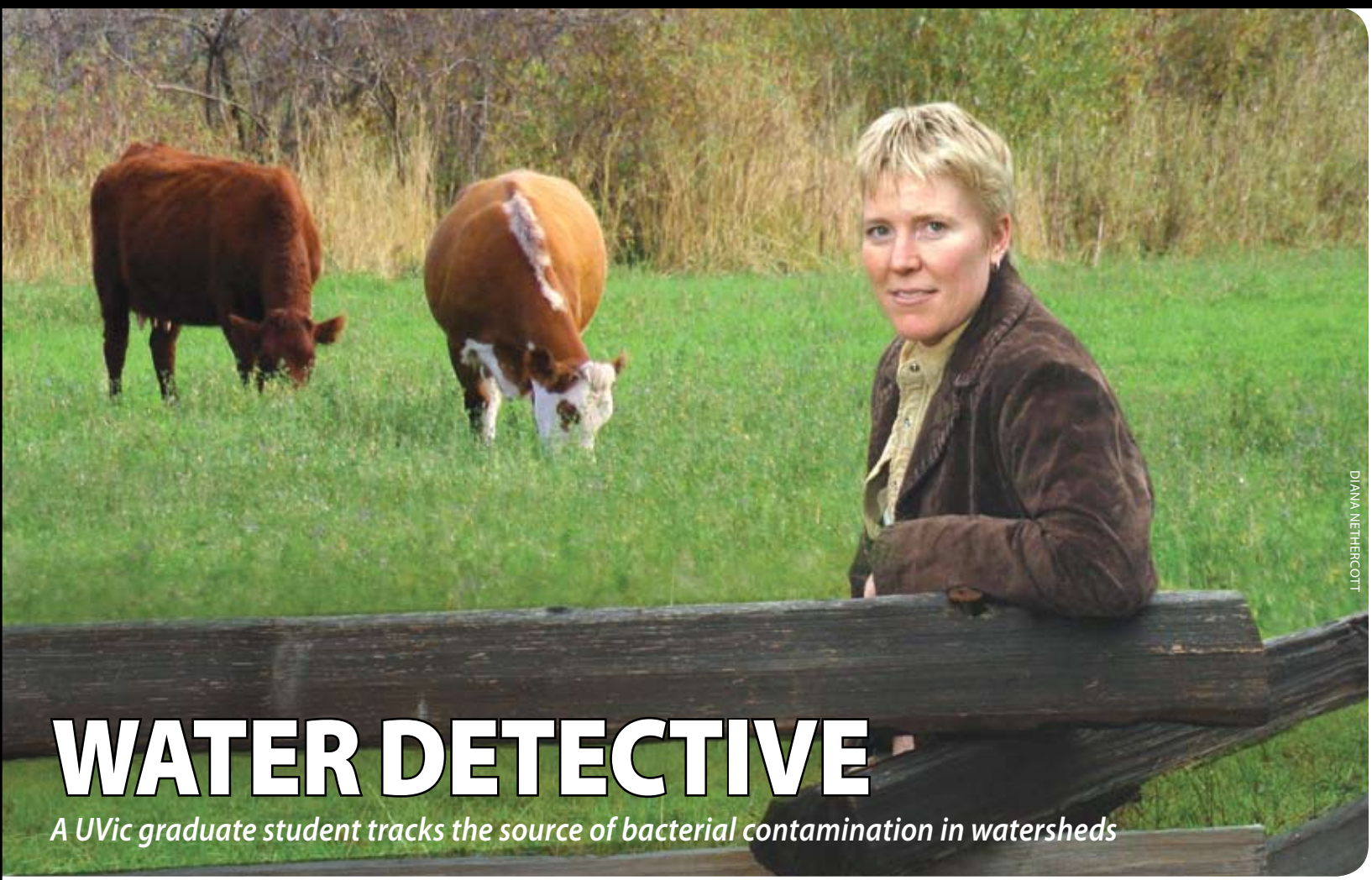

WATER DETECTIVE

A UVic graduate student tracks the source of bacterial contamination in watersheds

Meays

It's hard not to laugh when Cindy Meays tells you how she spent an entire summer working with cow patties—collecting them, blending them, reshaping them and, finally, analysing them.

"The students working with me thought I was a little crazy at first," grins the University of Victoria graduate student. "My friends call me 'Dr. Poo.'"

The joke possibilities seem limitless, but Meays's research is no laughing matter. For her PhD degree in biology, she has completed a landmark study on the bacterial contamination of drinking water in watersheds.

Many Canadians draw their drinking water from watersheds that are exposed to various land uses, such as agriculture, forestry, mining, urban development, and recreation. These activities sigificantly increase the risk of contaminated drinking water and disease.

As a result, hundreds of communities endure boil-water advisories every year. In B.C. alone, an estimated 300-400 communities are on boil-water advisories at any given time.

"Microbial contamination of source water is a major environmental and health issue with drinking water in B.C., Canada and around the world," says Dr. Asit Mazumder, a UVic aquatic ecologist and Meays's thesis co-supervisor. "Unless we know the source of contamination, we can't control it. Cindy's work is a big step in that direction."

Working near Vernon, B.C., Meays began her study with cow patties in what is more formally known as a fecal pat experiment. The object of her interest was the bacterium *Escherichia coli*, which occurs naturally in the intestinal tract of most warm-blooded animals, including humans. Most strains of *E. coli* are harmless, even beneficial, but some can be deadly.

"The presence of *E. coli* in water indicates that fecal contamination has occurred, so we typically measure it to see what the concentrations are," says Meays.

To find out how long *E. coli* can live, Meays placed 200 kg of collected, blended and re-assembled cow patties into a variety of controlled conditions and measured *E. coli* survival rates.

In general, shady, moist and cool are optimal for survival, although Meays was surprised at the bacterium's resilience. "By the end of 45 days the patties were very dry and you wouldn't expect any *E. coli* to be alive. But some were."

In the second phase of her study, Meays field-tested a new genetic technique for tracking the source of *E. coli* in a watershed. Known as molecular fingerprinting, or "ribotyping," it identifies the bacterium's host organism from a DNA analysis.

Meays's study—the largest of its kind in the world—analysed more than 4,800 *E. coli* samples taken from four watersheds over different time scales. She also tracked whether concentrations and sources of *E. coli* changed over time.

She found that *E. coli* numbers vary, depending on such factors as elevation and time of day. "This shows managers that monitoring water quality by taking occasional samples won't necessarily represent what's going on in a particular stream," says Meays.

The ribotyping revealed a wide assortment of animals contributing to *E. coli* contamination—depending on the watershed, everything from birds, rodents and deer, to cattle and domestic dogs. This is a powerful management tool, says Meays.

"It gives us a much better understanding of what's going on in a watershed so that stakeholders aren't just pointing fingers at each other," says Meays. "Instead, they can alter their activities to reduce the contamination risk."

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Most outbreaks of waterborne disease are caused by the contamination of drinking water systems with the feces of infected animals or people.

There are usually one or two recognized waterborne disease outbreaks in B.C. every year. In developing nations, 80 per cent of diseases are water-related.

Meays's research is part of a larger project studying how molecular and biochemical tools can be used to track bacterial and chemical contamination in drinking water. The project, which involves a team of Canadian and U.S. researchers, is led by UVic.

UVic is a national leader in drinking water ecology. The NSERC Industrial Research Chair in the Environmental Management of Drinking Water, established at UVic in 1999, conducts interdisciplinary research on a wide range of issues related to drinking water, watershed management, fisheries and land-use activities. For more information visit web.uvic.ca/water/.

Supporters of Meays's project included Agriculture and Agri-Food Canada, the B.C. Beef Cattle Industry Development Fund, Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council, and UVic.

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In 2004-05 University of Victoria graduate students were awarded a total of $3 million in research grants from the three federal granting councils, up 24 per cent from the previous year. Their success rate in attracting research grants is consistently above the national average.