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Renew

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UNIVERSITY OF ALBERTA
DEPARTMENT OF
RENEWABLE RESOURCES

Adaptive MANAGEMENT

A message from the Chair

As spring arrives, the University of Alberta is focused on several budget reduction measures with the goal of improving our competitiveness and resilience. Throughout this process we are focusing on our strategic priorities, adjusting our practices, and positioning ourselves for future success. Adaptive management is alive and well in our Department.

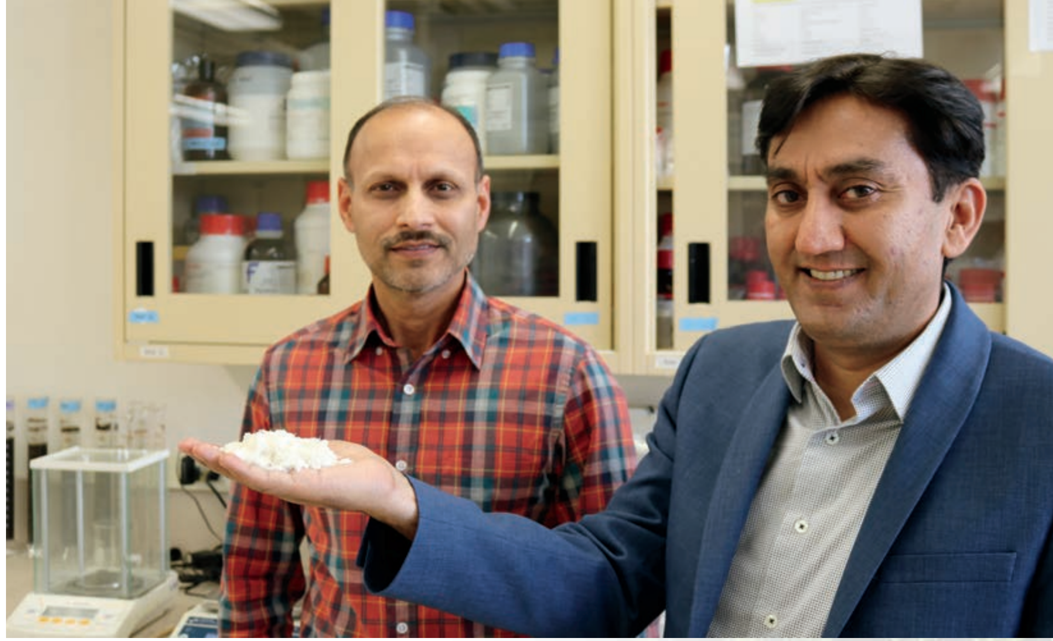
Despite the challenges a reduced budget can bring, we remain committed to the vision we have for our Department. We believe that what distinguishes our work is our focus on research that provides both the scientific foundation and practical solutions to our most pressing issues in natural resource management and conservation. We are also very grateful for the strong partnerships that allow us to deliver applied research and experiential learning opportunities to fledge the next generation of outstanding natural resource professionals.

In support of this, we're happy to announce that our forestry program has been fully accredited once again. The review panel was impressed with the high quality of our students and alumni and with our strong connection to the external forestry community.

I hope you enjoy our cutting-edge research profiled in this issue of Renew. As always, please reach out to me if you have feedback or to discuss partnerships and opportunities.

Ellen Macdonald
Chair, Department of Renewable Resources

Chicken **feathers** find new life **cleaning** industrial **wastewater**



Chickens have found a role in a place you may least expect them. A new study by Aman Ullah and Tariq Siddique has shown that chicken feathers hold incredible potential for removing contaminants from industrial wastewater.

The key to success is keratin, a protein that makes up over 90 percent of poultry feathers (it is also a key component of human hair and fingernails). Keratin has a unique structure that, when chemically modified, turns into a fibrous sponge that attracts a wide range of metals and other contaminants. Once these contaminants bond to the protein, they can be effectively removed from the wastewater. In fact, the process is 80 to 100 percent effective at removing metals such as lead, nickel, cobalt, zinc, chromium, vanadium, and even naphthenic acids.

The product is not only simple—it's very affordable. Poultry feathers are considered an agricultural waste product and are readily available for large-scale use in wastewater treatment.

So far the product has shown great potential in removing contaminants from industrial wastewater and oil sands process-affected water. Ullah and Siddique are also testing further modifications to the keratin surface to expand the product's application.

Tariq Siddique is an Associate Professor of Soil Chemistry and Remediation and Aman Ullah is an Assistant Professor of Agriculture and Biomaterials. Funding for this study was provided by Future Energy Systems, the Land Reclamation International Graduate School (LRIGS), and Canada Foundation for Innovation (CFI).

New **trap** for **mountain pine beetles** could help weaken their spread

Researchers have identified a new and more efficient technique that could help land managers monitor and control mountain pine beetles in Alberta forests. Jennifer Klutsch and Nadir Erbilgin caught far more of the pest by changing the existing bait formula and the spacing of mountain pine beetle traps.

To find a more effective bait formula, Klutsch and Erbilgin tried using two tree chemicals instead of just one, which is the usual practice in attracting the beetle. They discovered that the one-two punch of the extra chemicals, hung on tree traps along with a standard bag of pheromones, attracted 51 to 82 percent more mountain pine beetles than other bait formulas, including the one currently in use.

They then tested how trap spacing impacted the number of beetles caught. Government staff currently use a triangular formation spaced every eight kilometres to monitor beetle spread. After testing triangular, square and rectangular formations at one-, four-, eight- and 12-kilometre intervals they found that a square shaped group of four trees was most effective. In fact, it resulted in attack levels 1.5 times greater than the standard triangle of three trees.

"The square formation had more mass attacks, which means there are a larger number of beetles you take out of the population when the trees are removed," Klutsch said.

They also discovered that square formations could be baited 12 km apart instead of just eight, further increasing the trapping efficiency. The study's findings could help cut back on costly, labour-intensive field work if adapted into provincial and industry management policies, Klutsch said.

Jennifer Klutsch is a Post-Doctoral Researcher and Nadir Erbilgin is a Professor of Forest Entomology. The research was funded by fRI Research and the governments of Saskatchewan, Manitoba and Ontario.

New **professor** brings diverse knowledge of **insects** and spiders to **Alberta**

Carol Frost has a fascination with entomology that's hard to match. She has studied spiders in the boreal forest of Alberta, caterpillars in the rainforests of New Zealand, Little Fire Ants—among the world's 100 worst invasive species—on the island of New Caledonia, and now she's bringing her expertise back to Alberta to study pollinators and a range of other species.

Her focus is on the emerging field of "ecological networks"—a discipline that seeks to understand how different species interact and how human actions may encourage or upset the delicate balance between species.

Her current study on pollinators in Alberta is a good example. Honey bees and honey production have become extremely popular, with more than 40 percent of Canada's honey bees located in Alberta. Frost is curious how this introduced species might impact ecological networks between native pollinators and native plants, given that honey bees have a much higher appetite for pollen and nectar than most native pollinators. It's possible that honey bees may be displacing a wide range of native pollinators, and this could have impacts on both the native pollinators themselves and the plants that depend on them.

Frost is a new Assistant Professor of Conservation Biology in the Department of Renewable Resources. As she settles into her new role, she is eager to engage with a range of people in the ecological and land management communities. She is currently interested in partnerships that contribute to the emerging field of ecological networks while providing clear applications for the forest, energy and agricultural sectors.

Reclamation **student receives** international **award**

Prem Pokharel, a land reclamation graduate student, recently received international recognition for his thesis which documented seedling performance on oil sands mine sites.

Pokharel looked at ways to improve tree growth on challenging oil sands mine sites by loading seedlings with nutrients prior to planting. The nutrient-loading technique provided seedlings with the jump-start they needed to become established in the often-challenging conditions of a reclaimed oil sands mine.

Pokharel was presented the award at the recent Western Association of Graduate Schools conference in Las Vegas, Nevada. He was supervised by Scott Chang, a Professor of Soil Science.

Students witness **forest product innovation** in action

Students in a Wood Science and Utilization class recently had a glimpse at the future of the forest products industry as they toured some of the most advanced laboratories in North America.

The students visited two InnoTech Alberta facilities where they saw new engineered wood products being manufactured and tested. They then saw one of the world's few high-volume production facilities for nanocrystalline cellulose (NCC)—an emerging wood product used in a range of applications including car panels and lubrication.

John Wolodko, Alberta Innovates Strategic Chair in Bio and Industrial Materials and co-instructor for the course, saw the tour as an opportunity to reinforce his teaching with real-world applications.

"Some of the best classes that I can remember as a student included applied, hands-on experiences like this, so I try to bring these experiences to our students," said Wolodko.

Litter layer, not time, a key **predictor** of **species recovery** following oil sands **mining**

A new study has shown that the presence of aspen trees, and the resulting leaf litter, is critical for promoting the recovery of mites within reclaimed soils. These findings provide further evidence that aspen trees play a key role in re-establishing soil processes and nutrient cycling following oil sands mining.

Mites are tiny and easy to miss, but they are a key indicator of soil health. Most species are smaller than a pin head and a square metre of soil can hold several hundred thousand individuals. Their seemingly endless appetite for leaf litter, soil fungi, dung, and the dead bodies of other tiny organisms helps cycle critical nutrients in the soil, providing nourishment to the plants growing above them.

Sylvie Quideau and her team looked at how time since reclamation affected mite communities on oil sands reclamation sites. They studied sites with peat mineral mix soils that had been planted to either white spruce or trembling aspen.

To Quideau's surprise, time since reclamation had less of an effect on mites than the depth of forest litter. Stands with more than two centimetres of leaf litter had a thriving mite community. However, rare mite species were notably absent and will likely take decades to establish on the sites.

"The fact that some initial mite communities are present on these reclaimed sites demonstrates they are on a trajectory for recovery, particularly sites that contain aspen trees," said Quideau, a Professor of Soil Science.

The study was completed by graduate student Brittany McAdams in collaboration with Lisa Lumley (Royal Alberta Museum) and Mathew Swallow (Mount Royal University), and it was supported by the Natural Sciences and Engineering Research Council (NSERC) of Canada and the Canadian Oil Sands Network for Research and Development (CONRAD).

Long-term study offers **unique perspective** on bird responses to **forestry**

A long-term study is helping clarify how birds respond to forest harvesting over time, especially those that depend on old forests. The study is providing new perspectives on when and why birds use the habitats they do.

The Calling Lake Study, led by Fiona Schmiegelow and colleagues, is one of the longest-running studies of its kind. For the past 25 years, adventurous field assistants have made their way into the forest at the break of dawn to listen for and document the birds that are present.

The research team has found that songbird use of harvested sites is dynamic over time, especially for birds typically found in old forests. Eight of 21 old forest species used harvested areas and for three of these species, use occurred the year after they were observed in high numbers in unharvested stands. The results suggest a "spill over" into harvested areas from preferred old forest habitat.

For the other 13 species typically found in old forests, harvested areas simply did not provide the necessary habitat, even after 33 years of regeneration.

"These are the types of dynamics that we are not able to capture through short-term studies. It emphasizes the importance of long-term investments like this," said Schmiegelow.

Schmiegelow does, however, believe there are opportunities to improve the role of harvested areas for these bird species. Retaining snags, tall trees, and large conifer trees within harvest blocks may provide habitat for old forest species sooner than within clear-cuts.

This long-term study has been supported by many organizations and over 100 field assistants during its 25-year history. The results presented here were supported jointly by Alberta-Pacific Forest Industries Inc. and the Government of Canada through a Mitacs Accelerate grant to Erin Bayne and Lionel Leston. Fiona Schmiegelow is a Professor of Conservation Biology.

New **professor** in silviculture **brings** applied **focus**

Twenty years ago, Brad Pinno was an eager forestry graduate who relished the chance to apply his new-found knowledge. Serving as an Operations Forester with both the Alberta and Saskatchewan governments, Pinno cut his forestry teeth in an applied setting. Now a newly appointed Assistant Professor in Silviculture, he plans to draw on these applied experiences as he establishes his new research program at the University of Alberta.

Pinno is no stranger to scientific research. In his previous position with the Canadian Forest Service—Natural Resources Canada, Pinno used his knowledge of silviculture and forest soils to improve reclamation within the mineable oil sands. There he saw how his applied research focus helped industry partners refine the way disturbed sites are reclaimed. His research on natural tree seedling establishment and growth contributed to a shift away from broadcast fertilization, which was compromising tree growth by increasing competition.

In his new role, Pinno is excited to teach young students about the importance of silviculture. He also looks forward to refocusing his research on silviculture and forest management, thinking ahead to the various challenges and opportunities the forest industry may face. Specific topics of interest to Pinno include testing alternative silvicultural practices, linking tree growth to soil properties more effectively, and helping identify how forests can be managed to achieve multiple societal values. His goal is to use robust research to provide practical solutions that can be applied in current and future operations, allowing industry to be proactive.

"We need to be thinking of our future silvicultural options now so that we have more options in the future," said Pinno.

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New **study fills** an important **gap** about carbon accounting on unproductive lands

Robert Grant has created a model that can be used for evaluating the potential economic and carbon sequestration benefits of an uncommon, but potentially beneficial, agricultural approach called tree-based intercropping.

Tree-based intercropping involves the planting of regularly spaced rows of trees among agricultural crops. While it is rarely practiced on productive lands, there is growing interest in tree-based intercropping on marginal lands where carbon sequestration could increase economic returns for farmers.

Grant and his collaborators found that tree-based intercropping indeed increases carbon storage on marginal lands. However, there was an obvious trade-off with crop production—as the trees grew they shaded the nearby crops, decreasing their productivity. The declines in crop production could be mitigated by trimming the tree branches to allow more light, but this also directly affected the amount of carbon sequestered within the trees.

The study fills a much-needed knowledge gap for carbon accountants. They now have a tool to estimate the relative carbon benefits of a tree-based intercropping system under diverse climates, soils, and tree and crop management practices. Such a tool should increase the transparency and credibility of carbon credit programs that include tree-based intercropping.

Robert Grant is a Professor of Ecosystem Modeling. The study was funded by the Agricultural Greenhouse Gases Program of Agriculture and Agri-food Canada.

Phosphorous may be key to **helping** trees **overcome** salt **stress** on reclaimed mine sites

Young trees can struggle in the salty conditions that are often present on reclaimed oil sands mine sites, but a new study has shown that phosphorous availability may be a key factor for increasing tree growth and survival.

Samantha Olivier and Janusz Zwiazek tested how jack pine, white spruce, and black spruce trees grown in a greenhouse responded to differing levels of salt stress. They also tested whether the availability of key nutrients like phosphorous further affected growth and survival of white spruce and jack pine trees. The goal was to replicate a range of conditions trees may experience on reclaimed oil sands mine sites and provide direction on possible ways to mitigate the negative impacts of salt on tree survival.

They found that salt had negative impacts on all tree species and the impacts were further magnified when phosphorous levels were low in the soils, particularly for jack pine trees. Olivier and Zwiazek believe the negative impact of salt could be mitigated, at least to some degree, by applying phosphorous fertilizers to reclamation sites with elevated salt levels.

The study was funded by Total E&P Canada and the Natural Sciences and Engineering Research Council of Canada (NSERC). Samantha Olivier is a recent graduate of the Department of Renewable Resources and Janusz Zwiazek is a Professor of Plant Physiology.

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