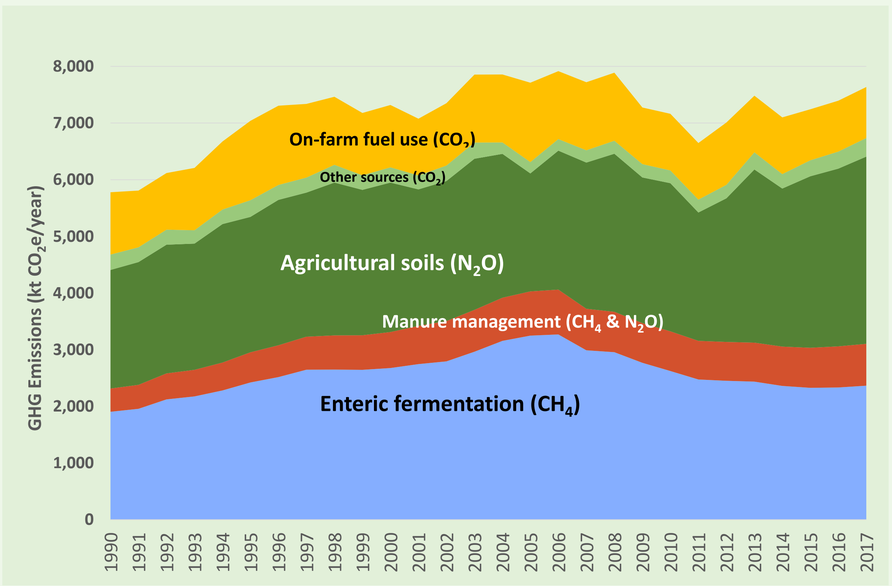

Figure 1. Agricultural greenhouse gas emissions estimates for Manitoba, 1990-2017.
Source: Adapted from 2019 National Inventory Report: Greenhouse Gas Sources and Sinks in Canada, ECCC.

BENEFICIAL MANAGEMENT PRACTICES

Table 1. A selection of Beneficial Management Practices (BMPs) for reducing agricultural greenhouse gas emissions.

ENTERIC FERMENTATION	MANURE MANAGEMENT	AGRICULTURAL SOILS	OTHER SOURCES	ON-FARM FUEL USE
IMPROVE GRAZING MANAGEMENT to boost forage quality, reduce enteric methane and increase growth rates	**REDUCE MANURE STORAGE TIME** to reduce methane generation	**IMPROVE SYNTHETIC N FERTILIZER USE** (i.e. *4R Nutrient Stewardship*) to maximize N uptake by crops and minimize N loss	**ELIMINATE CROP RESIDUE BURNING** to conserve organic matter, and to prevent associated methane and nitrous oxide emissions	**IMPROVE ENERGY EFFICIENCY OF FARM BUILDINGS**
IMPROVE HERD MANAGEMENT to raise breeding success and calf survival	**TEST FEED AND BALANCE RATIONS** to avoid exceeding protein requirements	**DEVELOP CROP VARIETIES** with improved N use efficiency	**MINIMIZE USE OF LIMESTONE, UREA AND UAN** to reduce associated soil CO_2 emissions	**IMPROVE FUEL EFFICIENCY OF TRUCKS AND FARM MACHINERY**
TEST FEED AND BALANCE RATIONS to optimize winter nutrition and identify appropriate feed additives	**OPTIMIZE MANURE APPLICATION METHODS** for avoiding N losses to the environment	**ADD LEGUMES TO CROPPING SYSTEMS** to reduce reliance on synthetic N		**ADOPT BIOFUELS** e.g. biomass for heating; biodiesel for transportation
INITIATE BREEDING PROGRAMS for more productive and/or efficient animals	**IMPROVE MANURE HANDLING AND STORAGE SYSTEMS** to reduce ammonia emissions	**INTEGRATE LIVESTOCK AND CROP PRODUCTION** to enhance nutrient cycling and reduce synthetic N use		**ELECTRIFY** Shift from fossil fuel to electric power where feasible

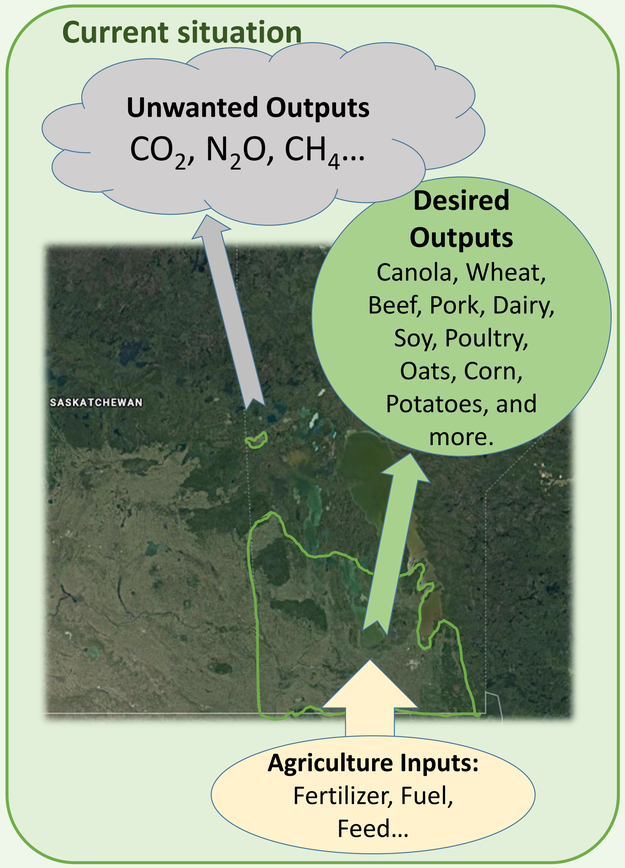

Figure 2. Simplified diagram of the current linear flow of agricultural inputs to, and outputs from, the agricultural regions of Manitoba.

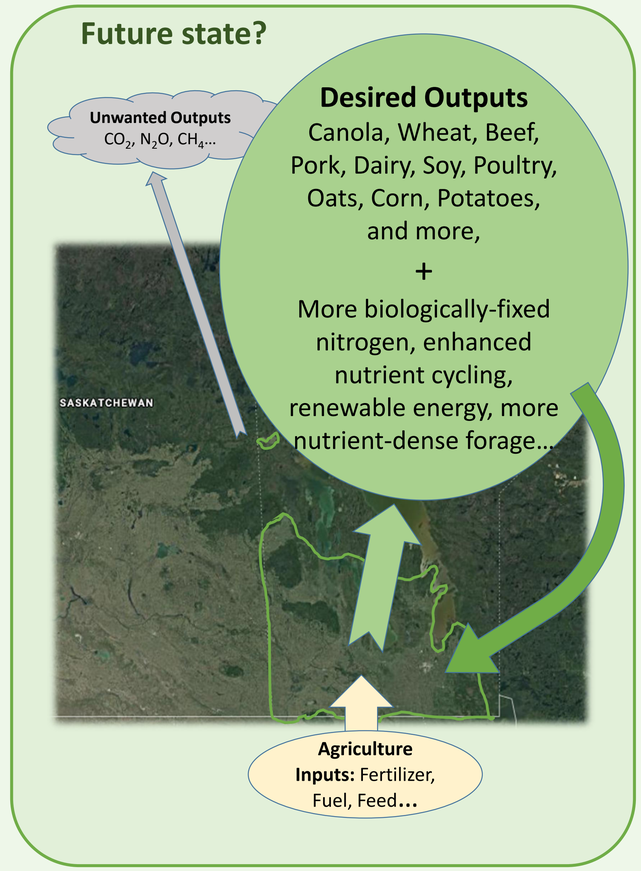

Figure 3. Simplified diagram of a future agricultural system in Manitoba with enhanced nutrient, water, and carbon cycling leading to reduced inputs, a broader range of desired outputs, and decreased unwanted outputs.

GHG INTENSITY HAS IMPROVED

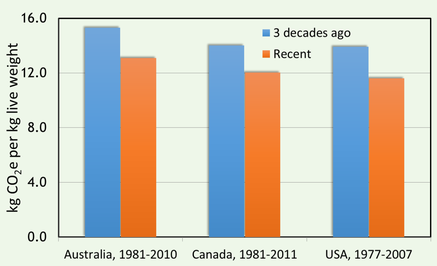

Figure 4. Change in greenhouse gas emissions per kg of beef live weight over three decades.
Source: Adapted from Legesse et al. 2016. Anim. Prod. Sci. 56(3):153-168.

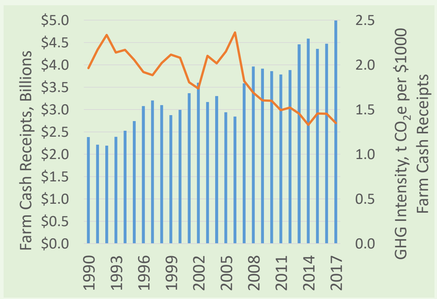

Figure 5. MB farm cash receipts for 1990-2017 corrected to 2002 dollars, and corresponding GHG intensity (orange line).
Sources: Adapted from: Statistics Canada. Table 32-10-0045-01 Farm cash receipts, annual; 2019 National Inventory Report: Greenhouse Gas Sources and Sinks in Canada, ECCC.

WHAT MIGHT BE POSSIBLE?

For consideration:

- How can the agriculture sector prioritize sustainability and farm profitability over maximizing production?
- What opportunities exist for maximizing natural sources of fertility?
- What is optimum diversity in the agri-ecosystem, what benefits can it provide and how can we get closer to it?
- What opportunities exist for increasing renewable energy use?

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