IOWA NATIVE PLANT SOCIETY

Erythronium

Newsletter of the Iowa Native Plant Society, vol. 28 no. 1 February 2023

Ladies'-tresses

by Kara Grady

Stepping out of my car, a gust of wind smacks me in the face. Despite the 70° temps, I'm bundled up in leggings and a sweater, praying that the remnant I'm about to visit isn't overgrown with the sticky seed of Illinois tick trefoil. That would be just my luck, to spend another week picking seed off my clothes as I search for another fall wildflower. Slinging my water bottle carrier over my shoulder, I set off down the trail.

I'm not visiting this remnant during my precious weekend time for just any flower either. My supervisor, Bill Johnson, had mentioned that he and our new co-workers had come across a ladies'-tresses orchid during their trip to what we call "Root Cellar". Part of a homestead that used to slope down to Brushy Creek, the pioneers' root cellar is now immersed in several hundred feet of water, but the prairie was saved and moved up the hill to form a new remnant. With the confidence of one who has been here before, I stroll along the dirt path, through some trees, and at a certain bend, plunge into the grasses.

"Spiranthes magnicamporum Great Plains Ladies' Tresses" by gmayfield10, CC BY-SA 2.0

It doesn't take long for me to find another fall flower Bill had mentioned: downy gentian, whose deep blue-purple color pops against the dusky browns of autumn grass. I bend down to snap photos, which blur with the force of the wind. Then I begin the ankle-twisting trek down to the water.

I wonder if this is how Ada Hayden felt during her own trips to find Iowa's secret treasures: full of wanderlust and the thrill of discovery, delighting in the big blue sky and the shimmer of the nearby lake. Yet it doesn't take much time of fruitless searching for me to turn to something Ada Hayden certainly didn't have: my phone. Scrolling to Bill's number, I call twice before the static crackle of his voice is snatched away by poor reception. Resorting to texting, he points me in the direction of the upper hillside, where the asters are still in full bloom and the goldenrod is beginning to set seed. Hiking back to the top, I glance around with the growing pangs of despair. Root Cellar Prairie isn't a big remnant by any means, but it would still take several hours to cover the entire upper slope. And what did Bill mean by that anyway? Several portions of Root Cellar could be defined as "upper hillside"!

In the end, I nearly step on it. A tiny, delicate white orchid with flowers shaped like flutes, some of which are already beginning to wither at the edges. I snap photos that the wind blurs but I'm too happy to care.

The one thing I forget to do is sniff. And when I return a week later to do just that, the ladies'-tresses have disappeared for good. So instead, I crack open my bottle of vanilla extract and breathe deeply.

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We would like to hear from you --
Questions or comments may be sent by email to any of the Board members at the addresses above or to the new INPS email account:
iowanativeplantsociety@gmail.com

Leaves of the President's Notebook

Greetings, INPS members and friends! What a year it has been! We have experienced many highs and lows. Most of the state suffered from drought, again, and many counties are desperately in need of moisture. We also lost close friends within this great community. Our hearts are deeply saddened by the news, but we are grateful for their friendship and the contributions they made to Iowa conservation in their own unique ways. Their work will have a lasting impact and we will continue to embrace their efforts and the memories we all share. Despite these challenges, we do have much to celebrate.

It is with great joy we can report we hosted five field trips this past year. We also co-sponsored the monthly Doolittle Prairie Walks throughout the summer. Gathering with members and friends in woodlands, prairies, and forests to explore native flora is the heart of what we do. Thank you to Vice President, Tom Scherer, who organizes our field trips and to our field trip leaders! We cannot offer these events without your help. We are amid planning more educational opportunities for the upcoming months. Stay tuned!

More exciting news includes launching a new website! Lael Neal, Liz Aderhold, and I collaborated for several months to revitalize our web presence and make information more accessible and digestible. Please take a moment and check it out https://www.iowanativeplants.org/! A big thank you to Lael and Liz for their time and energy in this grand undertaking!

On a personal note, the last eight months have been very difficult for me. I feel like the heavy blows of life keep testing my endurance and strength. In early June I unexpectedly lost my mom. This loss forced me to take a pause from my volunteer duties (for those who know me well, perhaps this was not necessarily a bad thing) and to really examine what is important in life and what is worth my time. Time is a precious thing and volunteerism can be overlooked and under rated. Our efforts are not often recognized and it's hard to know what all is put in to make field trips, newsletters, small grants, etc. possible unless one is in the thick of it. I cannot express how grateful I am for the INPS team. Even as I had to take a temporary step back, I did not worry. INPS is a well-oiled machine that was primed before I came into the picture. Although I hold the title of "president", it is the collaboration of all of us that keeps everything running. I will continue to take the time to do my best alongside the team to educate, encourage, and inspire others on all things native plants. This work is important and worth the time. The next time you see an INPS board member, be sure to give them praise and acknowledgement. They deserve it!

All the best,

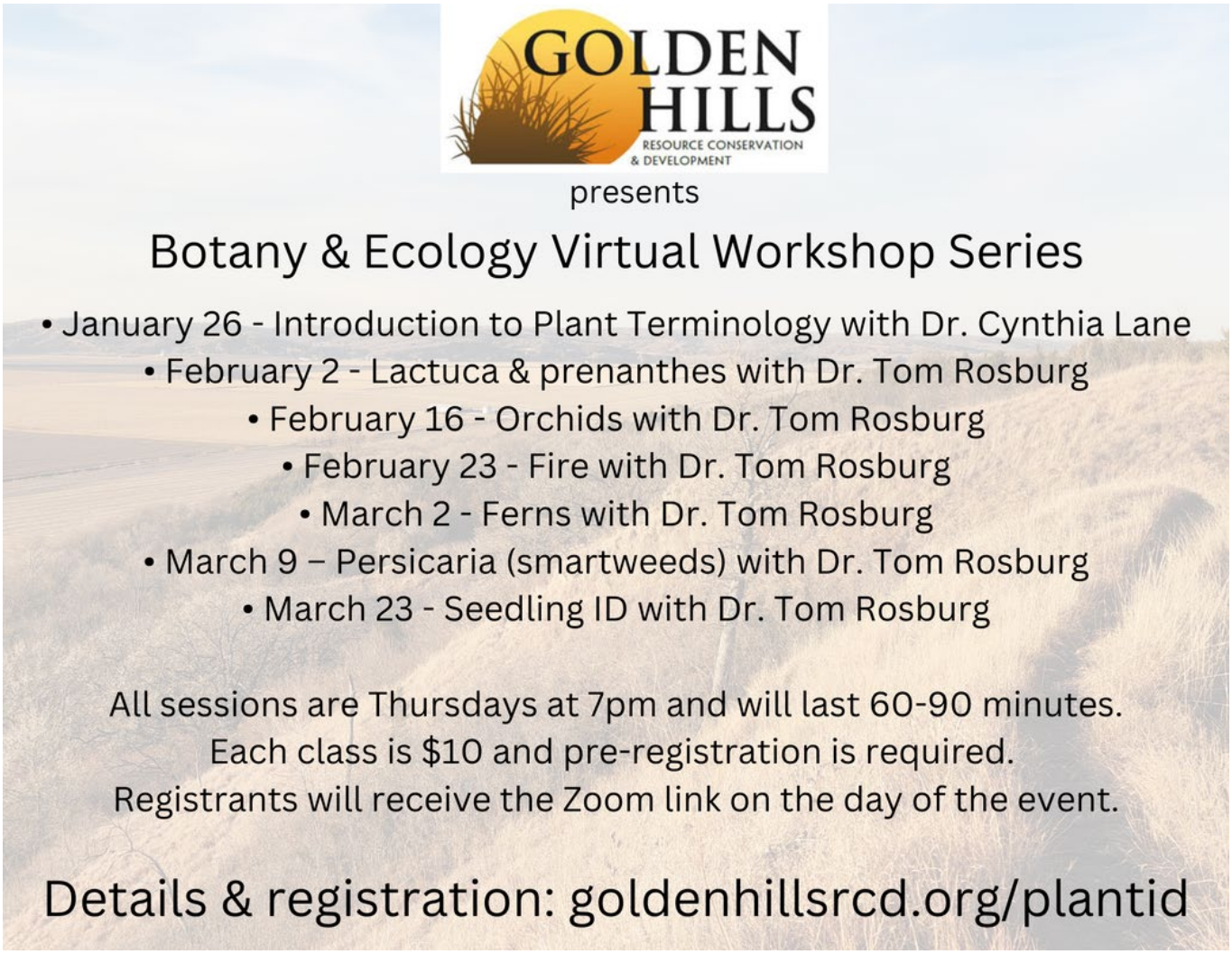
Sarah Nizzi

Upcoming Events and Activities

- February 16 - Native Orchid ID with Dr. Tom Rosburg
- February 23 - Fire Ecology with Dr. Tom Rosburg
- March 2 - Native Fern ID with Dr. Tom Rosburg
- March 9 – Persicaria (smartweeds) ID with Dr. Tom Rosburg
- March 23 - Native Seedling ID with Dr. Tom Rosburg

All sessions are Thursdays at 7pm and will last about an hour. Each class is $10 and pre-registration is required. Registrants will receive the Zoom link on the day of the event.

Please note that classes are recorded and posted online afterwards. The class fee is for the live event with Q&A, and registration includes the class handout/slides/resources.



IPN Annual Winter Seminar

Saturday, February 18, 2023
Doors open 9 am
"Prairies in a Changing Landscape"
Event 10:00 am – 5:00pm
Drake University Parents Hall
2875 University Ave, Des Moines, IA 50311
or Zoom

Our Mission: To learn about, teach about, enjoy, and protect Iowa's prairie heritage.
A network for education, advocacy, and support for Iowa's prairie heritage.

The 2023 Iowa Prairie Network Winter Seminar will be held at Drake University's Olmsted Center in Des Moines on Saturday, February 18, 2023. *The meeting is open to the public with a suggested free will donation of $10.* Donations will be accepted at the door, but can also be given ahead of time using the button below. Registration for in person registration will remain open until February 10, 2023. Registration for virtual attendance will remain open until 5:00pm on February 17, 2023. Your support is greatly appreciated!

If you are interested in having an exhibitor/vendor booth at this event, please contact Marlene Ehresman at marlene@iowawildlifecenter.org for more information.

Silent auction proceeds will support student scholarships to attend the upcoming North American Prairie Conference. To help make this fundraiser a success, please consider donating an item to contribute! If you would like to donate an item for the silent auction please contact Carman Rosburg at coneflwr@netins.net or 515-290-7384. Items for the auction may be brought to the seminar site starting at 8:00am on the 18th.

This event is wheelchair accessible with handicap parking and elevator access.

We want to make this event as inclusive and accessible as possible. If you have any questions or accommodation requests, please email us at iowaprairienetworkorg@gmail.com.
A recording of the zoom presentation will be edited and shared on Youtube following the event.

To protect yourself and those around you, masks are encouraged but not required. Masks and hand sanitizer will be on hand and available on site.

Agenda

10am to 11:20 am 3 concurrent morning sessions

Only option C will be available for viewers joining on Zoom.

A - **Seedling Identification -** *Room 310/311*
with Jon Judson, Diversity Farms & Tom Rosburg, Professor, Dept of Biology, Drake University

B - **Tackling Plant Blindness in Young Minds -** *Room 312/313*
with Kenny Slocum, Resource Manager & Naturalist, Clayton County Conservation & Tony Vorwald, Naturalist, Jackson County Conservation

C - **Prairie Strips and Other Practices for Landowners -** *North Parents Hall + Zoom*
with Tim Youngquist, STRIPS Farmer Liaison, Iowa State Extension & Tabitha Panas, Farm Bill Biologist, Pheasants Forever

11:20 to 12:00 Lunch break

12:00 to 5:00 Afternoon sessions

All afternoon sessions will be held in North Parents Hall.

All afternoon presentations will be available virtually on Zoom.

12:00 - 12:10 **Welcome Address**, Tabitha Panas, IPN President

12:10 - 12:15 Silent Auction Fundraising Recipient: North American Prairie Conference Student Scholarships, Jon Judson, IPN Board Member, Diversity Farms

12:15 - 1:00 **Prescribed Fire and Climate Change,** Kody Wohlers, Loess Hills Stewardship Director, Iowa Natural Heritage Foundation

1:00 - 1:30 **Break** - visit silent auction + vendors

1:30 - 1:45 **Bur Oak Land Trust Update, Jason Taylor**, Executive Director

1:45 - 2:30 **Prairies and Landscape Change: Notes from the Underground,** Dr. Marshall McDaniel, Associate Professor, Department of Agronomy, Iowa State University

2:30 - 3:00 **Break** - visit silent auction + vendors

3:00 - 3:45 **Grazing and Prairie Diversity,** Scott Moats, Director of Stewardship, The Nature Conservancy

3:45 - 4:15 **Break** - last chance to visit silent auction + vendors

Silent Auction closes at the end of break!

4:15 - 4:55 **Tending Iowa's Land: Visions for a More Resilient Future,** Connie Mutel, Editor; Dr. Lisa Schulte Moore, Professor, Department of Natural Resource Ecology and Management, Iowa State University; Dr. Larry Weber, Professor, Civil and Environmental Engineering, University of Iowa; Dr. Thomas Rosburg, Professor, Department of Biology, Drake University

4:55 - 5:00 **Closing remarks**, Tabitha Panas, IPN President

5:00 Pick up auction items and check out

2023 North American Prairie Conference: Prairie Conservation in a Changing World, June 26 - 29, central Iowa

http://www.northamericanprairie.org/

The North American Prairie Conference (NAPC) is America's oldest and most celebrated native grassland conference. It has been held since 1968, roughly every two years.

CALL FOR ABSTRACTS

The 2023 NAPC Planning Committee invites persons with all levels of prairie interest and expertise to submit an abstract to present either an oral paper or a poster. We welcome undergraduate and graduate students, professional and citizen scientists, prairie landowners and professional land managers, policymakers, and prairie authors, artists and enthusiasts.

Oral presentations

There are eight concurrent sessions in the program, each with two sessions for oral papers. These will be held on Monday, Wednesday and Thursday. Presentations should be NO MORE than 15 minutes long, with 5 minutes allowed for questions. All presenters will be required to adhere to this time limit.

Poster presentations

Posters will be divided into two sessions, each 90 minutes long, on Monday and Wednesday evenings. Poster presenters are required to be present at their poster during ONE of those sessions. Presenters of odd numbered posters will be available to answer questions on Monday, presenters of even numbered posters will answer questions on Wednesday. The maximum size for posters is 46 inches long by 36 inches wide (tall).

All presenters are required to register for the conference. Abstracts are due by May 15, 2023. For questions about submitting an abstract, contact Dr. Thomas Rosburg at thomas.rosburg@drake.edu

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Loess Hills Prairie Seminar
Monona County Conservation

LHPS 2023: Head for the Hills!

Save the date for June 2-4, 2023 for the 46th Annual Loess Hills Prairie Seminar. This year's theme is "Head for the Hills." Check back regularly for updates, and follow us on social media to stay connected to our community: https://www.loesshillsprairieseminar.com/

If you have any questions or would like to participate in LHPS as a speaker, volunteer, or in another role, please email: mccbnat@mononacounty.org

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More events will be added to the INPS website calendar as new opportunities become available, including additional information about events already scheduled – www.iowanativeplants.org/calendar.php. For events that are some distance in the future, confirm that the information provided here is correct by visiting the INPS Calendar of Events at the link above or visit the website provided in the event description.

Iowa Society of American Foresters Frudden Award Presented to John Pearson

Our congratulations (belated) to Dr. John Pearson as he was honored in fall 2021 with the Frudden Award, presented by the Iowa Society of American Foresters.

In the dedication speech delivered by Iowa SAF President Jessica Flatt, she notes: "John has taught many a forester to look deeper into the woods: under the leaves, on the rocks, and along the forest floor. He has shown many of us how to appreciate the forest in a more meaningful way. Whether he is supporting forest management through the Natural Areas Inventory process, attending field days to teach the public about the flora in our woodlands, or volunteering with Project AWARE, John is always open-minded, patient, and kind. So thank you, John, for your continued support of our forestry professionals, for sharing your knowledge with us and the public, and for teaching us to explore and better appreciate the forests where we work and play."

A Mother's Love: The Race to Provide

by Jessica Butters, Prairie Rivers of Iowa pollinator specialist

A speck of sunlight warmed the face of a mother, causing her to wake and stand up. She took a few steps toward the sunlight, letting it warm her cold legs in her tunnel. Looking back at the wall of her nursery, she knew she had limited time to finish her work. Behind that wall was a row of rooms, one for each of her eggs. Each nursery room was provisioned with pollen and walled off from the others, providing a safe place to hatch, overwinter, and hopefully emerge next year. Her antennae started twitching excitedly. She tried beating her wings; they buzzed. She was warm and ready for another day's work.

She cautiously peeped over the lip of her nest entrance. She was a metallic green sweat bee, and just last week she watched as a parasitic bee invaded one of her neighbors' nests, ending the hope of a future generation from that mother. To keep all her efforts from being in vain, she had to leave and enter her nest in complete secrecy. She scanned the area around her, checking for someone perched on the tops of rocks or hidden in the shaded spaces between grass stems. So far so clear. She stepped out of her nest, allowing the sun to warm her entire body. Looking around once more, and seeing no sign of threat, she zipped off to start her chores.

Gathering pollen was her favorite chore. She had already started a new nursery cell; all there was left to do was to lay an egg and provide a provision of food. Using the sun as a compass, she navigated to a large patch of gold that she had seen yesterday. The yellow rays of one unoccupied flower caught her eye, and she flew into its center, landing on a blanket of brown bristles topped with yellow tufts of pollen. The buzzing of other insects at neighboring flowers reverberated in the air around her, and caused the flower to tremble even more in the breeze. The air was slowly growing cooler each day. It was taking her longer and longer to warm up enough to fly in the mornings. The frantic buzzing of other insects confirmed a sense of fear she didn't quite understand. She sensed that she must hurry.

Metallic green sweat bee gathering pollen

After a while, the little sweat bee had as much pollen as she could carry. Pushing off the sunflower, she flew back toward her nest, only pausing once for a break on a stand of purple flowers. Back on the ground, she felt around with her antennae until she found her own nest entrance. She peered inside her dark nest. All was quiet, just how she left it. She

glanced behind her. No one had seen her; her family was safe.

Metallic green sweat bee locating her nest

As she pulled pollen off her legs and rolled it into a loaf, she had a sense that this may be the last nest she would finish. She felt much more tired compared to a few weeks ago. She was particularly proud of this nest: it was in a well-hidden location, its walls were smooth, and she had a good mix of pollen from different flowers within each loaf she had made for her children. Although she would never get to meet them, she was glad they would have all the nutrition they would need to start a successful life. She hoped they would find the yellow and purple flower patches. She grew more tired. Maybe one more pollen collecting trip before she turned in for the day.

Native Plant Spotlight – Snow-on-the-mountain, *Euphorbia marginata*

by Thomas Rosburg, Drake University

There are many reasons you might give for a plant being one of your favorite species. It might be the beauty or grandeur of a flower, the way it attracts and interacts with pollinators, or the cunning it exhibits to thwart wannabe herbivores. Then there is also the appeal emanating from a unique common name. You know, the fun there is in saying the name, in part to see the reaction of other people. Consider a few of my favorites like "cowboy's delight," a common name for the Great Plains species *Sphaeralcea coccinea* (Malvaceae), also known as scarlet globemallow. Or how about "obe-wan-conobea," the out-of-this-world Star Wars name (a variant of Obi-Wan Kenobi, the Jedi Master and mentor for Luke Skywalker) for *Leucospora* (formerly *Conobea*) *multifida* (Plantaginaceae). A more down to earth name is narrow-leaf paleseed, but who wants to use it? Butter-and-eggs comes to mind, the common name for the non-native *Linaria vulgaris* (Plantaginaceae). And I bet many are familiar with the common name for the indestructible houseplant *Sansevieria trifasciata* – mother-in-law's-tongue. Add to this list an especially favorite plant name of mine, in part because of its association with the Loess Hills, snow-on-the-mountain, the most frequently used common name for *Euphorbia marginata*. Other common names are smoke-on-the-prairie, mountain snow spurge, and variegated spurge.

Fig. 1. Euphorbia marginata *photo by Thomas Rosburg*

While it's possible you might find snow-on-the-mountain on sites in the southwestern ⅔ of Iowa (it's absent north and east of a line from Kossuth County to Clinton County), your best chances by far are in the Loess Hills land-form. Its real home is in the Great Plains, but it likes the Loess Hills, too, because of the dry and infertile microenvironments present. There are scattered populations east of the Mississippi River from southern Wisconsin to Massachusetts, and south to Florida and the Gulf coast. There are also a few populations in California. But all of these populations are considered adventive, or non-native to those states. No doubt this unsavory behavior is not of the plant's design, but rather due to widespread cultivation in ornamental flower beds. Its attraction is not the flowers, but rather the upper leaves. The species epithet "marginata" refers to the striking white margins present on the upper, most

distal leaves (Figure 1). I've seen some cultivars with upper leaves that are nearly entirely snow-white. The genus name, *Euphorbia*, which was published by Linnaeus in his 1753 *Species Plantarum*, is derived from Euphorbus, a Greek physician to King Juba II of Mauretania (ca. 50 B.C. to 19 A.D.).

Euphorbiaceae (spurge family) is an evolutionary and ecologically successful family. There are over 220 genera and 6,500 species worldwide, and about 24 genera and 260 species in North America. The family is most diverse in tropical America and Africa, but its diversity extends into subtropical regions and to a lesser extent into temperate latitudes. Euphorbiaceae are extremely diverse morphologically and therefore difficult to characterize. The best diagnostic features include: 1) an herbaceous growth form, 2) latex is often present, 3) unisexual flowers (monecious or dioecious), 4) apetalous flowers (no petals), and 5) fruit is a schizocarpic capsule (capsule splits apart into the carpel units that formed the ovary).

The genus *Euphorbia* is among the two or three most species rich flowering plant genera worldwide. It's also the center of the family's astonishing morphological variation, with species ranging from tiny herbaceous ephemerals (microplants) to shrubs and small trees to cactus-like succulents. *Euphorbia* are the poster child for teaching the concepts in convergent evolution. Most *Euphorbia* in North America, and all 21 species present in Iowa, are herbs. Iowa's species are primarily native (15, 71.4%) and either annuals or biennials (18, 85.7%).

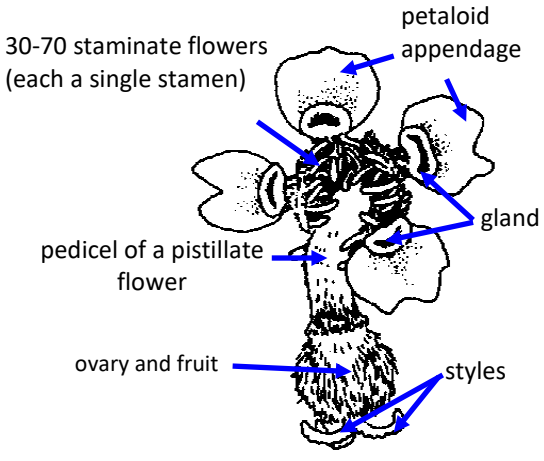

Fig. 2. Cyathium of Euphorbia marginata *(Murrell 2010)*

Euphorbias are characterized by very reduced flowers arranged in a unique inflorescence called a cyathium (Figure 2). The base of the cyathium is a cup-like involucre made from 4 or 5 fused bracts. The tips of the bracts are distinct (unfused) and develop a pair of glands that secrete nectar. The glands from adjacent bracts are usually fused together, making 4 or 5 visible glands. Often the glands bear appendages that resemble small petals. The glands and petaloid appendages are present on the rim of the cup-like involucre. Within the cup are many staminate (male) flowers, up to as many as 80 depending on the species, each represented by a single stamen. There is no perianth (sepals and petals), only a single stamen with a tiny bract at its base. The male flowers are aggregated together in groups (technically cymes); the number of cymes is equal to the number of glands. In the center of the cyathium is a single pistillate (female) flower, consisting of a compound, 3-carpellate pistil. There is no perianth, except in a few species where a few sepals are present. *Euphorbia* flowers are reduced as much as possible, to a single structure that determines their gender and function.

The cyathia are very small, which makes keying a species all the more difficult. Those of *Euphorbia marginata* have an involucre about 2.8 mm long by 1.8 mm wide. The petal-like appendages average 2.1 mm long and 2.4 mm wide. The entire inflorescence, with its calyx-like involucre and its corolla-like appendages, looks like a single, tiny, perfect flower (Figure 3). The term pseudanthium is appropriately used to describe the *Euphorbia* cyathium as a "false flower". In fact, it is so convincing that early botanists, including Linnaeus, were fooled into thinking the cyathium was a single bisexual flower.

Fig. 3. Euphorbia marginata *photo by Thomas Rosburg*

The nectar-producing glands attract many insects. A pollination study of three perennial *Euphorbia* species that inhabit desert grasslands in the American

Southwest found 221 insect species visiting the cyathia of the three species. The mixture of flies, wasps, beetles and bees observed was taxonomically, morphologically and biologically diverse. The insects ranged in size from tiny flies to wasps over 1 cm long. They were equally varied in their feeding ecology, displaying a wide variety of mouthparts and variation in the extent of their dependence on *Euphorbia* for food. The bees were among the most diverse floral visitors observed for these spurges. At least 10 bee species noted are obligately dependent (oligolectic) on *Euphorbia*, while others are polylectic (generalists). Other insects such as the ants, wasps and most of the flies observed are also generalists and utilize a number of plant species for nectar. Some insects take sap from floral structures rather than ingest pollen or nectar.

A pollination study of five *Euphorbia* species in Austria concluded that while all species had similar generalist pollination systems, the three more showy species attracted significantly more insects than the two inconspicuous species. The inconspicuous species, with greenish cyathia barely distinguishable from vegetative parts, were typically independent of insect visits for reproduction. In *Euphorbia*, the degree of entomophily seems positively correlated with showiness and size of attractive and rewarding organs. Among *Euphorbia*, snow-on-the-mountain certainly falls into the category of showy and attractive. It likely functions as an important pollinator plant and hosts some oligolectic insect species. The "snow" in its name comes from the bright white margins on the upper leaves that form a bouquet that screams "come here" to pollinators. Bees are especially attracted to white, yellow, or blue petals and to UV light. *Euphorbia marginata* is most closely related to *Euphorbia bicolor*, an annual species that inhabits prairies and grasslands in Texas, Oklahoma, Arkansas and Louisiana. Although we see *E. bicolor* with broad white leaf margins and white appendages on the cyathium glands, UV-seeing insects perceive them much differently (Figure 4). Reflection of UV light by plant flowers has evolved as a way to create contrast in what the pollinator sees and draw attention to the location of nectar and pollen by making it the center of the contrast.

Fig. 4. Euphorbia bicolor *(snow-on-the-prairie) in visible light (left) and UV light (right). Gaskill 2021, Photos by Michelle Wong*

Snow-on-the-mountain is an annual species; its life history strategy is to colonize disturbances and inhabit early successional communities. During my 4 years of field research on loess hill prairies, I found that snow-on-the-mountain occurs most often in what I identified as the bluff midgrass prairie and dry midgrass prairie. The bluff midgrass prairie occurs on the very steep bluffs that rise up along the eastern edge of the Missouri River floodplain. The bluff line delineates the western edge of the Loess Hills and has slope angles of 45° to 55°. The dry midgrass prairie occurs both on and off the bluff line on south, southwest and west facing slopes with slope angles of 30° to 40°. The steepness of these slopes causes slumping of the loess soil, especially when it is saturated. These mini-landslides create natural disturbances that favor snow-on-the-mountain and other ruderal species. Another natural disturbance that snow-on-the-mountain likes is overgrazing.

Snow-on-the-mountain exhibits some adaptive strategies to help it in these disturbance environments. Its milky latex is produced and stored by cells called laticifers that form a network of tubes through the plant. *Euphorbia* latex contains many chemicals in various complex formulations, but terpenoids are the most abundant and well known. Over 160 different terpenoids have been identified from 19 species. Other chemicals include phenolic compounds, alkaloids, saponins and flavonoids; the role these have on the effects of *Euphorbia* latex is less understood. It is well known that contact with the latex can cause severe dermatitis much like poison ivy. The National Capital

Poison Center strongly advises avoidance of any contact with the latex, as severe consequences can occur. For example, contact with the eyes can result in blindness. Some field guides report the dermatitis is so severe that latex from snow-on-the-mountain has been used by Texan ranchers to brand their cattle. Plant chemicals are usually designed to deter herbivory, which is undoubtedly the function of *Euphorbia* latex. The website Plants Toxic to Animals (University of Illinois, Urbana) reports that "approximately 3 kg of *E. marginata* fed to cattle produced severe scours and emaciation." We can easily observe the effectiveness of *Euphorbia* latex in protecting spurges when we see the abundance of snow-on-the-mountain in overgrazed pastures.

There is another strategy in the use of disturbances by snow-on-the-mountain. Extracts of three species of *Euphorbia*, including snow-on-the-mountain, were found to inhibit the growth of the nitrogen-fixing bacteria *Rhizobium* and *Azotobacter*. Many phytochemical studies of *Euphorbia* latex report that most species exhibit moderate to strong antibacterial effects. By inhibiting nitrogen-fixing bacteria, the plants can maintain the low fertility present in the early seral stages of primary succession. They effectively slow the process of succession and increase the time the site is in an early successional stage, which is beneficial for ruderal, early successional plants like many *Euphorbia* species. This is also a good strategy for species that live in ecosystems with naturally low soil fertility; or ecosystems characterized by environmental stress – ecosystems like the Loess Hills.

Like other *Euphorbia* species, snow-on-the-mountain utilizes autochory for seed dispersal. Autochory is when seeds are ejected by mechanical force from the fruit. Generally, this is accomplished by the elastic contractions of fruit tissues. Dispersal distances of up to 9 feet have been reported. The seeds of snow-on-the-mountain, unlike some other spurges, do not have a caruncle, which is a fleshy growth or appendage from the seed coat near the micropyle. It attracts ants and facilitates myrmecochory, the dispersal of seed or fruit by ants. Although secondary seed dispersal is not accomplished by ants in snow-on-the-mountain, it may be achieved by ectozoochory via seed sticking to mud on animals.

So how did snow-on-the-mountain get its name? One can only guess. Common names depend a lot on where you are. But I have seen in the Loess Hills, patches of white high up on a steep slope that look like, with a little imagination, a bit of snow, perhaps a snow drift, tucked into a fold or dip near the top of a mountain. A patch of *Euphorbia marginata* can indeed look like snow-on-the-mountain.

Information Sources

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Botanical Study of Iowa In the 21st Century: Making the Case For the County Inventory

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About three decades ago, when I began what has become a long-term (1991-present) study of the Story County flora, a fellow botanist while shaking his head expressed his opinion of the task in front of me: "Story County? Ugh, what a botanical desert!" I'll withhold comment on that statement and let you draw your own conclusions after reading this article. However, I will say that the results of this long-term (30+ year) floristic study of Story County, a collaborative study with significant contributions from six botanists (Deborah Q. Lewis, Richard O. Pope, Thomas R. Rosburg, Jimmie D. Thompson, Mark P. Widrlechner, and me), are surprising and provide compelling evidence that county flora inventories are worthwhile endeavors for botanists to undertake in the 21st century.

History

The flora of Story County has received much attention from botanists over the years. This is no doubt due to the presence of Iowa State University, a magnet for botanists for more than 150 years. Between 1870 and the end of the 19th century, these included Charles E. Bessey (founder of the ISU Botany Department), Albert S. Hitchcock (local flora, grass taxonomy), Louis Pammel (Iowa flora), Carleton R. Ball (willow taxonomy), and George Washington Carver (local flora, agricultural scientist and inventor). By the end of the 19th century, two floras of Ames (Bessey 1871, Hitchcock 1890) and a flora of Story County (Pammel 1898) had been published. Botanical study of Story County continued through the first 50 years of the 20th century by Louis Pammel and other prominent botanists, including students William A. Weber (Colorado flora) and Jacob P. Anderson (Alaska flora), and especially Ada Hayden (herbarium curator, Iowa flora). As evidenced by the roughly 7,000 plant specimens collected in Story County since 1859 and deposited in the Ada Hayden Herbarium at ISU, it is clear that floristic study of this county dropped off dramatically at mid-century coinciding with Ada Hayden's death in 1950. Although several botanical studies of Story County prairie remnants and a watershed were conducted by ISU students (Robert Freckmann, Greg Woodley and Louise Johnson) in the subsequent 40 years, extensive botanical study of the county did not resume until 1991 with our ongoing study.

Overview of Current Study (1991-Present)

The concept of a plant inventory of Story County did not originate in a single moment back in 1991 but rather evolved gradually over the past 30 years as team members undertook botanical projects that encompassed various public and private (with permission) lands within the county. These include natural area inventories of the municipality of Ames (1991-1995) and Story County (2017-2020) commissioned and funded, respectively, by the Ames City Planning Office and the Story County Conservation Board; comprehensive inventories of Doolittle Prairie State Preserve and the Richard W. Pohl Memorial Preserve at Ames High School; and several other small projects. In addition, one team member (Jimmie D. Thompson) took it upon himself between 1997 and the time of his death in 2021 to explore a wide variety of local habitats (roadsides, old fields, gravel pits, waste areas, mudflats, railroad rights-of-way, sandbars, etc.) in search of additional plant species. Although these projects had different goals, they were all conducted by botanists with "Boots on the Ground." This cumulative field work, easily more than 1,000 hours, has resulted in collection of more than 4,000 plant specimens and the preparation of plant lists for more than 150 public and private sites within Story County.

This project has been a collaboration among six botanists with diverse backgrounds: former ISU graduate students and current botany professors (Thomas R. Rosburg, me), a herbarium curator

(Deborah Q. Lewis), a horticulturist (Mark P. Widrlechner), an extension program specialist (Richard O. Pope), and a citizen scientist (Jimmie D. Thompson). Although team members brought diverse expertise, areas of specialty and time investments to this project, we shared a common enthusiasm for field work and excitement for learning about the current and historical flora of this county where most of us cut our botanical teeth.

Ames Flora project participants, ca. 2000 (Jimmie Thompson, Bill Norris, Deb Lewis and Mark Widrlechner). Not pictured: Rich Pope; Tom Rosburg had not yet joined the project

Results

Total Taxa. After intense botanical exploration of Story County by the above team over the past 30 years, several themes emerge. First, the county flora is diverse. Very diverse. Since 1991, we have documented the occurrence of about 1,230 vascular plant taxa (species, subspecies, varieties, and named hybrids) within the borders of the county. [Note: the total number of taxa is about 1,200 when subspecies and varieties are excluded]. This is about 100 more taxa than are documented from any other Iowa county. Does this mean that Story County is a botanical paradise with no peer in this state? Nope. This large number of vascular plant taxa is clearly an artifact of long-term, intense field work conducted by multiple botanists. If the floras of other counties in Iowa received similar attention, it is very likely that many of them would have comparable, or even greater, plant diversity than what occurs in Story County.

Taxa Unreported in the Iowa Checklist of Vascular Plants. "The Vascular Plants of Iowa: An Annotated Checklist and Natural History," by Lawrence J. Eilers and Dean M. Roosa, was published in 1994. It is, to this day, the seminal book on the Iowa flora, presenting the most recent, comprehensive coverage of vascular plant species documented in the state. Of course, botanical exploration of Iowa has continued since 1994 resulting in discovery and recognition of numerous new plant taxa to occur in the state, including almost 100 in Story County during this study. More than half of these are introduced taxa which are naturalized in the county, such as narrow-leaf dock (*Rumex stenophyllus*). A few are non-descript native species that were probably overlooked in Iowa prior to recent discovery during this study, such as midland sedge (*Carex mesochorea*). Some of these new taxa have been described in the numerous volumes of the *Flora of North America* published after 1994, frequently the result of taxonomic reevaluation of long-established species resulting in recognition of many newly recognized taxa, Examples include prickly quill sedge (*Carex echinodes*), three subspecies of knotweed/common knotgrass (*Polygonum aviculare*) and three varieties of Canada wildrye (*Elymus canadensis*).

Floristic Analysis. It is informative to look beyond the sheer number of vascular plant taxa documented in the Story County flora and examine its composition. The proportion of these 1,233 taxa that are native to central Iowa is in the 70-75% range. The Asteraceae (sunflower family), Cyperaceae (sedge family), Fabaceae (bean family), Poaceae (grass family), and Rosaceae (rose family) are especially well represented in the county flora, with at least 50 native taxa each, as are *Carex* (sedge), *Cyperus* (flat sedge), *Elymus* (rye), *Rubus* (bramble), *Solidago* (goldenrod), and *Symphyotrichum* (aster), which are each represented by at least 10 native taxa. The Story County flora contains one federally endangered species, prairie bush clover (*Lespedeza leptostachya*) and almost 30 Iowa T&E (endangered, threatened, special concern) species.

Conversely, and significantly, at least one quarter of the plant taxa in the Story County flora are not native to central Iowa, having been introduced from elsewhere (including other regions in Iowa). Some of these exotic taxa are invasive – Siberian elm (*Ulmus*

pumila), black locust (*Robinia pseudoacacia*), Tartarian honeysuckle (*Lonicera tatarica*), Amur honeysuckle (*Lonicera maackii*), garlic mustard (*Alliaria petiolata*), smooth brome (*Bromus inermis*), bird's foot trefoil (*Lotus corniculatus*), crown vetch (*Securigera varia*), reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*) – while the abundances of others range from common to occasional to sparse. In recent years, we paid close attention to vegetation along major highways passing through the county and discovered a number of species native to Iowa but most likely not to Story County flourishing as a result of roadside plantings, such as foxglove beardtongue (*Penstemon digitalis*), several ironweed species (*Vernonia gigantea*, *V. missurica*), rosinweed (*Silphium integrifolium*), ashy sunflower (*Helianthus mollis*), Ohio spiderwort (*Tradescantia ohiensis*), and wild lupine (*Lupinus perennis*). Likewise, roadside ditches occasionally provide habitat for plant species native elsewhere in Iowa that have escaped from adjacent garden plantings and become naturalized in Story County, e.g., pale Indian plantain (*Arnoglossum atriplicifolia*).

Many colorful prairie reconstructions in Story County contain forb species native to prairies elsewhere in Iowa or adjacent states but which are absent from native prairie remnants in this county, e.g., prairie turnip (*Pediomelum esculentum*), wild quinine (*Parthenium integrifolium*), and prairie dock (*Silphium terebinthinaceum*). Furthermore, much like that occasional apple tree that we find in woodlands occupying old homesteads, we encountered other mature non-native tree species, such as tulip poplar (*Liriodendron tulipifera*), Norway maple (*Acer platanoides*) and gray birch (*Betula populifolia*), that were surrounded by native tree species.

Our findings during this plant inventory have presented a number of puzzles. In the 1990s, yellow trout lily (*Erythronium americanum*), glade mallow (*Napaea dioica*) and wake-robin (*Trillium recurvatum*) all turned up in tree-dominated habitats within the city limits of Ames. What are they doing in Story County, far from their nearest natural populations elsewhere in Iowa? Likewise, within the past five years, we discovered the first (and only) populations of several wetland species in Story County associated with a wetland reconstruction, including wool grass (*Scirpus cyperinus*) and soft rush (*Juncus effusus*). Were these plant species introduced in seed mixes during creation of the wetland? Or, were seeds of these species transported on the feet of waterfowl? Hmm.

Clearly, each and every plant assemblage in Story County is a patchwork of interwoven native and exotic species reflecting unique histories that challenge interpretation by those of us who conduct plant inventories.

Documenting the Historic Flora. During the past two years, work on this project has shifted to a comprehensive inventory of the holdings of the Ada Hayden Herbarium (ISC) to locate and document all plant specimens collected in Story County since Bessey began his botanical exploration of Ames in the early 1870s. We estimate that there are ca. 7,000 of such specimens, of which we have examined and recorded label information from ca. 5,000 to date. This time-consuming work (to be completed in 2023) is nonetheless rewarding in that the data collected provide a window into the past vegetation of Story County to facilitate analysis of change with the current flora.

Image of ISC specimen of small white lady's slipper collected by G.W. Carver

For example, we know that three species of lady's-slipper orchid (*Cypripedium*) and several other orchid species in the genus *Platanthera* once occurred in the Story County flora, all documented prior to 1940, but we encountered none of these taxa during the current inventory. On the other hand, our team is pleased to report that both mitrewort (*Mitella diphylla*) and bracken fern (*Pteridium*

aquilinum), last documented in Story County by voucher specimens collected in the 1890s, were recently rediscovered here during the current project. Our recent discoveries of blue beech (*Carpinus carolinianus*) and great Indian plantain (*Arnoglossum reniforme*) in the county, both conspicuous native forest species, were not documented to have occurred in Story County prior to this study, nor was non-native wild teasel (*Dipsacus fullonum*) until discovered in December 2020. Were these conspicuous plant species overlooked by botanists over the years, or have they arrived in the county sometime after study of the Story County flora commenced in the mid-19th century? More unanswered questions.

A current trend in the herbarium world is for plant label data for specimens (often associated with digital images) to be made available in on-line data portals (e.g., SEINet, https://swbiodiversity.org/seinet/). We are thus fortunate to have access to such data from approximately 3,200 plant specimens collected in Story County and deposited in 30+ other herbaria. I frequently browse these data for new taxa, and recently spotted a record of puttyroot (*Aplectrum hyemale*) collected in Story County in the 1870s and deposited in the Putnam Museum Herbarium in Davenport. Curator Christine Chandler and volunteer Nick Stoynoff graciously made digital images of this specimen available to us, allowing us to confirm the identification of this orchid. Needless to say, there is no subsequent record of puttyroot in Story County. We are similarly working with curators of three other herbaria to obtain loans of other specimens which represent potential historic records of several other taxa documented in Story County from no other source. Once these herbarium inventories are complete, we will undertake a comprehensive comparison of the past and current floras of the county.

Final Thoughts

The floras of more than 20 Iowa counties have been inventoried since 1950, featured in 20 published floras and several unpublished master's theses. However, only two Iowa county floras (Boone and Hamilton) have been published in the past 30 years. Why is this? I don't have the answer to that question, but I do hope that this account of a long-term plant inventory of Story County has convinced you that such projects are rewarding and worthwhile. If you don't believe us, just ask Iowa citizen scientist Aaron Basten, who has undertaken an inventory of the Johnson County flora, updating Robert Thorne's studies in the 1950s. Keep in mind that there is no requirement that county plant inventories extend for three decades; e.g., the published floras of Boone and Hamilton Counties were each based on about four years of extensive field work by one citizen scientist. See below for a list of reasons to get moving on your own plant inventory, whether of a local natural area or an entire county:

- You will have lots of fun conducting the field work.
- You will make friends with other people interested in plants who will volunteer to tag along with you to add a pair of eyes. Let them!
- You will explore sites in your county that you have never visited before, even if you are a lifelong resident.
- You will learn a lot about the local and regional flora in your corner of the state.
- You will be forced to learn about plants that you have not paid much attention to in the past.
- You will be interviewed by local and regional reporters who will write about and publish feature articles about your project. You will thus be responsible for educating your community about native and non-native plants.
- You will find populations of state (and maybe federally) listed plant species which will trigger appropriate conservation measures.
- You will find populations of invasive plant species and alert local natural resource managers to take action.
- You will find plant species that are far out of range, which will prompt you to stretch your brain cells as you try to come up with possible explanations.
- If you have access to a local or regional herbarium, you will enjoy looking for historic plant specimens collected in your county.
- You will discover plant species not previously reported in Iowa, and thus contribute to knowledge of the Iowa flora.
- You will establish an important baseline of your county's flora which will allow botanists who repeat this

exercise decades from now to analyze for vegetation change in the intervening years.

Iowa botanists, let's go to work!

Hummingbird and Cardinal Flower

A photo-essay by Diane Porter

A flower made for a bird

Cardinal Flower *(Lobelia cardinalis)* is a wildflower native throughout eastern North America, including Iowa. It grows in full sun, but it likes damp soil, so we find it along creeks and in low damp meadows where the native plants have not been replaced by crops, concrete, or alien plants.

In my garden, I started Cardinal Flower from seeds. When the plants bloomed, they attracted a lot of attention from Ruby-throated Hummingbirds. I watched to see how pollination happened.

On most visits to the flowers, the top of the hummingbird's head made contact with the flower. Bingo! That had to be pollination in process. But what exactly *was* the process?

Like other Lobelias, Cardinal Flower has an unusual reproduction strategy. Pollen dispersal takes place at the tip of a long tube that emerges from the center of the flower. At the end of the tube, five anthers (male) are fused together, with the business side in. When the anthers produce pollen, it is released inside the tube. Also, inside the tube are the pistil, stigma, and style (female). However, the stigmas are not ready to receive pollen by the time that the anthers are providing it. Hence a flower cannot pollinate itself. Whoa! Then how do Cardinal Flowers get pollinated?

A Cardinal Flower's tricks

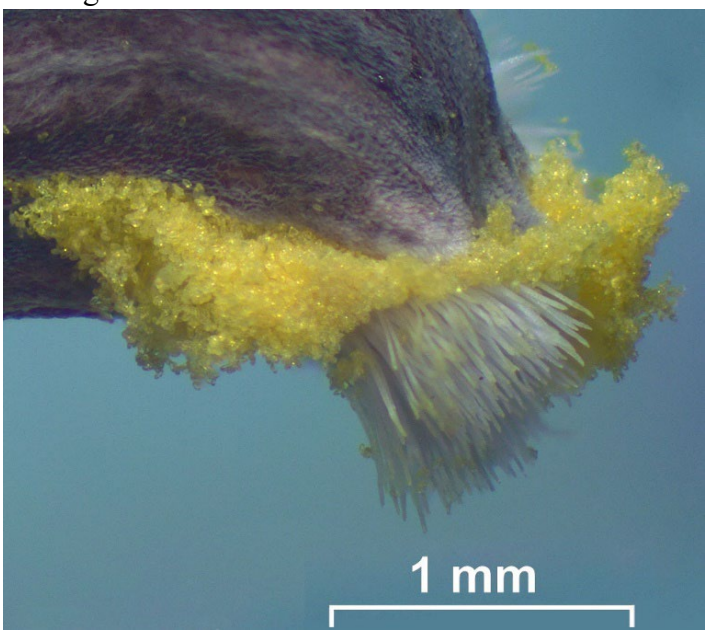
The bluish tube is formed by the five fused anthers. If you look at a newly-opened flower through a microscope, you see the anther tube has a "brush" at the end. The brush is made of whitish hairs that grow out of the ends of the tube.

I noticed that a couple of days after the little brush appeared, it developed a new trick. When I touched the brush, my finger came away with a tiny yellow dot.

Through a microscope, the dot looked like yellow powder. Pollen! As if it were a trigger, the brush released pollen from inside the tube when it was bumped.

When I gently squeezed the tube, quite a lot of pollen gushed out. This was not a measured amount as

happens with a touch, but it showed me there was a supply of pollen inside the anther tube.
Under higher magnification, individual grains of pollen become visible. These are what the styles are waiting to receive.



The hummingbird's role

The bluish anther tube is positioned as much as an inch above the spreading petals.

This position is just right to contact the head of a hovering hummingbird.
After a few days, pollen is no longer released from the tube. Instead, the style and stigma emerge from the center of the tube. In the next photo, the style is the slender red tube on the right. At the end of the style is the stigma, the two-part, sticky, magenta “Hot Lips" to which pollen easily adheres. You can still see the white brush, but it has no pollen.

If a hummingbird visits a Cardinal Flower in its male phase, it picks up pollen on its head. If the bird then visits a flower that is in its female phase, pollen transfers from the bird’s head to that flower’s stigma. And pollination is accomplished. The timing of male and female stages ensures a mix of genetic material from different flowers.

Meanwhile, unaware that it is being used, the hummingbird sips some nectar, then flies away, probably satisfied.

Tending Iowa's Land - A new book edited by Connie Mutel

Tending Iowa's Land: Pathways to a Sustainable Future is now available from the University of Iowa Press: https://uipress.uiowa.edu/books/tending-iowas-land. In addition to Connie as editor, the book includes chapters by several INPS members. It will be reviewed in the next issue of both *Erythronium* and *The Iowa Prairie Network Newsletter,* and there will be readings from it at the IPN Winter Meeting. It is a significant new work, and we congratulate those who contributed to it!

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