

# The Weather Men



## Saskatchewan Researchers Seek Better Drought Prediction

BY CHARLTON COMMUNICATIONS

**P**op quiz: When was the worst drought in Saskatchewan's history? If you said the Dirty Thirties, you would be off by nearly 70 years.

The 1999-2004 drought on the Prairies saw moisture levels at their lowest in at least 110 years. It is considered not only the worst drought in the province's history but also one of the worst natural disasters in Canadian history.

Multi-year droughts are hard not only on farmers but also cause severe damage to the economic and social fabric of a society. To understand the 1999-2004 drought and help the Prairie provinces prepare better for future droughts, the University of Saskatchewan (U of S) and McGill University

in Montreal have joined together to lead a nation-wide, multi-disciplinary team of drought researchers.

The project has succeeded in putting together a strong team. It has also secured a catchy acronym: the Drought Research Initiative (DRI).

John Pomeroy, a geography professor and director of the Centre for Hydrology at the U of S and Alain Pietroniro, P.Eng., a hydrological engineer with Environment Canada, are among the lead investigators for DRI in Saskatchewan. The two researchers see their role as using the past as a tool to predict the future.

"Right now, our ability to predict droughts on the

Prairies is not very good at all. We can't even predict a drought accurately six months in advance. Prediction models exist for other areas but no one has yet put in the parameters for our region. That is our job," says Pietroniro.

If successful, the impact of the DRI research on agriculture alone would be significant.

"If government could give better advice to farmers, give them some indication of when the drought is going to be, that would be a tremendous thing for a farmer. For instance, in November, before the seeding and planting, if there was some reliable indication of whether it will be a wet or dry year, that would make a big difference," says Pomeroy.

The DRI researchers also hope that society as a whole would be better able to cope with drought.

"Governments could start planning their responses in advance. If they knew eight months in advance that there was going to be a disaster on the Canadian Prairies, that allows programs to be put in place before it hits," Pomeroy said.

To achieve these goals, DRI has established an alliance of scientists working for universities and various federal and provincial government departments. Saskatchewan is home to six lead investigators and an extended team of more than 25, the majority of whom are engineers and geoscientists.

Last January, the project's funding partner, the Canadian Foundation for Climate and Atmospheric Sciences, awarded \$820,000 of the project's \$3 million budget to the Saskatchewan wing of the initiative.

Like some sort of Chinese feng shui proverb, the project combines expertise in sky and ground.

"It might sound a bit odd that McGill University in Montreal is a leading partner in prairie drought research, but McGill has a very strong atmospheric sciences department. The U of S Centre for Hydrology, on the other hand, gives us strong knowledge of what is going on with water on the ground," says Pietroniro.

Although climate change is not a focus of the study, it won't be far from the minds of the researchers. Scientists once believed that prairie droughts happened roughly every 20 years, but effects of climate change may mean that they happen more often in the future.



## FACTS ABOUT DROUGHT IN CANADA

- The southern regions of the Canadian Prairies are more susceptible to drought because of their highly variable precipitation.
- During the past two centuries, at least 40 droughts have occurred in Western Canada with multi-year episodes being observed in the 1890s, 1930s and 1980s.
- Drought is a major concern in Canada but rarely has it been as serious or extensive as the 1999-2004 episode. This event produced the worst drought in over a hundred years in parts of Canada and, in particular, the Canadian Prairies.
- Precipitation was well below normal in parts of Alberta and Saskatchewan for more than four consecutive years, extending from autumn 1999 to spring 2004.
- In 2001, Saskatoon was 30 per cent drier than in any year since 1891.



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"A lot of the uncertainties in our understanding of how water systems have changed on the Prairies will be cleared up by DRI. Those findings will be reincorporated into climate impacts work," says Pietroniro.

The key uncertainty that DRI must cope with is that many of the traditional methods of predicting drought may now be obsolete due to climate change. For example, scientists for decades have looked to climate trends in the Pacific Ocean as a predictor of prairie droughts. If Pacific water temperatures were relatively high, a prairie drought would often follow. This method, which proved useful for nearly 70 years, suddenly became unreliable for predicting the 1999-2004 drought years.

Drought researchers in Canada and abroad are now considering a range of new methods of prediction. These include finding correlations between prairie drought and snowfall in key places in North America and around the world. Other researchers are striving to improve the ability of supercomputers to predict weather systems on a global basis.

The final result will likely be a combination of things currently studied. However, with a subject as complex as predicting the weather, there may be a long road ahead for researchers.

"At the end of the day, what we are doing is theoretical research, so applications may be a long way off, but eventually such research will find its way into operational systems. Our goal is to create knowledge that will help the Prairies build a more sustainable economy," says Pietroniro.

The DRI team is also hoping that the public at large will be able to take away an important message from their findings.

"The public should be more aware of the issues surrounding stewardship of the watershed. We hope that our work will make the general public better informed about water issues so they can make better decisions. We also hope that the public can lead the various governments to make watershed management a bigger priority," says Pietroniro. ■



Official launch of construction of the South Saskatchewan River Project (Gardiner Dam) on May 27, 1959.

## SOME DAM FINE ENGINEERING

Although the 1999-2004 drought was more severe than the famous prairie drought of the 1930s, Saskatchewan residents did not see a return of the dust-bowl effects that gave the "Dirty Thirties" its nickname. Over the past 70 years, engineers, geoscientists and agriculture experts have worked diligently to make the province more resilient to recurrent droughts.

In 1935, the federal government formed the Prairie Farm Rehabilitation Administration (PFRA) to contend with the mounting problems of drought and soil erosion. It was estimated at that time that over 250,000 acres of Saskatchewan farmland were blowing out of control.

The mandate of the PFRA was to rehabilitate land affected by soil drifting and to develop and promote systems of farm practice, tree culture, water supply and land utilization that would rehabilitate eroded fields and ultimately the economic security of farmers in the region.

In 1959, the PFRA undertook its largest project, the design and supervision of construction of the South Saskatchewan River Project. This monumental undertaking entailed developing two dams (the Gardiner and Qu'Appelle) and a massive reservoir.

"What many people don't recognize is that the Gardiner Dam was redesigned a couple of times during its construction, owing to the difficulty in determining the strength of its clay shale foundation," says Doug Johnson, P.Eng., a water resource engineer with the Saskatchewan Watershed Authority. The project took eight years of round-the-clock work and resulted in the 225-kilometre-long Lake Diefenbaker. The lake has altered forever access to water in the province.

"It's the water supply for virtually half of Saskatchewan today, including the cities of Regina, Saskatoon and Moose Jaw, as well as being the source of the pipeline system that supplies the communities of Humboldt, Melfort and Wakaw," explained Johnson.

From 1935-2000, PFRA helped to develop more than 285,000 water supply projects, big and small. The deep scars of the 1930s have led Saskatchewan to be an overachiever in water management today. Of the 770 dams in western Canada, 53 per cent are located in Saskatchewan.

Throughout Saskatchewan's history, engineers and geoscientists have been at the forefront of helping the province deal with the challenges that nature throws at us. With the information gained through the Drought Research Initiative, the professions will help Saskatchewan find new ways to deal with climate changes.



## DROUGHT AND THE ECONOMY

- A preliminary analysis of the 2001 and 2002 drought years in Canada suggests the gross domestic product lost some \$5.8 billion in 2001 and 2002, with the largest loss – more than \$3.6 billion – occurring in 2002.
- Over 41,000 jobs were lost due to drought during 2001 and 2002.
- Drought contributed to a negative or zero net farm income for several provinces, for the first time in 25 years (Statistics Canada, 2003). Agricultural production across Canada dropped by an estimated \$3.6 billion in 2001-2002.
- In May 2002 the number of recorded natural prairie ponds was the lowest since record keeping began.
- In 2002 the incidence of forest fires in Alberta increased to five times the 10-year average.
- Between April and September 2001, at least 32 incidents of massive dust storms with associated traffic accidents were reported in Saskatchewan. The blowing dust may have been a contributing factor in two fatalities associated with these accidents.

## DRI GOALS

The Drought Research Initiative (DRI) five-year study will work towards three main goals:

- Quantify the physical features of this recent drought;
- Improve the understanding of the processes and feedbacks governing the formation, evolution, cessation and structure of the drought;
- Assess and reduce uncertainties in the prediction of drought and its structure.

By the end of the program, DRI researchers hope to be able to make these statements:

“We have greatly increased our understanding of drought through a focus on the recent 1999-2004 one over the Prairies and we have applied this to improved prediction.”

“We have left a legacy of comprehensive datasets, improved observational and modelling techniques, a new generation of drought scientists and a public better educated about drought.”

“We have, in partnership with others in Canada and internationally, developed a plan to improve drought and water cycle prediction at multiple scales.”