CAPI
THE CANADIAN AGRI-FOOD POLICY INSTITUTE

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Irrigation: Saskatchewan's unfulfilled dream

A *Perspective* Report prepared for CAPI by Nicolas Mesly

Perspective Report

The Canadian Agri-Food Policy Institute
960 Carling Avenue, CEF Building 60
Ottawa, ON K1A 0C6
www.capi-icpa.ca

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Note from CAPI

Canada's agricultural landscape encompasses multiple soil zones, crop and animal types, and policy environments. Each jurisdiction and watershed have distinct realities which are not always well understood beyond the regional levels. Case studies can help draw out these realities and communicate them to wider agri-food audiences.

Building on CAPI's Québec case study published in February 2023 (also by Distinguished Fellow Nicolas Mesly), this Saskatchewan case study looks at the potential benefits of irrigation in Saskatchewan agriculture. This report will incite reflection on the role that water management and government investment have on agri-food prosperity and economic viability in Canada.

Key Takeaways

- The Lake Diefenbaker irrigation project (500,000 acres), located in the semi-arid region of the Palliser Triangle in Saskatchewan, was launched in the 1950's, but work stopped in 1973 and the project was never completed. Today, barely 20% of the province is irrigated.
- Lake Diefenbaker provides water to 60% of the province's population, not only for cities such as Regina and Saskatoon, but also for industries such as potash mining and for sport fishing, vacationers, the ecosystems, national parks and, of course, farmers.
- There is enthusiasm by farmers in the Lake Diefenbaker region, but also reservation expressed by Saskatchewan scientists about the management, quantity, and quality of both surface and groundwater.
- Almost 11% of the world's aquifer water (largely non-renewable) is exported through global agricultural trade, creating pressures in water-deficit exporting nations such as the United States; for Saskatchewan, this may present an opportunity.
- As the second-largest country on the planet, with vast areas of agricultural land and 20% of the world's freshwater reserves, Canada has a major role to play in agricultural trade and food security, both domestically and internationally.

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List of abbreviations and acronyms

SCIC	Saskatchewan Crop Insurance Corporation
SIPA	Saskatchewan Irrigation Projects Association
GDP	gross domestic product
PFRA	Prairie Farm Rehabilitation Administration
WSA	[Saskatchewan] Water Security Agency

Text and photos: Nicolas Mesly

Centre pivot with low-pressure drop hose sprinklers.

Introduction

With a total area larger than France or California, Saskatchewan is not just the breadbasket of Canada; it is also one of the world's food baskets. With a population of 1.2 million, it boasts oil, gas, uranium, and potash.[1] The province has been incubating the Lake Diefenbaker irrigation project for 50 years. This project, poised to provide socio-economic benefits and to help tackle climate change, has the potential to transform a semi-arid region of 500,000 acres (202,343 hectares) into more fertile land and in the process to propel Saskatchewan's economy into Version 2.0. In this time of geopolitical uncertainty, the project could propel Canada to a leadership role in global food production.

Irrigation: Saskatchewan's unfulfilled dream

"This spot is where we are aiming to widen and extend this irrigation canal to the next reservoir, about twenty kilometres away," explains my guide, Jason Drury, Director of Irrigation Services at the Saskatchewan Ministry of Agriculture. "If this work had already been done, the face of agriculture and the economy of the province would not be the same," adds Drury, an engineer by training, standing in front of an old, grass-covered dike that has not been maintained for 50 years.

[1] Saskatchewan's potash mines make Canada the world's leading exporter of this fertilizer, which is essential to plant growth.

We are standing at the end of the main west canal in the heart of the Lake Diefenbaker Irrigation Project, a gigantic 500,000-acre (202,343-hectare) irrigation scheme in the Palliser's Triangle. In this vast, semi-arid region in the south of the province, which reaches into Alberta and the United States, a series of droughts from the 1930s to 1941 drove thousands of farming families off their land during a sad and notorious period known as the Dust Bowl.

Jason Drury, an engineer by training and director of Irrigation Services with the Saskatchewan Ministry of Agriculture, stands in front of the grass dike that blocks water from the main western canal at the heart of the Lake Diefenbaker irrigation project. Work to expand and extend this canal was stopped 50 years ago.

We head to the Gardiner Dam, named after the province's former premier. Built between 1959 and 1967, this multifunctional dam on the South Saskatchewan River created Lake Diefenbaker, named after the former Canadian prime minister. It is a huge freshwater reservoir some 225 km long. Four large pumping stations siphon water from the lake into elevated canals that flow by gravity like blue veins through the landscape. Some 60% of the province's population depends on this lake, which supplies the water not only to the cities of Regina and Saskatoon, but also to industries such as potash mining, for sport fishing, vacationers, the ecosystems, national parks and, of course, farmers.

Yet today, Saskatchewan only has 42,000 hectares (104,000 acres) of irrigated land, while its cousin Alberta has 625,000 hectares (1,500,000 acres) — two-thirds of all the irrigated land in Canada. Once almost desert-like, Alberta's land is now a veritable goldmine that generates $5.4 billion of revenue or almost 30% of the province's total agriculture sales, creates 46,000 jobs[2] and breathes new life into rural industry, recreation and wildlife. Irrigation is so crucial in Alberta that the Ministry of Agriculture was renamed the Ministry of Agriculture and Irrigation (in 2022).

To help Saskatchewan make up for lost time, in July 2020, the conservative Premier of Saskatchewan, Scott Moe, announced a $4 billion investment over ten years to begin building the gigantic Lake Diefenbaker irrigation project[3]. In the western part of the province alone, the project aims to rehabilitate and build 400 km of canals, more than 1,400 km of pipeline and install more than 2,000 irrigation systems.

Yet Saskatchewan already is Canada's breadbasket. The province accounts for 43% of the country's cultivated land. It is the leading producer of wheat, canola, lentils, chickpeas, and more. Its cereals, pulses, and specialty crops are exported to over 20 countries. Even France makes its famous Dijon mustard with mustard seeds imported from the province. Saskatchewan is also beef country: the second-largest herd of cattle in the country grazes its prairie. In fact, Canada has largely Saskatchewan and its 35,000 farmers to thank for the country's status as the world's 5th largest exporter of foodstuffs.

Apart from a recent boom in the construction of canola crushing plants in Saskatchewan, major agri-food processors such as Cargill (beef) and McCain (potatoes) have all set their sights on southern Alberta. "Outlook has never had the same economic success as Lethbridge because we don't have the critical volumes of potatoes, beetroot or fodder guaranteed by land irrigation — what we call high-value-added production — to keep the plants

[2] Alberta Irrigation Districts Association, 2021. *Economic Value of Irrigation Districts-A 2021 study*. Google Docs. https://drive.google.com/file/d/1YaWdoPpI3p8nF03q78JJJWHImOzJHc_u/view?usp=share_link&usp=embed_facebook.

[3] Saskatchewan, 2020. Saskatchewan Announces $4 Billion Irrigation Project At Lake Diefenbaker | News and Media. Government of Saskatchewan. https://www.saskatchewan.ca/government/news-and-media/2020/july/02/irrigation-project.

running," explains Jillian Brown, Executive Director of the Saskatchewan Irrigation Projects Association (SIPA), an association of producers who advocate for the development irrigation projects in Saskatchewan[4].

Outlook, the irrigation capital of Saskatchewan, has a population of around 20,000 and is adjacent to the former PFRA experimental farm, now the Canada-Saskatchewan Irrigation Diversification Centre.

What happened to irrigation in Saskatchewan?

In 1973, Saskatchewan's Minister of Agriculture at the time killed the Lake Diefenbaker irrigation development project on the basis that farmers in the area were not adopting irrigation technology quickly enough. The project required considerable public funds and for farmers who had long grown wheat, it would be a costly move that required substantial investment. The farming community was split between those in favour of irrigation and those who opposed it. The story of irrigation in Saskatchewan is told by agronomist Charles Oliver in his book, *The Irrigation of a Desert* (2022).

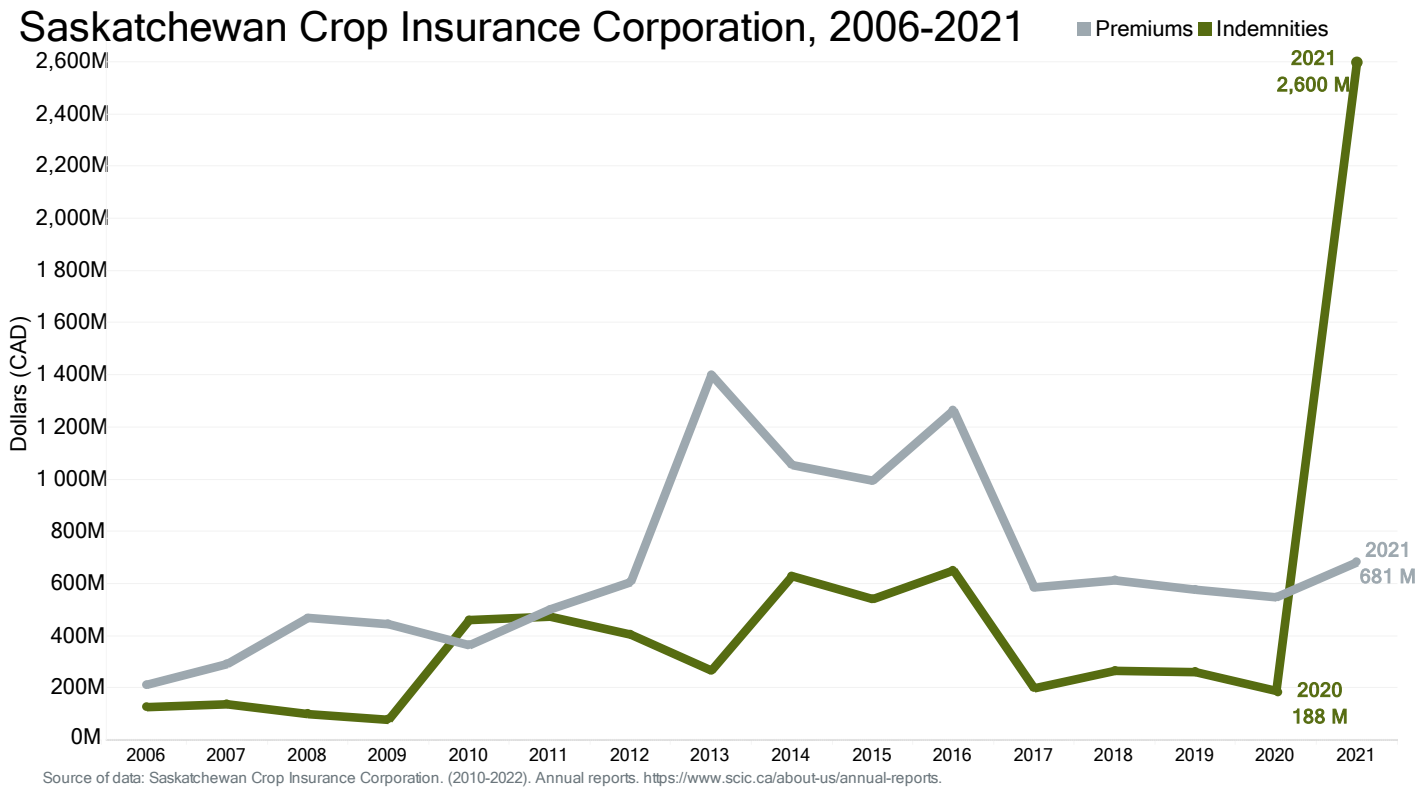
"We've been wheat farmers for four generations," says Jeff Ewen, 35, who farms 13,000 acres (5,261 hectares) in the Riverhurst Irrigation District, one of Lake Diefenbaker's three main irrigation districts. His family managed to acquire irrigated land over the decades with the result that, today, a third of the family business's acreage is lined with irrigation pivots. Wheat and canola yields on his land have doubled, or more. Ewen also grows lentils and chickpeas.

[4] According to official sources, there are around 2,800 individual irrigators and 200 member irrigators in 26 districts concentrated between Regina and Saskatoon, with a few smaller districts in the southwest of the province in the so-called "Palliser's Triangle." The members of a district collectively operate the maintenance of canals, pipelines, et cetera. The government needs to update its database to have an accurate idea of the number of irrigators.

In 2021, a severe drought took its toll on the province's economy. Yields of wheat, canola, lentils and barley fell by 40%, and overall cereal production plummeted by a record 47% according to Statistics Canada. "Irrigation is crop insurance against drought," says the young farmer, who, like most of his peers, received monetary compensation for his non-irrigated land.

Jeff Ewen has received financial assistance from the Sustainable Canadian Agricultural Partnership (Sustainable CAP) to develop his irrigation project. This assistance is for bringing water from the lake to the farm, but it does not include the irrigation pivots, which cost $150,000, or the cost of the electricity to run them. "When you're looking at 5, 10 or 20 pivots, your debt rises quickly," he says.

That year, the province had to pay out $2.6 billion in compensation, compared with an average of $312 million over the last five years[5] (Saskatchewan Crop Insurance Corporation, 2023). These figures include payments for climatic events other than drought, such as frost or hail. One of the arguments in favour of the Lake Diefenbaker irrigation project is that it will lead to substantial savings in crop insurance and lower premiums for all producers.



Source of data: Saskatchewan Crop Insurance Corporation. (2010-2022). Annual reports. https://www.scic.ca/about-us/annual-reports.

[5] Saskatchewan Crop Insurance Corporation, 2023. Annual Reports. SCIC. https://www.scic.ca/about-us/annual-reports.

A graduate in agronomy from the University of Saskatchewan (2012), Jeff Ewen would like to irrigate half of his farmland, but irrigation isn't cheap. There are the costs of maintaining his district's network of canals, pipelines, and the energy needed to pump water from the lake to the land. He estimates the cost of the on-farm irrigation project to be $10 million, which doesn't include the purchase of irrigation pivots at $150,000 each. "It will be the investment of a generation, and we have to make the decision as a family," says Ewen, who runs the business with his father and two brothers.

A well-maintained canal flows like a blue artery through the landscape.

Since 2019, the number of new acres under irrigation in Saskatchewan has almost tripled from around 5,000 acres to 15,000 acres (2,024 to 6,072 hectares). However, according to Jillian Brown, the government's plan to emulate Alberta by aiming for critical volumes of certain products, such as fodder for feedlot animals, is not practicable. "The government should just build the infrastructure and let the entrepreneurs decide on production and marketing choices."

"In terms of irrigation, we are 100 years behind Alberta." Jillian Brown, executive director, SIPA.

On very rare occasions, this spillway is used to drain the overflow from the lake into the South Saskatchewan River.

Two visions of development for potato growing

In 1996, as Charles Oliver recounts in his book, the provincial government created the Saskatchewan Potato Utility Development Company (SPUDCO) with two other partners to develop a critical volume of potato production. The aim was to attract a French fry processing plant. But the venture turned sour after the company spent $36 million in public funds—which included sums for the construction of warehouses where the potatoes ended up rotting—with no buyers and no processors. This led to an RCMP investigation and in 2000 an out-of-court settlement of nearly $8 million to compensate bankers and investors.

Some of these warehouses still exist in the small village of Broderick, a few kilometres from Outlook. It was here that I met Joel Vanderschaaf, General Manager of Tuberosum Technologies Inc, a company whose technology could revolutionize the production of seed potatoes. “SPUDCO was before my time,” he says, offering his own analysis of the situation. “To succeed in business, you have to keep your finger on the pulse of technology, consumer demand, marketing and competitors.”

His parents, of Dutch origin, founded The Little Potato Company in Broderick in 1996, targeting the table potato market, which is very different from the processing market. The company’s head office is now in Edmonton, Alberta. It has contracts with growers in Saskatchewan, Alberta and even the United States. Today, the company’s yellow, red and blue “Little” potatoes—which come with or without herb flavouring and can be quickly cooked in the microwave—are a big hit in grocery chains across Canada.

According to Joel Vanderschaaf, the Lake Diefenbaker irrigation project would attract other innovative potato processors if the volumes of potatoes being produced were sufficient and if processors diversified their portfolio with other products such as starch-based plastics, flour and animal feed products.

But the businessman and researcher points to a worrying phenomenon: “All the major food production centres use irrigation, but they are all faced with a worrying shortage of water. That’s the case in Idaho, California and Texas. Saskatchewan may have a limited growing season, but it could distinguish itself in the market with a project that’s holistic and respects the ecosystem. We must not make the same mistakes other regions made,” he says.

The Gardiner pumping station is one of four large stations on Lake Diefenbaker. Unlike Alberta, where water runs to farms by gravity, in Saskatchewan the water has to be pumped into elevated canals that run like blue arteries through the landscape.

Four huge pumps at the Gardiner station pump water from Lake Diefenbaker into a main canal located 15 to 20 metres higher (depending on the height of the lake). The annual operating cost is $500,000, which is incurred mainly in the growing season.

A short history of irrigation in the Prairies

- **1935.** The federal government creates the Prairie Farm Rehabilitation Administration (PFRA) in 1935, in the midst of the "Dust Bowl," to help producers and encourage them to stay on their farms.
- **1935-2000.** PFRA encourages soil protection and conservation techniques that prevent erosion and encourage water management. Hundreds of thousands of small dams, wells, reservoirs, irrigation schemes and pipelines are built.
- **1958.** An agreement is signed between the federal and provincial governments to build the Gardiner Dam on a cost-shared basis (75% Ottawa, 25% Regina).
- **1967.** PFRA runs an experimental farm on irrigation and technology transfer in Outlook as well as a nursery farm that promotes agroforestry to prevent soil erosion. Collective grazing is also encouraged.
- **1967.** Inauguration of the Gardner Dam and creation of Lake Diefenbaker along with infrastructure to irrigate 500,000 acres.
- **1972.** The Lake Diefenbaker irrigation project is halted. Barely 20% of the original area was irrigated.
- **2009.** The federal government dissolves the PFRA. The Outlook Experimental Station is renamed the Canada-Saskatchewan Irrigation Diversification Centre, which operates with the provincial Department of Agriculture and a university.
- **2020.** The federal government releases plan, "Prairie Prosperity: A Vision for the Management of Water Resources across Saskatchewan and the Prairies," in which it examines different funding scenarios for the Lake Diefenbaker Irrigation Project.
- **2020.** Premier Scott Moe announces a $4 billion investment in the project.

A new California?

Owners of Spring Creek Garden, the husband-and-wife team Dan and Chelsea Elardson, whom I met briefly at their business some 35 kilometres from Outlook, grow 400 acres (162 hectares) of broccoli, pumpkins, carrots, lettuce, Brussels sprouts and more. "Without irrigation, it would be impossible," says Dan. The couple sell their fresh vegetables to major chains such as Loblaws, Sobeys, and Federated Co-operatives Limited. Although Saskatchewan feeds part of the world with commodities such as wheat and canola, the province imports 95% of its fresh vegetables, leaving ample room for development of the domestic market.

Husband-and-wife team Dan and Chelsea Elardson grow 400 acres of broccoli, pumpkins, carrots, lettuce, Brussels sprouts and more. "Without irrigation, it would be impossible," says Dan.

“In 25 years, Saskatchewan will be a leader in table food,” says Aaron Gray, Chairman of SIPA, a grain producer and beef cattle raiser who uses irrigation. “We have the land, the water and the transport infrastructure,” he explains, citing the Global Transportation Hub, a sort of inland port located in Regina that functions as a food distribution hub. According to the company’s website, it can reach 60 million consumers in one day by train or truck and 270 million in two days.

Aaron Gray, chairman of the Saskatchewan Irrigation Projects Association. In his opinion, the Lake Diefenbaker Irrigation Project would bring tremendous economic and rural vitality not only to the province, but to Canada as a whole.

“We won’t replace California (North America’s fruit and vegetable bowl). However, climate change has already extended our growing season by 10 days, from 110 to 120 days. So, we could make Canadians less dependent on California,” says Jazeem Whazab, an agronomist and researcher at the Canada-Saskatchewan Irrigation Diversification Centre. A specialist in horticultural production, Whazab believes that, in addition to leafy vegetables such as chard and bok choy, low-cost mixed vegetables such as broccoli, carrots, onions and peppers could also be grown in the region. The volumes produced under irrigation would likely attract frozen vegetable processing companies to the region, and even allow Saskatchewan to compete with Quebec and Ontario in the business. “But we will still face the challenges of good water management and finding enough workers,” he says.

The multifunctional Gardiner Dam was inaugurated in 1967, creating Lake Diefenbaker.

Some major players are coming out in support of the Lake Diefenbaker irrigation megaproject. “It’s an important project that will upgrade infrastructure and adapt it to a context of extreme weather events. Having more water for irrigation will increase crop yields and food production… AGT already owns and operates rail lines in the region, so being able to load our railcars there will increase and secure our supply,” explains Frank Hart, General Manager, Special Projects at AGT Foods and Ingredients Canada.

The company is one of the world's largest exporters of lentils, chickpeas and beans. Its products are packaged in a factory in Quebec and sold under the Clic brand name. The company is also one of the world's largest processors of plant proteins, supplying Beyond Meat and Nestlé, among others. Headquartered in Regina, the company[6] has 48 plants worldwide and processes 3 million tonnes of grain a year.

Mac Hird, managing director of business development, and Frank Hart, manager of special projects, AGT Food and Ingredients

Is there enough water?

"The average annual water flow is more than half the capacity of Lake Diefenbaker. The largest part to the west of the irrigation project would only capture 3% of the median annual flow, a very small volume. We have more than enough water to meet demand," says Clinton Molde, Executive Director, Irrigation Development at Saskatchewan's Water Security Agency (WSA), the organization responsible for managing the province's surface, ground, and wastewater. In a median flow year, the entire irrigation project would use approximately 2 million cubic metres of water, or approximately 5% of the Lake's inflow[7]. Irrigation accounts for 50% of surface water licence allocations, with municipalities taking nearly 30%, while potash and uranium mines and the manufacturing, oil and gas sectors share the rest.

However, farmers using irrigation also face risks. "They are entitled to their full allocation seven years out of ten. That means they may not have access to the volume of water they want for three years," explains Clinton Molde. This hasn't stopped producers in irrigated southern Alberta, including feedlot owners, from acquiring land around Lake Diefenbaker in recent years—a godsend for these Alberta investors, since land is much cheaper in Saskatchewan than in Alberta.

Clinton Molde said he is also in talks with various agri-food groups and processors to assess the number of irrigated acres they would require to keep their plants running. The companies would be assured of receiving their full volume of water through the municipalities in which they are established. Municipalities will set the price for industrial water use.

"I can't tell you which processors we're talking to at the moment, because that's confidential," says Clinton Molde, who says it's too early to promote the Lake Diefenbaker irrigation project to foreign investors through Canadian embassies, for example. One thing is certain: at a time when countries like Spain, France and the United States, to name a few examples, are being hit with severe drought and water shortages, major food processors and investors are doing due diligence and identifying where the "blue gold" will be available in sufficient quantity and quality over the next 10, 20 or 30 years.

Scientists sound the alarm

The planet is roasting. It's affecting snowy regions everywhere, including the Himalayan mountain ranges that feed the great rivers of India and China and the Sierra Nevada mountain ranges that supply water to California,

[6] AGT Foods and Ingredients is a member of the Canadian Protein Industry Cluster, which aims to develop the vegetable protein market (Government of Canada, 2023). Canada's Protein Industries Cluster. Innovation, Science and Economic Development Canada. https://ised-isde.canada.ca/site/global-innovation-clusters/en/canadas-protein-industries-cluster.

[7] Diefenbaker Irrigation, 2021, p. 10. Lake Diefenbaker Irrigation Projects. https://diefenbakerirrigation.ca/wp-content/uploads/2021/09/Diefenbaker-Irrigation-Presentation-Slides-1.pdf.

which are starting to melt. The same thing is happening to the watersheds of Canada's Rocky Mountains, which are the source of the main rivers that flow across the Prairies, including the South Saskatchewan River.

"We've seen that there is half as much snow on the lower slopes of the Rockies as there was 50 years ago. The glaciers will be melting and there will be more rain," says Dr. John Pomeroy, an expert in water issues and Canada's Research Chair in Water Resources and Climate Change at the University of Saskatchewan in Saskatoon[8]. "Our models predict a 20% increase in the flow of the South Saskatchewan River. On average, the water level in Lake Diefenbaker will be able to support the irrigation project and meet demand from other users. On the other hand, two consecutive years of drought would seriously compromise the reservoir's water reserves," adds the expert. He points out that Canada does not have high-capacity reservoirs like the ones found in Colorado or California. In times of prolonged drought, water use from Lake Diefenbaker would need to be adjusted among users.

Dr. David Sauchyn, Director of the Prairie Adaptation Research Collaborative (PARC), at the University of Regina, issued the following warning: "Regardless of climate change, we have observed that nature follows a drought cycle every hundred years. The last one took place in the 1930s, creating the infamous Dust Bowl. But we haven't yet been hit by a similar phenomenon in the 21st century."

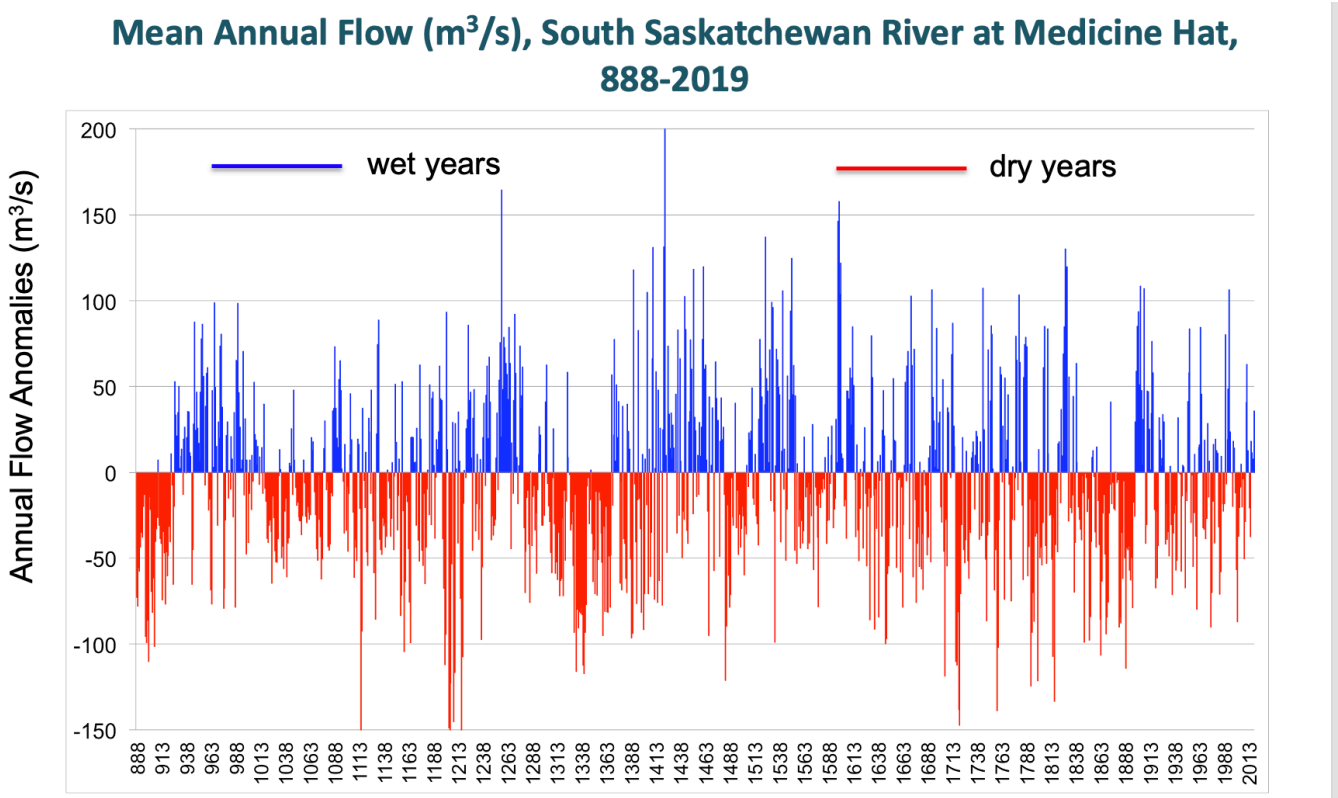
By studying the age of trees on the Prairies and in the Rocky Mountains, David Sauchyn's team was able to trace drought episodes from 888 to 2019, a period of more than 1,130 years. He believes that the key to Saskatchewan farmers successfully adapting to climate change—whether they are irrigators or not—will be to have healthy soils that are able to maintain a maximum water content, a goal that can be achieved by adopting better farming practices such as plant cover, crop rotation and minimum tillage.

At the same time, the scientist deplores the fact that farmers have moved away from windbreak hedge planting to be able to work with increasingly large machinery. The Prairie Farm Rehabilitation Administration (PFRA) used to encourage farmers to plant trees to prevent soil erosion, among other things. PFRA had a nursery at Indian Head in the south of the province. The organization, created in the 1930s, was abolished by the federal government in 2009. "Are we going to repeat the same mistakes that led to the Dust Bowl?" wonders David Sauchyn.

PARC Director Dr. David Sauchyn and his team have calculated the drought cycle over the last 1,000 years by studying tree rings.

Another important factor to consider: the flow of water from the South Saskatchewan River, like most other rivers coming from the melting snow of the Rockies, is subject to an interprovincial agreement between Alberta, Saskatchewan, Manitoba and the federal government that was signed 53 years ago, in 1969 (Master Agreement on Apportionment). In short, Alberta must allow 50% of its water to flow to Saskatchewan, and Saskatchewan, in turn, must allow 50% of its water to flow to Manitoba. So far, good relations have prevailed among provinces, but the severity of the predicted droughts could risk souring relations.

[8] University of Saskatchewan, 2023. John Pomeroy—Global Institute for Water Security. Global Institute for Water Security. https://water.usask.ca/about/profiles/people/john-pomeroy.php.


Mean Annual Flow (m³/s), South Saskatchewan River at Medicine Hat, 888-2019
Annual Flow Anomalies (m³/s)
wet years
dry years
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-100
-150
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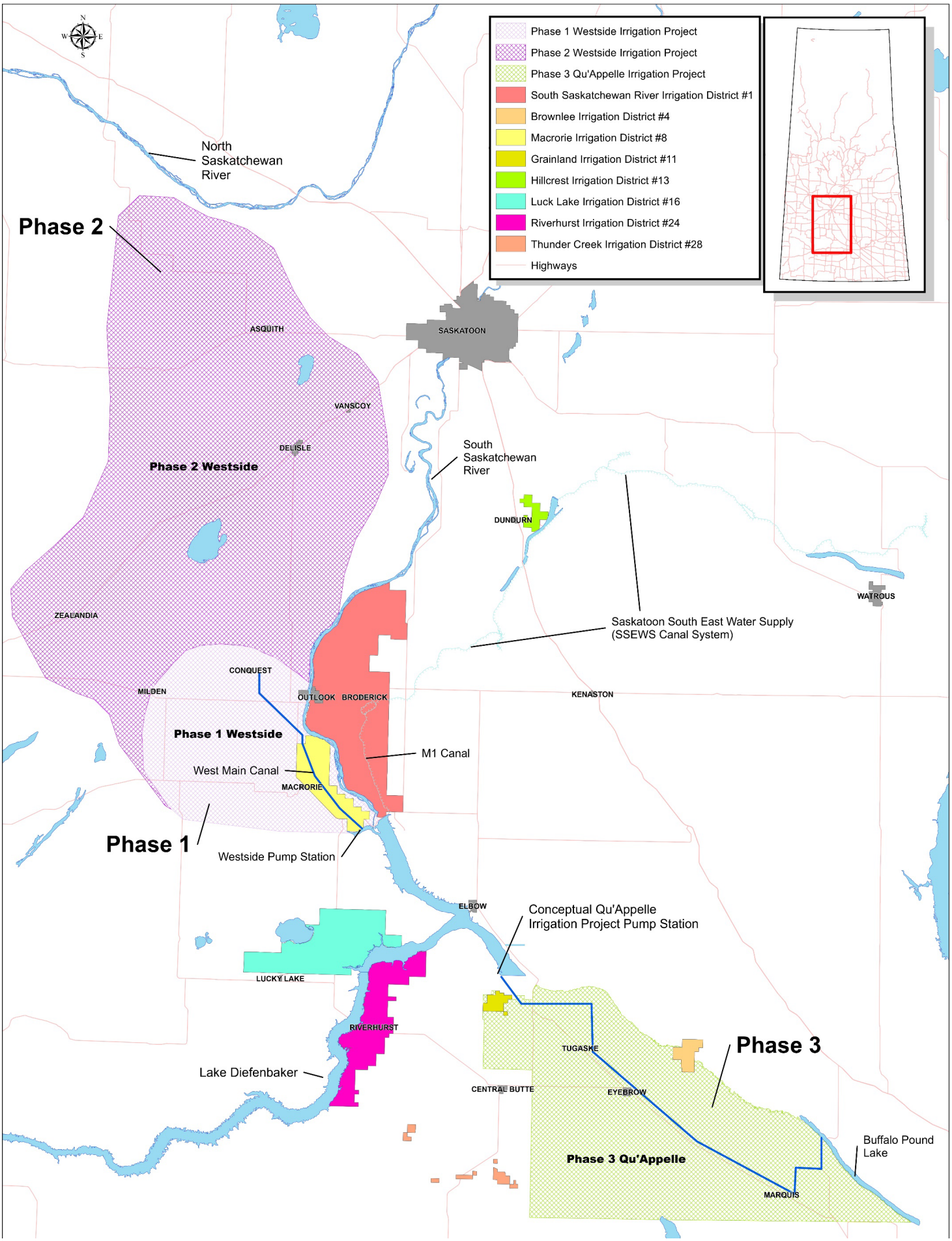
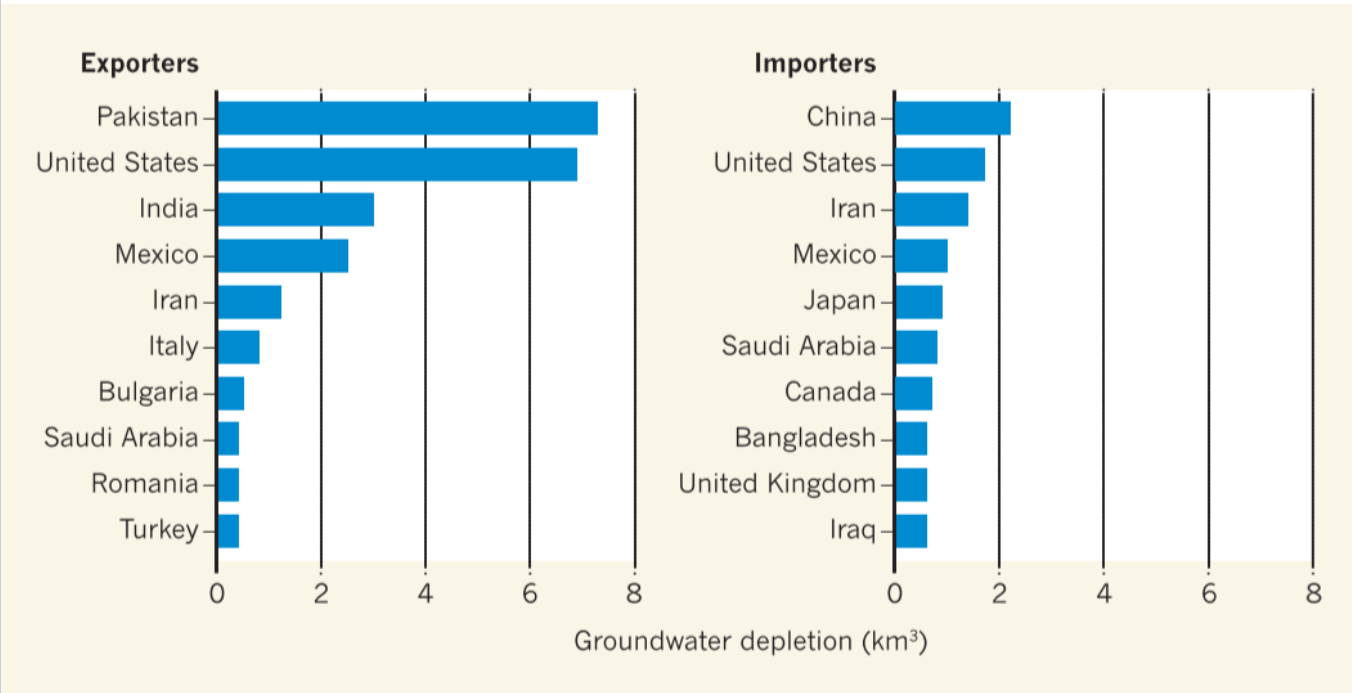
Lake Diefenbaker Development Area



Overexploitation of the world's aquifers threatens global food security

Almost 11% of the world's non-renewable aquifer water reserves are exported through global trade in agricultural commodities. These are the worrying findings of a study by Dr. Maite M. Aldaya[9], Institute for Innovation and Sustainable Development in the Food Chain, (IS-Food) based in Spain. Two thirds of these water losses, calculated between 2000 and 2010, take place in three countries: Pakistan, the United States and India.

Another worrying finding: the vast majority of countries that depend on imports to feed their populations obtain their supplies from exporting countries that pump nonrenewable water reserves from their aquifers. These exporters, the United States, Mexico, Iran and China. These four nations are all the more at risk of food insecurity because they not only produce, but also import food from countries where aquifers are overexploited.



Source: Aldaya, M. M. (2017). Eating ourselves dry. *Nature*, 543(7647), Article 7647. https://doi.org/10.1038/543633a

Even more worrying is the fact that almost half of the world's food production depends on irrigation from overexploited groundwater. This is the case, for example, of the two great aquifers: Ogallala and Great Plains in the American Midwest. These two aquifers generate an annual production of 35 billion US dollars. Climate change will exacerbate the quantity of the "blue gold" buried underground, and consequently global food production.

This is one of the reasons for caution in developing the Lake Diefenbaker irrigation project in Saskatchewan: "The expansion of irrigated agriculture on the Canadian Prairies will require the use of groundwater […]. The challenge will be to manage renewable surface water and slower-replenishing groundwater so that the latter can provide a large and sustainable water supply in times of drought," writes a Canadian government report[10].

[9] Aldaya, 2017. Eating ourselves dry. Nature, 543(7647), Article 7647. https://doi.org/10.1038/543633a.
[10] Prairies Economic Development, 2020. Prairie Prosperity: A Vision for the Management of Water Resources across Saskatchewan and the Prairies [Report on plans and priorities]. Government of Canada. https://www.canada.ca/en/prairies-economic-development/programs/policy-economic-development-publications/managing-water-prairies-report/prairie-prosperity-vision-management-water-resources.html.

A disputed project

Part of the reason the Lake Diefenbaker irrigation project is being contested is its cost. “We’re being sold this project as a way of fighting climate change and feeding the world. But the 500,000 acres in question only represent a tiny fraction of the cultivated land in Saskatchewan. On the other hand, its cost, $4 billion, is the equivalent of $16,000 per household in Saskatchewan[11]. Is this really the best investment to make to transform Saskatchewan’s economy into version 2.0? What kind of factories will we attract? Will we end up having companies that make biofuel for the airline industry instead of feeding the world? Exactly what kind of jobs will this create? Will we have enough workers? And when farmers see the cost of irrigation systems, will they choose to buy unirrigated land that’s half as expensive?” asks David Qualman, Director of Climate Crisis Policy and Action at the National Farmers’ Union (NFU).

The 2020 government report, Prairie Prosperity: A Vision for the Management of Water Resources across Saskatchewan and the Prairies, calculates the economic benefits of the Lake Diefenbaker irrigation project for both Regina and Ottawa. It is estimated that 27,800 jobs will be created during the 50-year construction phase and 22,700 jobs by the time the project is completed. According to the report, water and irrigation infrastructure will contribute $85 billion to Canada’s GDP and around $20 billion in net revenue for governments.

But there’s still a long way to go. The same document raises a number of questions, including the quantity and quality of the groundwater that will have to be used, which is still poorly inventoried in the region. The project would take place at a time when aquifers are already being over-exploited in the world’s most productive regions, such as the American Midwest and California.

And then there are the complaints about agricultural waste, phosphorus and nitrogen, and the quality of surface water (and groundwater). The South Saskatchewan River, which eventually joins the North Saskatchewan River to form one of the world’s largest inland deltas, is home not only to a wealth of wildlife but also to the homelands of several aboriginal communities. The Canadian Impact Assessment Agency is responsible for assessing the ecological risks: it’s estimated the process that could take from 1.5 to 6 years.

Canada’s reputation at stake?

And then there’s the thorny issue of how the cost of this colossal irrigation project will be shared between Regina and Ottawa. “Since the figures were published in 2020, the costs have probably doubled. We are currently awaiting the public release of the new figures from KPMG,” explains SIPA’s Executive Director, Jillian Brown.

The federal government is studying different scenarios for financial aid for the mega-project, but has not committed to anything so far. “Lake Diefenbaker is a sleeping giant. Ottawa is funding urban infrastructure projects to encourage urban transportation and reduce our carbon footprint, so why not invest in an irrigation project that will produce more food to ensure global food security and geopolitical stability, especially important since Russia invaded Ukraine?” notes Alanna Koch, Chair of the Board of Directors, Global Institute for Food Security, based in Saskatoon.

Former deputy minister with the Saskatchewan Ministry of Agriculture (from 2007 to 2016), Alanna Koch makes no secret of the fact that she is an ardent promoter of the Lake Diefenbaker irrigation project. “It’s a socio-economic project that will benefit Saskatchewan, but also Canada as a whole. To do that, you need vision,” she says.

[11] A household equals a family of four.

"I don't know the Lake Diefenbaker irrigation project will be realized in my lifetime. We've been waiting five decades for it," says Roger Pederson, 77, a member of the South Saskatchewan River Irrigation District and former president of SIPA. His farm is a stone's throw from Outlook. In the 1960s, his father built a small dam to irrigate the pasture for their two cows and the family vegetable garden. Today, a third of his 2,500 acres (1,012 hectares) is irrigated. He grows table potatoes on a contract basis and his wheat and fodder yields have more than doubled. For the project to get off the ground, he believes, "Prime Minister Justin Trudeau and Premier Scott Moe would have to settle their differences over the carbon tax to combat climate change, the way the Diefenbaker-Gardiners did with their different issues at the time."

Roger Pederson, an Outlook producer, has been hoping for the Lake Diefenbaker irrigation project for 50 years.

In the meantime, there are still no bulldozers to be seen enlarging and extending the main western canal at the heart of the Lake Diefenbaker irrigation project. The cost of the project today will certainly be very high. But given the urgency of climate action and the geopolitical context, how long can Ottawa afford to put off doing its part in funding it? Because the price we'll have to pay to remedy the state of the world is only getting higher.

"Well, the federal government has said very clearly, through direct financing, as well as the Infrastructure Bank, that federal financing is available. Neither of us are at the bargaining table to know the exact puts and takes of what each side has put on the table. But the federal government created the Infrastructure Bank for projects like this. And in fact, my understanding – once again, getting back to the old story – Alberta has already taken advantage of the Infrastructure Bank to get federal financing for water projects in Alberta. Not quite of the same order of magnitude, because the Saskatchewan project would be bigger, but the provincial government in Alberta was very proactive. As soon as the Infrastructure Bank made the announcement, which was I think about three years ago – they were available for big water infrastructure projects – Alberta was in the door the next day with an application."

–Ralph Goodale, former minister of Agriculture, Canada

Climate change: precision irrigation a must in Saskatchewan

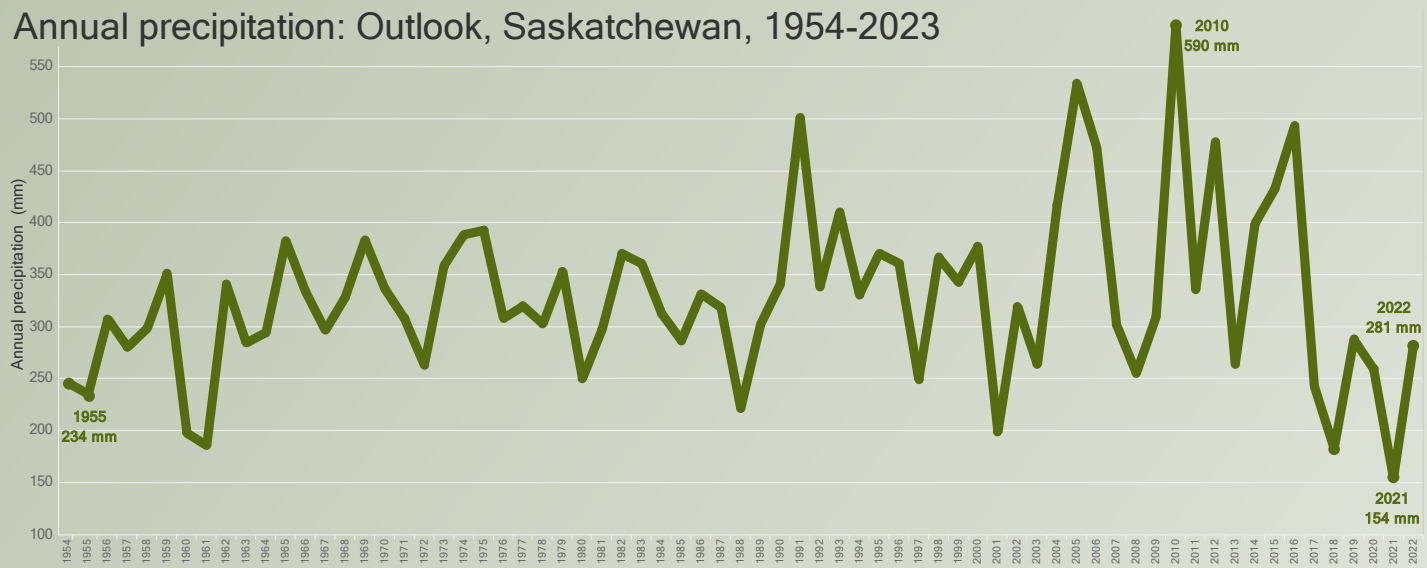
“Saskatchewan farmers would be much more efficient if they had to pay for water. It’s like fertilizer. They use too much out of fear of having lower yields,” says Evan Derdall, Irrigation and Drainage Engineer with the Canada-Saskatchewan Irrigation Diversification Centre based in Outlook.

The specialist knows that he is touching on a controversial issue that is still widely debated. Farmers do not pay for water in Canada[12] (unlike in California, for example) and the major infrastructure (canals, pipelines, reservoirs) from which they benefit has largely been paid for by federal or provincial public funds.

“In Alberta, water doesn’t cost anything, but the high cost of land has encouraged producers to adopt water-saving technologies to maximize their yields,” says the researcher as he shows me around his irrigation systems installed on the centre’s 80 hectares of land.

Irrigation technology has evolved considerably over time, from gravity-fed irrigation (60% efficiency or less), to high-impact sprinklers (60% efficiency or more), to central pivots with low-pressure nozzles (90% efficiency or more), because there is less loss through evapotranspiration and wind. The most efficient system is drip irrigation.

According to Evan Derdall, in order to avoid wasting “blue gold,” Saskatchewan irrigators absolutely must develop an irrigation program based on the weather, the needs of the plants and their root systems, the type of soil and its water content. The expert is working on software that could enable precision irrigation based on the 4 R’s, which (like for pesticides) are: water of the right quality, in the right quantity, available at the right time and in the right place, all of which can be accomplished using irrigation pivots with low-pressure nozzles and variable application rates.



Source of data: Government du Canada. (2023). Daily climate data. Extracted from climate station "OUTLOOK PFRA," ID 4055736. Image produced internally.

[12] In June 2023, for the first time in history and due to a severe drought, the Bow River Irrigation District in Alberta imposed a price of $5.00/acre on producers. Authorized water withdrawals were also reduced by half.

Wheat, canola, barley, peas, alfalfa and potatoes all have root systems of very different lengths, and all require a minimum amount of water from sowing to harvest, ranging from 300 mm to over 600 mm. Yet according to Environment Canada's Outlook station, the average amount of water available from rain or snow in this semi-arid region is only 300 mm. In 2021, a year of record drought, a mere 154 mm of precipitation fell from the sky!

The water deficit is being solved with irrigation. Saskatchewan's Water Security Agency (WSA) grants 12.5 inches of water (300 mm) per year to irrigators on Lake Diefenbaker. But that puts them in a precarious situation, according to Evan Derdall, because there are losses through evapotranspiration, among other things.

David Sauchyn, Director of the Prairie Adaptation Research Collaborative (PARC), refers to a recent study showing that 99% of plants cultivated by humans in the Americas have roots 60 cm shallower on average than natural plants. The deeper its roots, the greater a plant's ability to withstand drought by drawing water from deep in the soil. "However, our model indicates that rising temperatures and climate change will have a major impact on the water content of soils in southern Saskatchewan, which will fall from 12% to 8% in the near future," warns PARC researcher Mohammad Zare, co-author of a scientific study on the subject[13].

Water management and soil health will be crucial if Saskatchewan is to remain one of the world's food baskets.

Conclusion

This report is the result of research and a series of interviews conducted largely on the ground in Saskatchewan, mainly in the Outlook area, the province's irrigation capital at the heart of the Lake Diefenbaker Irrigation Project, as well as in Regina and Saskatoon. Farmers, scientists, government authorities, project champions, and business leaders were met and interviewed during the week of June 5-9, 2023. Due to time constraints, First Nations communities potentially affected by the project could not be met. This factor will be highlighted in the recommendations that follow.

To complete the analysis of this project, the author participated in the two-day "Alberta Irrigation Tour" on June 26-27, 2023 in southern Alberta, organized by the International Federation of Agricultural Journalists (IFAJ) during its annual congress in Calgary. The trip helped answer a fundamental question: "Why didn't Outlook become Lethbridge?"

The cost of the 500,000-acre Lake Diefenbaker irrigation project is unsurprisingly at the heart of discussions between Regina and Ottawa. Saskatchewan's conservative premier, Scott Moe, announced an investment of $4 billion in 2020 to develop the project. This represents an investment of $16,000 per household[14] in the province. But the actual cost of this investment today is not yet publicly known. Ottawa, for its part, has hinted at participating in the financing of this project through, among other things, a loan from the Infrastructure Bank of Canada. At the time of writing, however, the status of these negotiations is unknown.

There's no doubt that the longer this mega-project is delayed, the more it will cost. But in the context of climate disruption and the current geopolitical situation, we believe that the Lake Diefenbaker irrigation project should go ahead, for the socio-economic benefit of both the province and Canada. What's more, Canada, the world's second largest country and endowed with 20% of the world's freshwater reserves, is destined to play a crucial role in supplying agricultural markets and ensuring global food security. And Saskatchewan is the driving force behind it.

[13] Zare et al., 2022. Impact of Climate Change on Soil Water Content in Southern Saskatchewan, Canada. Water, 14(12), 1920. https://www.mdpi.com/2073-4441/14/12/1920.

[14] A household equals a family of four.

Recommendations

The province of Saskatchewan should adopt a strategy aligned with the federal government to ensure that this ambitious project has every chance of success.

For the project to be socially acceptable:

- Those responsible for the project should carry out impact studies both on the environment and on the repercussions for the First Nations populations concerned.
- Whether this mega-project is financed by loans or subsidies, costs will have to be supervised and monitored by competent authorities to limit overruns.
- Saskatchewan irrigators would benefit from increased assistance in irrigation technology transfer and agronomic advice through enhanced financial and personnel resources at the Canada-Saskatchewan Irrigation Diversification Research Centre in Outlook.

In addition:

- The province should update its outdated database of the number of irrigators/licenses (3,556) granted to growers and district members (200), in order to have an accurate picture of demand and the future development of irrigation projects.
- In terms of infrastructure construction, the province should draw inspiration from other irrigation district projects such as those in southern Alberta to: a) limit evaporation losses through better infrastructure and the most efficient on-farm irrigation technology; b) explore the economic viability of installing solar panels over certain irrigation canals to maximize the economic and social contribution of areas dedicated to irrigation infrastructure; c) examine ecological methods of controlling weed populations inside irrigation canals; d) build settling basins/riparian buffers to limit fertilizer or pesticide losses into watercourses; e) ensure that ecosystems subject to flooding benefit from the project; and f) provide quality water to all citizens and stakeholders.
- Irrigation producers in Saskatchewan have a knowledge and technology gap of “100 years” compared to their counterparts in Alberta. Budgets for producer support extension services should be substantially increased, notably at the Canada-Saskatchewan Irrigation Diversification Research Centre in Outlook, which operates with the provincial Ministry of Agriculture and the University of Saskatchewan.
- The federal government's abolition of PFRA in 2009 left a huge gap in service to producers in the areas of climate change, water management and soil health. Many stakeholders are hoping that the new Canadian Water Agency will be PFRA 2.0.
- Given the large sums of public money invested or to be invested in such a project, we recommend setting up an observatory of land transactions to find out who is buying what and for what purpose. The aim is to survey speculation and avoid a concentration of agricultural land in the hands of a few.
- Given the staggering growth and prohibitive cost of farmland, especially irrigated land, authorities should consider a mechanism for acquiring land at reasonable prices for young farmers from non-agricultural backgrounds, or for young immigrant farmers wishing to go into market gardening, for example.
- In the same vein, authorities should promote a mechanism for regulating leases on irrigated farmland to encourage the arrival of young, innovative farmers.
- The Canadian Water Agency should be a platform to encourage collaboration between provincial and federal authorities and NGOs, the sharing of knowledge and best practices in water management, and a uniform protocol for groundwater (and surface water) data collection, which varies from province to province.

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