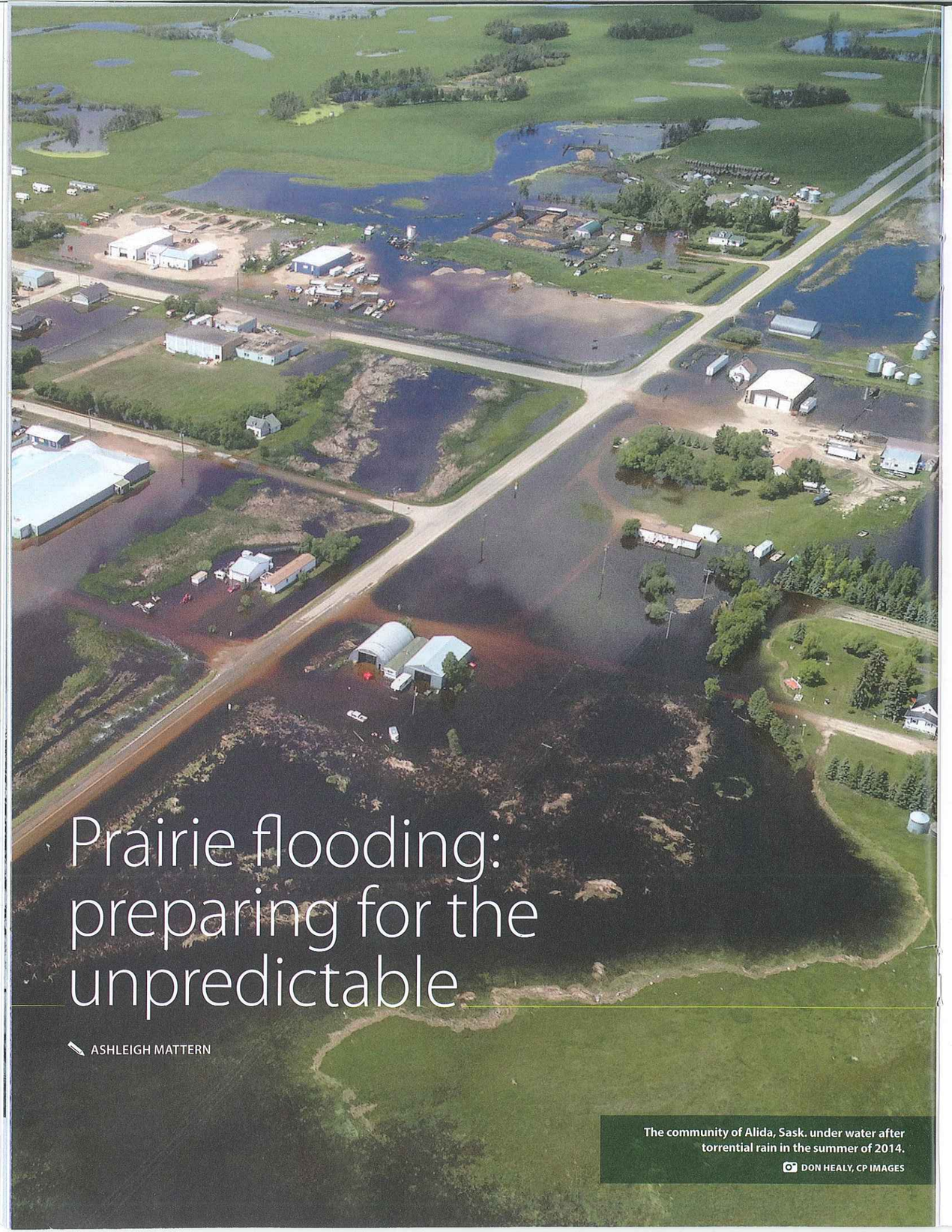

Prairie flooding: preparing for the unpredictable

ASHLEIGH MATTERN

The community of Alida, Sask. under water after torrential rain in the summer of 2014.
DON HEALY, CP IMAGES

So much rain fell on southeastern Saskatchewan and western Manitoba that more than 60 communities declared states of emergency.

The water blocked and washed out highways, flooded basements, disrupted flights, and destroyed eight to 10 per cent of Saskatchewan crops. In one weekend, anywhere from 100 to 240 millimetres of rain fell—that's two to four times what would typically fall in an entire month.

The circumstances that led to the flooding at the end of June and beginning of July 2014, started before a drop of rain fell, said Kevin Shook (BE'84, PGD'91, MSc'93, PhD'95), research scientist at the University of Saskatchewan's Centre for Hydrology.

Winter snows had created a sizable snow pack, and when the snow melted in the spring, the deep prairie soils became saturated. When the rain fell, it had nowhere to go.

"We're living in a very complicated climate," explained Shook. "People think the Prairies are simple because they're flat, but hydrogeologically, they're one of the most complex places around, and a lot of the things that people do in the rest of the world don't work here."

Elsewhere in the world, water basins flow down to a stream, which leads to a river, which eventually reaches the ocean. On the Prairies, water gets held in sloughs and depressions until it overflows.

"Only when all of those puddles and sloughs and wetlands connect together can water travel across the land into the stream," said Shook. "The contributing area of the basin changes dynamically, which makes trying to model the effect of the prairie basin difficult to do."

Shook said the flooding that happened in southeastern Saskatchewan and western Manitoba is not like the flooding in Alberta near the Bow River. In Alberta, the water was trying to get to the river. In southeastern Saskatchewan and western Manitoba, the water was going overland because there are no streams.

Geologically speaking, the drainage system of streams and networks on the Prairies is young, said Cherie Westbrook, associate professor of wetland ecohydrology in the Department of Geography and Planning at the U of S. The glaciers that formed the prairie landscape didn't cut small stream channels.

"The water doesn't have a channelized network to flow through like it would in Ontario," said Westbrook.

Human impact

Westbrook's research focuses on understanding how water is stored and moves through wetlands, and how that affects the ecological functioning. One possibility she has studied is whether human alterations to the landscape can have an effect on the way water moves.

That does seem to be the case in the Smith Creek basin—a watershed found along Highway 16 near the Saskatchewan-Manitoba border. The area has seen major changes in the past 50 years, transitioning from woodland and wetland to grain and oilseed crops through extensive draining.

"Humans are changing the drainage patterns on the landscape, and what we're trying to understand is what kind of an impact that's going to have on the hydrology of the basin," said Westbrook.

The research is not far enough along to know for sure if human actions had an effect, and once they have results, it will only apply to that specific water shed. But Westbrook noted that understanding the physical processes will help officials make land management decisions.

While it's difficult to know how to prepare for such severe, unusual weather as seen during the 2014 floods, the research Westbrook and others are doing can help communities prepare when faced with flooding from snow melt.

Because snow can be measured, in 2011, communities in the Smith Creek basin knew there would be flooding in the spring. Researchers worked with community leaders to figure out how much water was on the land and helped them to physically manage the water release through the site. The community of Langenburg had to make some hard decisions, like choosing who would lose income by rerouting the water through farmland, but in the end, their efforts helped save the town.

Helen Baulch, assistant professor at the School of Environment and Sustainability at the U of S, said part of the solution to protect communities and farmland from flooding is to ensure there is water storage in the landscape. Since the Prairies do not have a well-developed network of streams, most of the water is stored in the landscape. When wetlands are destroyed, that water storage is also destroyed. Restoring and maintaining wetlands would create water storage and protect against flooding.

She also noted that land and water management practices can have a big influence on nutrient transport. When water moves through the landscape, it carries with it nutrients from the places it has been. This can mean big problems for the bodies of water downstream.

"For example, systems like Lake Winnipeg, in extremely wet years, receive more nutrients [from run-off], and that makes problems associated with algal blooms in the lake worse," said Baulch.

Algae grows naturally in the lake, but when run off from farms increases the amount of nitrogen and phosphorus, the algae grows excessively, releasing toxins that are dangerous for humans and other species. Restoring and maintaining wetlands also helps reduce nutrient run-off into lakes, and part of Baulch's work is to figure out how to control nutrient inputs to try to maintain clearer waters.

Uncertain future

Shook said climatologists are predicting wetter weather for the Prairies: the trend is toward more rain than snow in the spring and fall, and more multi-day rain events. Hydrologists like Shook, Westbrook and Baulch are charged with figuring out how all that extra water is going to affect the landscape and what that means for the people who live in the Prairies.

"People have to think about how they want to adapt to changing conditions," said Westbrook. "I think that people across the Prairies have realized now, with a number of events happening in different communities in the last five years, that the infrastructure we have in the Prairies is not set up to deal with these kinds of events."

Westbrook said that water research is grounded in problems facing real communities, not only on the Canadian Prairies, but internationally. "Water researchers here at the U of S are very practical minded."

She has empathy for the people who are impacted by flooding, but she still finds the opportunity to learn from these events scientifically exciting. Some of the predictions and hypotheses about how the watershed would function when wet—based on more than 40 years of hydrology research in the Prairies—are not holding up. "We have noticed that the hydrology of the Prairies is changing, and changing quickly." That lack of certainty is what makes the research compelling.