IOWA NATIVE PLANT SOCIETY

Erythronium

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Pasqueflowers

by Aric Ping

Why aren't there pasqueflowers here? This is my third spring working at Hitchcock Nature Center in Pottawattamie County and it's my third spring asking this question. Each March and April I've searched for those fuzzy early bloomers along Hitchcock's loess ridges and slopes in vain. It's not just me. Pasqueflowers have never been recorded here. Undeterred by reality, I *knew* there had to be a patch somewhere. Maybe they'd been missed beneath heavy prairie verdure on a midsummer inventory? Perhaps they're just perched in seclusion on an unscalable bluff? I mean, how can you have a Loess Hills prairie without pasqueflowers? It's kind of embarrassing.

I asked the internet for help. The USDA Plants distribution map shows recorded populations a dozen miles to the north, huddled on the dwindling prairie ridges above Missouri Valley. Supposedly there's a population along the Platte in central Nebraska. They're even found in the Far East; dark exotic areas called "Illinois" and "Wisconsin." What do they have that we don't? Surely *some* spot here meets the pasqueflower goldilocks zone of soil moisture, light exposure, and temperature range. I grow them in my Omaha landscaping, for Pete's sake. If they can make it in suburbia, surely, they can make it here.

"Here" (Hitchcock) has recently expanded. One hundred acres or so of remnant prairie, oak savanna, and woodlands have been added to the footprint. Some of it potential primo pasqueflower ground. Other rare plants have been found in this new addition, and I needed to know if maybe, just maybe, there were pasqueflowers.

So, here I am, scouring unknown skinny ridgelines and scrambling across vertical prairie hillsides high above the Missouri River floodplain. Unburnt for a century or more, the vegetation lays limp and nearly as gray as the overcast March sky. A clumpy matrix of slippery prairie satin grass carpets the slope. Pinpoints of green grab my attention. I investigate each one, but they're not pasqueflowers, just optimistic sprouts of *Oxytropis* and prairie violets.

Shimmying across the nose of yet another pasque-less spur ridge, I slip on the prairie satin grass. I don't fall far, but a quiet, hollow *ting* fills me with dread. I look over my shoulder, downhill, and yep, there's my stainless-steel water bottle sliding over the satiny lip of a vertical cut in the hillside. More cat-leap than catstep, it's a sheer eight-foot drop.

There's no easy way down and no clear route back up. I consider leaving the *Klean Kanteen* there, but something pulls at my heartstrings. It's a mass-produced item. There are many like it, but this one is unique. It's scuffed and dented from fieldwork. Lopsided, it can't even stand on a flat surface. The mouthpiece tastes like soot and sawdust no matter how well it's cleaned. It even whistles when drank from, annoying my coworkers while perplexing nearby birders. I can't leave it behind. Plus, you know, I'd be littering.

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

Leaves of the President's Notebook

Greetings! Spring is here at last. The wild turkeys are gobbling, songbirds and frogs are singing, trees are budding, and flowers are beginning to pop above the soil surface. As I write, hepatica, spring beauty, snow trillium, and bloodroot are blooming in Boone county. It is a refreshing sight to see. Pasqueflowers and other early spring prairie bloomers are also blessing us with their presence. A sense of renewal we are all in need of. May has been dedicated Iowa Wildflower Month once again and as you read this, there will a new wave of blooming wildflowers on the Iowa landscape. Be sure to get out and see all that is offered to you on the prairie and below the tree canopies. Take photos and share those moments with others.

The INPS board is pleased to be hosting a number of field trips this spring and summer! We hope as many of you as possible will join us! There will be opportunities to see a wide range of habitat types. The events section below outlines our field trips, as well as many other opportunities to be involved in Iowa's outdoors.

What else has INPS been up to these last few months? We're working on updating our website and hope to have our updated look deployed in the next several weeks. It has been an exciting project to be involved in. We have also selected a number of great projects through our grants program. This year we will be supporting projects like floristic inventories and prairie restoration across the state with multiple agencies.

Enjoy the warmer weather ahead and we look forward to seeing you in the outdoors!
All the best,
Sarah Nizzi

Photo by Tom Scherer

Calendar of Upcoming Events and Activities

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.

INPS-sponsored or co-sponsored events are marked with ; acronyms of other organizations: IPN = Iowa Prairie Network; INHF = Iowa Natural Heritage Foundation; CC = County Conservation; DNR = Iowa Department of Natural Resources; TNC = The Nature Conservancy, Iowa Chapter

Thursday, May 19th, 6:00 pm - 8:00 pm
Codfish Hollow Field Trip (Jackson County), led by Ray Hamilton
Codfish Hollow Hill Prairie is near Maquoketa and includes a dozen native prairie knolls, untouched by plow. These are buffered and tied together as a landscape with a 35-year old reconstruction with highly local, hand-picked native prairie species. It is also a local reserve for locally scarce species and the home of many high-quality species. These include the butterfly Leonard's skipper (*Hesperia leonardus*), first to be rediscovered in eastern Iowa since the 1800's, and also one of the northernmost native populations of Purple Coneflower (*Echinacea purpurea*). These and others reflect connections to western Iowa in warmer interglacial times as well as residual from being on the edge of ancient glacial epochs. Planting and management of diverse populations to assure survival and no harm for all is always a topic covered as per "Native Prairie Management Guide". For more information, contact the Jackson CC office at 563-652-3783. The field trip series is sponsored by Jackson CC, INHF, IPN, INPS and Ray Hamilton.

Thursday, May 19th, 7:00 pm - 8:30 pm
Doolittle Prairie Walk (Story County), led by Tom Rosburg
Go to this website to register by 4:00 pm on 5/18 (free): https://www.mycountyparks.com/County/Story/Park/Doolittle-Prairie/Events/20385/Evening-Prairie-Walks.aspx
The walk format is casual and informational, focusing on questions from participants and identification of both blooming and vegetative plants. This is a good opportunity to view the prairie as it changes during the summer. Insect repellent, long pants, and sturdy shoes are recommended. The site has potholes so be prepared for some wet spots.
DIRECTIONS: Doolittle Prairie is located north of Ames and south of Story City. From I-35 take Exit 123 (Roland and E18/130th St exit) and go west on E18 for ~ ½ mile until 560th Ave (a gravel road); turn south and go 1½ miles. There is a sign at the preserve entrance on the west side of the road - follow the lane back to the parking lot and prairie.
Additional dates are June 16th, July 21st and August 18th. Sponsored by INPS, IPN, and Story CC.

Friday, June 3rd to Sunday, June 5th
Loess Hills Prairie Seminar (Monona County): Theme - Breaking Dormancy
Come explore, learn, and relax in the Heart of the Loess Hills for the 45th Anniversary of the Loess Hills Prairie Seminar! Experience a free, family-friendly weekend of hands-on learning activities and sessions with conservation partners to explore and experience the Loess Hills in Monona County, Iowa. Free primitive camping available on-site, other local options include motels, bed-and-breakfasts, and modern camping facilities. Optional meals to be catered and portable toilets will be available onsite. For more information and registration (required for meals): https://www.loesshillsprairieseminar.com/
Follow Monona CC on Facebook to stay up to date with news and announcements.

Friday, June 3rd, 9:00 am - 12:00 pm
Great Race Against Sun and Shade: G.R.A.S.S. (Monona County)
Help on one of the largest land restoration days in the state, at the Reese Homestead. The address of

the project site is 22133 Larpenteur Memorial Road, Turin, IA 51040. Think energy and impact! Work alongside INHF's land stewardship interns and staff, the DNR, TNC interns and staff, and others to cut and clear invasive brush to help the hillside prairies thrive. This event is dependent on volunteers. Bring loppers if you have a pair (some will also be supplied), water bottle, sturdy boots or shoes, hat, gloves, safety glasses, and sunscreen.

Tuesday, June 14th to Thursday, June 16th
Intro to Botany Workshop (Polk County), led by Tom Rosburg
Introduction to Botany: All Things Plants workshop, at Chichaqua Bottoms Greenbelt, Polk CC; 9:30 am - 2:30 pm daily. Tom Rosburg is the instructor; the fee for the three days is $100. Registration at: https://www.mycountyparks.com/County/Polk/Park/Chichaqua-Bottoms-Greenbelt/Events/20241/Introduction-to-Botany-Workshop-All-Things-Plants.aspx

Thursday, June 16th, 5:30 pm - 7:30 pm
UpCycle Stewards restoration at Gray's Lake (Polk County), INHF and other organizations
(also July 21st and August 18th)
Get outdoors and help restore some of Des Moines' most popular outdoor areas while also helping animals at Blank Park Zoo**!** Together, volunteers will help restore land for native plants by removing invasive species at Gray's Lake. After the event, organizers will take the plants to Blank Park Zoo where they will be "upcycled" into food for the zoo animals. Registration is required: https://cityofdesmoinesparksandrecreationdepartment.volunteerlocal.com/volunteer/?id=59128 For more information, see https://www.inhf.org/events/eid/98f040a91c24de38/volunteer/upcycle-stewards-june-2022-des-moines/ or contact Melanie Schmidt, mschmidt@inhf.org. Visit https://www.inhf.org/events/ for a full list of INHF events and details!

Thursday, June 16th, 7:00 pm - 8:30 pm
Doolittle Prairie Walk, led by Tom Rosburg
Go to this website to register by 4:00 pm on 6/15 (free): https://www.mycountyparks.com/County/Story/Park/Doolittle-Prairie/Events/20386/Evening-Prairie-Walks.aspx See additional information at the May 19th description.

Saturday, June 25th, 10:00 am - 12:00 pm
INPS Kalsow Prairie State Preserve Field Trip, Pocahontas County, led by Mark J. Leoschke
Kalsow Prairie State Preserve is owned and managed by the Wildlife Bureau of the Iowa Department of Natural Resources. It occurs in extreme southern Pocahontas County. Kalsow Prairie is both a state preserve (dedicated in 1968) and a wildlife management area. The preserve consists of 160 acres of relatively level tallgrass prairie that in the past was cut for hay and a portion was also pastured. It was purchased by the Iowa Conservation Commission (now known as the Department of Natural Resources) in 1948. The prairie is one of the remnants that Dr. Ada Hayden evaluated as part of her 1944 state-wide tallgrass prairie inventory which she hoped would lead to the protection of some remnants.
The preserve ranges from mesic to wet tallgrass prairie and shallow pothole marshes typical of the historical landscape in this portion of the Des Moines Lobe. It has over 100 species of native vascular plants. The prairie is home to typical grassland birds such as the upland sandpiper (known for its "wolf whistle" call), very vocal male bobolinks and northern yellowthroats. The prairie also has smooth green snakes and regal fritillaries. We will see the early summer flora of the prairie in the company of Mark J. Leoschke, botanist for the Wildlife Bureau of the Iowa Department of Natural Resources.
DIRECTIONS: From the intersection of State Highway 3 and State Highway 4 in Pocahontas (the county seat) drive 10 miles south on State Highway 4 to the intersection of State Highway 7 and County Highway C66 (620th Street, a paved road). Turn left (east) onto County Highway C66 and drive 6 miles to the intersection of County Highway C66 and 280th Avenue (a gravel road). Turn right (south) onto 280th Avenue. Drive 1 mile to the intersection of 280th Avenue and 630th Street (a gravel road). The northeast corner of Kalsow Prairie State Preserve occurs at this intersection and we will meet in the prairie. Park along 280th Avenue or 630th Street (see the aerial photo of Kalsow Prairie State Preserve with local road

names in the web link below):
https://www.iowadnr.gov/portals/idnr/uploads/wildlife/wmamaps/kalsow_prairie.pdf

Thursday, June 30th, 6:00 pm - 8:00 pm
Codfish Hollow Field Trip (Jackson County), led by Ray Hamilton
See the description for the May 19th field trip. For more information, contact the Jackson County Conservation office at 563-652-3783

Saturday, July 2nd, 10:00 am - 12:30 pm
INPS Tipton Prairie Field Trip (Greene County)
Tipton Prairie is located in southeastern Greene County; it is owned and managed by the Greene County Conservation Board. It is an approximately 3-acre native prairie remnant that features mesic to xeric prairie communities along with a forest/prairie edge. Recent research by Dr. Thomas Rosburg has documented 192 plant species, including 172 native species and over 32 species with a coefficient of conservatism of 8 or higher.
Directions: From Rippey -- (located 8.5 miles northwest of Perry). Take County E57 (290th Street) west from Rippey for 5.6 miles to the entrance for an access road on the south side of the highway. The access road is 0.75 miles west of the North Raccoon River. There is a sign at the access road for the Van Horn (or Old Franklin) pioneer cemetery located south of the prairie. We will meet at the entrance for the access road and then determine if the access road can be used to drive to the prairie.
If coming from the west, start from the town of Cooper and take County E57 (300th Street) east for 3.2 miles.

Saturday, July 9th, 8:00 am - 3:00 pm (rain date: July 16th)
Plant Specimen Preservation Techniques Workshop (Plymouth County), led by Bill Zales, Brian Hazlett and Rod Tondreau
The workshop will be held at Prairie Hills Farm (Bill and Dotty Zales' home) at: 15384 North Ridge Road, Westfield, Iowa 51062
Cost: $10 per person (includes supplies for individual plant press & mounting paper). Limited to 20 people. Learn basic field collecting techniques, ethics, field notes, plant pressing, plant identification, proper labeling, mounting techniques, conservation and more! Bring your own drinking water, bag lunch, sunscreen, etc. Must pre-register for the class at 712-258-0838 or camps@woodburyparks.org. (The class is recommended for ages 16 and up)
Optional campfire and social afterwards – RSVP to Dotty at zales66@hotmail.com.
Co-sponsored by: Woodbury CC Foundation and Board, Dorothy Pecaut Nature Center, and Loess Hills Wild Ones

Monday, July 11th, 1:00 pm - 4:00 pm
INHF Heritage Valley Summer Seed Harvest (Allamakee County)
Together, we'll hand-harvest native seed from Heritage Valley's hillside prairies. Seed collected will be used to diversify and expand the prairie. We'll kick the day off with conversation and a bit of background about Heritage Valley before heading out into the prairie. Seed harvesting can be done using your hands or clippers to collect seeds into buckets and bags. This activity is a favorite among our volunteers because of how peaceful and relaxing it is. It's a great way to get to know the prairie more intimately and learn about this special ecosystem.
Registration is required: https://www.inhf.org/register/heritage-valley-seed-harvest-2022/ For more information, contact Melanie Schmidt, mschmidt@inhf.org or visit https://www.inhf.org/events/eid/9e927ba0e3744b9f/volunteer/heritage-valley-summer-seed-harvest-2022/

Thursday, July 21st, 5:30 pm - 7:30 pm
UpCycle Stewards Restoration at Gray's Lake (Polk County), INHF and other organizations
See additional information at the June 16th description. Registration is required: https://cityofdesmoinesparksandrecreationdepartment.volunteerlocal.com/volunteer/?id=59128

Thursday, July 21st, 7:00 pm - 8:30 pm
Doolittle Prairie Walk, led by Tom Rosburg
Go to this website to register by 4 pm on 7/20 (free):

https://www.mycountyparks.com/County/Story/Park/Doolittle-Prairie/Events/20387/Evening-Prairie-Walks.aspx See additional information at the May 19th description.

Sunday, July 24th to Thursday, July 28th
North American Prairie Conference, Lincoln, Nebraska, see information as it becomes available at http://www.northamericanprairie.org/

Saturday, August 6th, 10:00 am - 2:00 pm
INPS Mossy Glen Field Trip (Clayton County), led by Tom Rosburg
Mossy Glen is an 80-acre preserve featuring a rugged forested area along the Silurian Escarpment. It is located 6 miles northwest of Edgewood and 6.5 miles northeast of Strawberry Point in Clayton County. The area was donated to the Iowa Conservation Commission in 1978 by Mildred Hatch in memory of her father, Charles A. Hesner, and her uncle, Henry Hesner. The area was dedicated in 1979 as a biological and geological state preserve. Over 300 native vascular plants have been observed in the preserve.
Bring a sack lunch and water.
Directions: From Edgewood, take Highway 3 west 1.5 miles to Eagle Avenue. Turn north (right) and go 4.75 miles to the end of the road. Park on the edge of the road at the top of the hill.
From Strawberry Point, take East Mission Street (becomes East Mission Road) east for 4.4 miles to County X17 (Ebony Road). Turn north (left) on X17, go 1.2 miles to 370th Street. Turn right (east) on 370th Street and go 0.5 miles to Eagle Avenue. Turn north on Eagle Avenue and go about 1.5 miles to the end of the road.
The lat/long coordinates for the meeting site at the end of Eagle Avenue are 42.7059, -91.4286. There is about 180 feet of elevation change from the entrance to the valley in the central portion of the preserve.

Saturday, August 6th, 10:00 am - 5:30 pm (possibly to Sunday, August 7th)
Iowa Prairie Network Annual Meeting
Region 4 (Northeast Iowa) will be hosting the event this year. At **10:00 am** we will gather for a guided prairie walk at **Codfish Hollow in Maquoketa**, followed by lunch and the official business meeting nearby. This meeting is where board member elections and executive committee elections will occur.
We anticipate a field trip at a second location Saturday afternoon, and a possible additional one on Sunday the 7th. Please stay tuned for an official agenda and more information about the meeting and field trips. A zoom link will be available for those wanting to join the business meeting virtually and sent out to all members.

Saturday, August 13
2022 Okoboji Blue Water Festival
IPN and INPS have a display at the festival thanks to Leesa McNeil. More details about time, etc., will follow.

Tuesday, August 16th (9:30 am) to Thursday, August 18th (2:30 pm)
Grass Identification and Ecology Workshop
Grasses, in the family Poaceae, are arguably the most important plant family, due to their evolution (5th largest family), ecology (dominance and function in the world's ecosystems), and ethnobotany (use as food, forage and fiber by humans).
Dr. Tom Rosburg, Professor of Biology at Drake University, is offering a three-day grass identification workshop on Iowa and Midwestern Poaceae. The course offers an advanced curriculum for professional conservationists (CCB, DNR, NRCS, FWS, NPS, ACE), graduate students, and avid amateurs. The hands-on workshop will enhance participants' field recognition of grass species, their understanding of grass morphology and terminology, their ability to successfully key grass species and conduct field assessments, and their understanding of ecological relationships among grass species.
The workshop will combine class time and hands-on exercises with field work and observation. Participants will use dissecting microscopes to examine grass morphology and to key specimens. Workshop materials include color handouts of the presentations used and floristic keys to identify grasses. Field work will investigate the grasses found

in several plant associations including oak savanna, forest, and prairie communities.
Pre-registration is required. Contact Amy Campagna, Environmental Education Coordinator at Amy.Campagna@pottcounty-ia.gov for additional course information. Workshop cost: $100 (before July 12); $125 starting July 13; $50 for students. This fee includes workshop materials and two days of lunch. Breakfast and supper are on your own. Registration is payable to Pottawattamie County Conservation. Please be prepared for outdoor weather conditions as the class will be held rain or shine.
The schedule is Tuesday 9:30 to 5:00, Wednesday 8:00 to 5:00, Thursday 8:00 to 2:30. The workshop will be held at Hitchcock Nature Center, 27792 Ski Hill Loop, Honey Creek, IA. 51542

Thursday, August 18th, 5:30 pm - 7:30 pm
UpCycle Stewards Restoration at Gray's Lake (Polk County), INHF and other organizations
See additional information at the June 16th description. Registration is required: https://cityofdesmoinesparksandrecreationdepartment.volunteerlocal.com/volunteer/?id=59128

Thursday, August 18th, 6:00 pm - 8:00 pm
Codfish Hollow Field Trip (Jackson County), led by Ray Hamilton
See the description for the May 19th field trip. For more information, contact the Jackson County Conservation office at 563-652-3783

Thursday, August 18th, 7:00 pm - 8:30 pm
Doolittle Prairie Walk, led by Tom Rosburg
Go to this website to register by 4 pm on 8/17 (free): http://www.storycountyiowa.gov/Calendar.aspx?EID=2284&month=5&year=2021&day=14&calType=0
See additional information at the May 19th description.

Tuesday, September 6th to Friday, September 9th
Natural Areas Conference in Duluth, Minnesota
The 2022 Natural Areas Conference (NAC22), ***Superior Visions: Navigating Complexity Amid Constant Change***, will be in Duluth, Minnesota. Registration will open in May. More information will be available on the conference website: https://www.naturalareas.org/duluth.php

Saturday, September 10th
INPS Annual Meeting and Field Trips
The 2022 INPS Annual Meeting and field trips will be held at Chichaqua Bottoms Greenbelt, the home of Engeldinger Marsh, Puccoon Prairie, Sandhill and so much more! Check for details at http://www.iowanativeplants.org/calendar.php as that date approaches.

Thursday, September 22nd, 6:00 pm -- 8:00 pm
Codfish Hollow Field Trip (Jackson County), led by Ray Hamilton
See the description for the May 19th field trip. For more information, contact the Jackson County Conservation office at 563-652-3783

False Rue-Anemone and Dutchman's Breeches, photo by Tom Scherer

INPS Field Trip Report: Pammel State Park, April 30th, 2022

by Tom Scherer

Our field trip leader was John Pearson, DNR Ecologist. We were also escorted by Steve Pearson, Madison County Conservation Director.

Steve gave us an overview of Pammel State Park and the ongoing effort by the entire community to recover and heal from the tragic tornado that struck portions of the park on March 5, 2022.

John was a wonderful walking scientist and storyteller. He shared so much natural history and gave us all insights into this wonderful Iowa State Park. It was a grand experience to listen and learn from both John and Steve and all of the various participants. WE were for sure, one intrepid group of approximately thirty-five individuals who came together on a cool, blustery day with intermittent, light precipitation.

Thank you, John and Steve! Thank you to all the folks who found themselves enjoying an early spring walk on the "devil's backbone" inside Pammel State Park.

Some of the plants and fungi" observed on our Field Trip: Dutchman Breeches, Spring Beauty, Yellow Violet, May Apple, False Rue Anemone, Pussytoes, Yellow Bellwort, Bloodroot, Poverty Oat Grass, and assorted fungi.

Iowa's oldest, living white oak -- 386 years, photo by Tom Scherer

The Value of Volunteers on Our Prairie Hills

by Bill Zales

In 1984 my wonderful wife Dotty and I purchased 160 acres of abused and neglected Loess Hills land at auction. We then retired to Iowa in 1999 and purchased 150 more adjacent acres. This is when we began our restoration projects.

After *much* tree removal, burning, broadcasting many species of local natives collected from our own few acres of original prairie, burning, and mowing (did I mention burning?) our reconstructions are looking more like what the Iowa Loess Hills should look like. Currently we are working on our woodlands; burning, thinning out early succession trees to expose the large open-grown oaks, broadcasting savanna species, burning, and removing logs and brush (did I mention burning?)

Volunteers are the backbone of our efforts. We trade fresh air, exercise, a little biological knowledge and what we call "4B" (brush, burn, brats and beer) for a few hours of their restoration labor.

In the late summer and fall we also host Seed and Feed parties to hand harvest our prairie forbs. Our volunteers can keep as much as they want, and the rest is used to enrich our restorations or donate to other conservation projects. Our volunteers thank us for the opportunity to help clear our woodlands, collect prairie seeds, assist with prescribed burning (maybe it is the adrenaline rush) and foster friendships with other dedicated nature lovers. Of course, Dotty and I are ones most appreciative of our generous friends and neighbors.

Woodland restoration -- burning

The response from our land was not immediate. Patience is a prairie virtue. We are very proud of how different our property looks now. To guarantee the improvements demonstrated by the response from all the native plants and animals is not wasted on more than 300 acres, we have a protective conservation easement on all of our acres. Come visit, we are happy to show off our Prairie Hills. Good times are had by all who participate. Thank you to our volunteers!
Bill & Dotty Zales

Bill and Dotty Zales with one of the volunteer 4B crews

Native Plant Spotlight – Common liverwort (*Marchantia polymorpha*)

by Tom Rosburg

Most people probably assume that there is not much a liverwort can teach them. Afterall, liverworts are as simple as a plant can be. *Marchantia polymorpha* (and other thalloid liverworts) have a ribbon- or strap-shaped thallus for their growth form (Fig. 1). It develops from a spore, which consists of a single cell that under the right conditions germinates, or begins a series of cell divisions. The spore came from a specialized reproductive structure that develops on a female thallus. Yes, common liverwort is dioecious, meaning that like cottonwoods and wild yams, there are male and female individuals.

The term thallus describes a flattened vegetative body of a plant that is not differentiated into organs such as stems and leaves. However, a cross section of the common liverwort thallus (Fig. 2) bears a strong resemblance to the cross section of a leaf.

Fig. 1. Common liverworts (Marchantia polymorpha) photographed in the Gila National Forest, New Mexico. Courtesy of Russ Kleinman.

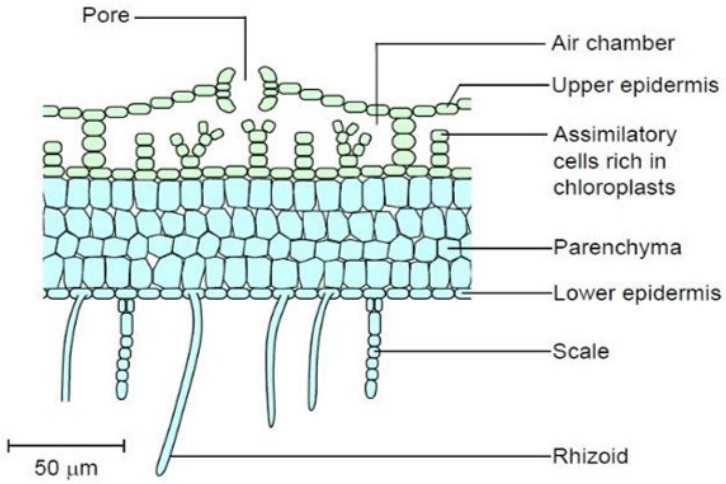

Fig. 2. Diagrammatic cross section of a common liverwort thallus (https://cronodon.com/BioTech/liverworts.html)

There is a single layer of cells forming the upper epidermis. Regularly spaced pores in the upper epidermis resemble and function like stomata. A circular stack of 4 or 5 cells around the perimeter of the pore are able to bend inward collectively as a group and decrease the pore diameter in a manner analogous to the guard cells of stomata. You might say the liverwort pore is a primitive stoma. Below the epidermis is a layer of chlorophyll-containing cells, similar to the spongy mesophyll tissue of a leaf, where loosely arranged cells allow air to circulate and bring CO_2 to photosynthetic cells. Several layers of parenchyma cells (general, non-specialized plant

cells) form a layer in the lower half of the thallus and provide food storage. The lower epidermis makes the bottom of the thallus. Single-cell rhizoids are root-like outgrowths of the lower epidermis that anchor the thallus to its substrate. Rows of short scales, each a single cell layer thick, are also present on the lower surface. They may facilitate water and nutrient transport over the ventral surface of the thallus.

Common liverwort consists of a dichotomous thallus (forking into 2 branches) 10-20 mm wide, 2-10 cm long, and about 0.5 to 1.5 mm thick. It is described as complex in comparison to the thalli of other liverworts that are simple, meaning they lack specialized layers of cells. Like its close relatives the mosses and hornworts, liverworts lack vascular tissue (i.e., lignified xylem and phloem tissue for transport of food and water and for structural support). They are also unable to make seeds, pollen, flowers or fruits. So liverworts are clearly simple and, one could argue, primitive plants. But do not make the mistake of interpreting that to mean liverworts are evolutionarily and ecologically unsuccessful. There is good reason to think the tremendous success and importance of the Kingdom Plantae is in part due to liverworts.

We know for sure that plants originated within a group of green algae in the Class Charophyceae. Estimates of when this happened range from 515 to 470 MYA (in the middle Cambrian to Early Ordovician). No plant fossils have been found to confirm this, but that would be expected given that the first land plants were algae-like growth forms composed of soft tissues. The earliest clear evidence of land plants is fossilized plant spores dated to approximately 476 MYA. The oldest plant megafossil is from 432 MYA and belongs to *Cooksonia*, a genus with leafless, dichotomously branching vascular stems a few centimeters tall. The identity of the plant that produced those spores is uncertain. But since the bryophyte clade is the most primitive, the assumption has been the plant was a bryophyte. A paper published in 1998 used mitochondrial DNA to confirm that liverworts were the first land plants. They are more closely related to Charophycean algae than any other plants.

The transition of life from water to land was especially challenging, so being the first land plant was a very difficult assignment. The biggest challenges were desiccation (due to high solar radiation), obtaining nutrients (from air and soil instead of water), staying upright (without the buoyancy of water), reproduction (in a waterless environment) and the mutagenic effects of UV radiation. The adaptations that plants exhibit to overcome these challenges provides a list of characteristics that separate plants from algae and distinguish different plant groups. While liverworts demonstrate some of these features, perhaps one of the most important characteristics pioneered by liverworts is their mycorrhizal-like associations with fungi. Fungi were already present on land when those first algae-liverwort plants colonized the land. Several lines of evidence, including fossilized plants and spores, molecular and genetic data, and physiological observations support a model wherein liverworts were associated with obligately biotrophic Glomeromycota, partially saprotrophic Mucoromycotina, or both fungal groups simultaneously. It is very likely that the challenges presented by the terrestrial environment, the problems of desiccation and starvation, were so extreme that successful colonization by plants could not have happened without the help of fungi. Nowadays about 85% of all plant species utilize mycorrhizae, thanks to liverworts.

Common liverwort occurs throughout Iowa, with collections from 40% of Iowa's counties. It's probably most common on wet, seepy sandstone walls, but has also been observed in fens, on limestone cliffs, on algific talus slopes, along streams and on north-facing forest slopes. However, its ecological success is much more impressive globally. *Marchantia polymorpha* has been observed from all over the world, from as far north as northwestern Greenland (77°N) and northern Svalbard, a Norwegian archipelago in the Arctic Ocean (80°N), to the southern tip of Chile (55°S). It occurs in the dry plains of western Nebraska and Kansas (in wet ditches and seepy stream meadows) and on 11,000-foot mountain peaks in Peru. Plants have established populations at 8,000 feet in the upper Praviy Talgar Valley deep in the Zailiskiy Alatau mountains of Kazakhstan, as well as in dense, humid tropical forests in northern Madagascar. It's been collected from a watered lawn off moist, shaded soil

on the University of Nevada campus and a site as remote as St. Matthew Island in the Bering Sea. Its distribution and ecological success are utterly amazing, and helps explain the numerous morphological taxa recognized – 3 subspecies, 26 varieties, 19 forms and 9 subforms. The name *Marchantia polymorpha* is exceedingly fitting.

The growth form of thalloid liverworts is ideal for the microhabitats the plant lives in. The flat, paper-like thallus, about the thickness of a credit card, has a very high surface area to volume ratio. It is able to directly absorb water and nutrients which are accessible to the cells inside the thallus by passive diffusion (no need for vascular tissue). The high surface area to volume ratio of liverworts (and other Bryophytes) makes them useful as bioindicators of environmental health. Liverworts provide a method for monitoring air pollution and detecting the presence of heavy metals. The same growth form is used by more modern flowering plants such as duckweed (family Lemnaceae) and riverweeds (family Podostemaceae). In these plants, their thalloid growth form is a strategy capitalizing on reduction and specialization. In the liverworts it was simply the best approach to living on Earth's early terrestrial environments given what the Charophycean green algae had to offer.

Liverworts and other bryophytes are considered shade plants, as the microhabitats they occupy often are shady. But common liverwort is quite capable of growing in sunny places. A recent paper demonstrated that among three bryophytes examined (a moss, a leafy liverwort, and a thalloid liverwort), the thalloid liverwort, represented by *M. polymorpha*, exhibited the greatest ability to acclimate to sun vs. shade light levels. This means that common liverwort plants growing in full sun were distinctly different than plants in the shade in ways that were beneficial. Sun acclimated plants were tougher, more leathery and resistant to water loss. The types and amounts of pigments in their thalli were better suited for high light levels and they had greater amounts of UV-absorbing compounds for protection. Shade-acclimated plants had higher total amounts of chlorophyll for increased absorption of light.

In western North America, common liverwort is chiefly associated with microenvironments in montane ecosystems where moist or wet mineral soil is exposed. The ability of common liverwort to acclimate to variation in the light environment is one reason why it is an important early successional species following fire. It can exhibit dramatic growth postfire and in some cases attain 100% cover of the soil, forming liverwort mats which help control soil erosion.

Ecologically, liverworts can hold their own against some pretty tough and successful plant species. As a division (Marchantiophyta), they do pretty well evolutionarily too. The number of liverwort species worldwide is estimated to be 9,000. That number easily exceeds the number of species in many well-known and respected angiosperm families, for example the mustards (Brassicaceae 3,780), the mints (Lamiaceae 7,280), and the sedges (Cyperaceae 5,000). Iowa has at least 63 liverwort species represented by 34 genera. Another genus and species of thalloid liverwort you might find when liverwort hunting in Iowa is snakeskin liverwort (*Conocephalum conicum*, Fig. 3). There are 141 vascular plant families represented in the flora of Iowa and only 6 of them have more species present in Iowa than there are liverwort species. It seems fair to conclude that liverworts are quite successful in terms of their diversity.

Fig. 3. A wet sandstone wall covered with snakeskin liverwort (Conocephalum conicum) at Ledges State Park in central Iowa. Photo by Thomas Rosburg.

The ecological and evolutionary success achieved by liverworts, the "simple" plants whose ancestors

colonized land 500 MYA, is by itself remarkable. It is especially more remarkable because that success has been achieved by the gametophyte generation, the plant life cycle stage in alternation of generations that is haploid, meaning there is just one set of chromosomes present in each cell. In alternation of generations, a feature present in all plants and some algae, there are two multicellular life cycle stages in the life of a sexually-reproducing individual. The gametophyte stage is haploid and where the sex cells, the sperm and egg cells, are produced. The other generation is the sporophyte generation. It is diploid and where meiosis occurs, but unlike in animals, meiosis produces spores rather than eggs and sperm. Both generations are required for sexual reproduction.

When you discover a liverwort plant, you are seeing its gametophyte generation. When you admire the beauty of a milkweed or climb up into a maple tree, you are touching its sporophyte generation. Bryophytes, which includes liverworts, mosses and hornworts, are distinctly different from all other plants in that the gametophyte generation is the dominant generation (i.e., the life cycle stage that makes the plant we see and name). This difference is the characteristic that is most important in making bryophytes "primitive" and aligning them as the plants most related to algae.

Because liverwort plants are haploid, they have half the genes that are present in a diploid sporophyte. Thus in a very direct way, they are much more constrained in terms of their range of possible phenotypes. An organism's phenotype is the total of its outward physical appearance and its inner anatomy and physiology. It is the product of the genes it carries and how they interact with the environment. A strong evolutionary trend in the plant kingdom has been to make the gametophyte generation smaller and less conspicuous, and at the same time to make the sporophyte larger and the dominant generation. As a consequence, in the vast majority of plants, like ferns, pine trees and sunflowers, the sporophyte generation is dominant and the one that interacts with the environment the most. Since the sporophyte stage is diploid (it carries 2 copies of each chromosome) it has twice the genes of a haploid organism and therefore greater amounts of genetic variation. We learned from Charles Darwin that genetic variation is an essential prerequisite for a species to respond to the environment and adapt. Sporophytes are better prepared for that than are gametophytes. For this reason, the ecological and evolutionary success demonstrated by liverworts is all the more impressive since they accomplished it with "one hand tied behind their backs."

When liverworts reproduce sexually, the sporophyte generation is present (it results when a sperm fertilizes an egg), but it is always much smaller than the gametophyte and completely dependent on the gametophyte for its nutrition. Remember that in liverworts, the gametophyte is the liverwort plant you see growing on damp soil or rocks. The common liverwort utilizes specialized structures that are slightly elevated above the thallus to produce eggs and sperm. On male plants these are about 1-3 cm tall, on female plants they are 4-6 cm tall. In all bryophytes, the sperm cells must somehow find and travel to an egg. This usually requires some swimming, although sperm can also travel in water drops and on small invertebrates. The chances that fertilization is successful is increased if the plants are small and crowded together and there is some water in the environment. Successful fertilization creates a zygote, which grows into a small structure that is the sporophyte generation. It produces tiny, single-cell spores by meiosis, which are released and serve as the dispersal propagule. If they find an appropriate environment, spores germinate and produce a new individual liverwort plant.

Like many plants, liverworts can also reproduce asexually. Asexual reproduction may be more common and important than sexual reproduction, especially if the sexes are on separate plants like in common liverwort. Fragmentation of tissue is a common method of asexual reproduction. If small fragments or pieces of tissue are separated from a plant and relocated they can produce a new plant. Another more active method of asexual reproduction in liverworts (and mosses) is the formation of gemmae, small, multicellular, flat to slightly biconvex disks. In common liverwort these are produced in gemmae cups (Fig. 4) on the surface of the thallus. Dispersal of gemmae is facilitated by raindrops

forcefully splashing gemmae into the air. Gemmae cups must be perfectly designed to maximize the conversion of the energy in a falling raindrop into explosive propulsion, as dispersal distances of up to 1.2 meters have been observed.

Liverworts have attracted the attention of scientists and naturalists for over 2,000 years, going back to the herbal writings of Aristotle and Theophrastus, who sometimes mistakenly referred to them as lichens.

Interest in *M. polymorpha* intensified in the 19th century and it has become one of the most studied species in plant science. The developing thallus, either from spores or from gemmae, has been used for nearly 200 years to study morphological and physiological responses to various environmental factors. It's a good bet that every botany textbook utilizes *M. polymorpha* as its example liverwort or bryophyte. Because *M. polymorpha* possesses many useful qualities that make it ideal for investigating plant biology, research labs around the world are becoming yet another form of habitat for common liverwort.

All in all, I'd say it's astonishing what a liverwort can teach you.

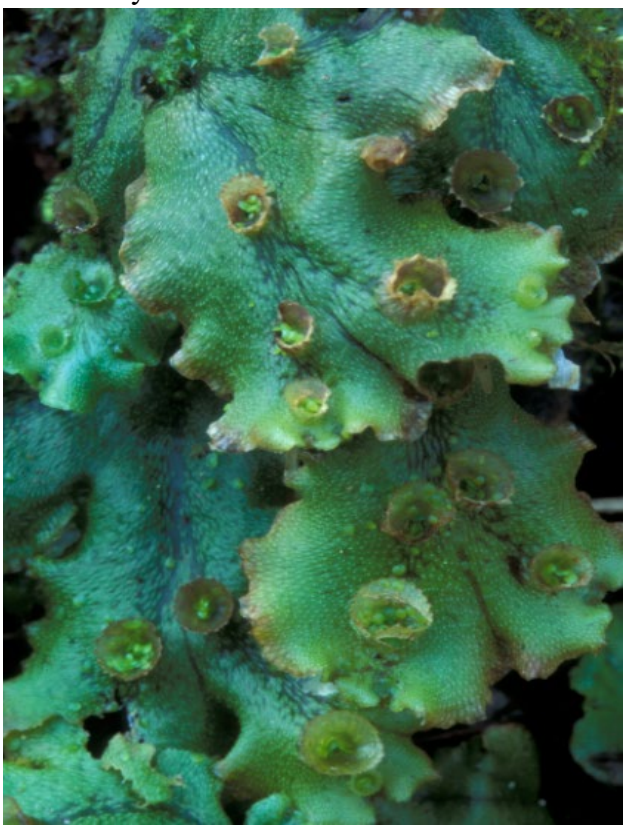

Fig. 4. Common liverwort on bank of the Upper Iowa River in Howard County. Gemmae cups are visible. Photo by Thomas Rosburg.

Pasqueflowers, continued from page 1

Peering over the edge I see a pile of loose, yellow soil maybe halfway to the bottom. I drop to it. My feet make a soft, muffled *pfffff* on impact like a head plopping onto a pillow. Another short hop and I'm at the bottom of the cut. I grab the bottle, easy peasy. The mouthpiece is muddy with spring rain and loess. I stand and wipe the soil away and do what I always do when next to a vertical slice in the land: look back in time.

Bits of irregular loess kindchen dot the beige windblown strata as if a fistful of misshapen teeth had been hurled against the embankment. Sun-bleached pink-white snail shells extrude from the wall, squeezed out like bits of toothpaste. Tiny gray-green leaves of scarlet globemallow huddle around wooden tendrils sprouting from the base of the cut. *Wait… scarlet globemallow!* Cowboy's Delight! *Sphaeralcea coccinea*! I forget the pasqueflowers immediately. Here is an old friend I haven't seen since my seasonal work "out west" seven years prior. It's common there, but rare in Iowa. I've never actually seen it on this side of the Missouri until this moment.

Found in only a handful of Loess Hills hideouts, the Iowa DNR lists scarlet globemallow as a state threatened species. This plant was recorded on a survey conducted here twenty-five years ago. It's not been seen since. On top of that, it hadn't been recorded in *this* spot. It's a new population. Mine. My own. My precious. I take several blurry pictures, drop a GPS pin, and collect a few leaves to confirm the identification back at the barn.

Thirsty from clamoring, I drink from my dirty, old bottle while scouting a way back up. A new, fresh chalky taste of loess mingles with the familiar flavors of burnt prairie and cedar sawdust. The bottle still whistles, but new clogged bits of soil have shifted the vibrating air to a different frequency. The subtle sonic change in my water bottle-become-rare plant dowsing rod reminds me that this prairie, and all prairies whistle their own tune. Each is a unique ensemble worthy to be heard. I don't know why there aren't pasqueflowers here or why there is scarlet globemallow, but I do know I'll keep searching these hillsides, listening for whatever song they may sing while keeping a loose grip on my water bottle.

Sad News: word has just reached us of the passing of Bob Scarth

Bob and Linda Scarth were very active, charter members of the Iowa Native Plant Society. They generously shared their photographs that graced a number of issues of *Erythronium*. In their retirement, they (as the photographers) and John Pearson (essayist) produced *Deep Nature: Photographs from Iowa*, a beautiful book of Iowa nature photography published by University of Iowa Press. More information will likely be available soon on the Iowa-Native-Plants listserv and in the "Gifts" section of the Iowa Native Plant Society website: http://www.iowanativeplants.org/gifts.php.

Bob at Backbone State Park field trip, 2015 INPS anniversary celebration; photo by Deb Lewis

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*The Iowa Native Plant Society is a non-profit organization under section 501 (c) (3) of the Internal Revenue Code. Annual contributions beyond basic membership are tax deductible.