Agknowledge

COLLEGE OF AGRICULTURE AND BIORESOURCES 02 | 14

A Different Planet

A unique northern field course offers students a life-changing experience in the polar bear capital of the world.

A Salty Tale

Researchers race to find ways to make tasty bread with less salt.

Until the Cows Come Home

A look at the new Rayner Dairy Research and Teaching Facility.

Trade Secrets

International trade policy may not sound terribly exciting but it has transformed the world.

University of Saskatchewan
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Inside this issue

On the cover: Northern lights near Churchill, Manitoba.
Photo by Matthew Sawatzky

Agknowledge

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Published by the College of Agriculture and Bioresources, University of Saskatchewan.

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Publication Date
February 2014

Dean's Message

Welcome to a taste of the College of Agriculture and Bioresources!

I know you will be amazed and intrigued as you see how the college is reaching out into so many different parts of our world – different and wonderful geographies, peoples, teaching, research and applications that are still all linked by our search for ways to improve the world. In all we do, from making our food more nutritious and safe, to finding more sustainable ways to use and protect the world's natural resources, to novel crops and innovative bio-based products, our students are our partners and co-explorers. Hands-on learning is nothing new for AgBio!

We are also providing ways for the local community to learn and engage in agriculture. School groups regularly visit the college for interactive tours. In the summer our AgBio Discovery Camps provide children hands-on fun experiencing aspects of life they had no idea were parts of agriculture and bioresources! The Feeding the World Interpretive Centre, located in the brand new state-of-the-art Rayner Dairy Research and Teaching Facility (featured in this issue) is a stellar example of our commitment to engaging our community in the wonderful world of agriculture and the challenges of sustainable production of food and bioproducts.

In this issue of *Agknowledge*, you will also see some of the ways our college is reaching out to the world around us, locally and across the globe. My recent working visits to Mongolia, Ethiopia and North Battleford, for example, have strengthened our links. These links often start with faculty research, and then grow into significant contributions to research, teaching and quality of life in those communities. Plus – you always run into Agro family, no matter where you go!

These sorts of visits, and merely talking with our next-door neighbours, demonstrate that our research isn't the only thing that is making a difference. The students we teach are venturing out into the world and leaving a positive mark. We constantly strive to develop new ways to reach new student populations, while also always serving our existing Agro family: industry, government and communities know our Agro grads help them thrive. You'll see an example of one of our really novel courses in these pages, and you'll see a profile on just one of our alumni who is making a difference and improving agriculture and our world.

So dive into this smorgasbord sampling of today's AgBio, and explore the tastes, sights, sounds and products of your college's efforts. Consider the implications for the world's future. And please, visit and chat with us whenever you can. We'd love to hear your thoughts.

Yours in Agro Spirit,
Dean Mary Buhr

Student Excellence

ENTRANCE AWARDS

AGBIO Renewable Entrance Scholarships
Devin Meijer, Saskatoon
Amy Pizzey, Binscarth MB
Amanda Pufall, Saskatoon
Danielle Schlehahn, West Kelowna BC
Jaqueline Toews, Glaslyn
Bailey Wilson, Tugaske

AGBIO Entrance Scholarships
Taylor Borowetz, Hudson Bay
Erin Cote, Saskatoon
Ailish Evans, Gibsons BC
Devan Guenter, Hague
Nathan Hebert, Rosthern
Rozlin Holoboff, Kamsack
Rylan Irving, Porcupine Plain
Anique Josuttes, Paradise Hill
Megan Kiefer, Melfort
Angele Lalonde, Saskatoon
Catherine Lang, Colonsay
Cydney Low, Saskatoon
Kaytlin Robertson, Unity
Annie Rosia, Okotoks AB
Laci Schmidt, Pigeon Lake
Madison Skjonsby, Estevan
Halayna Tetreault, Leoville
Lindsay Wells, Glaslyn

Arnold and Emily Robinson Scholarship
Kenton May, Central Butte
Keaton Schmidt, Saskatoon

Beatrice Murray Entrance Scholarship
Teagan Oleksyn, Yorkton

Douglas Christie Ferguson Fund Scholarship
Victoria Nameth, Cupar
Allie Noble, Mossbank
Alanna Orsak, Russell MB

Jim Anderson Scholarship in Agriculture
Connor Bohachewski, Porcupine Plain
Andrew Reddekopp, Hepburn
Chad Scott, Cupar
Emma Wilton, Kipling

McConaghy Award
Jacqueline Toews, Glaslyn

Robert and Maude Hale
Samantha McKee, Turtleford

Saskatchewan Chicken Industry Development Fund Award in Agriculture
Brandon Smith, Rose Valley
Carlotte Corbett, Bruno

CONTINUING STUDENT AWARDS

AGBIO Renewable Entrance Scholarships, Second Year
Benjamin Dietrich
Logan Pizzey
Jasmine Tenkink
Sarah Wist
Brianna Zoerb

AGBIO Renewable Entrance Scholarships, Third Year
Tracy Fehr
Sarah Johnson
Shannon Palmer

AGBIO Renewable Entrance Scholarships, Fourth Year
Melanie Hawrysh
Moira Petruic
Lukas Smith
Kathryn Stolle
Steven Tetreault

Adeline and William Haberman Memorial Scholarship
Kerrie Andreas, Saskatoon

Albert and Beatrice Trew Memorial Scholarship
Danica Lucyshyn, Saskatoon
Erin Hopkins, Saskatoon

BASF Canada Scholarship in Plant Sciences
An Gel Liew, Saskatoon
Rongrong Xiang, Saskatoon

Bert Hargrave Scholarship
An Gel Liew, Saskatoon

Bert Salloum Scholarship in Agriculture Economics
Colin Dutcheshen, Kamsack

Canadian Prairie Lily Society John Bond Scholarship
Coral Stang, Saskatoon

Canadian Prairie Lily Society T.A. (Andy) Dingwall Scholarship
Kathy Bergen, Saskatoon

Canadian Society of Animal Science Book Prize
Kirstie Rissling, Denzil

Carlson Scholarship in Renewable Resource Management
Rebekah Esau, Saskatoon

Charles C. Cook Student Leadership Award
Katie Bacon, Ogema
Lauren Ovinge, Scandia
Andrew Reddekopp, Hepburn

David J. Welch Memorial Prize
Harold Geist, Saskatoon

Dow Agrosciences Scholarship in Agriculture
Alexandra Jewell, Kenaston
Dana Tkachuk, North Battleford

Elaine Partington Equine Thesis Award
Cara Wooster, Saskatoon

Elmer Laird Memorial Scholarship for Organic Agriculture
Travis Ebens, Lacombe AB

- **Ernest Winn McKenzie Scholarship**
  Tracy Fehr, Rosthern

- **Ewald M. & Donna I. Kitsch Scholarship in Crop Science**
  Kerrie Andreas, Saskatoon

- **F.J. Fear Scholarship in Soil Science**
  Kelsey Henderson, Saskatoon

- **Grow Community of Independents Class Prize**
  Melanie Hawrysh, Borden
  Bo Langer, Saskatoon
  Earl Kieper, Radisson
  Nicole Labbie, Radville
  Tim Hilger, Prelate

- **Harvey Scholarship**
  Cameron de Wolf, Bow Island AB
  Mallory Erickson, Tulliby Lake AB
  Melanie Hawrysh, Borden
  Erin Hopkins, Saskatoon
  Zachary Kurtenbach, Deloraine MB
  Danica Lucyshyn, Saskatoon
  Rae-Leigh Pederzolli, Medicine Hat AB
  Kathryn Stolle, Christopher Lake

- **Howard Lindberg Memorial Award**
  Justin Dering, Kinistino

- **James Donald Hardin Scholarship**
  Folliott Baugh, Star City
  Harold Geist, Saskatoon
  Andrew Herle, Wilkie

- **Jickling Agricultural Scholarship**
  Jesse Bond, Marengo

- **John Mitchell Memorial Scholarship**
  Sarah Wist, Central Butte

- **Kelly Aulie Memorial Scholarship**
  Stacy Pritchard, Rathwell MB

- **Larry Janzen Memorial Scholarship**
  Jill Martens, Fiske

- **Molson Canada Book Prize**
  Erin Hopkins, Saskatoon
  Victoria Satiro, Saskatoon

- **Pat Toderian Scholarship**
  Rebecca Repski, Saskatoon
  Kirstie Rissling, Denzil

- **Port Metro Vancouver Scholarship**
  Kerrie Andreas, Saskatoon

- **R.K. Baker Prize for Excellence in Poultry Science**
  Kaylee Schnedar, Biggar

- **Robert and Maude Hale Scholarship**
  Delaney Murphy

- **Ross Johnson Memorial Scholarship**
  Danica Lucyshyn, Saskatoon

- **Rossnagel Scholarship for Academic Improvement**
  Dayna Raymond, Saskatoon

- **Russell Fisher Scholarship**
  Kirsten Roy, Moosomin

- **Saskatchewan Institute of Agrologists Diploma Scholarship**
  Harold Geist, Saskatoon

- **Saskatchewan Institute of Agrologists Scholarship**
  Iain MacDonald, Elrose
  Katelyn Stehr, Swan River MB
  Bradly Weir, Saskatoon

- **SaskMilk Undergraduate Scholarship**
  Rae-Leigh Pederzolli

- **SaskPower Shand Greenhouse Education Prize**
  Coral Stang, Saskatoon

- **Syngenta Achievement Award**
  Christine Mysyk, Saskatoon

- **University of Saskatchewan Scholarships**
  Rebekah Esau, Saskatoon
  Nicole Marleau, Saskatoon
  Christine Mysyk, Saskatoon
  Logan Pizzey, Binscarth MB
  Shannon Walker, Langham
  Sarah Wist, Central Butte

- **University Undergraduate Scholarship**
  Jennifer Burris, Saskatoon
  Lucy Edge, Saskatoon
  Jordan Gottinger, Neudorf
  Jessa Hughes, Eston
  Kaitlyn Kelly, Saskatoon
  Schian Yee Lim, Saskatoon
  Torbjorn Lokken, Saskatoon
  Danica Lucyshyn, Saskatoon
  Ge Pang, Edmonton AB
  Kelsey Richardson, Deslisle
  Kirstie Rissling, Denzil
  Amie Vowles, Saskatoon
  Harold Geist, Saskatoon

- **Walter Scott Scholarship**
  Shawn Cowie, Regina

- **William G. Barclay Scholarship**
  Michelle Hildebrand, Saskatoon

GRADUATION AWARDS

- **The Fulton Family and Saskatchewan Institute of Agrologists Award**
  Jason Fleischhacker

- **Farm Credit Canada (FCC) Top Graduate Medals (Agribusiness)**
  Brendan Kessel
  Jason Fleischhacker

- **Norman H. Horace Pearce Prize in Animal and Poultry Science**
  Angela Japp, Eston
  Danielle Saelman, Abbotsford BC
  Natalie Preston, Hays AB

- **Molson Canada Award of Excellence**
  Yun Wang

- **P.M. and Y.Y. Huang Distinguished Award in Soil Science**
  Blake Weiseth

- **Saskatchewan Horticulture Association Prize**
  Lisa Taylor

- **Saskatchewan Institute of Agrologists Gold Medal**
  Blake Weiseth

- **Frank Sosulski Graduation Prize in Plant Sciences**
  Andrea De Roo

- **William Allen Memorial Prize in Agriculture Economics**
  Vangelis Karamanos

POSTGRADUATE AWARDS

- **Ajinomoto Heartland/ Halchemix Scholarship**
  Emmanuel Opoku Yeboah
- **Alexander and Jean Auckland Postgraduate Award**
  Xiaoyu Liu
- **Barbara and Frank Pavelich Postgraduate Scholarship**
  Min Li
- **C. Paul W. and Marianne M. Ziehlke Postgraduate Award**
  Heba Fraij
  Rushikesh Warale
- **Canadian Dairy Commission Scholarship**
  Colleen Fitzpatrick
  Ricky Lam
- **Class of '43 60th Anniversary Award**
  Xue Lin
- **Dr. Robert E. Redmann Memorial Graduate Scholarship in Plant Sciences**
  Yusef Abu
- **Elmer Laird Memorial Scholarship for Organic Agriculture Postgraduate Award**
  Md. Nazrul Islam
- **F. V. MacHardy Graduate Fellowship in Grasslands Management**
  Lei Ren
- **Hanson Award in Soil Science**
  Chuwudi Amadi
- **Harris and Lauretta and Raymond Earl Parr Memorial Scholarship in Agriculture**
  Amanda Guy
  Angie Lam
  Courtney Phillips
  Jing Xie
  Sarah Tsoi
- **J.D. MacFarlane Scholarship**
  Cory Jacob
- **John Baerg Award**
  Gurcharn Singh Brar
- **John Blake Memorial Postgraduate Scholarship**
  Matthew Bernard
  Jun Liu
- **John Wickhorst Memorial Scholarship**
  Jordan Hamilton
- **Kathleen and Norman Lean Postgraduate Scholarship**
  Matthew Lawless
- **L.H. Hantelman Postgraduate Scholarship**
  Natallia Varankovich
  Orabile Kgosisejo
  Yang Yang
- **Martin Pedersen and Family Postgraduate Scholarship**
  Jeffrey Elder
- **Maurice Hanson Sr. Postgraduate Award**
  Chukwudi Amadi
- **Molson Canada Post Secondary Excellence Award**
  Maria Martinez
- **O.M. Elviss Postgraduate Scholarship**
  Erika Bachmann
- **Paulden F. and Dorathea I. Knowles Postgraduate Scholarship**
  Colleen Redlick
  Konstantinos Xyntaris
- **Purdy Postgraduate Scholarship**
  Ke Feng
- **Putnam Family Memorial Award**
  Kendra Purton
- **Rene Vandeveld Postgraduate Scholarship in Crop Science**
  Hussien Beshir
  Ke Feng
  Manu Pratap
  Ti Zhang
- **Roderick Alan McLean Memorial Award**
  Vladimir Pajic
- **R.P. Knowles Scholarship**
  Travis Anton
  Aron Cory
  James Dawson
  Hanny Elsadr
  Eric Gerbrandt
  Lindsay Griffith
  Laura Jeffries
  Kaya Lindenback
  Lisa Malo
  Kendra Meier
  Kirby Nilsen
  Jessia Tessmer
  Courtney Thompson
  Denise Welder
- **S.N. Horner Postgraduate Scholarship**
  Cory Jacob
  Dilshan De Silva Benaragama
  Christine Rosser
- **Saskatchewan Pulse Crop Development Board Dr. Alfred E. Slinkard Scholarship**
  Maya Subedi
- **SaskMilk Graduate Scholarship**
  Brittney Schurmann
- **Syngenta Scholarship in Sustainable Agriculture**
  Cody David
- **Syngenta Graduate Award in Pulse Production**
  Vladimir Pajic
- **Western Grains Research Foundation Endowment Fund Graduate Scholarship**
  Andrea De Roo
  Colleen Redlick

GRADUATE STUDENT SPOTLIGHT

Pursuing a Dream

ECONOMICS IS CALLED THE 'DISMAL SCIENCE,' BUT ERIKA BACHMANN KNOWS HOW CRITICAL IT IS FOR IMPROVING THE LIVES OF THE WORLD'S POOR

By Glenn Cheater

She's quick to laugh at herself for "not having the math," but it's a very serious, and heartfelt, desire that propelled Erika Bachmann down her unusual academic path.

Erika (left) during her trip to Benin.

In 2005, the B.C. native took time away from her undergrad studies to volunteer at an orphanage in a small village in Zambia. It would break her heart and ignite a passion that would eventually land her at U of S as a Masters candidate in agricultural economics.

"It was for kids orphaned by HIV/AIDS and most of them had HIV/AIDS," says Bachmann. "My job was to live with them and care for them like a mother would – reading them stories, helping them with school work, and that sort of stuff.

"You saw a lot of the worst cases. Mothers from the villages bringing their babies to the orphanage and asking us to care for them because the babies are starving. It got pretty overwhelming, but what scared me is that I started getting numb to it. I needed to come home to feel again."

She also wanted an explanation for what she had seen.

"In Zambia, you see so much poverty, but you also see this incredibly lush country – there are mangos the size of grapefruits and trees laden with avocados," says Bachmann. "You look at that richness and then the poverty, and it just doesn't make any sense. I wanted to make sense of that. Economics allows you to do that."

After returning to UBC to complete her history degree, Bachmann managed to find enough "artsy" courses that didn't require calculus or statistics to get a minor in economics.

"I became very interested in food-security issues and it all started to coalesce," she recalls. "I thought, 'OK, I want to work in food security and I'd like to have hard, practical skills – what I need is a graduate degree in agricultural economics.' But given my lack of math, it seemed like an impossible dream."

Of course these days, pursuit of the impossible starts with a Google search, and when Bachmann typed 'Masters of agricultural economics,' up popped U of S. That prompted an email to then graduate chair James Nolan.

"I asked if it was even possible for someone with my background, and he said it was – if I took the pre-requisites."

After spending a year taking calculus and statistics courses, Bachmann successfully applied and began her graduate studies in the fall of 2012. Her dream was to do food security research overseas but that, too, seemed unlikely. Then she met David Natcher, who in addition to being a professor in the department is also a cultural anthropologist and director of the Indigenous Land Management Institute, which works with aboriginal peoples in Canada's north.

"I was looking for a supervisor and he emailed back and said he would love to meet and chat about his research," says Bachmann. "Then he asked if I would be interested in doing research on a soil science project in west Africa."

Naturally, she said yes in a heartbeat. And so this summer, she spent three months in a tiny village in northern Benin, examining the economic, cultural and social aspects of a project involving fertilizer 'micro-dosing.' These small (and hence affordable) amounts of fertilizer could end up providing food security for millions – even in the parched regions of west Africa, where climate change is pushing the sub-Saharan ever southwards.

"Unlike Zambia, northern Benin is not lush and rich," says Bachmann. "It's much more arid and when it doesn't rain for a few weeks, the ground is almost like a desert. It's a real struggle to grow things. And the solutions – such as how to get more

organic matter in the soil – are also very complex and challenging."

Still, Bachmann describes her summer stay in Benin as the "best three months of my life." Although war and insurgency grip large portions of west Africa, she discovered a land whose people are welcoming, religiously tolerant, and "speak in proverbs."

> **"I DIDN'T EXPECT TO GET INTO THE PROGRAM BECAUSE I DIDN'T HAVE THE BACKGROUND AND DIDN'T HAVE THE MATH. BUT I'M SO GRATEFUL I GOT IN. THIS IS A DREAM COME TRUE FOR ME."**

"I'm hopeful because the people are so amazing," she says. "The farmers are incredibly hardworking and resourceful. If anyone can take small improvements and make a go of it, they can."

Giving people opportunity is a powerful thing, says Bachmann, quickly adding how much she appreciates the one she's been given. "I didn't expect to get into the program because I didn't have the background and didn't have the math. But I'm so grateful I got in. This is a dream come true for me." ■

Faculty Renewal

WELCOMING NEW FACULTY TO THE COLLEGE

CHRIS ESKIW

Joined U of S: July 2013, Food and Bioproduct Sciences

Academic Background: BSc, University of Alberta, 1998; MSc, University of Saskatchewan, 2001; PhD (Institute of Medical Science), University of Toronto, 2004; Postdoctoral Fellow, Oxford University (Dunn School of Pathology), 2004-2007; Postdoctoral Fellow, Babraham Institute/Cambridge University, 2007-2010.

Focus of Work: To understand how nutrient availability and sensing impact health and longevity at the genomic level by examining changes in gene expression, epigenetic profiles and genome organization. This research will help identify and characterize nutraceuticals/functional foods which promote health and long life.

Passion: Alteration in protein, cell and tissue structure results in changes/disruption in function. This is true for genomes as well. I am fascinated by the dynamic relationship between genome structure and function this is the drive behind my research program into how the nutrients we ingest impact health and longevity.

COLIN LAROQUE

Joined U of S: January 2014, Soil Science

Academic Background: BSc, University of Saskatchewan, 1993; MSc, University of Victoria, 1995; PhD, University of Victoria, 2002; Postdoctoral Scholar, University of Western Ontario, 2003.

Focus of Work: Dendrochronology; bringing the annual-resolution information in tree rings to bear on a wide variety of research problems, particularly climatological and ecological research questions. I have a particular focus on high-elevation and high-latitude ecosystems from coast to coast to coast.

Passion: Getting students outside of a classroom and into the natural environment for experiential learning. I'd like to think that this passion is interwoven through my teaching, research and service to the wider community.

▲ Grant Wood

Food for Thought

THE LOCAL FOOD MOVEMENT IS CHANGING OUR CULINARY SENSIBILITIES AND CREATING OPPORTUNITIES FOR INNOVATIVE FOOD ENTREPRENEURS, DIETITIANS, AND EVEN URBAN DESIGNERS

By Glenn Cheater, Photo by Dave Stobbe

It's a paradox: There's soaring interest in how food is produced – but the number of people who actually know how to grow it is plunging.

It was the latter factor that prompted Grant Wood to create his Urban Food Production course, but it's the former that has him excited about where the local food movement may take us.

The idea for the course came to Wood five years ago when a child of visiting friends was examining his garden and asked, 'Why do you keep your carrots in the ground?'

"And he's not the only one," says Wood. "At a garden show, we put up a sign that said 'vegetables need a minimum of eight hours of direct sunlight a day' and I was amazed at the number of young people who were saying things like, 'Oh, that's why the garden didn't grow under the spruce tree.'"

Of course, grandma didn't need a university course to learn how to garden, and Wood has a more ambitious goal for his multi-disciplinary course, which attracts students from four colleges – agriculture and bioresources, pharmacy and nutrition, kinesiology, and arts & sciences.

It's a "challenging mix of students," says the exuberant plant sciences professor. For example, the agbio students "are bored silly" when he covers basic soil science. But when a dietitian gives a guest lecture, those same students have to step out of their biosciences/production mindset and think about food in a very different way.

The course is a deliberate mash-up of ideas drawn from many disciplines. The production part ranges from the nutritional needs of crops and integrated pest management to proper storage of the harvest and how that affects nutrient levels. The section on finding suitable plots of land in the city leads into a look at how food production can influence urban design and why community building is critical to growing food in a city.

There's even a guest lecturer from Cuba, where financial woes fuelled a drive to reduce food imports and eventually made that country a global leader in urban agriculture. (Havana gets 60 to 90 per cent of its fresh produce from small plots in or near the city.)

Those economics aren't at play in Canada, but there are other forces driving our local food movement.

"We can always get cheap food, but there's a new group of youth concerned about where their food comes from," says Wood. "They want more control over the quality of their food and how it is produced."

While concerns over 'factory farming' gave birth to the local food movement, the increasing availability of fresh, high-quality farm produce has also played into Canadians' increasingly adventurous culinary tastes. People on this side of the Atlantic are adopting a European attitude towards food, says Wood.

"The attitude is shifting from food as sustenance to something we celebrate," he says. "I tell my students, 'I don't want you to just eat. I want you to dine.' You eat with salt and pepper. You dine with basil, oregano and other herbs. You impart flavour to enjoy the food you eat.

"So it's not just about local, but about taking fresh food and making something exciting and new with it."

Wood initially considered calling his course 'urban agriculture.' But after talking to his kids and their friends, he realized most young urbanites associate the words agriculture and farming with tractors and the like. Wood says he wants his students to be open-minded and create their own vision of what urban food production might look like in the future.

Those with an entrepreneurial bent are encouraged to think about how they might build a business around urban food production – would you partner with restaurants, use a smartphone app to match customers with what's available this week, or maybe combine your urban farm with a gourmet food truck? Those heading back to the family farm, says Wood, will be better positioned to capitalize on niche opportunities if they learn to think of food from the end-user's point of view. And instead of just telling their clients to "eat your veggies," those who become nutritionists or dietitians might find ways to use gardening to get them to embrace healthier diets, he says.

That's something Wood does, too. The self-confessed "vegetable hoarder" regularly dips into his pantry and brings dishes to class.

"I make chana masala for my students and I tell them the curried chickpeas are part of my one-mile diet," says Wood. "The spices are imported, but the chickpeas, tomatoes, garlic, and onions are grown on a plot within one mile of campus."

> **"WE CAN ALWAYS GET CHEAP FOOD, BUT THERE'S A NEW GROUP OF YOUTH CONCERNED ABOUT WHERE THEIR FOOD COMES FROM."**

And as any of his students can tell you, Wood always slips some fresh (and local) kale into the traditional Indian dish because, along with spinach, "it's one of the two biggies when it comes to nutrients per unit area."

Urban Food Production Pl Sc 235 itself is an unusual concoction, but a popular one. His first class in 2011 attracted 25 students, that number grew to 40 last year, and will have 90 students enrolled this year now that it's offered in both the fall and winter terms.

It's hard to know how students will put this learning experience to use, as urban food production is still in its infancy, says Wood. At this point, it's all about planting seeds in creative minds.

"It's a different way of looking at education," he says. "But it's also a tasty way of education, too."

A Different Planet

YOU DON'T USUALLY NEED ARMED GUARDS WHILE RESEARCHING, BUT POLAR BEAR VISITS ARE A GIVEN DURING RYAN BROOK'S UNIQUE NORTHERN FIELD COURSE

By Glenn Cheater, Photos by Ryan Brook, Aimee Schmidt and Anja Sorensen

It might be the most gripping course guide ever written.

The Animal Bioscience 475 field guide begins with the assurance Prof. Ryan Brook is an expert with firearms and "has safely resolved several hundred polar bear encounters without ever having harmed a bear or put any human at direct risk."

That sets the tone for what students can expect on their two-week course conducted each August in Churchill and neighbouring Wapusk National Park.

Bear monitors? Always at least one, and as many as four, armed with 12-gauge shotguns and "starter pistols with screamer shells." Bathroom breaks on the largely barren tundra of Wapusk? Either "ask everyone to face the other way" or if there's a boulder within shouting distance, have a monitor do a quick bear scan first.

You're warned the temperature can plunge 20 degrees in a few hours, accompanied by frigid rain and 50-kilometre-an-hour winds. There are two pages of clothing advice and another on how to treat a hypothermia victim. There's a frightening picture of Brook in his 'bug jacket' being swarmed by black flies. And during your six days in a small compound in Wapusk, you're to stay at least two metres from the heavy wire fence "since bears can and will reach through the wire."

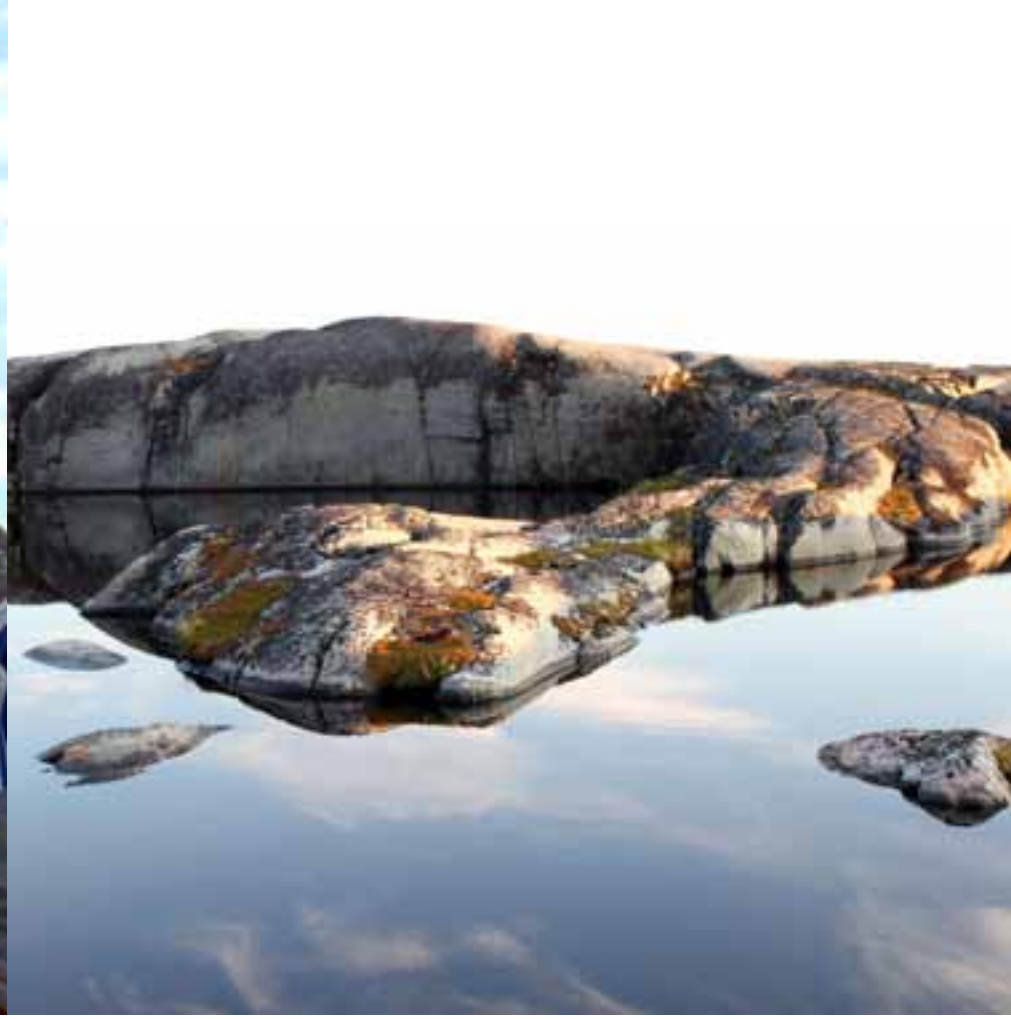
But Brook delivers his last warning in person.

"I always caution them this course will change their life," says Brook, assistant professor in the Department of Animal and Poultry Science and senior member of the Indigenous Land Management Institute.

"That's the most common comment we get from their feedback: It changed my life. It's pretty humbling, but it is one of the most amazing places on earth."

> **"THAT'S THE MOST COMMON COMMENT WE GET FROM THEIR FEEDBACK: IT CHANGED MY LIFE. IT'S PRETTY HUMBLING, BUT IT IS ONE OF THE MOST AMAZING PLACES ON EARTH."**

That's exactly what happened to Brook 19 years ago, when the then University of Manitoba undergrad noticed a posting for a northern field study of arctic foxes. He's been back every summer since, running the Field Studies in Arctic Ecosystems and Aboriginal Peoples field school since 2004.



Caroline Bjorklund, Dene elder in Churchill, holding a traditional caribou call while sharing traditional knowledge about caribou. ▲

"This course isn't for everyone – and I certainly say that a lot," he says. "It's not for the faint of heart, it is an adventure and, like everything else, there's some risk."

So far, 207 students have taken the course, part of the new Bachelor of Science in Animal Bioscience. Other than blisters, the only injury has been a sprained ankle suffered during a dodgeball game in the Churchill school gym. But that's why the 42-page field guide was created – the course's first lesson is you must know the risks in order to be prepared for them.

"These are people's children I'm taking out there and that is the most stressful component for me," he says. "Most of my grey hair has come from worrying about and, basically being the father to, 15 to 20 undergraduate students for two weeks each summer."

Brook was just 20 when he first travelled to the remote and frequently inhospitable shores of Hudson Bay. "It just clicked – it was like I had gone to a different planet even though I hadn't left my home province," he says. "I learned I like to be challenged. I like the extreme weather, I like being surrounded by pristine wilderness, and I like to be in a remote place where, if you're careful, you can have safe encounters with the world's largest land carnivore."

Just as critical, it's also a chance to do serious, and increasingly vital, science. Each summer, students add to Brook's detailed 16-year-old database on the permafrost layer and vegetation covering the sub-arctic peatland. Using a transect sampling method, students record the percentage of different vegetation (lichen, moss, herb, shrub and the rare tree), moisture levels, groundwater pH, and soil/sand/gravel percentages. Data has been collected at hundreds of sites and the vegetation map is used by virtually every researcher visiting the region.

But it's taken on added importance because of climate change.

"The most frequent question we're now asked is 'What change have you seen?' Well, the only way to answer that question is to have a baseline that you can measure change against."

Global warming has put the arctic and sub-arctic at tremendous risk, but to truly appreciate what's at stake, you have to see it with your own eyes, Brook adds.

"When you take students to a place like Wapusk National Park and say, 'If we don't do something, you are not going

Heading to the Churchill River Estuary to snorkel with beluga whales. ▲

Students measuring vegetation cover in the Hudson Bay Lowlands, the largest wetland in North America. ▲

to see polar bears in this area,' it makes an impact," says Brook. "Anyone back in Saskatoon would get that, but it means infinitely more to people who have actually been face to face with a polar bear."

The bears dominate life at Churchill during the four to five months (although increasingly longer) they spend in the area waiting for the sea ice to re-form. But the remoteness of the area, particularly the Nester 1 research camp, also makes for a deeply intense experience. It's a thousand-kilometre drive from Saskatoon to Thompson, Man., an 18-hour train ride to Churchill, and a 20-minute helicopter journey (mind the spinning rotors) to get to Nester 1. Every item – from food and fuel to biodegradable soap and garbage removal – must be precisely planned, and students must be equally rigorous in their research.

"The research is a platform to train students in science and that's the main reason I do it," says Brook. "Everything is geared towards engaging students and training them in the methods of science – designing research, collecting and analyzing data, and all those good things. They work in small groups and design their own research projects – everything from polar bears, wolves, caribou, and foxes to habitat change and working with local aboriginal people.

"It's about inspiring them. The science we do is important. Conservation is important. And there's something to be said for taking students to the really remote areas of Earth."

Many of the students have gone on to further ecosystem studies, including a graduate student who is now studying animal health and conservation under Brook and the Parks Canada official assigned to accompany his students this past summer, who took the course four years ago and is now a research technician in Churchill.

> **"THE SCIENCE WE DO IS IMPORTANT. CONSERVATION IS IMPORTANT. AND THERE'S SOMETHING TO BE SAID FOR TAKING STUDENTS TO THE REALLY REMOTE AREAS OF EARTH."**

As always, Brook can't wait to get back. The pull of the place never diminishes, he says.

"Sometimes life in the south is almost too easy," he says. "It's easy to slip into a rut. Well, if you want to get out of a rut, come to Churchill." ■

A Salty Tale

NEW SODIUM RULES COULD HAVE DRAMATIC CONSEQUENCES FOR BREAD LOVERS, BUT A CRACKERJACK TEAM FROM U OF S IS RACING TO FIND WAYS TO MAKE TASTY BREAD WITH LESS SALT

By Glenn Cheater, Photo by Dave Stobbe

Expect to hear a lot more about Mike Nickerson as the clock ticks down on a new low-salt regulation that threatens one of our favourite foods – our daily bread.

"Canada has set much more stringent standards for reducing salt than other countries," says Nickerson, an associate professor in the Department of Food and Bioproduct Sciences.

"But in bread, it's not just a taste factor; it's a processing issue. In fact, this could be a sustainability issue for bread companies."

There are two parts to this story. One is why salt in bread is such a big deal, and the other unravels the mysteries of one of the most seemingly bland things in the world – bread dough.

First the salt story. And the news is bad.

"Before I got into the research side, I never paid much attention to the levels of salt I was consuming," says the transplanted Maritimer, who is also the Ministry of Agriculture Strategic Research Chair in Protein Quality and Utilization.

"I now know we consume way too much salt – about 3,500 milligrams daily. Health Canada wants to lower that to 2,500 per day. But really we should be down around 1,500."

In fact, our bodies can get by with about 500 milligrams per day and you can get nearly that amount in 100 grams – or roughly two thick slices – of bread. The kidneys will flush out any excess, but they can only handle so much, and the avalanche of salt consumed by the average Canadian results in sodium in the bloodstream. That raises blood pressure, which can

Michael Nickerson

lead to hypertension and ultimately, cardiovascular disease.

"It has huge health implications," notes Nickerson.

On the surface, Health Canada's new salt guideline for bread – 330 milligrams per 100 grams versus the current 420 milligrams – is relatively modest. But it turns out that has a big impact on a lump of dough.

"Once you remove salt, the gluten network is unable to hold as much water and so you have a lot more water mobility in the dough matrix," says Nickerson.

"This makes it stickier, and that has big implications if you're processing tons of dough a day. You can imagine how costly it could be if you're always having to shut down to clean equipment."

Gluten network? Dough matrix? Can a mixture of flour, water, salt, and yeast be that complex?

In short, yes. Which is why Nickerson and his colleagues are in a race to unlock its secrets before Health Canada's new sodium regulations take effect in 2016.

"There are a lot of questions," he says. "How does stickiness arise? What is the mechanism and structure that underlies it? What is going on in the dough matrix? Dough is a very complex system and having a really good understanding of it will allow us to create strategies to deal with the issues that arise when you lower the amount of salt."

A crackerjack team has been assembled to answer those and other questions. Nickerson is the protein guy and will focus on the role of gluten (a composite made up of a variety of proteins) in the dough matrix. Departmental colleague Bob Tyler is the starch expert, Crop Development Centre's Pierre Hucl is the wheat breeder, and University of Manitoba food scientist Martin Scanlon has been brought on board because of his expertise in areas such as air bubbles in dough. And since scientists aren't renowned for their baking skills, Canada Bread – the country's largest baked goods company – has top bakers standing by.

Among the things on the to-do list is using the synchrotron at the Canadian Light Source as well as NMR spectroscopy to analyze the structure of bread dough. The researchers will also use rheology equipment (used to study the flow of materials in liquids and 'soft solids') to better understand such things as how water shimmies around the dough matrix when there's not heaps of salt to bind it.

While dough has been much studied, the quest to reduce sodium levels has opened up new frontiers.

"There's only sporadic work on low-salt products in the literature," says Nickerson. "There's been interest in making a healthier product, but never a big government push to do it right away. Now Health Canada's 2016 target is the driver."

That looming deadline is also why Hucl is part of the team.

"Pierre will be looking at wheat varieties as there's really quite a range of gluten strength in different varieties," notes Nickerson. "We may be able to choose varieties that perform better in a low-salt environment and also start breeding for those qualities. This could have huge implications on the breeding side."

In fact, even though the 2016 sodium regulation is causing stress for Canada's baking sector, it could prove to be a boon for Canadian wheat growers. Other countries, such as the U.K., have adopted an incremental approach – slowly lowering maximum salt levels so the tastebuds of consumers can adjust. But if Canada, already renowned for its bread-making wheats, can develop varieties that do a superior job on the low-sodium front, it will only increase demand for our Prairie crop, says Nickerson.

"Salt reduction is a global issue – we're not the only ones who consume way too much sodium," he notes.

"IF CANADA, ALREADY RENOWNED FOR ITS BREAD-MAKING WHEATS, CAN DEVELOP VARIETIES THAT DO A SUPERIOR JOB ON THE LOW-SODIUM FRONT, IT WILL ONLY INCREASE DEMAND FOR OUR PRAIRIE CROP."

Of course, the reason we consume so much salt is that we love it. Saltiness is not only one of the five basic tastes detected by the human tongue, it also helps propel some molecules into the air, which increases the aroma of food.

So will humanity be condemned to a future of bland-tasting bread if Nickerson and his colleagues are successful?

He laughs at the notion that one day he may be infamous as the man who ruined one of humankind's greatest pleasures.

"Will they put my picture up in bakeries and throw darts at it? I guess they could, but I don't think that will happen. You can have a really healthy product but if it doesn't taste good, people won't buy it. So we need to create breads that have less salt but are still something people want to buy." ■

Funding for the research is being provided by the National Sciences and Engineering Research Council of Canada, Canadian Institutes of Health Research, Western Grains Research Foundation, Saskatchewan's Agriculture Development Fund, and Canada Bread Company.

Until the Cows Come Home

AFTER MORE THAN NINE YEARS OF PLANNING, THE $11.5-MILLION RAYNER DAIRY RESEARCH AND TEACHING FACILITY OPENED IN FALL 2013 AND IS PROVING TO BE SO MUCH MORE THAN A BARN

Feeding the World Interpretive Centre located in the Rayner Dairy Research and Teaching Facility.

By Lana Haight, Photos by Dave Stobbe

The new Rayner Dairy Research and Teaching Facility at the University of Saskatchewan is more than a barn with dairy cows.

"People need to take blinders off. Don't take a narrow view of things," encourages professor Bernard Laarveld of the Department of Animal and Poultry Science in the College of Agriculture and Bioresources.

With the capacity to house 100 cows, the $11.5-million facility will be a centre for a wide range of research projects and will provide hands-on teaching for students studying in various fields, including animal science, plant science and veterinary medicine.

"Because of our strategic planning within the college and the department, animal nutrition and research as well as feeds research are high priorities. We designed the facility to meet the needs of that high priority within our integrated planning. That doesn't mean it's exclusive. The facility can also be used for physiology research, behavioural research, biochemistry research, health research, animal reproduction research and animal welfare research," says Laarveld.

Planning for a new dairy facility began about nine years ago when representatives from Saskatchewan's dairy industry approached Laarveld, who was then the head of the department. They were concerned that the existing dairy barn, built in the early 1970s, was old and aging. Mechanically, it was worn out and its 1960s design was no longer relevant to modern dairy farms. It was also too small. Cows in the 1960s grew to about 600 kilograms. Today, they are closer to 725 kilograms.

The new barn houses three different milking systems: a conventional parlour where 12 cows can be milked at a time, a robot system that milks one cow at a time when the cow chooses to enter that area, and a separate milking system in the barn's metabolism wing so cows involved in intensive research don't need to be moved to be milked. In all three systems, the amount of milk produced by an individual cow is measured automatically. A sample of that milk can also be taken for analysis specific to that cow.

"This is a dairy farm in the middle of the city," said Professor Andrew Van Kessel, head of the Department of Animal and Poultry Science, during a recent tour of the facility located near the corner of East Road and Preston Avenue.

Milk production is ranging between 39 and 41 litres per cow per day depending on the method of milking and the age of the cow.

"Our milk is sold. We rent quota from the Saskatchewan dairy farmers," said Van Kessel.

Betty Lang, John G. Rayner's daughter, meeting the cows at the facility's grand opening.

"Eventually we'd love to have dairy products on campus from these cows. They could supply the university's milk requirements."

The milking parlour that occupies about half of the main barn is equipped with 16 computer feeders that monitor the feed intake of animals individually. The feeders can be programmed, allowing a cow to eat a set number of times each day or a certain amount of ration. How much is eaten and when can also be recorded.

"These cows are on an Omega-3 diet," said Van Kessel during the tour referring to another group of animals being fed using individual feeders.

Entering the metabolism wing, he noted the room is both heated and air-conditioned so the temperature is precisely controlled.

"The cows in here might have cannulas into the rumen. They might have catheters into their blood so we can look at metabolites in blood on a minute-by-minute basis. We can collect urine. We can collect feces. Here is where we can look at detailed physiology of animals as they respond to different nutritional strategies and different feed additives."

In the six months since the animals were moved into the new barn, the number of research projects being conducted

has at least doubled compared to the number conducted in the old facility. Laarveld expects the number could even triple. That's due, in part, to a larger herd. The old barn housed 55 cows while the herd currently sits at 92 cows.

"With all of this new equipment that we have, we can do far more measurements on the animals. The data-mining that we can now do with this new facility will be much enhanced. We are going to get a lot more data with the milking systems and the computerized feeders," says Laarveld.

Some of those projects will relate to cow behaviour.

"You want to work with nature. You don't want to fight nature. That's what it's all about. When you work with nature and with the cows, you have a smooth functioning operation with high standards of animal care," says Laarveld.

scientific practices in order to improve their farm products as well as their lifestyles. The founder of the Saskatchewan 4-H movement, Rayner was also instrumental in the development of the Canadian Council of Boys' and Girls' Clubs.

Appropriately, the dairy facility named after an educator includes the Feeding the World Interpretive Centre, designed to educate the public not only about the dairy industry but about the role Saskatchewan agriculture plays in global food production.

Feeding the World was high on the list for the dairy producers.

"They felt that we needed to be concerned about the link between the consumer and the agricultural production system," says Laarveld.

"YOU WANT TO WORK WITH NATURE. YOU DON'T WANT TO FIGHT NATURE. THAT'S WHAT IT'S ALL ABOUT. WHEN YOU WORK WITH NATURE AND WITH THE COWS, YOU HAVE A SMOOTH FUNCTIONING OPERATION WITH HIGH STANDARDS OF ANIMAL CARE."

Grooming brushes located in the barn that the cows activate themselves has one researcher speculating that cows in good health groom themselves regularly. A reduction in grooming behaviour could indicate a health issue. Funding to explore this is being sought.

Other research projects will focus on environmental sustainability and developing green technologies that can be used by dairy farms.

"We want to start working with the manure. There's a need and an opportunity," says Laarveld.

It was a warm and sunny afternoon on October 15 when the new dairy facility was a buzz of activity. Representatives from government, industry and the university, dairy producers, students and one very special family were among those celebrating the official opening.

Betty Lang, daughter of John G. Rayner, came from Montreal along with several other family members. With dairy cows feeding in the background and the sweet aroma of manure wafting amid the dignitaries, Lang cut the ribbon of the facility named in honour of her father. Director of the Department of Agricultural Extension at the U of S for 32 years from 1920 until his death, Rayner dedicated his career to improving agricultural practices and to educating rural youth. He travelled extensively throughout Saskatchewan, encouraging farmers to adopt

"We approached it as agriculture as a system. All agriculture is interdependent. We are trying to show the relatedness of all agriculture."

In addition to interacting with a variety of displays, people can walk through the dairy barn on a suspended walkway to observe the dairy herd and watch the cows being milked conventionally and by the milking robot. Wheelchair accessible, Feeding the World is open daily from noon to 4:30 for self-guided tours.

"The interest in the gallery is exceeding expectations without even promoting it. We have seen a lot of groups, schools, 4-H, producer organizations, government representatives and even farm dealerships wanting tours," says Laarveld.

Funding to build the $11.5-million Rayner Dairy Research and Teaching Facility came from Agriculture and Agri-food Canada, Western Economic Diversification Canada, Saskatchewan Ministry of Agriculture, SaskMilk, SaskCanola, SaskFlax, Moody's Equipment, New Holland Agriculture, Seed Hawk, Agrifoods International Cooperative, BMO Financial Group, Farm Credit Canada, National Bank and RBC Royal Bank.

Planting a Seed

Pat Beaujot

PAT BEAUJOT HAD MANY 'A-HA MOMENTS' IN HIS STUDENT DAYS, AND WOULD PUT THEM TO USE TO MAKE HIS COMPANY A GLOBAL LEADER IN AIR SEEDER MANUFACTURING

By Glenn Cheater

It's 1986, and Pat Beaujot and his brother are admiring their handiwork – an air seeder they modified in the yard of the family farm in Langbank, Sask.

It was simple, but there was much to admire: They'd swapped the soil opener with a split shovel that sent seed into two rows, and added tubes that dribbled fertilizer from a trailing wagon between the rows. Their handcrafted prototype had torn through seeding that spring, laying down seed and fertilizer in one go without having to first cultivate the field. And it didn't just save time, fuel and wear-and-tear on equipment. Seeding into straw from last year's crop was going to dramatically reduce soil erosion and, because the stubble catches snow and slows evaporation, make continuous cropping possible.

This was a game-changer.

But even as he stood there, Beaujot could hear the voices of two of his former professors. Both were saying, 'Not this machine. It isn't good enough.'

"Once we switched to no-till for our cereals, it was so fast and easy to get that part of the crop in," recalls Beaujot, who earned his agriculture degree from the University of Saskatchewan in 1981.

"But I knew we had a ways to go. That first machine placed the fertilizer at the same depth as the seed. Fertilizer needs to be below so the roots could grow down into it. And because you couldn't precisely control seeding depth, it didn't work for canola and flax. To plant those crops we had to till the field, broadcast the seed, and harrow it in.

"So yeah, I heard the voice of Don Rennie saying, 'You'll still be tilling half your fields.' and Les Henry saying, 'Never forget what farmers have to do to get a crop in the ground quickly.'"

So over the next six years, Beaujot, now 54, and his partners basically created their own air seeder from scratch. The result, dubbed Seed Hawk, would go into commercial production in 1992 and truly was revolutionary. The complex array of independently moving soil openers and knives allowed for precise placement of seed at just the right depth (critical for crops such as canola and flax) with fertilizer laid down off to the side and below.

Their raft of innovations would make Seed Hawk a global leader in air seeding technology and dramatically change the tiny hamlet of Langbank, southwest of Moosomin. Today, 250 people work in the perpetually expanding 115,000-square-foot plant. Over the last 21 years, they've manufactured nearly three thousand seeders, and thanks to a 2006 partnership with Swedish equipment maker Väderstad-Verken, the machines are now in use everywhere from Western Europe and Australia to Kazakhstan and South Africa. (In October, Väderstad bought the company, although Beaujot will remain on the Seed Hawk board.)

But Beaujot says he can't see any of that happening without the education he received at U of S, particularly from the late Don Rennie and Les Henry.

Rennie, a leading and early advocate of soil conservation, made a deep impression on an 18-year-old Beaujot, who grew up watching his father search for ways to keep the sandy soil on his Langbank farm from blowing away.

"He was so good at explaining things," Beaujot says of the former Dean of Agriculture. "He talked about how – if we stopped tilling, let the straw trap snow, used fertilizer, and were really careful to conserve soil moisture when planting – we could actually grow crops year after year without using summerfallow.

"He was so far ahead of his time, and he really did a good job of shocking us students into realizing what a bad practice summerfallow was."

Rennie's extensive research on soil conservation and the practices that we now collectively call no-till was compelling for the young Beaujot. Equally memorable were the teachings of Henry, now a professor emeritus of soil science.

> **"YOU CAN TALK ABOUT THE SCIENCE ALL YOU WANT, BUT WHEN YOU TALK TO FARMERS, YOU HAVE TO THINK ABOUT WHAT THEY HAVE TO DO WHEN THEY'RE IN THE FIELD."**

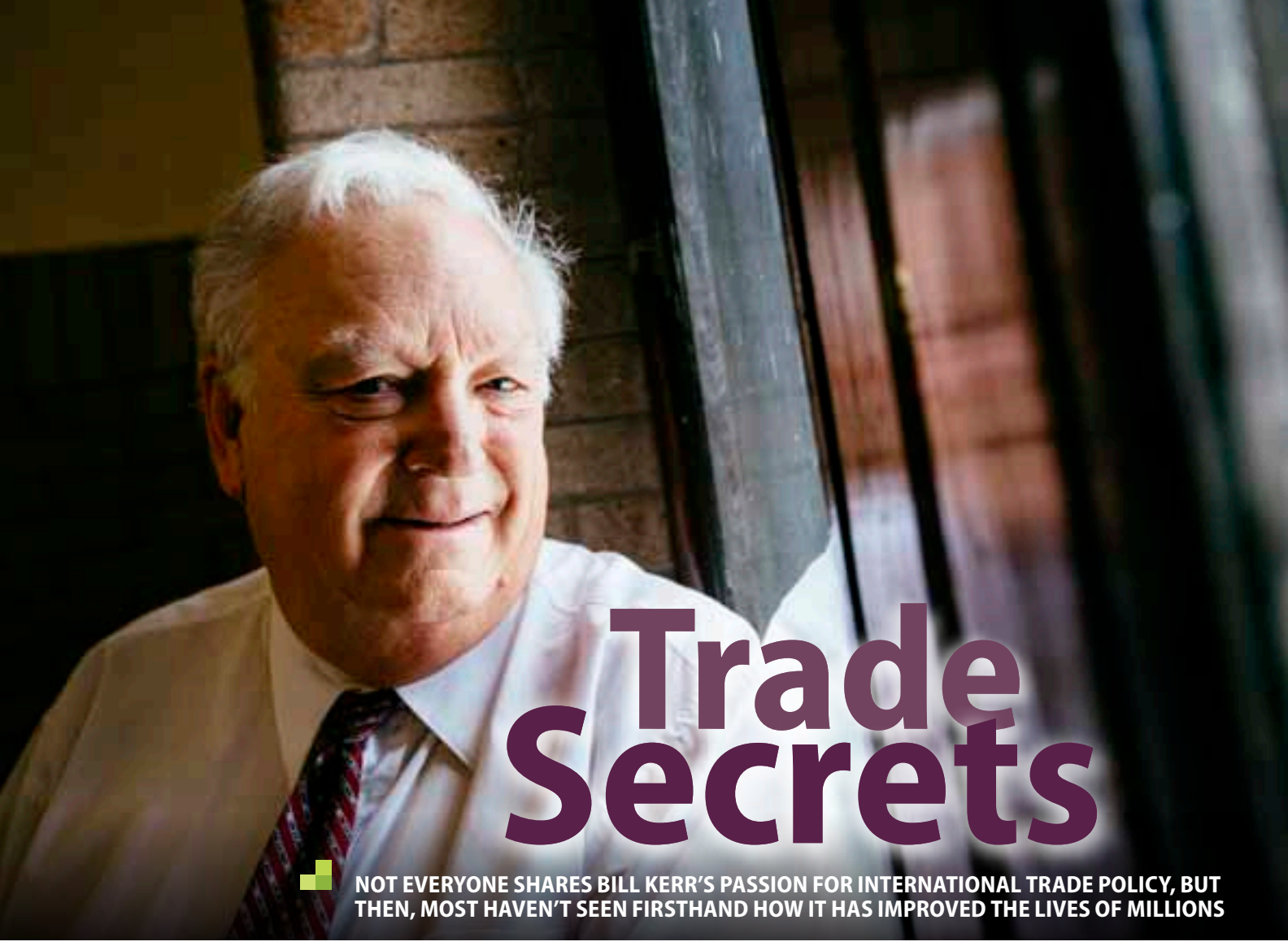
"He was very practical," recalls Beaujot. "He would say, 'Don't get too scientific – you can talk about the science all you want, but when you talk to farmers, you have to think about what they have to do when they're in the field.'"

Which is why, all those years ago, Beaujot realized that first prototype wasn't going to cut it. But he was confident he could find a way.

"At university, you learn how to learn," he says. "Don't get me wrong. I wouldn't call myself a keener – after all, I was social director in fourth year and did my share of partying – but when it came to soil science, I was interested.

"At home, there was a strip of sandy soil across the road you could see from the picture window. When the wind got up in spring, that soil would blow and blow, and something like that burns in your memory. So when I walked into those classrooms and they talked about the science behind that, the damage it caused, and what could be done about it – well, those were some big a-ha moments for me."

Today, in places like dry and windy Kazakhstan, other farmers are having their own a-ha moments – thanks to seeds of knowledge planted three decades ago. ■



Trade Secrets

NOT EVERYONE SHARES BILL KERR'S PASSION FOR INTERNATIONAL TRADE POLICY, BUT THEN, MOST HAVEN'T SEEN FIRSTHAND HOW IT HAS IMPROVED THE LIVES OF MILLIONS

Bill Kerr ▲

By Glenn Cheater, Photo by Dave Stobbe

International trade policy has been a lifetime passion for Bill Kerr, but he knows it's not one everyone shares.

"I've been doing international trade research since I graduated and took my first university job in 1980," says the ag economist and professor in the Department of Bioresource Policy, Business and Economics.

"I guess most people would find us boring, just like they would if they were listening to a group of literary scholars discussing 18th century poetry."

Actually, the poets might be easier to understand. But get beyond the talk of transitional safeguard mechanisms, geographical indications, and ad valorem equivalents, and you'll discover one of the most powerful forces in modern history. One that has lifted hundreds of millions out of poverty in the last two decades. And one that will need to continue working its magic as Earth's population surges towards nine billion and climate change hits home.

To see why, jump in a time travel machine and join Kerr on his first trip to China in 1984.

"The country was still very closed back then — no privately owned cars, everyone on bicycles, virtually nothing to buy," he recalls. "It was all human powered, and in a place like Shanghai, it took this huge effort just to feed the city every day."

Now set the dial for 2008. Kerr and some colleagues are in Shanghai to conduct seminars for graduate students on the finer points of trade policy. The city has changed so much it is almost unrecognizable, says Kerr.

"It was totally transformed," he says. "Automobiles may not be a good thing environmentally, but they were everywhere. Shanghai had become a modern city with supermarkets and all the rest. This came about because China opened up and was able to trade."

The trip also provided Kerr with one of the most surreal experiences of his academic career.

The 66-year-old has written or co-authored more than 20 books, but he writes for a select audience, one where a few thousand copies constitutes a bestseller. Occasionally, a foreign publisher asks for permission to translate one of his books, which was the case for The Economics of Biotechnology, a 2001 book written with U of S colleague Jill Hobbs and three others. Kerr had forgotten about the Chinese version until the 2008 trip.

"Everyone had read that darned book," he says. "It was in the bookstores, and students would stand up at our lectures and quote passages from it. I was just astounded."

But it's a sign that trade policy is seen differently in countries developing their economies through exports. And with good reason. Take, for example, Vietnam, which aggressively expanded shrimp farming after shifting to a market-based economy. Shrimp farming now provides a living for 250,000 families, with the country exporting $2.5-billion worth of shrimp last year. Much of that goes to the U.S., and Washington's efforts to protect American 'shrimpers' has resulted in anti-dumping duties and a 10-years-and-counting legal battle fought through the World Trade Organization and other international bodies.

It's a familiar story for trade experts. Because while trade benefits both poor nations and consumers, it inevitably impacts competitors somewhere else, and "anytime you have a big change over a short period of time, that leads to trouble," says Kerr. Recently, similar trade disruptions have negatively impacted Saskatchewan livestock and flax producers, he adds.

If the international trade system does not function efficiently, it will have major implications as the world's population heads toward nine billion. Most of the fastest-growing regions are already densely populated and unable to grow significantly more food. But they can produce and trade other goods.

"Being able to trade is fundamental to their food security," says Kerr. "If they're prevented from exporting non-agricultural products, they're going to have trouble paying for the food they need."

Maintaining a free flow of trade will also be critical in dealing with the impacts of climate change, he adds. For example, most people have either barely noticed or since forgotten that Russia, Ukraine and Kazakhstan suffered a serious drought in 2010. Against the urging of the international community, all three imposed bans on grain exports – mostly to keep bread prices at home from rising sharply.

"But that raised world prices. And it was rising food prices, particularly for bread, that kicked off the Arab Spring in Egypt," says Kerr. "It's all inter-related."

Viewed through that prism, trade policy is anything but boring.

That's why the Estey Centre for Law and Economics in International Trade (located at U of S) has helped to train experts in trade policy. Kerr, a senior associate and editor of the Estey Journal, has been part of that effort, making teaching trips to Southeast Asia. (The Vietnamese translation of another of his books, the Economics of International Business, is on the curriculum at Vietnam's Foreign Trade University.) Previously he did similar work in Eastern Europe after the Berlin Wall came down.

"One major problem with the system we have now is that the capacity of developing countries to engage in the process is extremely limited," says Kerr. "Canada and other western countries need to help out and make sure developing countries are not left out."

It's in our own interest.

"Saskatchewan exports a greater percentage of its agricultural production than any other province," he adds. "A smoothly functioning international trade system is not only good for our farmers, but also for consumers here and around the world."

> **"SASKATCHEWAN EXPORTS A GREATER PERCENTAGE OF ITS AGRICULTURAL PRODUCTION THAN ANY OTHER PROVINCE."**

Discussions on global food security generally focus on whether we can grow enough food to feed nine billion people. But we will also need "an awful lot of infrastructure to move that food to where it's needed."

"And to get people to make those investments, you need a system of international rules that provides them with a certain level of security when it comes to the free flow of trade," says Kerr.

That makes trade policy as fundamental as any branch of agriculture.

"We're all in the food security game, we just don't call it that," he says. "And it's as true today as it was when the College of Agriculture was founded a century ago. We developed early maturing varieties so we'd lose less of the crop to frost or drought, and better growing systems so we could produce more. Early farm management economists in the college helped farmers integrate new knowledge into their operations and that continues in today's College of Agriculture and Bioresources.

"So whether it's ag economics or wheat breeding, the ultimate goal is food security."

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A Paying Proposition

CAN REDUCING GREENHOUSE GASES BE GOOD FOR THE BOTTOM LINE? YES, SAY U OF S RESEARCHERS, WHO ARE SHOWING HOW CUTTING N_2O EMISSIONS GIVES FARMERS MORE BANG FOR THEIR FERTILIZER BUCK

By Glenn Cheater, Photo by Fran Walley

It's been called the 'forgotten' greenhouse gas, but reducing emissions of nitrous oxide is key to the effort to stop global warming.

"Carbon dioxide is the one everyone hears about – whether it's from auto emissions, industrial sources, or the oil sands," notes U of S soil scientist Rich Farrell. "But a kilogram of nitrous oxide will trap 289 times more heat in the atmosphere than a kilogram of carbon dioxide. And unlike CO_2, the major source isn't exhaust pipes or industry, but agriculture."

There's another difference: Unlike CO_2, the effort to reduce N_2O emissions is less concerned with portraying emitters as the bad guys and more focused on getting the job done.

"To be honest, when we first started working on this, we looked at it strictly from the position that nitrous oxide emissions are an environmental problem," says Farrell, who has researched greenhouse gases for two decades. "That's the negative way to view it, and probably why many farmers looked at us skeptically."

The initial research of Farrell and his colleagues focused on getting a handle on how much N_2O gas comes off fields and pastures, and the impact of nitrogen fertilizer. Just talking about this research sometimes prompted farmers to call the Rhode Island native a 'tree hugger' who was going to get the public riled up about fertilizer use.

However, their work set the stage for more advanced research into how specific farm practices affect N_2O emissions. That's when it became clear that reducing them could be a paying proposition.

"We realized a system that's producing a lot of nitrous oxide is like a car that's leaking oil – it's a sign of a bigger problem," says Farrell, Strategic Research Program co-chair in Soil Biological Processes.

"So now we don't tell farmers to do this because it's good for the planet. Instead, we're basically saying, 'Do this and you'll get more bang for your buck – better yields, lower costs, and more profit. And it'll be good for the environment, as well.' "

PhD student Nils Yannikos with soil scientists Dan Pennock and Rich Farrell.

The idea that N_2O emissions are a sort of fertilizer-efficiency gauge fits in well with the '4R approach' (the right rate of the right fertilizer at the right time with the right placement) and is finding an audience in the farm community.

"Some are still skeptical, but more and more farmers see this research as a good thing," says Farrell.

That number will surely grow as results start coming in from the Agricultural Greenhouse Gases Program. The federally funded $27-million, five-year initiative has U of S scientists monitoring N_2O emissions at three sites in the province to identify economically and environmentally superior ways to apply nitrogen, irrigate fields, and create better agronomic management systems.

In Carrot River, Farrell and fellow soil scientist Fran Walley are examining the practice of broadcasting nitrogen fertilizer on forage seed crops. When nitrogen fertilizer is broadcast (as opposed to being incorporated into the soil), a large percentage escapes into the atmosphere.

"In the field, we're using urea, a common nitrogen fertilizer, which is transformed by microbial action into chemical forms that can be taken up by plants," says Walley. "But that frequently makes it subject to gaseous losses, either as ammonia or N_2O."

Together with their students, they are studying 'inhibitors,' which interfere with this chemical process, temporarily halting the transformation of urea at the ammonium stage and retarding the subsequent production of nitrates. Plants can use both forms, but nitrate is the primary source of nitrogen lost as N_2O. So slowing the nitrification process reduces N_2O emissions.

And what's good for the environment is good for the pocketbook.

"The fertilizer losses can be significant, as much as 50% depending on environmental conditions," says Walley. "We want to minimize the environmental impact, but that also leaves more nitrogen for plant uptake."

The research has already confirmed inhibitors greatly reduce N_2O and ammonia emissions, and crop analysis will yield an idea of the potential economic benefit for farmers.

"THE RESEARCH HAS ALREADY CONFIRMED INHIBITORS GREATLY REDUCE N_2O AND AMMONIA EMISSIONS, AND CROP ANALYSIS WILL YIELD AN IDEA OF THE POTENTIAL ECONOMIC BENEFIT FOR FARMERS."

At the Canada-Saskatchewan Irrigation Diversification Centre in Outlook, a small-plot study is comparing emission levels in fall versus spring application of nitrogen, and whether they're impacted by the crop-rotation order (in this case, potato, wheat, pea and canola). Again, the goal is to develop agronomic practices that both reduce N_2O emissions and give farmers a bigger bang for their fertilizer buck.

A third study, just outside Outlook, is a collaboration with Warren Helgason in the Department of Civil Engineering and Reynald Lemke of Agriculture and Agri-Food Canada. It's comparing emissions from two large (quarter-section) fields – one irrigated and one not. Water, whether rainfall or irrigation, leads to spikes in N2O emissions called 'pulses.' The strongest of which happen just as the ground, still moist from snow melt, warms up. In fact, up to 60% of annual emissions can occur in just a few days in spring.

The scientists are measuring the strength of these spikes on the irrigated field and comparing them to what's happening on the nearby dryland one. It's early stage stuff, but the goal is to more effectively use both water and nitrogen fertilizer – another economic and environmental win-win.

When Farrell began his greenhouse-gas research, no one really knew how much nitrogen fertilizer ended up as N_2O. (When the fertilizer is put into soil, it's small – 1.2% is lost in wetter growing areas such as Ontario and Iowa, and about one-third to one-half of that in semi-arid areas such as Saskatchewan.) But with Earth's population forecast to hit nine billion by 2050, there's an urgent need to learn more.

"We know we're going to have to use more nitrogen to feed an ever-growing global population," says Farrell. "So the question is: How can we do it smarter? We want the nitrogen to go to the plant and not be flushed out the bottom through nitrate leaching, or lost out the top as N_2O or ammonia."

Meanwhile, some farm organizations are finding another use for the research.

Pulse Canada's website proudly proclaims lentils, beans and chickpeas are "low-carbon footprint foods" and offers links to research showing pulses have lower nitrous oxide emissions. Part of this research was done at U of S. It disproved notions that pulses release high levels of N_2O when 'fixing' nitrogen (converting it from the air into a biologically useful form) or when their nitrogen-rich root systems decay.

"Some markets, particularly in Europe, are looking at the cropping system and its carbon footprint," says Farrell. "So organizations such as Pulse Canada are able to say, 'Look, Canadian pulse production has a smaller carbon footprint compared to pulse production in other countries.' "

Using this research as a marketing tool was something no one considered when Farrell began studying greenhouse gases, but attitudes have changed, he says.

"I think we're past the stage of pointing fingers and casting blame," he says. "Today, the attitude I most frequently encounter is: How are we going to adapt to this and move ahead?" ■

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