PRAIRIE BREEZE

THE LIVING PRAIRIE MUSEUM NEWSLETTER FALL 2017

INSIDE THIS ISSUE:

FALL INTERPRETIVE CENTRE HOURS

Sundays,
10 AM to 5 PM,
to October 8th

UPCOMING EVENTS

Volunteer Seed Collecting

See p. 4

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Fall Prairie Harvest

Our weekday public hours may have ended, but our work has not! The fall season brings seed harvesting at LPM. This time of year involves a lot of hands-on work, from collecting to processing to packaging.

We work hard to produce native seed throughout the season. LPM maintains native seed plots in St. Norbert, where rows of beautiful grasses and wildflowers grow, bloom, and produce a bounty of seed. Maintaining this site takes a lot of labour: weeding, watering, mowing, tilling, planting...it's a small scale farming operation! Much of this work is thanks to our seasonal staff, namely Green Team and Canada Summer Jobs students, who are supported through grants from the Friends. Their efforts mean that we're able to produce the native seed that is essential to our restorations.

In fall, we make the journey to our plots to hand-collect the seeds. Seeds mature at different rates depending on season and species, so we have to get the timing just right to get the most viable seed. It's so satisfying to hear the rain of prairie dropseed sprinkling into a bucket, or to get a handful of Canada wild rye off the stem. It's a wonderful process, and all of us feel closer to the prairie and its ancient vegetation after a good day at the plots.

Seed is brought back to the museum, dried, weighed, and bagged. Our native seeds are stored over the winter to be used in naturalizations within our city, or to increase diversity in prairie sites that need a little help.

Not all of the seeds we collect come from our plots. Seed is also harvested from the remnant prairies in our city. This is an important part of the process. It allows us to gather seed from uncommon species in order to propagate them. It also ensures fresh genetic material in our seed plots, as genetic diversity is key to producing hardy plants. It's important that this is done in a sustainable fashion, as we must leave seeds in the habitat to ensure the species is not lost due to overharvesting.

You have the opportunity to help with this process through volunteer seed collecting. We offer several sessions at different prairie sites in our area. You can keep some of what you collect to create a prairie of your own. If you're interested in registering, please see page 4 for details!

Heard it through the grape vine?

Our understanding of plant communication (phytocommunication) has come a long way. We have gone from maintaining that plants are unresponsive, uncommunicative organisms, to realizing that plants communicate in many ways. Plants warn of herbivore attacks, pathogens, and droughts. They can even recognize kin. How will this new understanding change our view of plants, and plant communities like tall grass prairie? This article is not a critique of the science of phytocommunication – then or now - but a review of its history in order to consider the interconnections on our prairie.

How Plants Communicate

* puffs of airborne chemicals, or VOCs (volatile organic compounds) for fast 911 signals;
* roots exchange soluble compounds in the soil rhizosphere;
* CMN (common mycelial networks), the fungal-root lacework in soil, for communication between plants and between species;
* may use sound beyond human hearing (ultrasonics).

1. VOCs

In the early 1980's the first "talking tree" studies were widely ridiculed. Pioneering botanists David Rhoades, Lynn Erckmann, and Gordon Orians from University of Washington found that when *Malacosoma disstria* (forest tent caterpillars) attacked *Salix sitchensis* (Sitka Willow), the trees altered their leaf chemistry by increasing terpenes and tannins to make their leaves less palatable and nutritious. Within hours, nearby but unaffected *Salix* made the same defensive response. Later, Jack Shultz and Ian Baldwin from Dartmouth College identified that odorous chemicals - VOCs - were produced by herbivore-damaged seedlings when warning of danger.

Most ecologists discredited this plant communication for a decade. Results were hard to replicate and harder to explain. If the emitting tree did not benefit from the communication, and if releasing VOCs cost the plant energy, why would such a function persist? In 2000, Richard Karban, University of California, Davis, designed more careful experiments showing that *Nicotiana rustica* (wild tobacco) grown adjacent to *Artemesia tridentata* (sagebrush) became resistant to herbivores through VOCs released by the *Artemesia* whose leaves had been clipped. Other researchers reported similar VOC-induced responses, both intra and inter species. Currently, VOC-based plant communication is well described. A 2013 literature review identified 48 studies where plant defenses increased when neighbours were damaged.

Could VOC communication be more eavesdropping than sentry-duty? In sage, lima beans, and poplars, VOCs from the damaged area signal the plant to coordinate its own physiological responses. The within-plant signal leaks out and is picked up by other species. Research has shown that plants that receive VOC communication repel herbivores and parasites, which improves survival and reproduction.

2. Soluble compounds

The soil rhizosphere crackles with communication. Ariel Novoplansky of Ben-Gurion University of the Negev discovered that *Pisum sativum* (pea plants) eavesdropped on their neighbours through their root systems during drought stress. He found that 15 minutes after droughting a plant, the next plant in line responded by closing its stomata (tiny pores used in gas exchange) even though it was not experiencing drought. This response continued through other plants for the next hour.

Heard it through the grape vine?

Researchers have since extracted and applied the soluble chemicals released by droughted plants to non-droughted plants, and the drought response is consistent. Is it ABA (abscisic acid), a hormone involved in osmotic and drought stress? Too soon to say, but researchers are currently focused on metabolomic studies of root exudates.

Susan Dudley of McMaster University, Hamilton, showed that *Cakile maritima* (sea rocket), a beach weed common on the shores of the Great Lakes, sensed whether it was growing among siblings or unrelated plants of the same species. When growing among strangers, it grew more roots to grab water and nutrients. Root growth was reduced when growing next to kin. Researchers have demonstrated kin recognition in other species as well, where leaf and stem growth was reduced to avoid shading siblings. Ongoing research by Dudley showed *Arabidoposis*' kin recognition depended on soluble compounds from roots.

3. CMN

Researchers are investigating CMN, the labyrinth of fungal filaments and plant roots whose mutualist relationship works like Craig's list: a biological marketplace for trading plant sugars for much-needed phosphorus and nitrogen. We know CMN helps recycle water and nutrients, but research from South China Agricultural University in Guangzhou shows interplant connections via CMNs also leads to increased leaf blight resistance in tomatoes. Healthy plants connected to tomatoes that had previously been infected with leaf blight developed greater resistance. University of Scotland - Aberdeen researchers Zdenka Babikova and David Johnson blocked VOC communication to show that plants with CMNs were able to respond to aphid infestation by becoming repellent to aphids and attractive to the parasitic wasps that use aphids as hosts.

4. Phytoacoustics

Finally, there is interesting research on phytoacoustics from University of Western Australia, Perth. Monica Gagliano suggests that plants may be communicating with each other using sound, but her data are being met with skepticism. Her 2012 experiments showed chili seedlings growing next to fennel germinated faster than those next to other chillies, despite blocking all known channels of communication except the ultrasonics that she detected. However, fennel is known to release allopathic chemicals that inhibit growth in other plants, so she suspects the rapid germination of the chili may be a compensatory strategy.

Gagliano cited bioacoustics research where young corn (*Zea* spp.) plants grown in water make clicking sounds. When sounds in the same frequency range were played back to the roots, they bent towards the source. Her most recent research showed that corn growing in an inverted Y-maze moved toward isolated frequencies of soil water, even if there was no water present. However, when both moisture and acoustic cues were available, roots preferentially used soil moisture over acoustics. Might acoustic gradients assist water detection at a distance, while moisture gradients help reach the water target more accurately? Gagliano admits she does not know how they produce or detect sounds.

This is nascent research, and there will be dead ends and corrections. Do we need to rethink the ecological role of communication on the prairie and envision a more dynamic plant world than ever imagined? Ian Baldwin from Max Planck Institute urges that rather than anthropomorphize plants, we might do better by phytomorphizing ourselves. Maybe we should listen to some Marvin Gaye while learning to think like a New England Aster.

In Memory

We're sad to announce the passing of our resident tiger salamander, Steve. We worked hard with the veterinarians at the Assiniboine Park Zoo to make his final days as long and comfortable as possible. We thank the Zoo staff for their compassion.
Steve will continue to contribute to education: a tissue sample will be analysed to help researchers better understand the genetics of his species.

Volunteers Needed

See our seed collecting events for details!

MUSEUM STAFF

Sarah Semmler
Lois Grieger
Kelly Ferrand

Thank you for receiving your newsletter electronically.

UPCOMING EVENTS

Volunteer Seed Collecting

Join us for the opportunity to collect prairie seeds. Seed collecting is very important for our propagation efforts - it ensures that we maintain genetic diversity in our restorations and seed plots. This is also a great opportunity to start a little prairie of your own, as you have the option of keeping a portion of the seeds you collect.

We review sustainable harvesting practices, and help you learn some target species.

Please call to register, and remember to leave a phone number in case plans change due to weather.

Sunday, September 17, 11:00 AM - Living Prairie Museum. Meet in the interpretive centre.

Tuesday, September 19, 6:30 PM - Living Prairie Museum. Meet in the interpretive centre.

Wednesday, September 27, 6:30 PM - Little Mountain Park. Meet in the north parking lot in the middle of Farmer Ave.

Thursday, October 5, 6:30 PM - Assiniboine Forest. Meet in the lot at Chalfont and Grant.

Tuesday, October 10, 6:30 PM - Little Mountain Park. Meet in the north parking lot in the middle of Farmer Ave

Winter Events

Our Winter Speaker Series and Snowshoe Sundays will return in January 2018! Keep an eye on our web pages and social media for updates on speakers and snowshoeing.

Winnipeg

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