NATURE ALBERTA MAGAZINE

FALL 2020
VOLUME 50 | NUMBER 3

A COMMUNITY CONNECTED BY A LOVE OF NATURE

Insect Informants
What Aquatic Invertebrates Tell Us About Pesticides in Our Wetlands

Cumulative Effects Modelling

Nature Club Activities in the COVID Era

Rewilding Alberta One Forest at a Time

PM40015475

North Raven River Conservation Site

It's an Alberta thing.

Alberta Conservation Association

wildlife | fish | habitat

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Publisher Nature Alberta
Managing Editor Jason Switner
Technical Editor Richard Schneider
Creative Susan May, intrinsic design
Cover Image Stephen Srayko

Editorial Committee
The Magazine Editorial Committee, which consists of dedicated volunteers, who all have a passion for nature, lend their respective experience and expertise to developing editorial outlines, commissioning articles and reviewing/vetting article submissions for the magazine. The committee includes:

Lu Carbyn
Linda Howitt-Taylor
Kim MacKenzie
Valerie Miller
Richard Schneider

Content editor@naturealberta.ca
Subscriptions circulation@naturealberta.ca

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Nature Alberta
11759 Groat Rd NW
Edmonton, AB T5M 3K6
P. (780) 427-8124
E. info@naturealberta.ca

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About Nature Alberta
Alberta is home to incredible natural spaces comprised of beautiful and varied landscapes, and rich biodiversity reflected in our abundant and diverse flora and fauna. Across the province, natural history clubs and their members are engaging Albertans in the conservation and appreciation of this natural heritage. Nature Alberta represents a network of these natural history organizations in Alberta.

NATURE ALBERTA

A COMMUNITY CONNECTED BY A LOVE OF NATURE

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FROM A PRESIDENT'S PERSPECTIVE

The morning I wrote this missive, a magnificent stag wandered through our fading garden. On the lake outside my window, geese have gathered in preparation for their southern flight. It was cool last night and I must sadly acknowledge that I've had my last hummingbird sighting for this season. The adaptations of the natural world to the changing seasons inspire us to adapt and change as well.

The Board of Nature Alberta recognizes that, having served nature clubs in our province for 50 years, we need to adapt to a more modern world. We need to renew the organization to prepare for the years to come and to benefit our member clubs and individual members. As members, you are the heart of the organization. The volunteers on the Board and on various action committees are here to serve you as best we can as we continue to adapt to the challenges that many not-for-profit organizations face.

The past several months have challenged us all to adapt to new ways of doing things. There are several ways clubs and individuals can adapt to our post-COVID reality.

Member clubs, stay connected. Continue to hold regular meetings using technology like Zoom. (Personally speaking, I've found it much easier to use than I would have thought at first.) Keep in touch with your membership through e-newsletters and social media. Grow your network by reaching out to other clubs. Organize small, outdoor gatherings where people can explore our natural world while staying socially distanced.

For individuals who are not part of a club, consider joining one. Consult our Club Directory at naturealberta.ca to find an organization near you that aligns with your interests. You'll find people who share your interests and enthusiasm for nature, and have plenty of knowledge and experience to share, too. Share your passion for nature by inviting a friend to join with you.

Social activities improve our personal well-being and provide opportunities to learn and share in a community with common interests. Join us as we move through the changing seasons together.

LINDA HOWITT-TAYLOR

Nature Alberta News

Shoreline Planting Event at Lac La Nonne

On Saturday, August 22, Nature Kids hosted a shoreline naturalization event with the families of the Willowbend RV Resort at Lac La Nonne. On hand for the small, socially distanced gathering were Nature Kids Program Coordinator Zoe MacDougall, Birds and Biodiversity Coordinator Kelsie Norton, and past Living by Water Coordinator Sheldon Helbert.

This event was part of a bigger project that began last year to bring nearly 600 native trees and shrubs to the shoreline of this resort. With this effort came the opportunity to educate and involve the residents of the resort that would benefit from it the most. This naturalization using native plants provides a buffer between the lake and the human activities on the shore to help improve and maintain the overall health of the lake.

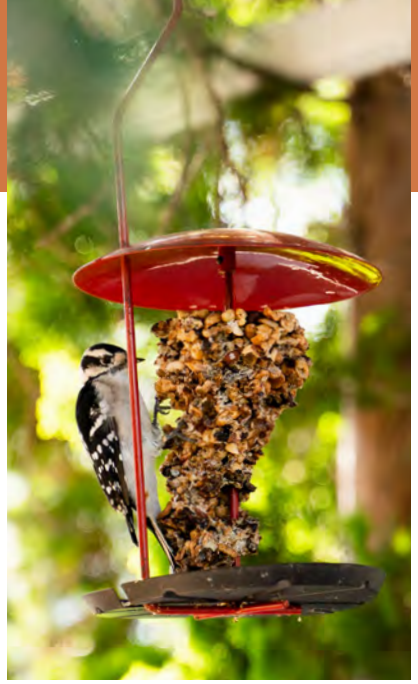
MacDougall worked with Helbert back in October 2019 to begin planting these trees and shrubs in one area of the shoreline. In July 2020, an additional 500 plants were put in the ground by professional landscapers. In between, the owners of the resort asked Nature Kids if we would plan a community event to involve the families that own RV lots at Willowbend and encourage them to participate in improving the health of their lake. The result was the gathering in August.

Local families spent the day planting some 60 trees and shrubs. The kids had fun adopting — and naming! — their favourite plants to take care of throughout the year. Along the shoreline now, you'll find Honey Melinda the bracted honeysuckle, Jeff the wild blueberry plant, and Hope the pincherry among other flora friends!

While the families planted, the organizers educated them on what they were planting, why they were planting them, and how they can continue to take care of their lake for years to come. Resources on bird conservation as well as booklets on invasive species and reports on the lake from the Alberta Lake Management Society (ALMS) were provided.

Everyone had a great time and the lake will benefit from the community's efforts for a long time!

This event was funded in part through the Watershed Stewardship Grant, a program of the Land Stewardship Centre financed by Alberta Environment and Parks. Thank you to our funders for helping make this event such a success.



Urban Nature Initiative Update

Over the past few months, Urban Nature Initiative (UNI) Coordinator Kelsie Norton has provided ten passionate urban homeowners with various tools to enhance and support biodiversity. The homeowners' experiences were captured by an Edmonton-based media team, and will be showcased in three digital stories to inspire others to start their own urban nature journey. Watch for these videos on our social media!

This project is as much about community as it is about biodiversity. In the spirit of supporting the local economy in these trying times, Norton went to the effort of making sure the bird supplies, such as seeds and nest boxes, were purchased from local businesses, and even the bat boxes and pollinator habitats supported a local organization.

As we settle into the changing season, there's still time to begin your urban nature journey. You can read the Nature Alberta Checklist, *Supporting Nature and Biodiversity in Urban Yards*, online at **bit.ly/uni-checklist**, or contact **birds@naturealberta.ca** for a physical copy.

Update on Park Closures

In March 2020, the Alberta government announced plans to remove 164 of 473 sites from the provincial parks system, including nine provincial parks and 12 natural areas. Nature Alberta voiced its opposition to this proposal, as did other conservation groups and thousands of individual Albertans from across the province. Subsequent polling has shown that 69% of Albertans are opposed to the closures.

Since the initial announcement, the provincial government has been mum on this file. In fact, the list of parks slated for closure has been quietly removed from the government's website. (You can still find it on our website at **naturealberta.ca/whats-new**, March 11 entry.) The meaning of this removal is unclear. Perhaps it is meant to signal that the decision is final and everyone should just move on. Or maybe the government has come to view the proposal as a political liability and is beginning to back away from it.

What is clear, thanks to a Freedom of Information request by the Canadian Parks and Wilderness Society (CPAWS), is that the proposal was never thought through. The objective was, ostensibly, to rein in budget expenses — a reduction of $5 million was suggested. However, it appears that no formal cost-benefit analysis was ever done to assess the consequences of the park closures. In fact, notes marked "confidential, advice to minister" suggest such costs savings are unlikely. In any case, a savings of 0.009% of the provincial budget is hardly a sound argument for the delisting of Alberta parks on a massive scale.

The Freedom of Information request also shows that top advisers to Environment and Parks Minister Jason Nixon were concerned about the plans to shrink the province's parks system and made recommendations he did not follow. In particular, department officials recommended that there should be broad, high-level public consultation and engagement followed by a second phase of consultation for specific sites. The minister overrode this advice and no consultation was ever done. Nixon had previously told The Canadian Press that consultation was unnecessary because the party had made its intentions clear in its 2019 election platform. In reality, the 114-page platform included just one vague sentence on parks policy.

One has to conclude that the park closures are ideologically driven, though the rationale remains elusive. Why advance an agenda that is opposed by a majority of Albertans and provides no meaningful fiscal benefits?

The lack of a sound rationale for the park closures provides reason to hope the proposal can still be reversed. The hard calculus of politics dictates that political liabilities must eventually be abandoned. Therefore, it is imperative that everyone who loves our parks system — that is, almost all of us — must continue to make our voices heard. Keep writing to the minister with stories about parks that are special to you and let him know your views about the proposed closures. Send your messages to **aep.minister@gov.ab.ca** ■

True to its name, the big brown bat is one of the larger types of bats in Alberta, typically weighing between 15–20 g. CORY OLSON

Bat House Monitoring at Ellis Bird Farm

BY SHAYE HILL, MYRNA PEARMAN, CLAUDIA LIPSKI, AND NATALIA LIFSHITZ

Bats are fascinating creatures, playing a critical role in supporting biodiversity. Because they consume their body mass in insects every night, bats also fulfill an important role in the control of nocturnal insect populations, providing economic services to many agriculture sectors, including reducing the need for the use of pesticides. Bats are also good indicators of environmental health because their populations are sensitive to decreases in insect abundance as well as to changes in water quality and environmental management practices.

Regrettably, bat populations in North America are declining due to human influences such as pesticide use, habitat destruction, and introduced diseases. For example, white-nose syndrome, a condition caused by an introduced fungal pathogen (the spread of which may be linked to climate change), has caused catastrophic bat declines across much of North America and is expected to eventually affect bats in Alberta as well.

Bat houses (also called bat boxes) are conservation tools that are being used as part of an effort by some bat enthusiasts to prevent — and hopefully reverse — bat population declines. In addition to providing suitable maternity locations, bat houses are accessible structures that enable researchers to count the occupants and track population trends.

Of the nine species of bats found in Alberta, only two commonly use artificial roosting structures: little brown myotis (now listed as an endangered species) and big brown bats. These bats can roost alone or in groups that can number over a thousand individuals. Males typically roost alone, so bat houses occupied by large numbers

of bats are usually exclusively adult females and their pups.

Ellis Bird Farm (EBF), a Nature Alberta affiliate located northeast of Red Deer, became actively involved in bat conservation in 1994 when it erected two large bat houses on site. The houses were built and donated by Zoltan Gulyas of Calgary. The boxes were mounted on the south sides of old buildings, one on a calving barn and one on an old grain elevator.

The Alberta Community Bat Program (ACBP) is dedicated to bat conservation, education, and research (albertabats.ca). Its mission is to raise awareness of bat conservation issues, provide information to help residents manage bats in their buildings, and to collect data needed to monitor and better understand bats in the province. EBF teamed up with ACBP to learn more about the bats on their site, track bat house use, document internal box conditions, and promote bat conservation by hosting an annual bat night at the farm.

Until 2016, monitoring of the EBF boxes was done on a sporadic basis, with the boxes being checked each season only to determine whether or not they were being used. A webcam placed in the grain elevator box in 2016 revealed that the box contained a surprisingly large number of bats. This prompted us to start conducting exit counts, using a click counter to record each bat as it left the roost for the evening to feed.

From 2016 to 2018, counts were conducted at least four times between April and October, with most checks undertaken during the breeding season (June–August). In 2019, under the mentorship of ACBP, a more detailed survey was conducted. Between April 20 and August 17, we recorded exit counts between sunset and one hour after sunset, noting the time when the first bat emerged and the time when the count concluded. Once the bats had all exited, a flashlight was used to facilitate counting of all remaining adults and pups. Temperature probes were also installed to record maximum and minimum internal roost temperatures and humidity levels. ACBP also installed a webcam near the grain elevator to capture footage of exiting bats.

One of the two artificial roosting structures — bat boxes — at Ellis Bird Farm being checked for inhabitants. MYRNA PEARMAN

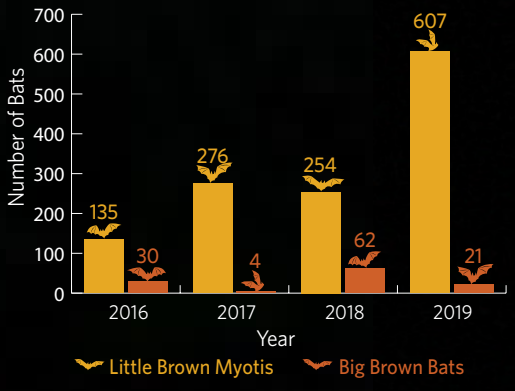


Figure 1. Highest recorded number of little brown myotis and big brown bats exiting their respective roosts, 2016–2019.

Dry guano was collected beneath each box in July and August 2019 and submitted to ACBP, who then submitted samples to a genetics lab for DNA barcoding. The guano tests confirmed that the grain elevator box was used by little brown myotis while the calving barn box was occupied by big brown bats.

Interestingly, during two of the 2019 surveys, two great horned owls, one adult and one juvenile, landed on the roof adjacent to the roost. Although we had no visual confirmation of them preying on the bats, we presume that the owls, which have nested near the grain elevator for many years, did capture some bats as they exited the boxes.

From 2016 to 2019, the number of little brown myotis exiting from the grain elevator roost ranged from a low of 135 in 2016 to a high of 607 in 2019 (Figure 1). The 2019 peak represents the highest number of bats ever recorded in a box monitored by ACPB. Big brown bat occupancy of the calving barn roost was, by contrast, much lower and more sporadic (Figure 1). Counts ranged from a low of four in 2017 to a high of 62, in 2018. Box checks in September of 2018 and 2019 indicated there were still big brown bats in the roost, even though there was already snow on the ground.

A total of 14 exit counts of little brown myotis were conducted at the grain elevator box in 2019. The bats arrived at the box between April 20 and May 9, and the occupancy ranged from just one individual on both April 20 and 27, to a high of 607 on July 4 (Figure 2). A total of 16 exit counts of big brown bats were conducted at the calving barn box. The bats arrived at the box sometime between the May 9 and May 26 counts. Numbers remained relatively low and stable after June 4 (Figure 2).

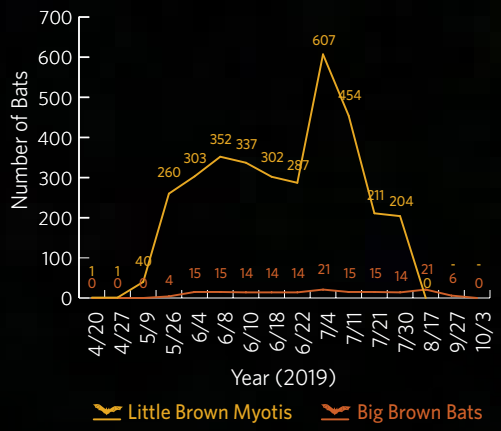


Figure 2. Exit counts of little brown myotis from April 20 to August 17, 2019 and big brown bats from April 20 to October 3, 2019.

The temperature probe data obtained from the grain elevator box in 2019 revealed that internal temperatures reached a maximum temperature of 40.8°C on June 4. The minimum temperature recorded during that period was –4.9°C on April 28. The maximum temperature the calving barn box reached in 2019 was 38.7°C on May 29 and the minimum temperature was –6.01°C on April 28.

It is not known why the little brown myotis population has increased in the grain elevator box. In part, it could be a result of ongoing efforts to maximize biodiversity at the site. While some herbicides are applied on EBF crops, no insecticides are used anywhere on the 640-acre (259-ha) farm. This being the case, we assume that the insect populations in the vicinity of both bat boxes are healthy.

The low and fluctuating numbers of big brown bats is not unusual, since this species tends to use several maternity locations each season, even switching roost sites if one becomes too crowded or does not meet their temperature requirements.

The peak exit count of 607 little brown myotis, on July 4, 2019, occurred during the period between when the pups are born and when they reach independence. The numbers decline as the pups begin to disperse and the bats start to depart for their overwintering locations.

Despite the summer of 2019 being generally wet and cold, there were some days of extreme heat. ACBP has suggested that internal box temperatures above 40°C can cause heat stress, especially during the nursery stage when both mothers and pups risk dehydration. Fortunately, the temperature inside the grain elevator box remained generally below this threshold, so the little brown myotis adults and pups would have been comfortable through the nursery period.

Ellis Bird Farm will continue to monitor the site's bat boxes and work in cooperation with ACBP to conduct research, raise awareness, and promote bat conservation. ■

Shaye Hill is an environmental science student who headed the EBF research team in 2020. Myrna Pearman is the EBF Biologist and Site Services Manager. Claudia Lipski oversees the EBF bluebird trail and education programs. Natalia Lifshitz is the EBF Science Advisor.

Acknowledgments:
We would like to thank Ellis Bird Farm for supporting this research and offer a special note of gratitude to Cory Olson of the Alberta Community Bat Program for his continued mentorship and support.

The little brown myotis, also called the little brown bat, is the most common bat species found throughout Alberta.
CORY OLSON

Nature Club Activities in the COVID Era

Separated by Necessity, Connected by Passion for Nature

BY CLAUDIA LIPSKI

The Buffalo Lake Nature Club (BLN), based in Stettler, has been active since 1973. And we mean active! We hold monthly meetings and several field trips each spring and summer, as well as fall walks, Christmas Bird Counts, and Nocturnal Owl Surveys. Like any club, we've had our share of ups and downs through the years, and have had to cancel the occasional planned activity. But 2020 has been something else!

We have a faithful, connected group, and on three Sundays in December 2019, three Christmas Bird Counts were held with good participation. Our annual Christmas potluck on December 22 followed one of the bird counts and is commemorated with a photo collage of the 19 participants. In retrospect, we are particularly grateful to have documented this fun time near the close of last year.

Enter 2020: The BLN Annual General Meeting, which was to have been held January 16, was postponed until February 20 due to extremely cold weather. Our new executive was elected and committee positions were filled. The executive and directors met on March 6 and planned speakers and activities for the year. We thought we were off and running!

Then came mid-March 2020, with the announcement of the worldwide COVID-19 pandemic. Schools closed. Restaurants and businesses closed. Meetings and conferences were cancelled. There was a rush to purchase essentials. Travellers were told to get home. Everyone was told to stay home. We discovered a new appreciation for health-care workers, grocery store employees, and truck drivers. Alberta Health Services mandated that no more than 15 people were to gather indoors or outdoors, and a distance of two metres between family/cohort groups was required. The March 19 BLN Club meeting was cancelled. So, as it turned out, would be the rest of the year's.

It appeared that all our planning of club activities for 2020 had been for nought. Members with health concerns or having family members with compromised health have wisely chosen to curtail their in-person involvement with the club for the time being. However, we have continued to offer most of our outdoor activities because physical distancing is achievable. We have stayed in touch with BLN members and friends with online newsletters and social media posts.

By having families/cohorts travel in separate vehicles, we were able to complete two Nocturnal Owl Surveys between March 20 and May 5. Despite a blast of single-digit temperatures on May 21, the annual Bird Survey at Shuckburgh Slough was completed, again with family/cohorts remaining in their vehicles.

As spring wore on, it seemed people were getting a little tired of staying home and seeing just their families, because we had an exceptionally good turnout for the annual Lady Slipper Walk and Paddle at the Narrows on June 11! It was a delight to be together again, enjoying the Lady Slippers, paddling, nature and each other's company — from a healthy distance.

Les Fodor explains the history of the Buffalo Lake Water Management project prior to the Lady Slipper Walk and Paddle at the Narrows Provincial Recreation Area (June 2020). CLAUDIA LIPSKI

The following week we held our Annual Potluck Picnic, which was definitely not a potluck! Each cohort group supplied their own picnic supper and we spaced ourselves appropriately throughout the ample group site at Rochon Sands Provincial Park. Again, we were grateful for the time together, particularly because we needed to make our members aware of the pending closures or privatizations of 175 Alberta Parks and Natural Areas. Members were urged to contact their MLAs and Environment Minister Jason Nixon to express their concerns. Now, more than ever, our parks and natural outdoor spaces are vital for our well-being.

Our next scheduled club event was the 21st Annual Dry Island Buffalo Jump Provincial Park Annual Butterfly Count on July 5. Inspired by the work of Dr. Charles D. Bird, in previous years, upwards of 50 participants have joined in this research project. This year, the number of participants was limited due to COVID restrictions and we also found ourselves impeded by a washed-out access road. However, dedicated members of the Alberta Lepidopterists' Guild, Ellis Bird Farm, Alberta Parks, and BLN joined forces to ensure that Charley's legacy continued.

At our most recent gathering, club members and friends met for a walk to Potter's Seep. The club had nominated the balsam poplar grove as a Heritage Tree Site in 2006 and it is now featured in the book *Heritage Trees of Alberta* (Fairweather, 2008). On hand was Jim Potter, after whom the grove is named in appreciation for his and his brother's efforts in clearing debris from the historical seep. Walking the nature trail, visiting with friends, and absorbing the energy of the children made for a very enjoyable outing. We beat the rain clouds, too!

As the weather cools and the club's outdoor activities diminish, we realize what COVID has taken from us. We have been able to take solace in keeping the routine of most of our club's outdoor activities, but we will not be resuming our monthly meetings with guest speakers. A tradition dating back 45 years, they will be sorely missed. If there's a silver lining to be found, it's that in the absence of meeting commitments, each of us is afforded the opportunity to dust off the field guides we've collected and to connect with other naturalists through online methods.

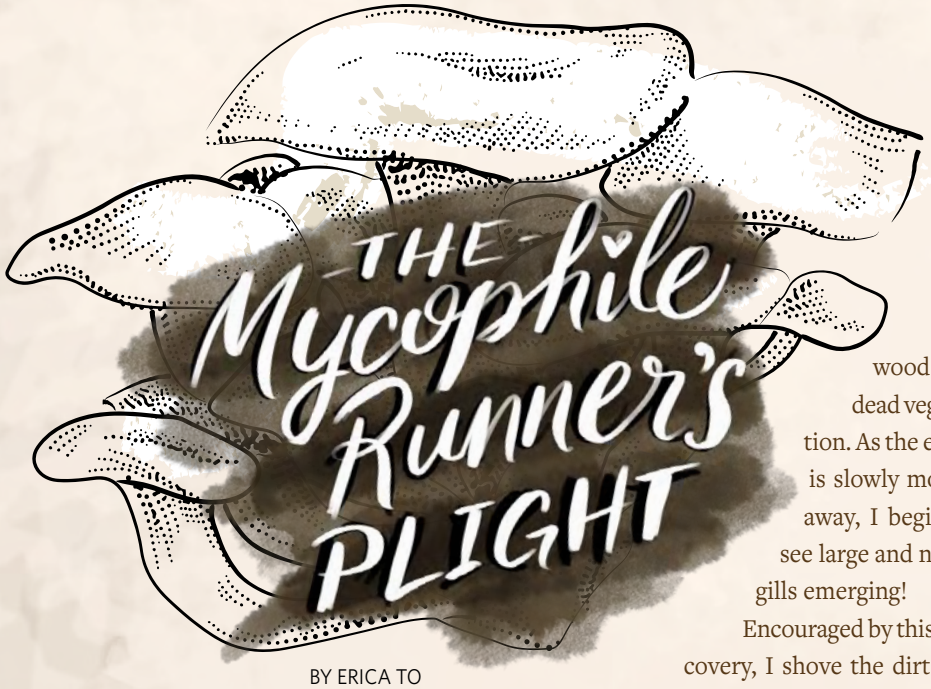
Buffalo Lake Nature Club Lady Slipper Walk and Paddle at the Narrows. Karin Lindquist and Neil Whatley smile and paddle in style! CLAUDIA LIPSKI

Going forward, that sense of connection is vital. While the separation is sad, it really makes us appreciate the times we have spent together. Let's keep connected as best we can. And let's continue to get outdoors and enjoy nature! ■

Claudia Lipski has been a member of the Buffalo Lake Nature Club since 2004 and is the club's representative on the Nature Alberta Board of Directors. She enjoys the outdoors and sharing nature exploration with like-minded people.

Buffalo Lake Nature Club walk to Potter's Seep (August 2020). CLAUDIA LIPSKI

Jim Potter leads the Buffalo Lake Nature Club on a walk to the seep that bears his family name for their efforts in restoring the area. CLAUDIA LIPSKI



The Mycophile Runner's Plight

BY ERICA TO

The steady drizzle is light and the droplets so fine, the air feels rejuvenating and cool. I wouldn't even call it raining. In fact, my skin and lungs would assert that they prefer this weather for running. I hit start on my fitness tracker and off I go down the sidewalk. I'm gleeful, practically frolicking, for it seems that most of the city's occupants have deemed the weather too morose to venture outside. I'm filled with selfish delight that I have this fine morning all to myself.

As I leave the neighbourhood full of eclectic houses with their inconsistently manicured lawns and lope into the woody trails, I've reached a steady stride and my breathing has fallen into a controlled rhythm. I have a good feeling, a very good feeling indeed, about this run. Perhaps it'll be my best run time ever.

I catch a glimpse of something out of the corner of my eye and do a double take. What on earth? Or should I say, what under earth? I slow down, circle back, and squat onto my heels. Something large appears to be pushing up the mulch and dead leaves. I grab a somewhat soggy stick and prod gently around the protrusion, removing some of the obstacles in its way — loose twigs, wood and dead vegetation. As the earth is slowly moved away, I begin to see large and noble gills emerging!

Encouraged by this discovery, I shove the dirt and mulch off the top. It becomes apparent to me that I'm digging the soil out from a cap that is quite deep! Giddily, I realize that I am uncovering an ambitious eight-inch fungi of the *Russulaceae* family!

"Live! Breathe!" I exuberantly cry.

My outburst startles someone who is walking briskly past me. They stare with silent offence for the disturbance of the quiet morning, but I do not apologize. I point at this handsome creature I have unveiled. They swivel their head forward and hurry off, clearly not comprehending the earthbound glory before them. I turn back to admire my new friend some more before thinking, "Oh, right, I'm supposed to be running."

With a final nod of comradery, I depart and attempt to find my breath and pace once more. I trot up a set of well-worn wooden stairs and emerge onto a small clearing resplendent with benches. I am huffing and puffing quite unbecomingly. As I make a loop around this small, secluded area, I appreciate the quiet rustle of the foliage. The fine mist in the air condenses and is drawn into larger droplets that quiver on the tips of delicately veined leaves. Water drips down upon stems and trunks of knotted trees, and glistens on the fine, silvery-blue, striated, translucent tops of mushrooms.

I find myself squatting again, feeling breathless, but not necessarily just from running. Could it be a cluster of *Coprinus lagopus*? Is it possible that I have been blessed with the opportunity to see this inky mushroom, whose adult form lives but an hour? I can't be sure, for the caps of these mushrooms have already begun lifting, their edges curling into an ebony black. The characteristic "rabbit feet" fuzziness on the caps of the younger mushrooms is difficult to distinguish. That being said, I would feel no regret should these turn out to be *Coprinus plicatilis* instead. The caps appear ephemeral with the light penetrating through, and the stalks are ever so crisp and white against the dark, damp ground. Even decaying, their melodious beauty remains. I curse myself for being tardy getting out of bed this morning.

In the shivering clearing, the silence of the area suddenly reminds me that I must be off. I pump my arms as I try to recover some precious time, thinking that maybe channeling exuberance into excessively rapid arm movement will make me go faster. It does not. I bound through the paths, my lungs voicing protest with ragged breaths. I cross a long bridge, unusually absent of the normal vehicular traffic as I cross from one side of the river valley to the other. I unsuccessfully skip and manoeuvre between puddles accumulated from overnight precipitation. Step by step, out from under the steel beams of the bridge and back into the comforting embrace of the trees.

Now I find myself wading through bushes, pushing aside branches. I come to a stop and I stare down at a fallen tree trunk, which has erupted in mushrooms. The base of the trunk, which had been cleanly cut at the time of the tree's unfortunate passing, is now covered

in moss and sprouting vibrant, yellow mushrooms. The trunk is sporadically peppered with them. I beam up and down the length of this fallen trunk in a very satisfied sort of way.

I give a sudden start as I remember my original purpose for this outdoor venture. I blunder out of the bushes, brushing away the unseen spider webs and caterpillar silks. My shins feel soggy, but I squelch on.

I arrive back at my home, feeling victorious upon completion of my Sunday loop. I had only stopped four additional times to appreciate more fungal friends that had found the atmosphere conducive to sprouting. And only once had I knelt down, my face almost touching the grass, to peer under the pale cap of a mushroom and observe the rusty brown gills. I had only put one foot onto a stranger's front lawn as I craned my neck to peer into the hollow of a stump on their property. There was nothing there. Trespassing without reward.

As I pass through my gate, I check my fitness tracker. This is perhaps my worst run time ever, but my footsteps are of enlightened defeat, and I cannot stop the grin from spreading across my face. ■

Erica To is a writer and engineer who discovered the fascinating world of mycology in 2018 and has been an enthusiast ever since. Her attention is constantly pulled between the excitement of gallivanting through the wilderness and diving through the crisp pages of literature. A version of this story previously appeared in the Alberta Mycological Society (albertamushrooms.ca) newsletter, *Spore Print*.

Clockwise from top:

A close look at the brightly coloured *Phyllotopsis nidulans*.

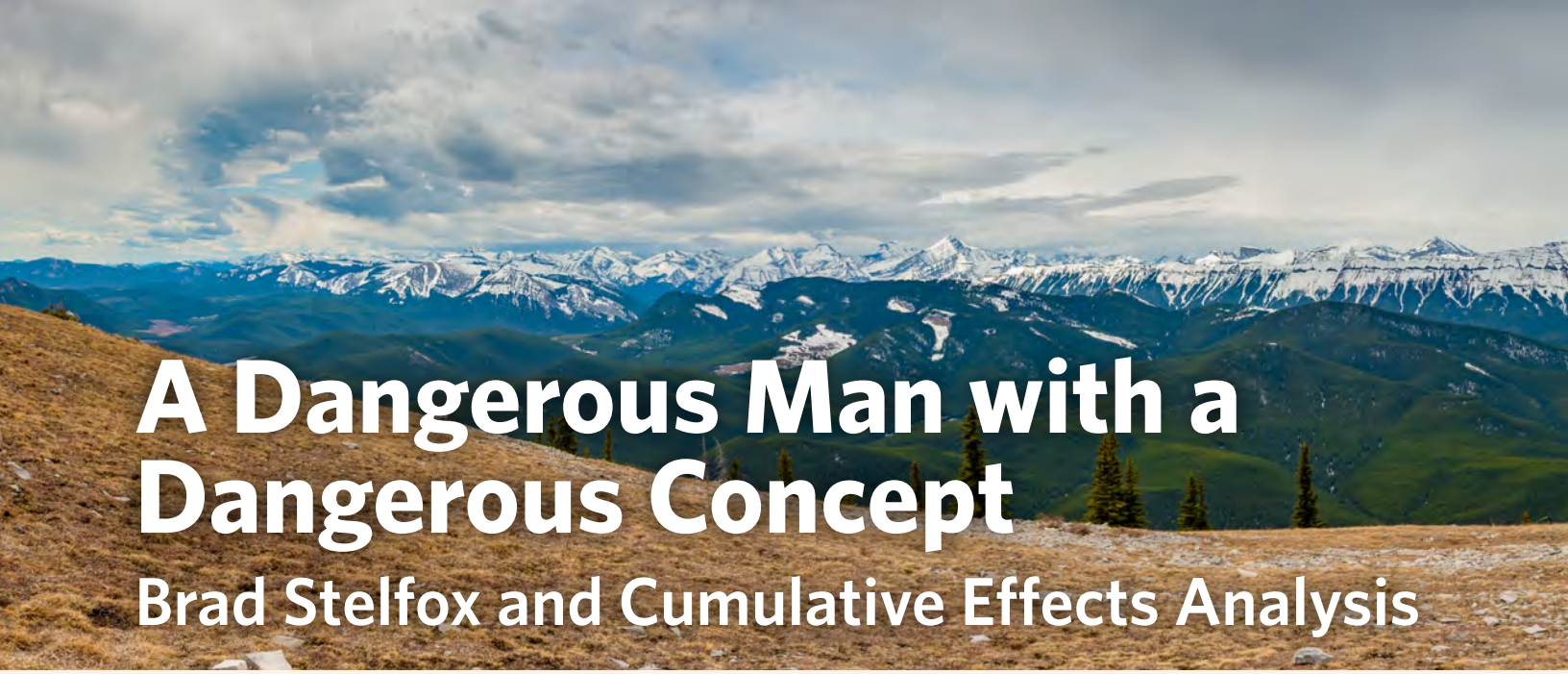
Inocybe species fungi in mulch at different stages of growth.

Saprophytic fungi on a fallen log.

Agaricus species fungi couple in the grass.

A tight grouping of the delicate, translucent *Coprinus lagopus*.

ERICA TO



A Dangerous Man with a Dangerous Concept

Brad Stelfox and Cumulative Effects Analysis

BY LORNE FITCH, P. BIOL.

Once upon a time, in a far-off land, a ruler had a vision of an impending famine. He bought up all the grain in the surrounding area to feed his city. The famine came to pass and his subjects had enough to eat, but he discovered, too late, that the grain was contaminated and those who ate it would, over time, go mad. The ruler summoned his most loyal young subject and gave him all the remaining uncontaminated grain in the city, with strict orders to only eat that grain. The loyal subject asked his ruler, "Why me?" The ruler solemnly answered, "Because you are young and we will need someone sane, when we are all mad, to tell us what we are."

In present times, many have partaken of the myth of constant growth, inevitable progress and inexorable economic advancement — arguably to the point of madness. To inject some sanity in a growth-focused world, "to tell us what we are," is a dangerous, yet necessary undertaking.

Over time there have been some notably dangerous men and women who have confronted the status quo, toppled conventional thinking, debunked ideologies, and pried off our blinders. Copernicus and Darwin come to mind, as do contemporary exemplars like Rachel Carson, David Suzuki, and David Schindler.

Dr. Brad Stelfox is another David confronting the Goliaths of industry, commerce, politics, and entrenched self-interest. Rather than a sling, his weapon of choice is cumulative effects assessment (CEA).

Using data collected over many years from industry, government, and academia, Stelfox developed ALCES — A Landscape Cumulative Effects Simulator — to objectively measure and track land-use activities and their accumulating footprint.

We tend to see the world in snapshots: one well site, another subdivision, a new road, a cutblock appearing. It's hard to add up the incremental, additive changes and losses; to do the math over time and project that trendline into the future. That's why it's always a surprise when the nebulous future becomes our present and we run short on water, land, and wildlife.

All land uses, and all their effects, are cumulative simply because everything accumulates and lingers, both over space and through time. A series of seemingly insignificant individual changes can accumulate to result in a significant overall effect. The sum of these individual stressors may be devastating to ecosystems and ecosystem function.

That's the mirror CEA holds up: showing our world isn't limitless and our growth trajectory isn't endless. CEA is one of very few tools that gives us the capability to understand today's actions and their implications for tomorrow.

The process of modelling cumulative effects neither defends nor demonizes the status quo, often termed the "business as usual" case. As Stelfox says, "While there may be no inherent right or wrong in our decisions, there inevitably will be consequences." The opportunity CEA affords us is to set a better trajectory for balancing ecological, social, and economic goals. We can invoke choice, rather than chance, and inform the pathway to tomorrow with the decisions of today.

Stelfox acknowledges that the pragmatic science of CEA cannot give us all the answers. The most difficult questions, the most persistent problems, and often the greatest challenges are not matters of science — they are related to values. The primary impediment to

Eastern Slopes of the Rocky Mountains in springtime.

sustainable resource management is not a lack of ecological understanding — it is social, political, and economic forces. The problem is not that we do not know enough, but that we do not allow what we know to constrain our behaviour.

Cumulative effects models can deal with skepticism, but not denial. Sometimes messages about the future are unpopular because the listener perceives they will be affected in a negative way. Understanding what the future may bring introduces an aspect of change, from the familiar and expected to the new and uncertain. Those who want to do nothing and make no change can find enough uncertainty to avoid doing anything. The point of CEA is to inform change, while change is still possible; to exercise flexibility, alternatives, and choice. The utility of CEA lies in seeking agreement on what future is desired, not through guesswork, but through scientific tools including thought, planning, and foresight.

Cumulative Effects in the East Slopes

Despite decades of progress, watershed planning for the East Slopes of Alberta is still in its infancy. This is a busy landscape that's only getting busier as a growing population demands more resource extraction and recreation. Meshing these demands with a landscape that provides an essential water source for downstream water users, unique biodiversity attributes, wild space, and stunning scenery requires far more than maintaining the status quo.

What Albertans draw from the East Slopes is substantial — economically, ecologically, socially, and personally. Yet, the rate of reinvestment isn't proportional to the take, and the signals of overuse are evident. Native trout declines are a message hard to ignore. Their plight is a signal that many of the values Albertans hold for the East Slopes are at risk. In some cases, like flooding, land-use decisions pose a risk to downstream communities.

The point of cumulative effects assessment is to inform change, while change is still possible.

The East Slopes do not represent an inexhaustible supply of benefits for Albertans. We need to set ecologically relevant limits and thresholds; without them we continue to spiral towards overuse. Investments need to be considered for restoration, especially where limits have been exceeded. Research needs — like better measurements of water quantity and quality, biodiversity, and the effects of climate change — require adequate resources. Central to this process is understanding and untangling the additive effects of every need and desire for the East Slopes.

We have to understand where we are, compare that to where we came from (the historical benchmark), and assess whether our trajectory will take us to a desirable future.

A satellite image of the foothills forest west of Drayton Valley illustrating cumulative industrial impacts. The small squares are oil and gas wells, the straight lines are roads, and the large pale polygons are forest harvest blocks. GOOGLE IMAGES

That's the mirror cumulative effects assessment holds up: showing our world isn't limitless and our growth trajectory isn't endless.

The Alberta Chapter of The Wildlife Society and several funding partners recently commissioned Cumulative Effects of Land Uses and Conservation Priorities in Alberta's Southern East Slopes to assist in an important dialogue on land-use planning for the region. (https://wildlife.org/wp-content/uploads/2020/07/Cumulative-Effects-Final-Report-May-8-2020.pdf)

The results indicate cumulative effects present substantial risk to bull trout and Westslope cutthroat trout, now and into the future. As native trout species are a surrogate, or indicator of watershed integrity, this indicates issues with the combined level of past and present land-use activity, and points to concerns with other species, like grizzly bears.

This science-based assessment provides an opportunity to better understand different management scenarios and clearly show expected outcomes. Preventing harmful future development, reclaiming temporary footprints, and managing access have the potential to improve trout performance in these watersheds. With different management trajectories, there is an opportunity to make a real change in terms of conservation.

Cumulative effects modelling shows the status quo approach — continuing to maintain land-use pressures — is taking us down a road of unfavourable, perhaps irreversible, consequences. However, like a road, the future isn't just a place we're headed; it can be a place we get to create. Recognizing that, a set of alternatives need to be posed and tested. Stelfox's development of a method for measuring and tracking cumulative effects helps us with that challenge.

How we move forward in the East Slopes is a test — a test of our ability to be good stewards of an essential Alberta landscape. ■

Lorne Fitch is a Professional Biologist, a retired Fish and Wildlife Biologist and a former Adjunct Professor with the University of Calgary.

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Project Forest

Rewilding Alberta One Forest at a Time

BY MIKE TOFFAN, P. BIOL.

As a silviculturist, my life is trees. I love the mystery of the forest. Each and every moment, it's changing, never the same as the day before. Walking through a forest and taking in its intricacies can be both magical and humbling; those trees were there long before I was born and will be there long after I'm gone.

This profound love of trees isn't mine alone. It's universal. People. Love. Trees. We don't need research (though it exists) to tell us that trees ground us, relax us and have a significant, positive impact on our health and well-being. And forests are arguably the most cost-effective means of capturing atmospheric carbon. But they do so much more than that. They clean the air and water, support animal habitat, and — possibly my favourite benefit — provide us with a vast, natural playground.

When you do the kind of work I do, you end up having a lot of conversations around trees. People are fascinated by forests. They're interested in deforestation and climate change and forest cover degradation and ultimately, how we — as Albertans, Canadians and simply humans on this Earth — can help.

There are a number of options for people to get involved and help combat climate change through tree planting. Organizations like Ten Tree, One Tree Planted, the United Nations, Pachama, and a number of others offer programming that allows donors to support positive impact around the world. That's all valuable, important work. But the general theme we've encountered time and again is that it's a challenge to find meaningful opportunities to support programs that benefit Canadian forests, and more specifically, Albertan forests. It can be even more challenging for businesses to get involved at a corporate level.

Globally, we're seeing more companies committing to becoming carbon neutral, but struggling to find ways to apply their efforts here in Canada. There are afforestation (establishing forest in an area where there was no previous tree cover) projects in the United States, Africa, India, and elsewhere that are frequently represented, but few opportunities to support our own forests. On top of that, there are laws and regulations in place to govern the deployment of trees on Crown land, which limits the ability of the average citizen to contribute locally.

Above: One-year-old white spruce seedlings, ready to plant. TREE TIME SERVICES

Left: A white spruce seedling planted on a reclaimed wellsite in northern Alberta.
TREE TIME SERVICES

Project Forest founder Mike Toffan inspects tree growth on site in the Ghost Public Land Use area.
RHONDA KRAUSE, ADVENTURE ALBERTA

Yet we know there is an abundance of land in Alberta that could benefit from afforestation.

As the Chinese proverb says, "The best time to plant a tree was 20 years ago. The second-best time is now." At Tree Time Services, our commitment to that philosophy is what spurred our team into action. We decided we could spend more time daydreaming about a non-profit that could affect change here in our own backyard, or we could develop it now. So we did.

Project Forest is dedicated to building a community of businesses that work together to capture carbon naturally in Alberta by rewilding local landscapes.

"Globally, we're seeing more companies committing to becoming carbon neutral, but struggling to find ways to apply their efforts here in Canada."

When you break it down, the model is really quite simple. Project Forest will connect with conservation groups and private landowners to identify and convert their non-productive agriculture land or underutilized land to forest. From there, we'll share the opportunity to rewild that land with interested businesses. Together, we'll be in a unique position to make a significant impact.

One aspect that sets Project Forest apart from other initiatives is our ability to leverage Tree Time Services' team of silviculture foresters to develop site-specific plans that ensure the correct seed and species are used. Our foresters have been responsible for the deployment of over one billion seedlings and have the knowledge and skills to plant the right tree, in the right place, where it can last a lifetime.

Another core mandate is that every Project Forest location will be no further than an hour from a municipal centre. It's essential that Albertans are able to walk among these forests and participate in the legacy they're creating. And perhaps most importantly, Project Forest will ensure that every forest we plant becomes a mature forest, contributing to Canada's forested landscape and our national commitments to the Paris Climate Accord. Over the lifespan of each forest, the new landscape will clean the air, support habitat for generations of wildlife, remove carbon from the atmosphere, and offer recreational opportunities for community members.

Our hope is that with the launch of this project, Alberta businesses will see that the right time to plant a forest is now, for your children or grandchildren to enjoy it 20, 30, 50 years from now — and beyond. If you're interested in supporting Project Forest's efforts to rewild Alberta, please visit **projectforest.ca**. ■

Mike Toffan is the General Manager of Reclamation and Forestry for Tree Time Services and founder of Project Forest. He holds a B.Sc. in Forest Business Management from the University of Alberta and a Technical Diploma in Forest Technology from the Northern Alberta Institute of Technology. While he loves managing his team, Mike's never happier than when he's in the field, among the trees.

A prairie pothole wetland surrounded by a canola field near Peterson, SK. Just a few metres of cattails are left between wetland and crops.
ANDREA WADE

PESTICIDES IN OUR PRAIRIE WETLANDS

BY ANDREA WADE AND EGINA MALAJ

The prairie pothole region of North America is a unique biological and hydrological treasure that spans Alberta, Saskatchewan, Manitoba, and multiple U.S. states. This region is defined by the speckling of wetlands that range in size and permanence across its landscape. Up to 90% of the freshwater from rainfall and snowmelt across the prairies is collected in these wetlands and will never make it into a river.[1] This isolation creates closed basins with unique hydrology and ecology, providing many valuable ecosystem services, including groundwater storage and aquifer recharge, greenhouse gas sequestration, and nutrient cycling and retention. Wetlands host a diverse community of invertebrates, amphibians, birds, small mammals, and aquatic and terrestrial flora. In spite of the valuable ecosystem services wetlands provide, many have been erased from the landscape as a result of drainage; therefore, it is especially important to conserve the wetlands that remain.

Many prairie wetlands are greatly affected by the agricultural activities that surround them. The pothole region is Canada's most agriculturally intensive area, growing crops like canola, wheat, barley, pulses, and corn. Farms in the prairies have become larger over time, with technological advancement allowing for more efficient crop production with fewer labour inputs. Producers often grow just one or two types of crops because of the specialized farm equipment and chemicals required to grow each crop at such a large scale. This large-scale production of a limited number of crops has resulted in expansive areas of monoculture, where little else can be seen growing aside from wheat and canola.

Proponents of these large-scale operations claim that they are more economically profitable; however, these farming practices can lead to soil degradation, nutrient deficiencies, and the build-up of pests. For insect pests that prefer a specific type of crop, endless fields of nothing but their favourite food is a dream come true. These monocultures lack the balance and species diversity found in natural ecosystems, including beneficial insects that prey on pests. With natural insect predators in short supply, pest populations can flourish unabated. Consequently, in large-scale monocultures, there is a greater need to apply commercial fertilizers and chemical products to control pest insects (insecticides), diseases (fungicides), and weeds (herbicides). As you can imagine, chemicals that are engineered to kill pest insects will indiscriminately kill other insects too, such as those that live in wetlands.

While pesticides can be harmful to and potentially kill wetland life, this can only occur if the pesticide reaches a wetland at a high enough concentration. One of the fundamental principles of toxicology is that "dose defines the poison." In other words, a chemical is only toxic if it is present in sufficient concentration. The concentration of pesticides

in wetlands is directly related to the level of use — the more you apply to the land, the more ends up in the water. Another factor is the rate of chemical degradation in the soil. Some pesticides are so persistent that they can be found in soil for years after application. The most famous example is the insecticide DDT, which can stay in soil for 10 to 15 years depending on the soil type.

Not all chemicals are equal when it comes to their toxicity and effects on animals. For example, many herbicides pose a relatively low risk to animals because herbicides are selectively designed to kill plants. Insecticides, on the other hand, can pose a serious risk to aquatic animals at concentrations much lower than what would be a safe concentration of most herbicides. In summary, the concentration of a pesticide and the type of pesticide it is, taken together, determine the level of toxicity.

Dr. Christy Morrissey's lab group, based out of the University of Saskatchewan's Toxicology Centre, has been researching the adverse effects of pesticides on aquatic species for the past decade. A recent analysis led by Egina Malaj mapped the distribution of pesticides across the prairies relative to the distribution of wetlands in the region.[2] Pesticide contamination "hot spots" were predicted using reported pesticide applications, chemical properties and toxicity of each pesticide, and environmental conditions. This study helped to identify which wetland areas were at high risk of pesticide contamination and which pesticides would most likely be found in wetlands at dangerous concentrations.

The results of the mapping exercise were validated through subsequent field studies in 2017–2019. Malaj and her teams monitored the concentrations of 160 pesticides in 300 selected wetlands across the three prairie provinces. The most commonly found pesticides across all provinces were the herbicide glyphosate and the group of insecticides known as neonicotinoids. These findings were in line with expectations from the earlier modeling study.[2]

Although the herbicide glyphosate is not particularly toxic to insects or other animals at the concentrations detected, many of the neonicotinoid concentrations are of serious environmental concern. Three of the most commonly detected pesticides in wetlands in Alberta and the greater prairie region were neonicotinoids: thiamethoxam, clothianidin, and imidacloprid.

Neonicotinoids are neurotoxic insecticides that are widely used as seed treatments. They were engineered to be systemic, meaning after a treated seed is planted, the plant takes up the neonicotinoid, incorporating the insecticide in its tissue. This protects the plant from pests, but also leaves a significant amount of insecticide in the soil, where it can persist for years.[3] As a result, spring snowmelt can carry last year's neonicotinoids into wetlands, where they contaminate the wetland's water even before farmers have begun spring planting.[4] When we estimated the risk pesticides pose to aquatic insects, nearly half of the region's wetlands were at risk from neonicotinoid insecticides.

Wetlands are at risk from neonicotinoids when concentrations in the water are high enough to kill aquatic invertebrates or impair biological

Above: Healthy wetlands support an astounding diversity of plants and animals. Left to right: a dragonfly rests on a cattail; a bumblebee visits a native orchid growing in a wetland's outer vegetation zone; a nest of red-winged blackbird eggs woven into cattails.

Bottom: Egina Malaj collects a water sample to be analyzed for for pesticide concentrations. This wetland, surrounded by wheat, is completely devoid of natural wetland vegetation that would normally provide wildlife habitat.

ANDREA WADE.

Andrea Wade nets an aquatic invertebrate sample from a wetland 10 minutes east of Saskatoon. STEPHEN SRAYKO

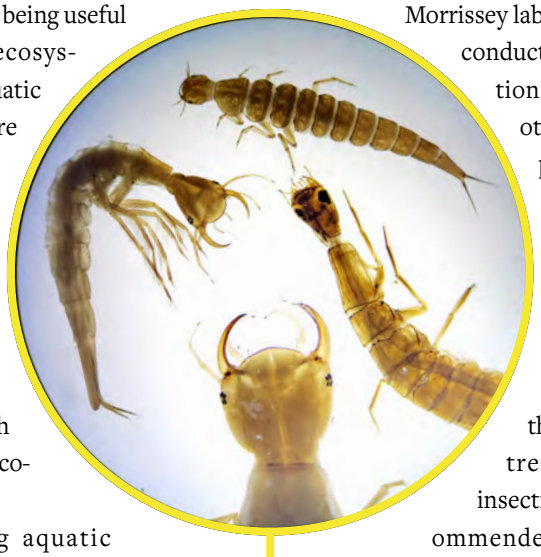
functions integral to their life cycle or reproduction. Studies performed in laboratory settings have found that high concentrations of neonicotinoids can quickly kill some aquatic insects, while the lower concentrations typically found in actual wetlands can cause some insect larvae to fail to emerge.[5] The implication is that midge larvae exposed to the sub-lethal concentrations of neonicotinoids found in many wetlands may be unable to reach adulthood and reproduce. By breaking the natural life cycle, neonicotinoids could seriously harm emergent insect populations and populations of other wildlife that depend on these emerging insects for food. Indeed, studies have found that neonicotinoid contamination of wetlands causes a drop in abundance and biomass of emerging insects.[6]

Current research by Andrea Wade, a master's student in the Morrissey lab, is focused on understanding how pesticides found in wetlands affect aquatic invertebrate communities. If you dip a net into your local prairie wetland, you're likely to catch a wide variety of aquatic invertebrates, such as dragonflies, damselflies, mayflies, midges, beetles, and caddisflies, in their aquatic life stages. We've long understood that aquatic invertebrates can be useful indicators of ecosystem health. Many naturalists and anglers know that abundant mayflies and stoneflies are a sign of a healthy stream. What we don't yet know is which insects are a sign of a healthy prairie wetland. Wetlands and streams are distinctly different ecosystems, and that extends to the invertebrates that live in them. While we do find mayflies in pothole wetlands, most of our wetlands are dominated by fly larvae in the family chironomidae, commonly known as non-biting midges.

In addition to being useful indicators of ecosystem health, aquatic invertebrates are an important food source for animals like bats and insectivorous birds. Wetland health is integral to the health of surrounding ecosystems.

By sampling aquatic invertebrates in a variety of wetlands that range in the degree to which they are contaminated by neonicotinoids and other pesticides, Wade plans to find out if these pesticides are impacting the invertebrate community. While this alone is a sizable task involving water sampling, invertebrate sampling, and months of identifying invertebrates under the microscope, environmental variables need to be accounted for as well. Agriculture not only impacts wetlands through pesticide contamination, but also through vegetation removal as a result of herbicide spraying and tillage around the open water. These factors are all being examined in our study.

With our research, we are hoping to provide solid evidence of the effects of neonicotinoids on aquatic ecosystems. Studies like ours are important for informing policy-makers as they make decisions about the future use of these pesticides. The Pest Management Regulatory Agency (PMRA), a division of Health Canada, is responsible for regulating pesticide use in Canada. PMRA periodically re-evaluates pesticides based on their value and on new scientific data such as the work of the Morrissey lab. In 2016, PMRA conducted a re-evaluation of the neonicotinoid imidacloprid, finding it to be harmful to aquatic insects and potentially harmful to birds and small mammals that feed on seeds treated with this insecticide. They recommended a phase-out of all agricultural outdoor uses of imidacloprid over the next three to five years (2016-2021). Similar recommendations were proposed for two other



Diving beetles (family Dytiscidae) are top predators of the wetlands. Dytiscid larvae, pictured here, use their sickle-shaped mandibles to pierce their prey and slurp up their insides. Genera, clockwise from top: Agabus, Graphoderus, Dytiscus, Dytiscusn. ANDREA WADE

neonicotinoids, thiamethoxam and clothianidin, in 2018. This was groundbreaking, as most of the neonicotinoid bans have been proposed based on pollinator declines, not on aquatic insect data. Despite its recommendations, PMRA has yet to address all concerns raised by interest groups and the general public, a process which is typically slow and complex. A final decision on the fate of these products is not expected until the end of 2020.[7]

Although the government's decision could end neonicotinoid use in Canada's prairies, banning pesticides one at a time is an uphill battle. Chemical companies have already found replacements for neonicotinoids known as diamide insecticides, which are currently being used. We have already detected these replacement insecticides in our wetland monitoring study, however, their toxicity to different species is still under investigation. In a system where new pesticides come on the market faster than their effects can be thoroughly researched, Canada might need to rethink its pesticide management strategies and farming practices. ■

Andrea Wade is a master's student and Egina Malaj is a Postdoctoral Research Fellow at the University of Saskatchewan's Toxicology Centre.

Andrea Wade meets a newly emerged damselfly, which spent the first stages of its life swimming around the wetland she's standing in. STEPHEN SRAYKO

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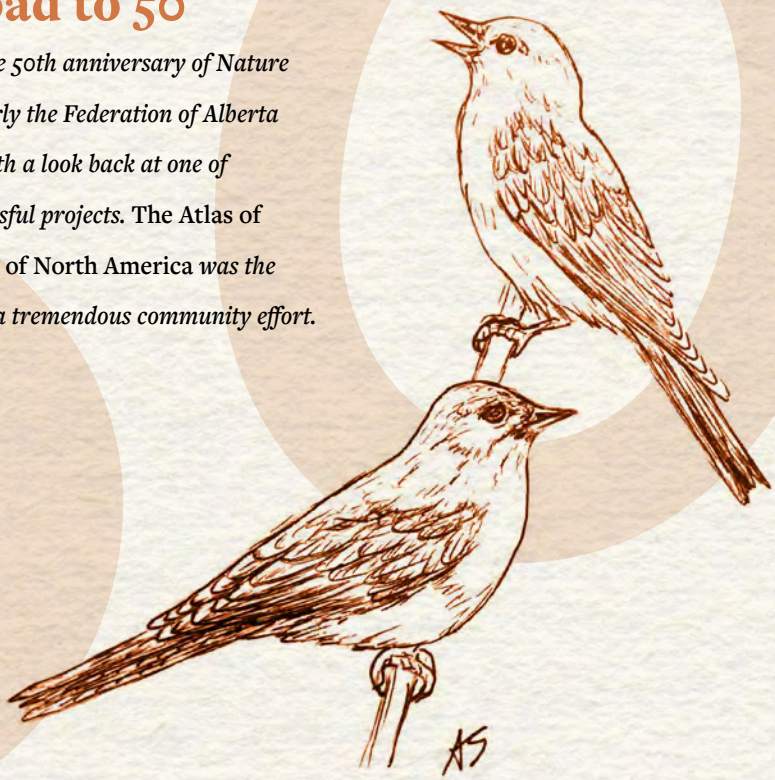
The Road to 50

We celebrate the 50th anniversary of Nature Alberta (formerly the Federation of Alberta Naturalists) with a look back at one of our most successful projects. The Atlas of Breeding Birds of North America *was the culmination of a tremendous community effort.*



A Soaring Success

BY JASON SWITNER

Nature Alberta's mandate is to bring the community of nature-lovers together and to facilitate sharing knowledge and passion for natural history. These principles were exemplified in the historic publication of *The Atlas of Breeding Birds of North America.*

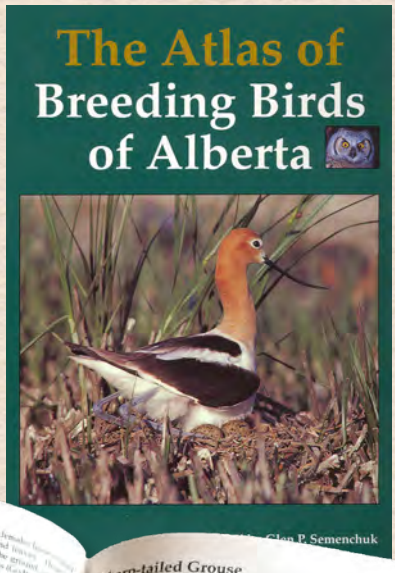
The book is the culmination of over five years of fieldwork and data gathering by a legion of volunteers between 1,000 and 1,500 strong, representing tens of thousands of survey hours. Glen Semenchuk served as the Executive Director of the Federation of Alberta Naturalists (FAN, as Nature Alberta was formerly known) for 15 years, and oversaw the atlas project as editor. "The *Atlas* is a tribute to all the people who volunteered to put it together," he says, "it really was a collective effort."

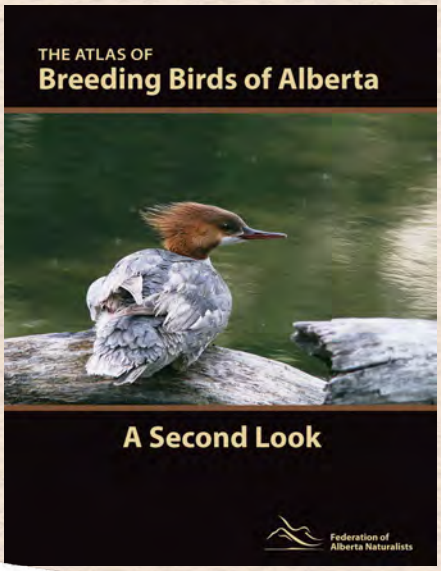
FAN undertook the unfamiliar route of self-publishing, both to maintain editorial control and retain any financial rewards the book produced. In an effort to secure those rewards, the book was designed for mass-market appeal. Every introductory bird Order page enjoyed a beautiful illustration by Ann Stefura. Every species account featured striking colour photography. Colourful distribution maps were accompanied by comprehensive natural history information presented in an organized, easy-to-read page layout.

On its release in 1992, the book's reception was incredible. Selling over 12,000 copies in its first few years of publication, it became not only a Canadian double best seller, it was the most successful atlas project ever published in North America.

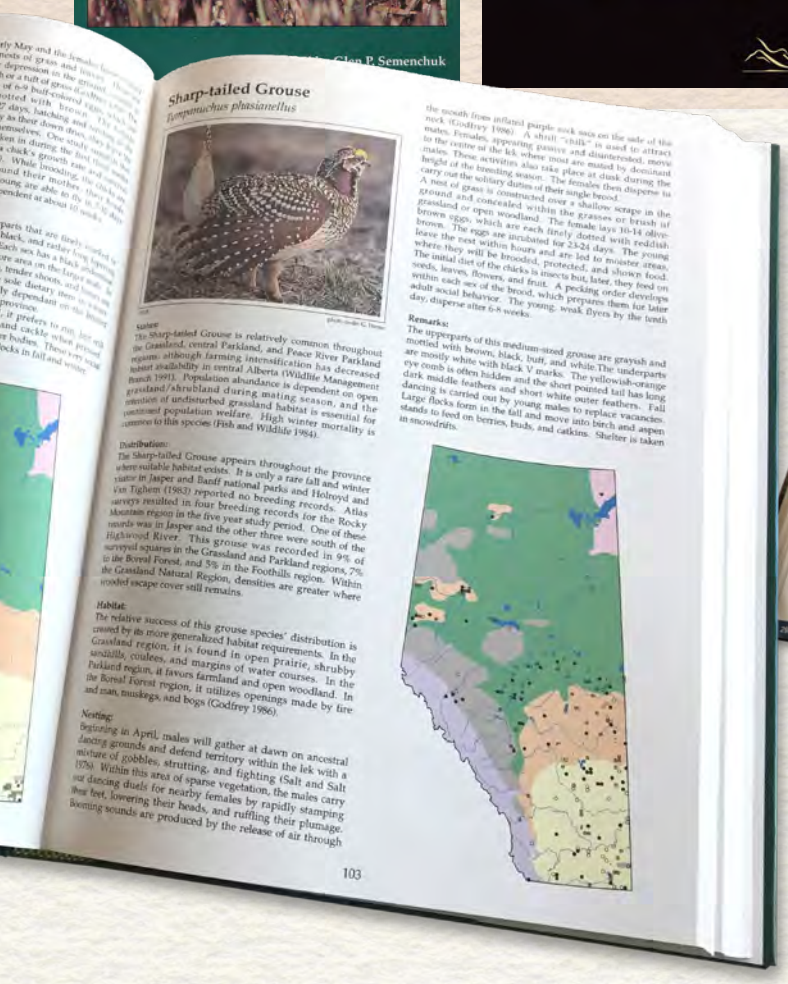
Semenchuk says the success of the Atlas is a testament to both its utility and the passion of those who poured time and effort into it. "Anybody who wants to know something about a breeding bird in Alberta, it's there in one place. It brought all that information together. And it brought together the efforts of all these volunteers. All those volunteers were proud of that book. And we made sure that anybody who volunteered, their name appeared inside. It honoured all the volunteers and it was a fantastic source of information."

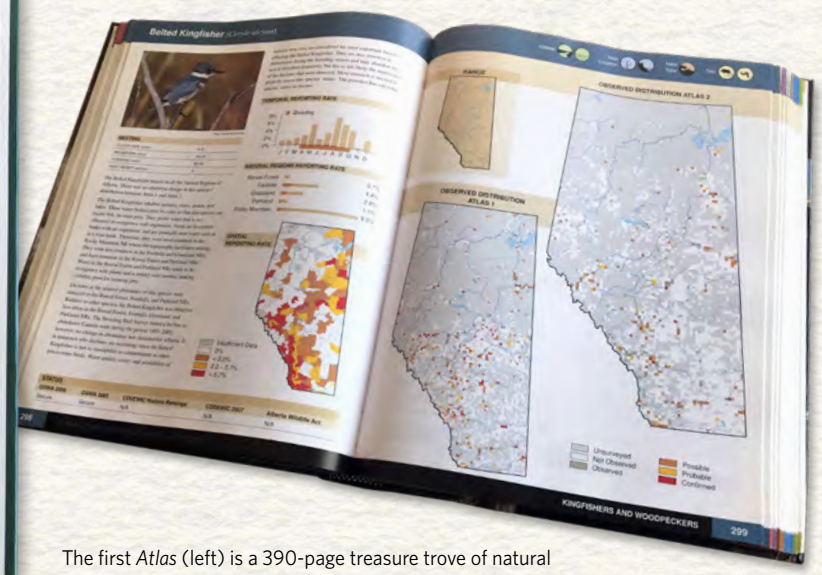
With FAN's first foray into publishing being such a financial boon to the organization, they were able to extend that success





These atlases make a welcome addition to any naturalist's reference shelf, and their attractive design makes them just as appealing on your coffee table. You can purchase copies, and explore more Nature Alberta publications, in the BOOKS section of the Nature Alberta online store: nature-alberta.square.site





The first *Atlas* (left) is a 390-page treasure trove of natural history details covering more than 270 bird species. The glossy, 626-page sequel, *A Second Look* (above), with double-page entries colour-coded by bird families, focuses on the status of species in a rapidly changing landscape.

across numerous other publications. This would include a sequel volume entitled *The Atlas of Breeding Birds of North America: A Second Look*, published in 2007. Spurred by rapid industrial development occurring in Alberta, *A Second Look* summarized the natural history information of the first volume in a system of tables and symbols, its content placing more emphasis on species' status and observed changes in bird populations in a remarkably short period of time.

In addition to serving as excellent reference books, these atlases are tangible examples of what dedicated people who are passionate about nature can achieve by working together. ■

Taking Wing

BY MARGOT HERVIEUX

At some point in our lives most of us wonder what it must be like to fly like a bird. That question is not straightforward, however, because different birds fly in different ways.

Despite their differences, the basics of flight are the same for all birds. The curve of the wing and feathers provide lift, flapping generates forward thrust and the bird steers by making small adjustments with the wings and tail.

If you watch birds in your yard, take note of how they move around. You will notice both flapping and gliding and that the birds change the angle of their wings and adjust their tails when they take off and land.

Birds have different wing shapes depending on the type of flying they do most. The most common is the short, round wing, which allows for quick take-offs and steady flight. Grouse have particularly short wings for their size, which gives them that extra burst of speed when they leave the ground.

Like many birds, black-capped chickadees have short, rounded wings.

For birds that fly fast or migrate long distances, narrow, pointed wings work best. Falcons, swallows, shorebirds, and ducks all utilize that design. Peregrine falcons, the world's fastest flyers, can fly at a cruising speed of over 170 km/hour and when they pull their wings in for a dive can reach 250 km/hour.

Peregrine falcons, the world's fastest flyers, reach incredible speeds thanks to their narrow, pointed wings.

The next time you see a hawk soaring overhead, notice its long, broad wings. These wings offer lots of surface area for soaring but are not as good for quick acceleration. Many soaring birds, including eagles and pelicans, can spread their primary feathers at the tips of the wing to give them extra control.

A red-tailed hawk soars above a field looking for its next meal.

Soaring is different from simply gliding because the bird is riding on moving air. We most often see birds soaring on rising air that has been warmed by the sun but there are also currents over hills or other landforms and above the surface of waves. Ravens love to take advantage of the air moving around the tops of buildings on a windy day.

Some of the most amazing flyers are hummingbirds. These tiny birds can not only fly forward but they can also hover and move up, down, and backwards. Hummingbirds accomplish these aerial feats by moving their wings in a figure-eight motion and beating their wings at a rate of over 50 times per second.

The tiny ruby-throated hummingbird can fly in any direction, even backwards.

Hummingbirds may be the only birds that can fly backwards but there are other birds that can hover. Hovering can only be accomplished using long, narrow wings. Watch for kestrels hovering along roadsides, northern harriers watching for lunch over a field, or terns hovering before diving on a fish.

Birds are fascinating for many reasons but there is no doubt that flight sets them apart. All we can do is watch in wonder as they perform their aerial displays. ■

The long, narrow wings of a tern allow it to hover, patiently waiting for a tasty fish.

Margot Hervieux is a founding member of the Peace Parkland Naturalists, an honorary member of Nature Alberta, and a longtime Nature Alberta board member. This article originally appeared in her "Naturally Yours" column in the *Peace Country Sun*, which she has been writing for 15 years. You can read more of her archived columns at peacecountrysun.com

Avoiding Avoidance

How Alberta Wetland Policy is Coming up Short, and How We Can Improve

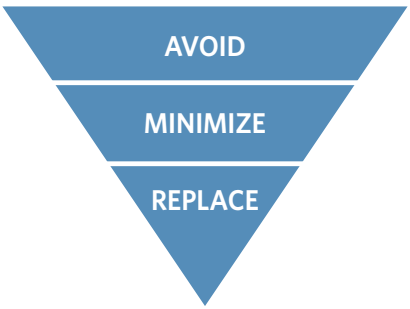
BY EDEN NORTHCOTT AND JAY WHITE

Recognition of extensive wetland loss worldwide has catalysed the implementation of recent legislation and policy at a provincial, federal, and international scale to protect wetland ecosystems. In our province, the Alberta Wetland Policy (2013) aims to conserve and manage wetlands through the use of valuation tools and a "mitigation hierarchy." This hierarchy attempts to integrate wetland ecological services into management decisions, to avoid and minimize negative impacts to high-value wetlands, and to replace lost wetland value where necessary.

Under the Alberta Wetland Policy, wetland management is achieved through a sequential process, with an emphasis on avoidance first and foremost. Where avoidance is not possible, impacts to wetlands must be minimized through adjusting activity plans. As a last resort, where avoidance and minimization are not a possibility and permanent wetland impacts will occur, wetland replacement or compensation is required. Wetlands are to be replaced on a "type-for-type" basis, meaning replacement aims to construct or enhance wetlands of a comparable value, ideally in the same area as the original loss.[1]

However, in practice, wetland compensation does not often result in wetland values being maintained on the landscape. This approach has been criticized as ineffective, with no legitimate incentive to achieve this goal. There is concern with how avoidance and minimization are approached during the approval application process. Contrary to the intentions of wetland mitigation, avoidance is more often ignored than implemented. Compensating for wetland loss and repeatedly favoured over avoidance.

So, why does wetland avoidance fail within the mitigation hierarchy? There are a myriad of reasons, including: a lack of understanding and agreement as to what constitutes "avoidance," undervaluing wetlands and their role on the landscape, having too much faith in constructed wetlands, the inability of regulators to say "no," and a lack of enforcement and compliance monitoring by regulatory agencies.



What Does Avoidance Mean?

There is a lack of agreement among regulators as to what constitutes avoidance. The Alberta Wetland Policy defines avoidance as: "To prevent impacts to a wetland by identifying an alternate project, activity, design, or site, or abandoning the project or activity altogether or by denial of an application by the regulator."[2] To some, the confusion surrounding the term avoidance means never developing in or around a wetland, whereas to others it means to have no permanent impacts to a wetland. The absence of a standardized methodology for evaluating this regulatory requirement creates a subjective interpretational caveat among regulators with respect permitting decisions, resulting in piecemeal outcomes for wetland avoidance among jurisdictions in Alberta.

Contrary to the intentions of wetland mitigation, avoidance is more often ignored than implemented.

Under the Alberta Wetland Policy, the proponent must assess whether avoidance is feasible or not when submitting a permit application to the regulator. Where avoidance is deemed "not possible," demonstration of alternative plans which are considered "adequate" for

Above: Yekau Lake. Yekau Lake is located on Enoch Cree First Nation. It plays a key role in celebrations of the culture and identity of the Cree community. EDEN NORTHCOTT

Left: The marsh marigold is a perennial plant that is found in marshes, swamps, woods, and stream banks with a preference for slowly moving water. A blooming marsh marigold is often one of the first signs of spring. EDEN NORTHCOTT

wetland conservation is required. Again, what is considered "not possible" and "adequate" is subject to the discretion of the regulatory program, such as Alberta Environment and Parks or the Alberta Energy Regulator. It is always faster to move through the approval process by simply paying in-lieu fee compensation and moving on.

Some conservationists are concerned that the application requirements of alternative plans for avoidance never result in projects actually being relocated to another area where high-value wetlands are not present; they only alter the impacts that may occur in the originally proposed location. Applicants have the opportunity to simply submit a project analysis stating no practical alternatives are feasible and avoidance can not occur, and thus an approval is awarded.[3]

Undervalued Wetlands

Wetlands are given a value based on biodiversity and ecological health, water quality improvement capabilities, hydrological function, human use, and relative abundance.[4] Using these functional qualities, a wetland can be given a value on which a compensation payment is then based.

Under the Alberta Wetland Policy, replacement seeks to recreate lost wetlands of a comparable value to the original, in ideally the same area as the original loss. However, replacing a lost wetland in the same location is often not a realistic approach due to lack of available land or the scale and nature of the activity footprint.[5] Off-site wetland replacements are highly favoured by proponents as it is more cost-effective, easier, and faster to accomplish.

Permit holders may fail to acknowledge the abundant ecological services wetlands provide for the landscape. Creating replacement wetlands off-site from their original location causes a myriad of environmental complications within the location of the original loss, including changes to wetland distribution, type, and hydrological connectivity. But wetland replacement decisions are made based on where land is most readily available, not from an ecological standpoint. Using wetland replacement to restore lost wetland value at equivalency assumes that the ecological services are also compensated for.[6]

Too Much Faith in Constructed Wetlands

The perception that a constructed wetland that visually resembles a natural wetland adequately compensates for lost wetland value fails to acknowledge the need for wetlands to grow and develop over time.[7] Wetlands are highly variable and are influenced by regional and local climate, biodiversity, hydrology, geology, soil composition, and other factors. With the prevalence of off-site replacement, wetland creation takes place on a landscape where soils and the water regime do not support a wetland-type ecosystem.

... quite often, constructed wetlands will not perform the same ecological functions as the original and are lower in value.

Constructed wetlands are often difficult and costly to create and maintain. To prevent groundwater contamination, many constructed wetlands have a clay liner to eliminate groundwater recharge. But the ability of wetlands to recharge groundwater is one of the very things that makes them so valuable on the landscape.

Wetlands constructed for compensation must mature, requiring years to stabilize and replace the natural functions of a naturally occurring wetland. These time frames are rarely considered when compensation is implemented and quite often, constructed wetlands will not perform the same ecological functions as the original and are lower in value.[8]

Located in the White Zone, Chestermere has a myriad of marshes, swamps, and shallow open water on the landscape . AQUALITY ENVIRONMENTAL CONSULTING LTD.

The Inability to Say "No"

The growing demand for development has wetland mitigation strategies traversing away from avoidance toward a permissive, market-based idea of "exchange" or "replacement." Compensation payments have created a perception that avoidance is impractical, as the assumed wetland value is monetarily lower compared to the direct economic gain of the destructive activity, such as oil and gas, roads, housing development, and forestry.[9] When regulatory agencies are presented with "adequate" evidence that avoidance and minimization are not possible, they often have the inability to say "no," deferring to compensatory measures for wetland loss.

Lack of Enforcement and Monitoring

Compliance monitoring and enforcement are essential to ensure adherence to the terms of the granted permits.[10] Enforcement ensures that violation of the Alberta Wetland Policy has not occurred, and land alteration has not begun until permits are approved and secured through regulatory agencies.

While it is important to enforce approval regulations, it is also necessary to monitor constructed/replaced wetlands to validate that the compensated wetland is performing adequately as outlined in the conditions of the permit. This is usually left up to the proponent's consultants. Again, not all constructed wetlands succeed from both an ecological and regulatory standpoint. Constructed wetlands can fail to meet the conditions of the regulatory requirements as well as fail to mature and stabilize on the landscape. The reactive approach to wetland management in Alberta appears to be conducive to a lack of monitoring.

Do you have water on your land? The policy applies to you, too.

Landowners may be surprised to learn that Albertans do not own the water on their land, and may also not own the land under that water. Landowners cannot change the flow of water entering or leaving their land without an approval. This is complicated because many wetlands are difficult to identify and, due to fluctuating water levels, they may look like uplands during certain times of the year. Land titles do not acknowledge wetlands that are currently on an individual's respective property and thus, Crown Ownership Claimability may apply.[15]

Wetlands are some of the most complicated and challenging landforms to understand. Before beginning any project that may impact a wetland, make sure you understand the permitting process and the ecological services that a wetland provides on your land. Activities as small as building a driveway through a watercourse, putting in a culvert, or draining a wetland for agricultural purposes can get expensive during the permitting phase, but even more so when environmental compliance becomes an issue. Always consult an Authenticating Professional with extensive wetland knowledge to identify, classify, and delineate your wetland.

In a recent example, an Albertan purchased a plot of rural land with the intention of building a home. Once the home was built, he needed to put in a driveway to access the home. The only point of access where the driveway could be built was over a small waterway containing aquatic vegetation with the potential for fish.

For a seemingly simple project, the process quickly became pretty complicated. Permitting requirements included a Water Act approval under the Code of Practice for Watercourse Crossings as well as a Water Act approval under the Alberta Wetland Policy. This meant the wetland had to be valuated and delineated, and a qualified engineer was also needed to design and construct an appropriately sized culvert for water passage. Even though the area of impact was only 0.0006 hectares, compensation for lost wetland area was required. Potential impacts to fish or fish habitat also had to be assessed, involving federal Fisheries and Oceans regulations as well.

The cost of this simple driveway project will range from $40,000 to $70,000. While far exceeding the landowner's expectations, the consequences of failing to comply with environmental regulations can be even higher. When approaching construction around a wetland area, always consult a qualified professional.

Wabamun Lake. This watershed hosts a variety of species of breeding and migratory waterfowl. Because of its rich biodiversity, it is one of Alberta's most popular recreational lakes. AQUALITY ENVIRONMENTAL CONSULTING LTD.

Next Steps for Avoidance

Improving wetland mitigation strategies in Alberta begins with the understanding that wetland retention is easier, cheaper, and faster to achieve than wetland replacement. Knowing the short-term and long-term impacts of various activities on wetlands can help both regulators and proponents make better land-use decisions to protect these natural areas.

A qualified determination of what constitutes "avoidance" and "adequate" demonstration of the inability to avoid the destruction of a wetland must be made. If avoidance is left to the subjective discretion of the regulatory party, consistency can not be achieved. Creating a systematic guideline of requirements that a proponent must meet reduces interpretational oversight and allows for more consistency from the regulatory agency.

Identifying wetlands of high ecological value before land zoning and acquisition for proposed activities would better inform developers and landowners about the cost, benefits, and the unapparent consequences of development.[11] Through planning at a more local and comprehensive level, valuable wetland ecosystems could be acknowledged at the primary stages, allowing for more appropriate zoning and land-use choices. A local and regional watershed scale must be used when identifying the value of a wetland to maintain biodiversity, hydrology, and connectivity.[12] These wetland services and ecosystem features should be considered at the approval step of the application process in order to maintain natural processes on the landscape of original loss. A proposed activity that will impact wetlands that are difficult or near impossible to restore, such as fens or bogs, should require stronger evidence that avoidance or minimization are not feasible. If wetlands are considered to have a low value, strong evidence of avoidance infeasibility should still be demonstrated, as they are only considered low value to the proponent. Removing wetlands in areas of high abundancy disrupts the interaction between uplands and wetlands, adversely affecting connectivity and biodiversity support.

In-lieu fee payments can be used as an effective avoidance measure — if the fee exceeds the instant economic gain of development by a significant margin.[13] Proponents often have a perception that removing wetlands from developable land is a matter of a simple

transaction. By re-evaluating the cost associated with wetland destruction, more comprehensive land-use planning may occur, motivating the permit holder to assess if the location is economically worth developing.

Regulatory agency oversight of proponent activities, including increased interaction with permit holders, consistent site visits, and more stringent and frequent enforcement measures, could improve compliance.[14] If the cost of violation outweighs the cost of regulatory requirements, proponent accountability to uphold the conditions and requirements of the permit would improve. Effective legal and financial assurances for site sustainability and monitoring of constructed wetland projects may ensure the replacement of lost wetland value.

Evaluating the operational effectiveness of avoidance in wetland mitigation under the Alberta Wetland Policy proves it needs work. With development on the rise, avoidance must maintain its importance as the most preferred method of wetland mitigation. Wetland retention must be more sought after than wetland replacement to preserve wetland functions on the landscape, such as biodiversity support, water quality improvement, flood abatement, and groundwater recharge. Through having a standardized understanding of what avoidance means; by creating a consistent, systematic guideline for adequacy and feasibility that must be adhered to; by acknowledging the true ecological value of wetlands; and through monitoring wetland functionality and enforcement of compliance, avoidance can be more achievable and successful for both proponents and regulators. ■

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Eden Northcott is an Aquatic Biologist at Aquality Environmental Consulting Ltd. and a member of the Alberta Society of Professional Biologists. Her work mainly focuses on her greatest passion: Alberta's fish and fish habitat.

Jay White is a Professional Biologist, owner of Aquality Environmental Consulting Ltd. in Edmonton, and Scientific Advisor to eDNA Metagenomics Inc (EMI). He is a past president of the Alberta Society of Professional Biologists and Vice-President of the Alberta Water Council.

Nature Kids

My BIG Alberta Backyard

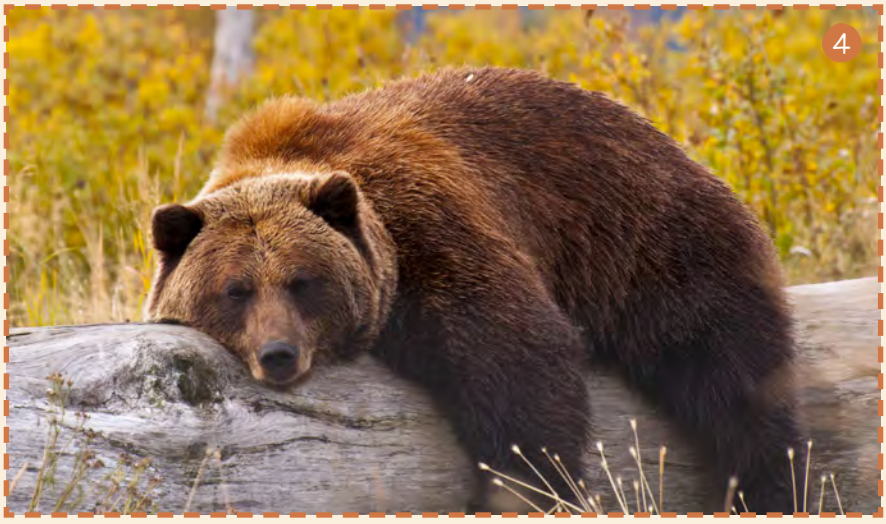
BY ZOE MACDOUGALL, NATURE KIDS PROGRAM COORDINATOR

Alberta is a great place to live. It's a big beautiful province full of all kinds of natural wonders. This is where we introduce you to the diversity of wildlife, and unique and interesting wild spaces, that are part of your Big Alberta Backyard. This time, instead of looking at one place, we are going to explore the Provincial Parks and protected areas of Alberta and learn why they are so important.

The province of Alberta consists of six major ecosystem types: grassland, parkland, foothills, boreal forest, Rocky Mountains and Canadian Shield. Due to the diversity of ecosystems within the province, more than 60,000 species call Alberta home. This includes mammals, birds, plants, trees, insects, and many species that are not visible to the human eye as they are microscopic. According to the Alberta Biodiversity Monitoring Institute, only 4% of Alberta's biodiversity has actually been discovered and named up to now, so we still have a lot to learn about our province!

What we do know is that at least 1,500 of our plant species and over 100 of our animal species are "at risk," which means that there aren't very many of them left in the ecosystems of our province. The list of animals that are considered to be at risk includes the northern leopard frog, the American white pelican, the great gray owl, the grizzly bear, and the bull trout. These are all important animals that make up part of the biodiversity in Alberta and they need safe places to live.

Alberta has over 400 protected areas, which include Provincial Parks, Wilderness Areas, Natural Areas, and Ecological Reserves. These places help to protect the wild species that live there by preventing disturbances that could cause a loss of their habitat (homes), which they need to survive. Many of the species mentioned above live within these protected areas and need a safe place to call home. Protected areas, like Provincial Parks, are also important for families and people from the communities of Alberta because these areas are kept wild and natural for us to enjoy activities like camping, hiking, fishing, and cross-country skiing, and are also used for educational and scientific purposes. We are thankful for our province's protected areas, but right now some of them may be at risk themselves.



If you and your family love to camp and fish and visit natural areas within the province of Alberta, especially during these times when we can't travel outside of our country, you have probably visited a protected area

It's not just dinosaur fossils that you can find in Dinosaur Provincial Park! This protected area is a habitat for many important species.

within Alberta before. These areas are special because they have specific rules that make it so the forests stay intact, the lakes stay healthy, and the wildlife get to live undisturbed. There are some changes being talked about that may affect our protected areas in Alberta.

A few of the more than 100 animal species considered "at risk" in Alberta include 1 northern leopard frog, 2 the American white pelican, 3 the great gray owl, and 4 the grizzly bear.

Learn More

Here are some websites you can visit to learn more about the protected areas of Alberta, the changes people are talking about, and what you can do to help:

https://albertawilderness.ca/issues/wildlands/protected-areas/#parentHorizontalTab3

https://albertawilderness.ca/news-release-government-plans-to-remove-164-sites-from-parks-system/

https://cpawsnab.org/our-work-2/defend-alberta-parks/

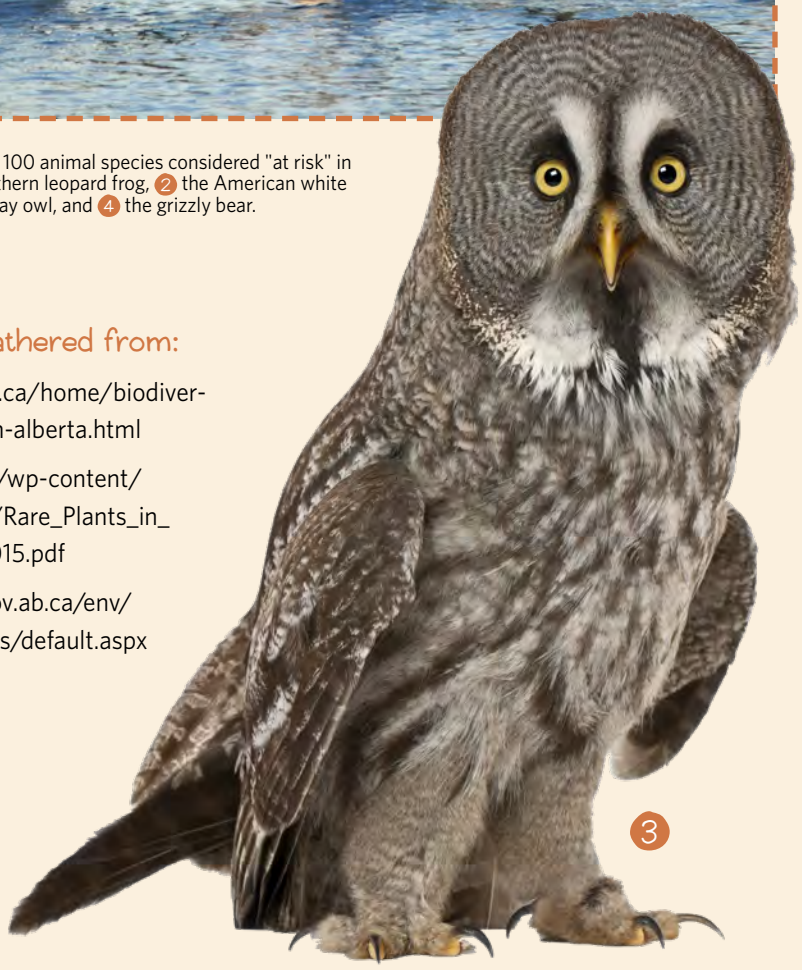
https://www.iusealbertaparks.org/ ■

Information gathered from:

https://www.abmi.ca/home/biodiversity/biodiversity-in-alberta.html

https://anpc.ab.ca/wp-content/uploads/2014/12/Rare_Plants_in_Alberta_ANPC_2015.pdf

https://extranet.gov.ab.ca/env/wild-species-status/default.aspx



Nature Kids

Out and About

BY ZOE MACDOUGALL, NATURE KIDS PROGRAM COORDINATOR

All About Owl Watching!

Leaves are changing colour... Birds are migrating south for the winter... Fall is a great time for exploring nature! In this issue, let's talk about owls and how you can spend your nature walks watching and listening to our lovely feathered friends!

We spoke with our friend Lisa Priestley, a biologist at Strix Ecological, who has lots of experience studying and monitoring owls. She said: "The fall time is pretty quiet for owls, but young great horned owls will still be quite noisy, trying to beg for food from parents that have reduced feeding so the young owls are forced to start hunting themselves. People can listen for the begging calls at night in rural areas, or in Edmonton's river and creek valleys." She suggested searching for this video on YouTube to hear what their calls sound like: **bit.ly/fledgelingowlcall**

Lisa also mentioned that "some adult owls get a little confused about the seasonal change, the shorter days, and may call a bit more. Listen for their hooting, it sounds kind of like 'Who's awake? Me too!' Females have a higher pitch than males. It is best to listen for owls at sunset or just before sunrise." She suggested checking out this YouTube video to hear the difference between the female and male pitches: **bit.ly/owlhootingduet**

The great horned owl is a special owl as it has been designated Alberta's provincial bird. Hopefully as you are out on your evening or early morning nature walks, you will be able to hear this owl based on the tips Lisa has provided. Make sure to bring your binoculars to see if you can spot where the calls are coming from!

Another neat thing that we would like to mention is that in the springtime, around March and April, families can participate in something called the Alberta Nocturnal Owl Survey, in which volunteers help to listen for and count owls along roads in rural Alberta. Keep an eye out for the Winter issue of *Nature Alberta Magazine*, when Lisa, who happens to be the coordinator for the Alberta Nocturnal Owl Survey, will tell us more about the survey coming up in the spring of 2021. In the meantime, you can learn more about this neat opportunity at **birdscanada.org/bird-science/nocturnal-owl-survey/**

Thank you for helping out our wonderful bird friends! We hope you decorate your windows full of bird decals to help prevent bird window strikes. They also make great gifts for friends and family to put up in their windows too! ■

Great horned owl spotted on the Beaver Hills Biodiversity Trail.
MICHAEL ROSS

"WHO" wants to hear some OWL CALLS on YouTube?
bit.ly/fledgelingowlcall
bit.ly/owlhootingduet

Nature Kids

Ask Stuart

ZOE MACDOUGALL, NATURE KIDS PROGRAM COORDINATOR

Welcome to Ask Stuart, a regular feature in which Stuart, our Nature Kids mascot (who just happens to be a swift fox) responds to questions asked by kids across Alberta. From time to time Stuart will also ask local experts to help him answer these questions. If you have a question you would like to ask Stuart, send it along to our Nature Kids Program Coordinator at **naturekids@naturealberta.ca** and it may be featured in a future issue.

Q How do bears hibernate?

Zzz...

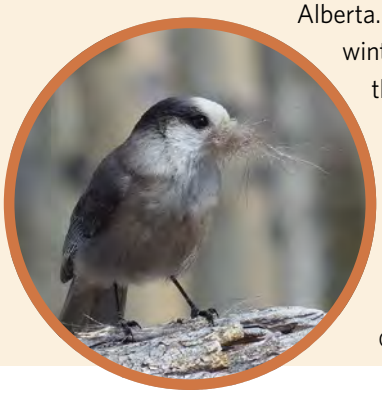
Bears spend the fall eating a LOT to fatten up for the winter. Once the weather gets colder around October or November, they look for a comfortable place to spend their hibernation. They usually look for somewhere that is small and protected from the wind and snow. Sometimes they have spots they have used before, but often they dig themselves a hole to make a new winter home. While they hibernate, they can lose from 10% to 30% of their body weight, which would be anywhere from 40 to 130 pounds (20 to 60 kg) for an average black bear. That's a lot of weight to drop! When they hibernate, their heart rate lowers from about 50 beats per minute to anywhere from 8 to 19 beats per minute. During their hibernation, bears don't eat, drink, or go to the bathroom at all! This is why they have to eat so much before going into hibernation — they won't eat again until the spring! ■

Information gathered from: http://www.albertawow.com/wildlife/Black_Bear/Black_Bear

Q Do all birds migrate in the fall?

Migration is the movement that birds do in the spring and fall every year. In the spring, they fly north to where their breeding grounds are to build nests and have babies. In the fall, birds fly south to warmer places to spend the winter where there is lots of food. There are over 400 bird species in Alberta. Not every species will migrate in the winter. Some birds are adapted to living through our dark, cold winters, which is an amazing feat considering many of them are so small! Black-capped chickadees are one of the most common birds you will see flying around in winter. They spend their time looking for insects and seeds and they survive the cold by lowering their body temperature to conserve energy. Another very common bird that sticks around all winter is the Canada jay. These birds have no problem staying in the cold winters and because they do not spend a lot of energy migrating, they are able to live quite a long time even though they are such small birds!

For a really great resource on birds that live in your area at a certain time of year, check out this wonderful Photo Identification Guide by Birds Canada. Just zoom in to where you are going bird watching, enter the date, and voila! You get a lovely photo guide to take on your nature walks: **birdscanada.org/apps/checklist/index.jsp** ■



Canada Jay in Kananaskis, High Noon Hills (Sheep River) carrying nesting material. JANE POTTERS

MEET A MEMBER CLUB

BY GEOFF HOLROYD

The Beaverhill Bird Observatory

Nature Alberta is proud to support a diverse range of naturalist organizations, representing people passionate about all things nature — birds and reptiles, plants and mushrooms, butterflies and beyond. In this issue, we feature the Beaverhill Bird Observatory, approaching 40 years of operation.

Located in Beaverhill Natural Area on the southeast corner of Beaverhill Lake, the Beaverhill Bird Observatory (BBO) has monitored bird migration and studied breeding birds for 37 years. While BBO started as a group of volunteers banding birds on weekends, we are now a full-fledged conservation organization nearly 700 members strong.

The Beaverhill Natural Area is open to the public, and BBO activities have attracted increasing interest in recent times. In prior seasons, dozens of visitors would stop by our lab daily, and last autumn up to 70 people arrived to watch our owl banding! The growing interest in our research and education programs is encouraging, but also means we are in need of renewing our facilities. Our 30-plus-year-old buildings are showing their age. In 2018 we were able to replace our oldest bunkhouse, and we are currently working on replacing our main building with a two-storey, solar-powered education and research centre.

BBO members have witnessed many changes over the decades. Beaverhill Lake dried up in the early 2000s, but is now refilling thanks to heavy rainfall. It is currently about 75% of its previous size. In the spring of 2020, the sounds of migrating waterfowl filled the air around the lake. Songbird populations are also changing. Despite an abundance of nest boxes, the number of nesting tree swallows has declined 25% and they are producing 10% fewer young than in the 1980s. We are catching fewer migrating songbirds, and some species weigh less than they did 20 years ago. As a member of the Canadian Migration Monitoring Network, our data are used to help document these changes, but with limited resources we are not able to determine why these changes are occurring.

With climate change and human activity placing pressures upon bird habitats, it is clear that more education about birds is badly needed. We have expanded our education program to include about 12 interns each year; these university students conduct projects under the watchful guidance of a volunteer mentor and document aspects of wildlife at BBO. We host an annual Young Ornithologist Workshop where up to 10 youths spend a week camping with our biologists, banding birds in the morning and exploring many other species with various experts through the afternoons. In winter, our BirdSmart outreach program gives presentations about bird-related topics to schoolchildren and other groups, accompanied by one of our live education owls. In the winter of 2019-20 we gave 254 presentations to 21,024 people, and the response was universally positive.

We encourage you to visit **beaverhillbirds.com** to learn more about BBO, and while there you can sign up as a lifetime member for only $10. The temporary closures and reduced visits of this year have resulted in some shortfalls in our building plans; if you are able to make a donation to help us maintain our facilities and continue our programs, it is greatly appreciated. Thank you to all who have supported BBO over the decades and continue to share in the joy of birds. ■

Dr. Geoff Holroyd is the Chair of the Beaverhill Bird Observatory. He can be reached at chair@beaverhillbirds.com

Book Review

REVIEW BY DOROTHY FABIJAN

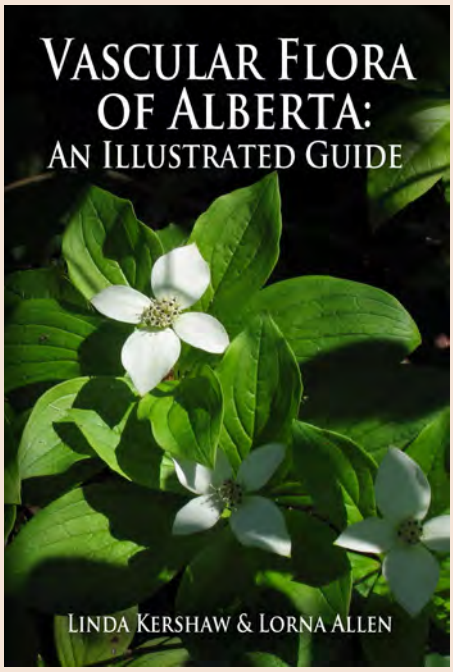
A lot has happened in botanical research and exploration since the publication of the revised *Flora of Alberta* (E.H. Moss, edited by J.G. Packer) in 1983. With the application of DNA analysis, our understanding of the relationships between species, genera, families, and even orders of plants has been greatly enhanced. The massive Flora of North America (FNA) project has also prompted a taxonomic review of all plants north of Mexico, resulting in many name changes. Along with these scientific advances, many organizations have been very busy building accessible online databases of herbarium collections and scientific nomenclature. In Alberta, industry and government have been scouring the province for biodiversity data, resulting in an increase of over 100 species recognized to exist in our province. Who can keep track of all of these goings-on?

Kershaw and Allen have done us the favour of distilling the Alberta species list and the FNA treatments down into a useable guide to the vascular flora. This has been a years-long project, which has included online publication (Alberta Native Plant Council website, anpc.ab.ca), test-driving selected keys in plant study group meetings, and incorporating the feedback. Their publication in book form provides the user with keys in non-technical language, illustrations within the keys, and illustrated terms.

The initial keys include the usual key to families but also separate keys for aquatic and woody plants. Keys to genera and species within those families follow, in phylogenetic order. All scientific names are as up to date as possible with many synonyms or previous names included. Where applicable, names are also appended by superscripts indicating rarity or introduced status within Alberta. Unfortunately, subspecific taxa are mostly excluded, except in such obvious cases as Petasites, where what were well-known species are now ranked as varieties. Common names are only given for genera.

Many people will appreciate the effort to reduce technical terminology, though it does make for some awkward phrasing, such as "branched flower cluster" rather than specific inflorescence type, "panicle." This term, and some others, are illustrated and defined in the glossary but not used in the text without the definition. The main body of the keys include illustrations of family-specific flower parts, which is very helpful, especially where technical terms are unavoidable, such as the flower parts of Poaceae (grass family). It's a fine balance.

I've used these keys exclusively over the past several months and found them to be very workable, especially with the illustrations on the sidebar of every page. A line drawing is worth a thousand words! Illustrations are understandably small, and unfortunately slightly pixelated, reducing their clarity. Ease of use could be improved by using family and/or genus names as headers at the top of each page. I have only a few minor complaints about couplets with only one character, such as mature fruit, to go on. This is a common issue in writing keys and not one that is easily overcome.



Vascular Flora of Alberta: An Illustrated Guide **by Linda Kershaw and Lorna Allen, 2020, 510 pp. Available at amazon.ca.**

I applaud the authors in accomplishing a much-needed new key to the flora of Alberta. The effort to make it more user-friendly by including illustrations and reducing technical terminology will be appreciated by many, I am sure. I recommend this volume as the most nomenclaturally up-to-date flora for Alberta and one that is quite easy for non-specialists to use. Don't get rid of your 1983 *Flora of Alberta* just yet, though; the species descriptions and the distribution maps remain invaluable. ■

Dorothy Fabijan has an M.Sc. in plant taxonomy and has been the Assistant Curator of the Vascular Plant Herbarium, Department of Biological Sciences, for the past 20 of her 35 years with the University of Alberta.

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