Canadian Beef Advisors – Industry Goals to 2030

Updated February 19, 2025

Water Goals

These goals are not presented in any particular order:

- Promote practices that maximize water quality and retention, to deliver healthier landscapes, resilience to drought and flood events, and groundwater recharge as appropriate to the region's precipitation
- Improve water use efficiency in the beef value chain
- Build recognition by the public and policy-makers of the benefits provided by grassland ecosystems, including:
    - Protection of wetlands
    - The role of wetlands as important carbon sinks
    - Filtration of nutrients that protect water quality and reduce non-point source pollution
    - Resilience to drought and flood events
    - Support groundwater recharge and future water supplies

Context

More than 500,000 hectares (1.23 million acres) of wetlands have been lost in the Canadian prairies over the last 60 years (Ducks Unlimited Canada, 2020, CRSB 2020). Developed areas of Canada have seen major wetland losses (>90% in some regions). Beef producers tend to preserve wetlands on pasture. There are approximately 1.6 million acres of wetlands found in grasslands across Canada (Ducks Unlimited Canada, 2020).[1]

Protecting wetlands is a priority for multiple reasons. First, wetlands are natural carbon sinks. Drainage of wetlands in the Canadian prairies is estimated to have resulted in the loss of 43.5 million tonnes of carbon that was stored in sediment and vegetation (Ducks Unlimited Canada, 2020). This is equivalent to emissions from around 33.5 million cars. Beef producers generally maintain wetlands on their land, this action prevents emissions of carbon that would be released if wetlands were converted to other land uses.

Wetland drainage increases watershed connectivity and nutrient export. Reduced storage as a result of wetland drainage result in increased peak flows, total volume discharged, and this can increase the risk of soil erosion. Wetland drainage can convert areas that were acting as phosphorus sinks into phosphorus sources and facilitate the export of nutrients at the watershed scale. Additionally, grasslands act as a natural filter for nutrients through plant uptake and/or through higher infiltration rates, which reduces run-off. Grass can be used as buffer strips at the edge of cropland. Grazing these grass buffers can increase plant diversity and contribute to surface roughness that increase nutrient uptake. The characteristics that promote nutrient retention and protect water quality were observed to be more prevalent on grazed grasslands than on ungrazed grasslands (Lord et al. 2002, Lloyd et al. 2019, Mapfumo et al. 2002).

Erler et al. (2019) noted a risk to food production due to climate change with increased regional drought and flood events. In the Canadian prairies, climate changes is expected to result in droughts increasing by as much as 7%, floods are thought to increase by upwards of 3% with the severity being 104% greater than current flood events (Shrestha et al. 2017, Zargar et al. 2013, Ammar et al. 2020). Floods can lead to water contamination and property damage. An increase in water availability was predicted, but only regionally in the east. Wetland drainage from 1958 to 2008 is estimated to have increased the 2011 flood peak in the Smith Creek drainage in east-central Saskatchewan by 32% and annual streamflow volume by 29% (Pomeroy et al. 2014). Wetlands or depressions, soil permeability and surface roughness all support the landscapes natural water storage capacity, acting like a sponge, and can help reduce peak flows during a flood. This water storage capacity varies based on soil characteristics and how much

[1] Estimated using AAFC grasslands layers, the Canadian Wetland Inventories, and CanVec datasets. Analysis completed by Ducks Unlimited Canada.

moisture soils are holding from the previous season. When mitigating flood risks, implementation of retention ponds can reduce peak discharge by 50% and total runoff volume by 40% (Posthumus et al. 2008).

Vegetation composition plays a key role in the soil's ability to retain water. Hedgerows and 5-meter buffer strips with a vegetated ditch can decrease runoff volume by as much as 30% (O'Connell et al. 2007). For every 1% increase in soil organic matter results in as much as 20,000 gallons of available soil water per acre.[2] Converting grassland to forest led to a decrease in annual recharge rates from 9.65cm/year to 0.07 cm/year (Adan et al. 2018). Grazing livestock on grassland maintained 99% of the total rainfall in groundwater aquifers compared to 2.33% in arable land (Sharma 2001). In Saskatchewan, research has shown that the infiltrability of the frozen soil in the grassland is high enough to absorb most or all of the snowmelt, whereas in the cultivated fields the infiltration into the frozen soil is limited and significant runoff occurs (van der Kamp et al. 2002).

How the goals could be achieved

Good grassland management practices (around wetlands) have proven to be key in reducing impacts on aquatic ecosystems. The table below lists practices that can contribute to achieving these goals (this list is not comprehensive). It should be recognized that the effect of specific practices on water quality is highly dependent on precipitation levels. For example, buffer strips may reduce sediment and nutrient loss during extreme rainfall events, but buffer strips may not be needed in semi-arid regions or cold climates where natural runoff levels can be low.[3] It is critical to choose regionally adapted strategies as appropriate.

Water Quality	**Drought/Flood Resilience**	**Supporting Carbon Sinks**
• Maintain wetlands • Good grazing management (e.g. avoid overgrazing) • Buffer strips as environmentally appropriate • Retention ponds • Limit livestock access to water bodies via off-site water troughs, access ramps and fences[4]	• Maintain wetlands • Improve soil permeability (i.e. water infiltration) • Improve soil water holding capacity • Maintain surface roughness with pasture and grazing • Retention ponds and/or planned storage	Soil organic matter increases under strategic grazing; • increasing carbon and nutrient sequestration • boosting water-holding capacity of soils Promote ecosystem service payments to landowners • Maintain wetlands
Groundwater recharge/storage	**Water Holding Capacity**	**Improving Water Efficiency**
• Maintain wetlands • Maintain grasslands (e.g. minimize afforestation) • Improve irrigation efficiencies	• Maintain and restore wetlands • No-till • Stubble • Catch snow	• Recycling water at feedlots and processing • Irrigation efficiencies

While in natural grasslands the best approach is to leave all wetlands to perform their natural function, with grazing management accommodating these riparian areas as needed. It is recognized that in tame pastures and other, younger or rotational grasslands, a wider range of management techniques may be required to optimize water outcomes, depending on landscape and local environmental conditions.

FAQs

Q: **How are wetlands defined?**
A: "Wetlands" and "waterbodies" include streams and creeks – often termed "riparian" areas and isolated wetlands such as prairie "potholes".

Q: **How does this water goal connect with the other 2030 industry goals?**
A: A strong water goal contributes to the land-use and biodiversity, and greenhouse gas and carbon sequestration goals as wetlands are rich in biodiversity supporting wildlife and are significant carbon sinks.

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[2] https://www.nrdc.org/experts/lara-bryant/organic-matter-can-improve-your-soils-water-holding-capacity
[3] https://www.topcropmanager.com/do-vegetated-buffers-actually-mitigate-nutrient-runoff-in-canada/ and https://cdnsciencepub.com/doi/pdf/10.1139/er-2017-0077
[4] See https://cowsandfish.org/about-us/ and the impact of the cattle industry on water quality https://cowsandfish.org/publications/riparian-areas-and-grazing-management/

Q: **What about other ecosystem services?**
In addition to goals around water quality and quantity there are goals set around other ecosystem services associated with beef producing landscapes such as land use, biodiversity, and carbon sequestration. While these goals are presented separately it is recognized that they are interconnected and will work together on the landscape.

Q: **Is there scientific literature that supports these goals?**
A: Yes (see reference section). Cattle are a key part of maintaining grassland and vegetation health. Research has shown there is negligible risk to water quality under effective grazing management. Negative impacts on water quality are typically associated with overgrazing, reducing water filtration, direct pollution from defecation and erosion when cattle have direct access to water sources. Grasslands can help maintain water quality and availability. Grasslands have superior nutrient uptake and filtration capabilities compared to conventional cropland. Grasslands minimize and mitigate, groundwater nutrient load and nutrients carried in field runoff. The effectiveness of nutrient filtration is impacted by soil type and slope. Effective grassland placement is key to mitigating nutrient leeching into aquatic ecosystems.

Having wetland/depression storage, soil permeability and surface roughness present on the landscape resulted in reduction of peak flows during floods and increased groundwater recharge (Aquanty, 2020). Higher wetland/depression storage and higher soil permeability both act to shorten the flood hydrographic tail. Higher surface roughness slows down runoff, extending the flood hydrograph tail. Higher wetland/depression storage and higher surface roughness both act to hold more water on the land surface. Higher soil permeability reduces water on the land surface which increase available storage during floods. All three enhance flood resiliency by storing water on the landscape, reducing peak flows, and reducing the seasonality of water flows, which also enhance drought resiliency (Aquanty, 2020).

The scientific community is working to develop and validate tools to better quantify the water holding capacity of agricultural landscapes. This is yielding a better understanding of the natural infrastructure potential associated with agricultural land management decisions.

Q: Why is there not a percentage reduction target for the water use efficiency goal?
A: The Canadian beef industry uses 631 litres of blue water per kilogram of boneless beef (packaged, delivered and consumed) (CRSB NBSA, 2016). Continuous improvement is a tenet of sustainable beef production and the beef industry is always looking for ways to reduce any environmental impact. More efficient crop and cattle production means that it took 17% less water to produce 1 kg of beef in 2011 compared to 1981 (Legesse et al. 2018). There are new innovations becoming available that will allow for an even greater use of recycled water within the supply chain. New technologies to recycle and re-use water can reduce the amount of water needed for beef processing by 90% (Legesse et al. 2018).

Irrigation is the largest contributor to water use. As investments are made into irrigation infrastructure across Canada in the coming decade it is expected that water use efficiencies will improve for any feed grown on land with irrigation. It should be noted that in Canada irrigation of feed crops is substantially lower than in other regions - with the by-products of high-quality food products going into cattle feed. Only 9% of cropland is used for cattle feed production in Canada (CRSB NBSA, 2016).

Q: Given wetlands are really important, how can they be protected or restored?
A: The ability to prevent wetland drainage of the existing 1.6 million acres of wetlands found on grasslands across Canada is threatened by competing uses (i.e. urban expansion), the economic returns to grain versus beef production, and potential of new irrigation acres.

Building a recognition of the economic and environmental benefits from wetlands is a first step. Research that quantifies the natural water storage capacity of wetlands can assist in communicating this value to various stakeholders. In addition, have carbon payments to producers that include the carbon sequestration from wetlands would provide an incentive to maintain and potentially restore them.

Q: **Wetland preservation requires a coordinated approach with the crop sector, how does this goal compare?**
A: The Canadian Roundtable for Sustainable Crops (CRSC) draft Responsible Grains Code of Practice (Dec 2020 version) has sections on Protection of Surface and Ground water and Protection of Riparian Areas that encourage use of buffer zones or vegetative areas around natural and man-made water bodies. As well as a section on Agricultural Land Drainage Management. The CRSC and CRSB are sharing information on areas of mutual interest.

Q: There have been government announcements about expanding irrigation acres in 2020, how will that impact these goals?
A: Provincial investments in dams and expansion of irrigation acres will impact several watersheds. It should be recognized that irrigation allows for more food to be produced per acre and consequently less land is needed for the same amount of production.

Q: What are the benefits to consumers from these goals?
A: Protecting water quality by filtering nutrients has the potential to reduce water treatment needs and costly infrastructure investments. For example, the New York State Agriculture department provides monetary incentives to producers. By reducing peak flows during floods damage to buildings and cities can be reduced. In addition, greater agricultural resiliency to drought and floods provides a more stable food supply and less fluctuation in consumer prices.

Q: Are there benefits for producers from improved water quality?
A: Yes. Good water quality support herd health and animal performance through weight gain. When provided with directly access to water sources, cattle will defecate in that water about 25% of the time. Animal manure in water encourages algae growth. A kilogram of phosphorous, derived from animal manure, will spark the growth of 500 kg of algae. Lakes, ponds, dugouts and sometimes rivers and streams can experience large algae blooms. This strongly influences water palatability, and some algae are toxic to livestock. Surface water contamination contributes to herd health problems including increased exposure to water-transmitted diseases, bacteria, viruses and cyst infections, blue-green algae toxins, foot rot and reduced weight gain (Alberta Agriculture and Forestry 2007, Willms et al. 2002, Lardner et al. 2005, Holechek 1980).

Q: Are there benefits for producers from improving soil's water holding capacity and water infiltration?
A: Yes, by improving the soil's water holding capacity and water infiltration; the impact of flood and drought can be mitigated making operations more resilient to weather extremes.

Q: **Was the cost of implementing these goals calculated?**
A: It was recognized that there are costs to industry in changing practices to achieve these goals, particularly, in lost crop productivity when wetlands are not drained. As noted in the Land Use and Biodiversity goal fact sheet there is a need to develop market mechanisms that provides payments for ecosystem services such as protecting wetlands. Investments may be needed that lead to desirable water outcomes.

Producers have historically adopted and invested in practices that are economical and provide value. Ongoing production efficiencies tend to be quickly adopted when they make economic sense to individual operations. Historically incremental improvements have been made with a focus on production efficiencies and economic viability.

Q: How does this goal account for the water cycle?
A: Cows, like all food production, use water, but we need to remember that water cycles in the environment. Cattle are not sponges that endlessly absorb water. Nearly all the water that people or cattle consume ends up back in the environment through manure, sweat, or water vapor. We know that most of the water plants take up from the soil is transpired back into the air. Like city water, the water that beef processing facilities take out of the river at one end of the plant is treated and returns to the same river at the other end of the plant.

Practices that contribute to how the goals can be achieved include things that actively improve water quality and quantity at key points within the water cycle (whether in the animal, the processing plant, or the grassland environments in which the animals are grazing).

Update on Progress (February 2025)

- Blue water footprint in 2014 was 1912.4 Liters per Kg boneless beef, consumed (CRSB NBSA 2016), that was slightly higher in 2021 at 1919.2 Liters per Kg boneless beef, consumed (CRSB NBSA 2024).
- Water quality as reported by Freshwater eutrophication potential in 2014 was 4.1g P eq live weight (CRSB NBSA 2016), and decreased in 2021 to 2.6g P eq live weight (CRSB NBSA 2024).
- Recognition of benefits is being built by partners, for example promotion of the Guardians of the Grasslands video and educational resources.
- The 2025-30 National Beef Strategy outlines the plan industry is following to achieve these goals with Status Updates reporting progress. The Canadian Roundtable for Sustainable Beef's National Beef Sustainability Assessment follows internationally recognized methodology for measuring and monitoring these goals.

For further information, go to: Beefstrategy.com

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