Alberta NAWMP Partnership

Science Stories

Could Wetland Retention Be Better for Crop Yields Than Wetland Drainage?

"The perception that we hear often from agricultural producers is that draining a wetland produces an economic benefit because you create an area where you can now grow crops. But is there actually an economic benefit to the practice of draining and cultivating a wetland in a crop field?"

So asks Dr. Shari Clare, Director and Senior Biologist with Fiera Biological Consulting. Clare is leading an Alberta project to explore this question in a quantitative, objective way. The findings could inform efforts by Alberta NAWMP, the Prairie Habitat Joint Venture (PHJV) and others to encourage Alberta crop growers to not drain existing wetlands and to restore drained wetlands.

When Prairie wetlands are left intact, they provide vitally important wildlife habitat, as well as many other ecosystem services such as flood reduction, water quality treatment and soil retention.

Incompletely drained wetlands in this canola field have poor crop yields. Photo: Fiera Biological

"Despite increased scientific understanding of wetland benefits and the implementation of government policies to prevent or minimize wetland drainage, wetland ecosystems continue to be lost," she says.

Loss of wetland ecosystems is a serious concern. Alberta's Wetland Policy states, "Since the late 1800s, wetlands in Alberta have been subject to loss and degradation due to human development activities on the landscape. These activities, which include agricultural and urban expansion, forestry, oil and gas exploration and development, and mining, can result in direct wetland loss….It is estimated that Alberta has lost two-thirds of its wetlands in the White Area (settled area) of the province; these losses are ongoing."

Clare points to a couple of reasons why draining and cultivating a wetland might not be a guarantee of improved economic returns for a crop grower – in either a wet year or a dry year.

One reason is that drained wetlands often tend to be wet spots in a field. Typically these wetlands are drained using ditches, but often the drainage is incomplete. Especially in wet years, these imperfectly drained wetlands have soggy soils that produce poor crop yields.

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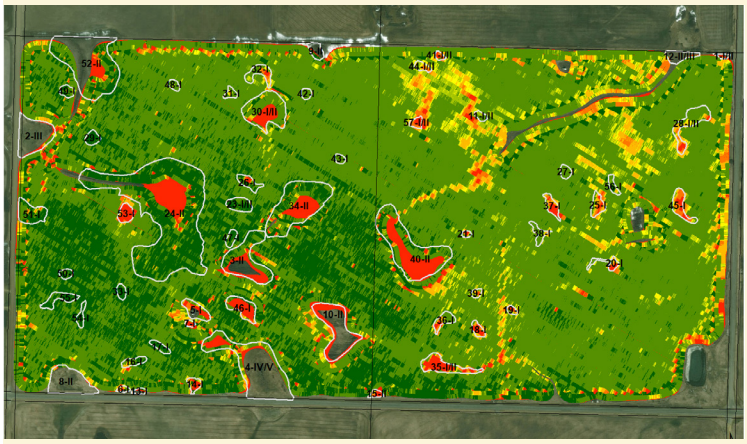

The profit/loss map for each field was overlaid with a map of the wetlands (which are outlined in white) to show how decisions about managing wetlands impacted profits. Photo: Fiera Biological

The other reason is that an intact wetland might actually benefit crop growth particularly in hot, dry years. Clare explains, "Wetlands influence their surrounding lands by increasing soil moisture and nutrient retention, as well as by moderating temperatures." Research shows that this 'halo' effect occurs in natural areas, so Clare is wondering if it might also boost crop yields near the margins of retained wetlands.

Quantifying profits and losses

To take a closer look at these two factors, the project is quantifying the crop yields and profits within and adjacent to drained-and-cultivated wetlands, and the yields and profits along the margins of retained wetlands.

Clare and her team at Fiera Biological are collaborating on this project with Dr. John Pattison-Williams of Pattison Resource Consulting Ltd. The Alberta NAWMP Partnership's Science Fund and the Alberta Conservation Association funded a portion of this work in 2019.

For 2019, the researchers partnered with three farmers in the Camrose Creek watershed of central Alberta to collect data from four canola fields.

These four fields contain many wetlands, encompassing a wide range of management practices including: completely drained wetlands that are cultivated; imperfectly drained wetlands that are cultivated; retained wetlands that are seasonally wet and sometimes cultivated; and intact wetlands that are never cultivated.

Using imagery from a drone in 2019 along with air photo and satellite imagery from the past, the researchers mapped the boundary of each wetland and characterized it in terms of management practices.

Clare explains, "For instance, if we could see clear evidence of drainage, then we characterized that wetland as a drained wetland . Some of the wetlands appeared to be intact hydrologically. Some fields had really extensive drainage with only a few retained wetlands. Some fields had consolidated wetlands [where the water from several smaller drained wetlands is directed into a larger, retained wetland]."

The drone took images of the four fields at three different times during the growing season to track things like crop development and changing soil moisture conditions. The researchers also used the imagery to model the water flow dynamics within and around each wetland.

Pattison-Williams, a resource economist, interviewed the three producers to get a realistic picture of the key crop input costs to include in the project's economic analysis.

The producers provided data from their farm equipment on seeding rates and fertilizer applications and the variation in canola yields across each field. The researchers used this information to calculate the crop input costs and canola revenues across each field.

From that dataset, they created a net profit map for each field. "So for each location on the field – we could pinpoint locations in about 50-centimetre increments – we could estimate whether the producer made a profit or a loss based on the inputs and outputs," explains Clare.

"Then we overlaid the profit map onto a map of the wetlands in the field. And then we calculated whether there was a profit or a loss for the farmer, within the boundaries of each of the drained-and-cultivated wetlands."

She notes, "For the intact wetlands, there are no input costs and no crop yields because the producers are staying out of those wetlands entirely. As a result, they are making neither a profit nor a loss on those wetlands."

Preliminary results and next steps

The weather in 2019 was tough for the producers. The spring was dry while the rest of the growing season was wet and cold. The fall weather was so poor that they weren't able to take their crops off until November or December.

Clare and her team are currently finalizing their spatial

analysis of the 2019 data. They have already completed the analysis of the profits and losses within the drained-and-cultivated wetlands in the four fields.

The results really varied from wetland to wetland.

A few of the drained-and-cultivated wetlands remained well drained over the growing season, and produced good yields and good profits. However, many of the drained-and-cultivated wetlands were too wet for good crop growth. For those poorly drained wetlands, the producers had input costs for seeding and fertilizing, but the canola yields were poor, sometimes as low as zero. For some of those too-wet areas, the revenues were lower than the input costs.

"The results for the drained-and-cultivated wetlands ranged from losses of a nearly $300 per acre to profits as high as $450 per acre, with an overall average profit of about $16 per acre," summarizes Clare.

To put those numbers in context, a 40-bushel per acre yield for canola is considered good in the Camrose area, and canola was priced at about $10 per bushel at the time. In general, a net profit of around $100 per acre would be considered reasonably good.

The researchers will also be looking at the profits and losses for small, retained wetlands that are seasonally wet but are typically seeded and cultivated, as well as areas within 10 metres of the wetland margins to assess the possible halo effect .

Implications for producers and conservationists

"This one year of data suggests that draining and cultivating wetlands may not be as profitable as producers expect," says Clare.

"However, 2019 was an unusual year in terms of the weather, and we're sensitive to the fact that people might dismiss the findings because it's just one year of data. We would really like to be able to collect more data over additional years and try to get a dry year and some average years so we can have a look at a longer-term average.

"The 2019 weather was probably an extreme in terms of excess moisture. So our findings may be giving us a worst-case scenario in terms of economic losses. But even in drier years, I think there will likely be trade-offs."

For instance, the wetlands that are well drained in a wet year may be too dry for good crop growth in a dry year.

"One of the take-home messages is that you probably need to have a close look at each drained-and-cultivated wetland [to see whether it is worthwhile to continue trying to grow crops in it]," notes Clare.

The project's findings could also have implications for developing policies and incentive programs to encourage wetland retention and restoration. "Giving farmers a more realistic understanding of how much money they actually are making off those drained wetlands – it is a relatively small profit margin in most cases – might bring producers around to the idea that there may be better choices than draining wetlands," she explains.

"For instance, in a payment-for-ecosystem-service scheme, the amount of money that a conservation organization might need to pay to encourage wetland retention might be lower if producers understand that in many situations drainage does not lead to large profits."

Clare concludes, "In Alberta, it is accepted that you make money if you drain. But this research challenges that notion. It shows that the situation is more complicated. I think we have to have a more nuanced discussion with producers around whether drainage is profitable for the agricultural community."