fall 2018

Renew

in this issue:

UNIVERSITY OF ALBERTA
DEPARTMENT OF
RENEWABLE RESOURCES

Honouring Significant ACHIEVEMENTS

A message from the Chair

This fall, I am honoured to showcase a series of recent awards received by faculty members and students in the Department of Renewable Resources.

First, I'm pleased to announce that Dr. William Shotyk has been elected as a Fellow of the Royal Society of Canada. This prestigious honour recognizes his pioneering work on the use of peat bogs to document the global history of heavy metal pollution and environmental change.

Dr. M. Anne Naeth was named as this year's recipient of the University Cup, which is the highest honour bestowed by the University of Alberta on academic staff. It recognizes Dr. Naeth's outstanding contributions across the breadth of academic responsibilities—teaching, research and service.

Dr. Peter Murphy, a former Chair of our Department, was nominated as a Fellow of the Canadian Institute of Forestry. He now ranks among a select few Institute members who have received this significant honour. The award recognizes a member who has made outstanding contributions to the advancement of forestry or to the Institute.

Dr. Mike Flannigan was recently awarded the Canadian Institute of Forestry's Scientific Achievement Award at the annual conference in Grande Prairie, September 18th. The award recognized Flannigan's significant contributions to wildfire science in Canada, and the impacts of climate change on wildfire cycles.

Finally, land reclamation graduate student Stephanie Chute-Ibsen received second place in the University of Alberta's *Falling Walls* competition. The competition challenges students to give a three-minute presentation about their research. Stephanie will now travel to Berlin to represent the University of Alberta in this international competition.

Please join me in congratulating our faculty and students for their significant achievements.

Ellen Macdonald
Chair, Department of Renewable Resources

Perennial crops could be **good** for carbon, nutrients and **agricultural productivity**

In an industry dominated by annual cash crops like barley, wheat and canola, one researcher is exploring a change in perspective. Guillermo Hernandez Ramirez, Associate Professor in the Department of Renewable Resources, believes that perennial grain crops will be the next innovation in sustainable agriculture.

The premise is simple. Spend less time tilling soils, seeding, and managing crops and allow the plants to spend more time in the soil building up root systems and production potential. Perennial crops typically produce grain and forage for at least three years, compared to a single year for annual crops.

The carbon savings alone could be significant.

"We think perennial crops may be an important source of carbon credits, with much greater potential than practices related to no-till and fertilizer management," stated Hernandez Ramirez.

But the benefits of perennial crops may go far beyond carbon. Using rye as a test crop, Hernandez Ramirez's research team has shown that perennials have larger root systems and are able to access water resources unavailable to annual crops. This increases resilience to drought conditions while also increasing soil health, nutrient uptake, and greenhouse gas mitigation potential.

It may all sound too good to be true, but Hernandez Ramirez isn't ready to jump to conclusions just yet.

He has two specific concerns: how perennials will compare to annuals from a weed and disease management perspective, and how perennials can fit into long-term, diversified crop rotations. Perennial varieties of wheat are also just emerging and require many years of scientific testing.

Erin Daly and Keunbae Kim are graduate students currently working with Hernandez Ramirez to deliver this project. The research is funded by Agriculture and Agri-Food Canada through the Agricultural Greenhouse Gases Program.

Lodgepole **pine trees** face risks when shifted to **new climates**

A new study has found that when lodgepole pine seedlings are moved to new locations, they are more at risk to early fall or late spring frosts. This increased risk can affect seedling and sapling survival and compromise wood quality of older trees. The findings have important implications for assisted migration to address climate change.

With his colleagues, Department of Renewable Resources Professor Andreas Hamann found that when seedlings are moved north, early autumn frosts presented an unexpected challenge. While northern trees go dormant early in the season to shield themselves from frost, the southern trees stayed active for too long, making them vulnerable to earlier fall frosts.

"We think this is because they are genetically pre-programmed for different growing-season lengths," said David Montwé, a Post-Doctoral Fellow who co-led the project with PhD student Miriam Isaac-Renton.

But the story doesn't end there. Montwé and colleagues were able to simulate the effect of a warmer climate by planting northern trees further south. They found these trees faced risks too, but in the spring, not the fall.

"In the north, if trees get the signal of a warm spell, then they start flushing and that reduces their frost tolerance," said Montwé.

The response means that northern-origin trees may get tricked into thinking spring has arrived, when it's just a quick blast of warmer southern weather—a process known as false springs.

Hamann suggests, however, that current approaches to assisted migration likely won't need to be changed. They found that trees moved 300–500 km still show reasonable levels of resilience to frost, but trees moved up to 1,500 km could face significant risks.

The study was funded by NSERC, the Alexander von Humboldt Foundation, and Alberta Innovates. It was published in the prestigious journal, Nature Communications.

Relationships between **trees** and **fungi** may grow stale over time

For years scientists have observed positive benefits between trees and mycorrhizal fungi—tiny soil fungi that attach to tree roots and increase nutrient uptake by trees. However, a new study has shown that too much time together leads to diminishing returns for trees in this relationship.

Justine Karst, an Assistant Professor in the Department of Renewable Resources, led a team that looked at a database of 172 papers and analyzed how trees respond to fungal inoculation. One question Karst and colleagues looked at in detail was whether trees grew better with fungi found naturally within their geographical range, or novel fungi that grow outside their geographical range.

Karst found that trees experienced fewer benefits from fungi within their geographical range than from fungi outside their range.

"We found that as the relationship becomes more experienced, the trees derive fewer benefits from the fungal interactions," stated Karst.

The study has important implications when considering the success of assisted migration trials.

UNIVERSITY OF ALBERTA
DEPARTMENT OF RENEWABLE RESOURCES

Karst notes that assisted migration studies typically investigate the impact of climate on the relative success or failure of such trials. However, this study clearly suggests that the interactions with fungi are an important aspect that needs consideration in future studies.

The study was funded by the Natural Sciences and Engineering Research Council.

National network aims to cultivate **future leaders** in water **resource management**

A recently announced network is seeking to advance the science around water management and identify ways to ensure safe drinking water is available to hundreds of communities across Canada. The network is particularly timely given recent wildfire events in North America that are challenging traditional approaches to the treatment of drinking water for millions of people.

The $11.6 million program is called *for*Water. Created as a training ground for current and future utility managers, treatment engineers, forest managers, resource economists and researchers from across Canada, the goal is to transform the way current and future leaders think about water management. More specifically, the network aims to encourage more strategic thinking about how climate change may impact the reliability of municipal water supplies.

"Forests are strategically important for drinking water, and because of climate change there are increasing pressures on the state and condition of our forests," stated Uldis Silins, the network co-leader and Professor in the Department of Renewable Resources.

Recent large-scale wildfire events in California, Colorado, British Columbia and Fort McMurray have resulted in rapid increases in both sediments and contaminants within municipal water sources. Associated treatment challenges have water utility managers looking upstream for solutions.

"Severe wildfires likely pose the most extreme natural landscape risks to the provision of safe drinking water—in the water industry, there is a clear and growing interest in managing watersheds to prioritize mitigation of these risks," said Monica Emelko, a Professor at the University of Waterloo and co-leader of the *for*Water network.

The network's statistics are impressive. Twenty-five researchers. Nine Universities. A plan to train 110 students over five years. But what's even more impressive is that water utility managers and forest managers are coming together to engage in more integrative thinking.

The network is already having a positive impact. Emelko, Silins and their numerous colleagues recently hosted a field tour as part of a week-long annual training event. Graduate students, researchers and utility managers visited water treatment facilities in the City of Calgary. They then travelled upstream to observe a range of land use pressures within the forested watershed. This included drives through old and recently managed forests and hikes to observe the dramatic effects of the 2003 Lost Creek Wildfire in the headwaters of the Oldman River.

Within just a few days, ideas were being shared and new research questions were being raised.

"We were thrilled to see the connections that are being made and we're looking forward to delivering on the possibilities and impacts that our network and the people within it can have," said Emelko.

The official *for*Water name is the "NSERC Network for Forested Drinking Water Source Protection Technologies". Funding and in-kind contributions to the network have been made by 16 Canadian partners, nine academic institutions, and five international partners.

A new study has shown that cranberries in some of the most remote areas of Alberta's boreal forest contain trace amounts of heavy metals such as cadmium and lead. But scientists aren't rushing out to discourage wild berry consumption. Rather, the study is helping shed light on the natural presence of heavy metals within traditional foods. This information can then be accounted for when examining foods which have been potentially contaminated due to development.

The study was completed by William Shotyk, Professor in the Department of Renewable Resources, with graduate student Samantha Stachiw and their colleagues. They collected cranberries from two remote locations 100–300 km northwest of Fort McMurray. The presence of heavy metals in traditional foods like berries has become a key point of discussion in the oil sands region.

New **study** establishes baseline **knowledge** about **cranberries** in the **oil sands** region

"We need to understand the impacts of human activities on the presence of heavy metals, but we need to know what the natural levels of these compounds are in traditional foods first," said Shotyk.

Shotyk found that even berry samples from remote areas of Alberta, far upwind of the oil sands development, had trace levels of key heavy metals. Cadmium was found within the berries, and lead was in the dust found on the berries.

"There is not a natural object that doesn't contain some amount of lead," said Shotyk.

With this baseline information in hand, the research team is now analyzing cranberry samples from the oil sands region. This way they can assess whether, and how much, oil sands development affects contaminant levels within the berries.

The study was funded by Alberta Innovates. Shotyk sees the study as a key opportunity for western science and traditional knowledge to intersect and take steps towards reconciliation.

Preparing **students** to provide **solutions**

Student Profile: Caroline Franklin

Diverse perspectives. Quality supervision. Exceptional instruction. These are lasting memories for Caroline Franklin as she looks back on her time spent in the Department of Renewable Resources pursuing her doctoral degree in Forest Biology and Management.

Caroline Franklin worked with Professor Ellen Macdonald and Associate Professor Scott Nielsen, both with the Department of Renewable Resources. She studied how plants and mammals responded to variable retention harvesting treatments at the EMEND research project in northwestern Alberta. While Franklin expected to find many plants, one finding came as a complete surprise.

"We sampled mammals with motion triggered cameras that captured photographs of woodland caribou, which was a pleasant surprise because it was not one of our initial target species," said Franklin.

A surprise indeed. In a landscape where few caribou have been observed before, Franklin captured 102 caribou detections through her random sampling design. She cautions that's not equivalent to 102 individual caribou as one individual may be photographed multiple times, but it's still an impressive number.

Franklin sampled coniferous forests, where caribou were not detected in clear-cuts or stands with 10%

retention. However, stands with 20% retention or more showed increasing levels of detection, with the highest detection rates within the unharvested forests at EMEND. Franklin also found similar responses for wolverine and fisher, species of interest to local stakeholders.

The findings have sparked important discussions with both her industry and government collaborators on the project.

The study was funded by NSERC, the Government of Alberta, Daishowa-Marubeni International, Canfor and the Alberta Conservation Association.

UNIVERSITY OF ALBERTA
DEPARTMENT OF RENEWABLE RESOURCES

One cup of **water** enough to **detect** presence of invasive Prussian **carp**

Fisheries managers in western Canada have a new approach in the race to document the rapid expansion of the invasive Prussian carp.

The new approach is based on a technique called qPCR and it requires only a tiny number of cells from Prussian carp to be effective. It's a game changer for fisheries biologists who can now detect carp by collecting just a single cup of water from a pond, lake, stream or river. Previously these same biologists needed to use more invasive and labour-intensive techniques like electrofishing.

The approach was adapted for use with Prussian carp by Mark Poesch, an Associate Professor in the Department of Renewable Resources, in collaboration with the Alberta Conservation Association and the University of Saskatchewan. It's already being applied to map out Prussian carp locations in Alberta.

"The project results will help generate a current distribution map of Prussian carp in the province and contribute to the knowledge and information needed to develop effective management plans for this invasive species," said Britt Schmidt, a biologist with the Alberta Conservation Association.

Once invasive species become established, they can often be difficult to eradicate.

"Being able to detect invasive species early is our only hope for curbing their spread" said Poesch.

In one recent study, Poesch's team showed that native fish species were quickly lost following Prussian carp invasions—disrupting the entire aquatic community.

"Prussian carp are considered one of the worst invasive species in Europe. They have now shown their breeding potential and impacts in Alberta, and they are just as bad here. With the use of this technique we now have an early warning system to help manage their spread," said Poesch.

Naeth appointed **Director** of ambitious **Future Energy Systems** program

Dr. M. Anne Naeth has been appointed the Director of a prestigious program that seeks to understand the environmental, economic and technical aspects of future energy systems in Canada. She'll be overseeing the largest single grant in the history of the University of Alberta—an impressive $75 million.

The Future Energy Systems program is focused on applying technologies to address energy challenges and opportunities in the near future, including the transition to these new systems.

"We have new technologies, but they need to be field tested to get us from where we are now to where we want to be," said Naeth, a Professor in the Department of Renewable Resources.

In addition to advancing technical innovation and deployment of energy systems of the future, Naeth also sees a clear opportunity to embed environmental objectives into discussions about any energy source.

"My goal is to see better and faster reclamation be a part of any energy project plan from the start," said Naeth.

As Director, Naeth will oversee investment and collaborations in four strategic areas: developing hydrocarbons responsibly, improving environmental performance, enabling sustainability, and supporting system-wide enablers. To learn more visit *www.futureenergysystems.ca*.

UNIVERSITY OF ALBERTA
DEPARTMENT OF RENEWABLE RESOURCES

Credits:
Content: Matthew Pyper
Fuse Consulting Ltd.
Photos: Guillermo Hernandez Ramirez (p.2), Justine Karst (p.4), Uldis Silins (p.5,6), William Shotyk (p.7), Britt Schmidt (p.9), Kenneth Tam (p.10).

Renew fall2018

Department of Renewable Resources
University of Alberta
751 General Services Building
Edmonton, AB T6G 2H1
CANADA

Phone: 780-492-4413

Fax: 780-492-4323

www.rr.ualberta.ca

UNIVERSITY OF ALBERTA
FACULTY OF AGRICULTURAL,
LIFE & ENVIRONMENTAL SCIENCES

UNIVERSITY OF ALBERTA
DEPARTMENT OF
RENEWABLE RESOURCES