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Plants on the Move

Botany

by Paul E. Rothrock

Trout lily flowers open in the morning and close by evening. Bur cucumber tendrils rotate in space and miraculously clasp objects they encounter. The root of a germinating acorn unfailingly bends downward into the soil. Sugar maple saplings angle toward the opening in the forest canopy and position their leaves with a minimum of overlap. All these commonplace examples loudly say that "plants move."

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In the morning trout lilies (Erythronium americanum) open their petals in about 30 minutes. Later in they day they close, growing bigger day by day.

Plants move and bend and grow in specific directions through a series of responses known as nastisms and tropisms and all of this movement is accomplished without muscles or nerves.

Nastisms are movements whose direction is independent of the direction of the stimulus. These include the opening and closing of flowers and the bending of some tendrils. Tropisms, involving light and gravity, cause plant parts to bend toward or away from a stimulus. Both nastisms and tropisms generally result in different rates of growth on one side of a plant organ compared to the opposite side. Many of these responses received their earliest scientific investigation by Charles Darwin and his son Francis about 130 years ago in *The Power of Movement in Plants*.

I have always found the opening (and closing) of trout lilies fascinating, a process that takes about 30 minutes. In the morning, the inner surface of the petal rapidly grows in length as the temperature rises, whereas the outer surface does not. Late in the day or with a change in weather, the cooling results in a more rapid growth of the outer surface. Thus, the petals of trout lilies are slightly bigger at the end of each day. Although no one is quite sure why these flowers open and close, one suggestion is that closure reduces the risk of entry and growth of pathogens on rain- or dew-soaked tissue. To see an outstanding time lapse video showing a

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On the move – from page 1

spring blossom opening and closing, go to http://www.youtube.com/watch?v=m5lZ2FpXvb4.

The coordinated movements of bur cucumber tendrils are an even greater marvel. It is by tendrils and other clasping organs that vines climb upwards while expending a minimum of energy making wood. The action of tendrils begins with their slow sweeping motion. Should the tendril contact a rigid object, within minutes it begins to form a spiral coil that will wrap firmly around the object touched. The relatively sudden change in tendril motion is the result of water exiting mechanically stimulated cells. As a result, one surface of the tendril grows more slowly than the other. In addition to this "contact coiling," bur cucumber also exhibits "free coiling" along the remainder of its tendril and forms a spring with both right handed and left handed helices. Recent research has demonstrated how this remarkable spring structure gives rise to additional coils as the tendril dries, thus drawing the vine closer to its support structure. Check this out on a really cool web video – http://www.youtube.com/watch?v=Vbzgv5iKEyY.

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Wikimedia - Joh Sullivan

Fast moving plants from top: closed trout lilies, open trout lilies, and the tendril of a pea.

The bending of an acorn's taproot towards gravity, while less dramatic than the movement of tendrils, is a more universal plant adaptation. Root tips are covered by a cluster of protective cells called the root cap. In gravity-sensitive roots these cells are loaded with heavy starch grains called statoliths. Regardless of the orientation of the cell, its statoliths always fall to the "bottom". If you were to carefully cut off the tip of the acorn root, it would no longer "know" which is down. While statoliths explain how gravity is perceived, there remains the need to pass that information to cells further up the root where bending can occur. Most recent experiments indicate that a long-familiar plant hormone called auxin is responsible for carrying this message. To see gravitropism in action visit http://www.youtube.com/watch?v=zctM_TWg5Ik.

"Plants move and bend and grow in specific directions ... and all of this movement is accomplished without muscles or nerves."

Auxin also plays an important role in steering plant stems toward light and so, in turn, in positioning maple leaves for maximum light absorption. Most evidence suggests that auxin is either inhibited on the lighter side of a stem or preferentially transported away. This chemical cue allows cells on one side (the shaded side) to elongate more than those on the other. It is fun to visualize how these tiny, moment by moment movements iterated throughout the canopy of leaves can result in the beautiful matrix of green in our forests.

As you hit the trails this summer, look for examples of plants on the move. See how much can be accomplished by the simple principle of one side of a plant organ growing faster than the other.

Dr. Paul Rothrock is Professor of Earth & Environmental Science & Biology at Taylor University in Upland, IN as well as an INPAWS member and popular hike leader.

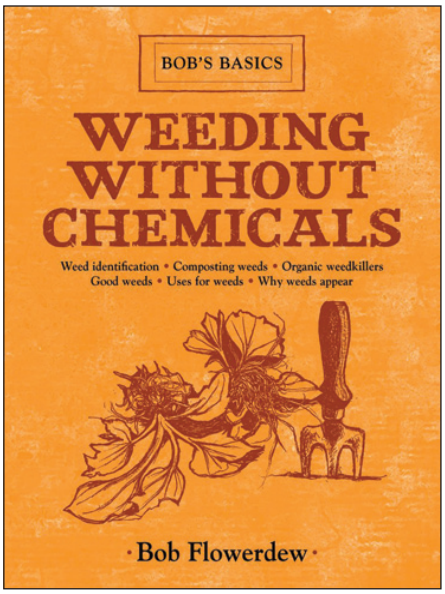
Bob's Basics:
Weeding Without Chemicals

Book Review

Patricia Happel Cornwell

"Never stop weeding," writes Bob Flowerdew. Do it "again and again until the victory is yours." I was afraid he was going to say that.

In his book *Weeding Without Chemicals*, one of six in his "Bob's Basics" series, the author describes a surprising number of ways to kill or remove weeds without the use of herbicides. The book is a sturdy little hardcover, 6 ¼ x 8 ¼ inches, full of photos and illustrations, with clear headings that make it easy to hop around and find what you want.



This Brit with the strangely appropriate name, long braid, and toothy grin is a familiar character in England. He has written more than a dozen books on organic gardening, appeared on the "telly," and been a regular panelist on BBC Radio's "Gardener's Question Time."

Since we got our place listed by the National Wildlife Federation as a Certified Wildlife Habitat, I have felt a little helpless in the battle against weeds. I just want a little order in my borders around the house. The weeds and snakes can have the other 18 acres.

My favorite Flowerdew suggestion is killing weeds in hard-to-weed places simply by pouring boiling water on them. "Tougher weeds require several applications, but die they do," he promises. I can't wait to try it on the weeds that keep popping up between the flagstones of our walk and patio.

Other suggested weedkillers are salt, soaps and detergents, vegetable oils, corn gluten meal, even steam and flames. Flowerdew doesn't shrink from hoeing, raking, digging and plain old-fashioned pulling, but he gives practical advice on how to maximize success with each of these methods.

The author offers numerous ideas for types of mulches to suppress weed seed germination and different strategies for getting rid of weeds in vegetable gardens, flower beds, rose beds, shrub borders, lawns, driveways and patios. In brief appendices, he lists what weeds tell you about your soil, the mineral values of weeds, and which weeds are valuable to which insects.

The only reservation I have about the whole book is Flowerdew's recommendations for controlling weeds in woodlands, which I consider too aggressive. The author suggests using shears or string trimmer on unwanted plants and establishing ground cover ("long grass in sunny parts and ivy in shade") to suppress weeds. Granted, I spend many hours every summer out in my own woods, uprooting Japanese honeysuckle until I can hardly stand up straight. But, for the most part, I prefer to let my woodland set its own agenda.

Weeding Without Chemicals is a beautiful and useful little book. It shines a slender ray of hope on a never-ending chore and cheers us on. Maybe not today, maybe not tomorrow, but someday we may get just one step ahead of the weeds.

Bob's Basics: Weeding Without Chemicals *by Bob Flowerdew. Skyhorse Publishing, New York, 2012*

"I have a room all to myself; it is nature."

~ Henry David Thoreau

A Wildflower from Outer Space?

Plant Profile

*"I found numerous odd plants blooming cock-eyed right out of a pile of gravel. The plants looked like something from outer space." The alien turned out to be clammyweed (*Polanisia dodecandra*), pictured at right.*

Reviewed by Patricia Happel Cornwell

You're going to think I made this up.

I was walking a dog in Sioux Falls, South Dakota, when I found a plant called redwhisker clammyweed. We were visiting our daughter and her family. While their dog sniffed every curb for signs of fauna, I scanned for flora. Where the subdivision ended at a disturbed field, I found numerous odd plants blooming cock-eyed right out of a pile of gravel. The plants looked like something from outer space.

The dog wasn't finished sniffing, but I hurried back to do an online search and discovered that this strange species is actually terrestrial. "Redwhisker" describes the feathery purplish stamens that extend well beyond the four loose petals of each small white flower in the racemes. (While reference sources use the term raceme, the impression of these clusters of flowers is that of a compound umbel.)

"Clammyweed" refers to the short sticky hairs that cover the plant. Each leaf has three lanceolate leaflets, ½ to 1 ½ inches long. From a central stem, arm-like branches extend, each topped with a cluster of whiskered flowers. The weirdest feature of redwhisker clammyweed is its pods. Two to three inches long, they point straight up on either side of the flower cluster, like alien green hands saluting the mother ship.

This plant with the unattractive common name has a pretty Latin name: *Polanisia dodecandra*. A member of the caper family (*capparaceae*), it is closely related to spiderflower (*Cleome*), but *Cleome*'s pods point out or down and its leaves have five to seven leaflets.

Polanisia dodecandra blooms contentedly from May to October in full sun and barren, gravelly, preferably disturbed soils. It grows to 32 inches, but the specimens I saw were 12 to 16 inches. While it is considered a plant of the plains, the only states in the continental U.S. where redwhisker clammyweed *does not* grow are the Carolinas, Florida, Louisiana and Maine. So yes, it can be found in Indiana, although it is an introduced species here.

One web site calls it "an easy-to-grow annual that makes a nice airy filler plant in gardens." Another source says it "self-sows freely." Nowadays, when drought seems to be an annual occurrence, many of us are looking to add drought-tolerant species to the landscape.

Mike Homoya, botanist and plant ecologist with the Indiana Department of Natural Resources and author of *Wildflowers and Ferns of Indiana Forests*, says, "I consider *Polanisia dodecandra* var. dodecandra a native in Indiana in some habitats, such as gravel bars. It is not cultivated as far as I know. I haven't seen any real invasive problems with it in Indiana, but it has been known to escape elsewhere." Homoya says another variety of the species, *var. trachysperma*, is "the showier western variety that is cultivated and probably not native to Indiana."

© Patricia Happel Cornwell

Kay Yatskievych, research associate at Missouri Botanical Garden, who lists *Polanisia dodecandra* in her *Field Guide to Wildflowers of Indiana*, notes that she considers it a subspecies, "as does *Flora of North America*."

I found another wildflower that same afternoon in South Dakota. It goes by the name curlycup gumweed. But that's another story.

Patricia Happel Cornwell grew up on a farm in Floyd County, where she first became enamored of wildflowers. She and her husband John live on 19 acres registered as a National Wildlife Federation Certified Wildlife Habitat in rural Harrison County. She became an Indiana Master Naturalist in 2010.

Part II

Perils of the Beach Pea

by Barbara Plampin

You'll recall from Part I in the Winter 2013 issue of the INPAWS Journal, that the state-endangered beach pea (*Lathyrus japonicus glaber*) is down to just one population in Indiana. Circumpolar, our plants do grow at the southern end of their range; they've suffered grievously from human trampling and ATV's and the disturbance of sand movement caused by jetties and seawalls. You'll remember that in his 2007 pilot study, MS candidate John Dollard of Indiana Dunes National Lakeshore (IDNL) strove to prevent extirpation by examining the effects of supplemental watering on 300 greenhouse-grown beach pea seedlings he introduced at six foredune or blowout sites, where the plant had been known historically.

By October of 2007, a dry year, all pilot study plants had died. Dollard concluded it was because of insufficient supplemental watering and sand accretion (burial). But Dollard learned from failure.

Instead of having water table-reaching taproots, beach pea depends for moisture on the fibrous roots of rhizomes up to 32 meters long that grow horizontally at 10 to 20 centimeters below the surface. Supplemental watering is necessary. The problems are how much moisture to provide and how to eliminate sand burial until juvenile transplants mature.

The next year, in his spring 2008 to spring 2009 experimental reintroduction study, Dollard repeated his 2007 layout of both watered and control (unwatered) plots. He planted his greenhouse-grown seedlings at the same two isolated locations (four sites at one, two at the other), but he moved all plantings further back from foredune crests or onto secondary dune ridges to diminish winter sand burial. At a new third location, he added a seventh, somewhat dissimilar site where cottonwood (*Populus deltoides*) provided some shade and where the ground was more open because the associate, marram grass (*Ammophila breviligulata*), was not too thick. Here more surface water was available. This site turned out to be the best. Here he installed 50 plants, raising his 2008 introductions to 350 from 2007's 300. He also increased the supplemental watering of 7.5 liters per plot from twice to thrice weekly. He put sand collars around all 350 plants and arranged silt fencing to keep away blowing sand. Further, he installed larger seedlings (6 to 12 months old) earlier – in May instead of June.

Results: eighteen transplants survived into the spring of 2009. One survivor even sent out a single flowering stem in 2012; however there were no seeds. (Sowing seeds doesn't work anyway because the seed coat is too tough.) In a sense Dollard had failed again. According to the Center for Plant Conservation, fifty plants constitute "a minimum viability population." But in another sense Dollard succeeded because his work does prove the value of supplementary watering when transplants are puny. Mature plants need less supplemental water.

Dollard established other "protocols," among them using several locations to disperse risk, placing locations in remote areas to avoid human disturbance, adding plants to existing reintroductions, growing plants in the greenhouse longer to avoid transplant shock, collecting seeds from more than a single population to create genetic diversity, putting sand collars around first year transplants, and establishing sand barriers for two years. Furthermore, he placed semi-permanent water tanks at sites to eliminate the impractical hand-carrying of water.

No single MS thesis can do it all, but Dollard's work is important. It is stored at IDNL, registered at the International Plant Registry at the Center for Plant Conservation in St. Louis, Missouri, and will appear as an article in the peer-reviewed journal *Ecological Restoration*. His work is responsible for IDNL's planning to establish a panne site (pannes are intra-dunal ponds created when wind blows away sand down to the water table), where near-perpetual surface moisture may yield a successful population.

UPDATE: This spring, I saw 200 very healthy beach pea seedlings in the IDNL greenhouse awaiting transplant.

Barbara Plampin is a Life Director of the Shirley Heinze Land Trust and a field botanist. She does rare plant monitoring, often for the Indiana Department of Natural Resources. She holds a Ph.D. in English and lives in the Indiana Dunes.

*The beach pea (*Lathyrus japonicus glaber*) is in danger of extirpation, but a scientist at the Indiana Dunes National Lakeshore is testing ways to protect and expand its presence.*

Why Do the Scientific

Taxonomy

by Michael Huft

As I take part in field trips and talk to plant enthusiasts, I find that one topic that often puzzles people is the frequent changes in scientific names of plants. Shouldn't *these* names, at least, be unchanging? It is true that one of the principal purposes of scientific names of plants is to provide stability. But there are other reasons for scientific names as well, and these reasons, especially the attempt to encapsulate something about the classification of a plant in its name, sometimes work at cross purposes with the goal of stability.

There are many reasons why names change, but before we can make sense of them, it is useful to describe a few basic principles of botanical nomenclature and classification.

Principle 1. The basic unit of plant classification is the species. A group of closely related species are collected together into a larger group called a genus (plural: genera). The goal is to circumscribe a genus so that all the species in the genus are more closely related to each other than any one of them is to any species in another genus. A genus may consist of two or more subgroups of species, each of which conforms to the goal for a genus, just as the entire group does. Accordingly, botanists may differ among themselves – one treating the entire group as a single genus, another treating them as two or more closely related genera.

Principle 2. The scientific name of a species of plant consists of a genus name followed by a specific epithet. For example, the wild bergamot is known as *Monarda fistulosa*. The first word in this name, *Monarda*, indicates the genus to which this species belongs. The word *fistulosa* is its "specific epithet." There are other species in the genus *Monarda*, and they each have a different specific epithet, for example, the bee-balm, *Monarda didyma*, or the horsemint, *Monarda punctata.* Because all three species (as well as two other Indiana species and several non-Indiana species) are in the genus *Monarda*, it is clear that they are closely related, a fact that is obscured by the very different common names for these species.

Principle 3. Each species must bear the earliest available specific epithet given to that species. For example, bee-balm was given the name *Monarda fistulosa* in 1753. Later, in 1756, someone gave the name *Monarda mollis* to a plant that was later shown to be the same as *Monarda fistulosa*. Because it was published later, the name *Monarda mollis* cannot be used for this species. A baseline date applies to this principle of priority, which is the publication of Linneaus' book *Species Plantarum* in 1753 – the agreed-upon starting point for scientific names of plants. That book was an attempt to describe and classify all the plant species in the world and to give them consistent names. It was also the first publication that consistently used the two-word form of species names, i.e., genus name plus specific epithet, for all species. Names for any plants published prior to 1753 are not valid.

Hairy puccoon, which resides in northern Indiana and attracts butterflies, has gone through a scientific name change under principle 4 of botanical nomenclature.

Principle 4. Species are recognized by differences in several characteristics, in each of which there is a noticeable gap in the variation. Members of the same species may be quite variable in several characters, but the variation is continuous, for example, a range of flower color from near-white to blue, such that there is no meaningful place to draw a line.

With these principles in mind, we can now examine various ways in which the scientific names of plants can change.

Names of Plants Change?

One type of change results when someone discovers an older name for a given species (Principle 3). For example, the sky-blue aster had long been known as *Aster azureus*, a name that was first published in November 1835. In 1983, a botanist discovered that another name for this species, *Aster oolentangiensis*, had been published slightly earlier, in April 1835. Thus, since 1983, that name has been used for the plant instead of *Aster azureus* (though a number of publications do continue to use the name *Aster azureus*).

Much more common than this type of change, however, are changes that result when it is found that a plant has been classified in two different ways. Suppose a species is first discovered in the eastern United States and given a name. Somewhat later, a botanist who is unaware of the eastern species finds the same species in the Midwest and gives it a name. For a while, books and field guides in the east will use the older name, while similar books in the Midwest will use the newer name. Eventually, someone will realize that the two "species" are actually the same, and that the older name, originally used in the east, will have to be applied to both species.

A similar situation might occur where the second botanist is aware of the first species from the east, but finds a plant in the Midwest that differs from the eastern plant in several characteristics. He therefore names it as a new species in the same genus and gives it a different name. Later, as botanists become more familiar with the plants in the genus growing in areas between the localities where the eastern and the midwestern species were first found, they find that although the differences are real, there is a continuous variation between the eastern and the midwestern populations such that it is not possible to draw any clear dividing line between the two extremes (Principle 4). As a result, the two "species" are combined into a single species under the earlier name, the one originally given to the eastern extreme. People using field guides in the east will not notice any change, but those in the Midwest will see a name change.

An example of this type of change is provided by the plant known in northern Indiana as hairy puccoon (*Lithospermum caroliniense*). The name *Lithospermum caroliniense* was first applied to plants from South Carolina. In 1935, similar midwestern plants were named as a new species, *Lithospermum croceum*, based on relatively small differences in a number of characters. Later studies showed that those differences were not significant and did not form gaps of the type that generally signify differences between species. Thus, the southeastern as well as the midwestern plants are now all treated as a single species, using the older name, *Lithospermum caroliniense* (the most recent edition of Swink and Wilhelm's *Plants of the Chicago Region*, however, still uses the name *Lithospermum croceum* for the midwestern populations, as does Charles Deam's *Flora of Indiana*). The differences, however minor, do remain, though, and botanists sometimes treat the midwestern population as a separate variety (a subdivision of a species) from the southeastern populations, *Lithospermum caroliniense* var. *croceum*.

Although most name changes result from a change in classification, and a few because of the discovery of older names, there are also special cases. One example is provided by two common species of the spurge genus, *Euphorbia* – creeping spurge, an annual whose branches grow flat on the ground, and nodding spurge, a similar species with arching branches. Under the rules, each name of a species must be tied to a specific specimen of that species, called the type specimen, stored in a herbarium (the rules governing type specimens are complicated, and I won't begin to describe them here).

The name *Euphorbia maculata* was first used by Linnaeus in his book *Species Plantarum*. In Linnaeus' herbarium, which contains the specimens that form the basis for his book, there are two specimens labeled *Euphorbia maculata*. One of them is creeping spurge, and the other is nodding spurge. If the name *Euphorbia maculata* is applied to nodding spurge, then the earliest name available for creeping spurge is *Euphorbia supina*, and you can find that pair of names in many manuals and field guides. On the other hand, if the name *Euphorbia maculata* is applied to creeping spurge, then the earliest name available for nodding spurge is *Euphorbia nutans*, and

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Submissions

All are invited to submit photos, articles, news, and event postings. Acceptance for publication is at the discretion of the editor. INPAWS welcomes differing points of view.

Please submit text and high resolution photos (300 ppi) via e-mail to journal@inpaws.org. Submission deadlines for specific issues are:

Spring–February 23 for April 1 mailing
Summer–May 23 for July 1 mailing
Autumn–August 23 for October 1 mailing
Winter–November 23 for January 1 mailing

Mission

To promote the appreciation, preservation, conservation, utilization and scientific study of the flora native to Indiana and to educate the public about the value, beauty, diversity, and environmental importance of indigenous vegetation.

Membership

INPAWS is a not-for-profit 501(c)(3) organization open to the public at inpaws.org.

Share

Please direct Information of interest to webmaster@inpaws.org.

Small Grants

We are pleased to announce that each of the following projects has been awarded an INPAWS 2013 grant. The Small Grants program received a total of 19 applications.

Jameson Camp (Indianapolis) Native plants will be further added to the grounds of the camp for educational and habitat value.

Osborne Park Restoration (New Castle) Originally a flat woods habitat, the current herbaceous layer is predominantly fescue and brome, but has many spring wildflowers and sedges. The project proposed will chemically remove the Eurasian grasses, drill an upland woodland seed mix, plant oak seedlings, install interpretive panels and trail.

HOPE (Evansville) A garden for **H**abitat **O**bservation and **P**reserving the **E**nvironment at Vogel Elementary School. Vogel will create a butterfly garden along with a short grass prairie, shade garden, and sun garden using native Indiana plants. Over 650 students will benefit from the HOPE garden.

Lily Day Nursery (Indianapolis) This project will use native plants to create two exciting planting bed pockets where kids and visitors will interact and discover. Part of multi-purpose outdoor classroom areas connected with natural pathways.

Remington Parks Prairie Grass (Remington) The project will establish prairie species in a low flood prone area.

Mulberry Library Demo Rain Garden (Mulberry) This project will serve as a demonstration area for library patrons, local schools, FFA programs, and persons interested in conservation, water quality, and the importance of native Indiana plant communities. The Demonstration Rain Garden will also be used in programming for Clinton County Soil and Water Conservation District.

Research conducted by Asya Robertshaw: Mutualisms in a Warmer World (West Lafayette) The project will evaluate the community composition of spring wildflowers and their pollinators under ambient and elevated soil temperatures while contributing to the educational resources at a local biological reserve. Changes in environmental conditions may disrupt plant-pollinator interactions if each partner responds differently to changing

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Equinox Garden Tour
September 22, 2013

You may have wondered how native plant gardens and specific native plants look throughout the garden season; this year you can find out! You will be able to view photos and read descriptions of our garden tour sites at three times – late May, late July and early September and then visit them on Sunday afternoon, September 22nd.

Mark your calendar now and check the INPAWS website and blog throughout the summer for more detailed information and photos.

The Equinox tour includes a wide variety of environments in which native plants are used, providing biodiversity as well as beauty and interest. The sites include:

- Three residential sites planned and tended by three active INPAWS gardeners
- A church property facilitated through the efforts of an INPAWS member. (A teaching garden and educational materials were provided through an INPAWS grant.)
- The common area entryway into a neighborhood, exhibiting how native plants are used for both the enjoyment of residents and savings (less mowing and maintenance)
- A city park
- A public school

INPAWS Hikes

Saturday, July 27. Prairie Creek Barrens Nature Preserve in Daviess County. (details on page 15)

Saturday, August 17. Muscatatuck National Wildlife Refuge in Jackson and Jennings counties

Visit inpaws.org and the INPAWS blog for more information.

Appalachian Filmy Fern

Life in a Twilight Zone

Plant Profile

by Michael Homoya

Tucked away in some of Indiana's most remote and rugged areas there exist a few small populations of a most fascinating and delicate little fern known as the Appalachian filmy fern (*Trichomanes boschianum*). Named for its translucent one-cell-thick leaf blade, this plant has long captured the interest of botanists and fern enthusiasts, although not necessarily for any exotic beauty it possesses. It is the fern's life history that is the focus of attention, and rightly so, as few Indiana plants are as interesting and mysterious as filmy fern.

*Indiana hosts seven populations of the filmy fern (*Trichomanes boschianum*), some of which are small enough to fit into the palm of one's hand.*

One of the most amazing things about filmy fern is that it's here at all. This statement is made in light of the fact that the vast majority of the filmy fern family members (Hymenophyllaceae) occur in tropical rain forests. There they occur mainly as epiphytes, growing luxuriantly on other plants such as tree trunks and their branches. Constantly bathed in the rain forest's relatively warm, moist air, the tender filmy fern thrives.

How, then, can a species with relatives such as those described above survive the Hoosier climate? In some years it barely does. It exhibits considerable dieback during cold extremes, and our populations were almost decimated during the winter of 1977-1978 as well as those of the early 1980s. With this harsh reality in mind, one must ask again, how can a species seemingly better suited for the tropics occur here? The answer can be found by examining the very specific habitat in which filmy fern grows.

Ask yourself this: If you were a plant with tropical tendencies, where in Indiana would you grow knowing your need for protection from bitter winter winds? Not sure? Think of a setting where certain indigenous people in prehistoric southern Indiana lived and you have the answer – sandstone rock shelters.

A sandstone rock shelter, also called a rock house, or an overhang, is a cave-like indentation in a cliff. Those rock shelters that face south and are shielded from north winds are relatively cozy places, as evidenced by the copious signs of Indian occupation. Research has shown that rock shelters modify climate like well-controlled greenhouses, maintaining humidity and temperature at moderate levels while avoiding extremes. Because of this greenhouse effect our fragile little filmy fern can exist in Indiana.

Filmy fern normally grows at the very back edge of a rock shelter, where the ceiling arches down to join the floor. Damp, dimly lit and subdued are good adjectives to describe this particular environment. It is a twilight zone, and filmy fern is perhaps the only vascular plant in Indiana restricted to such an environment. It is a troglo*phyte*, if you will; a cave plant. Being in this environment makes for great fun for the adventurous botanist. Imagine yourself with flashlight in hand doing a belly crawl on a damp, sand/mud floor while peering into grottos for signs of life. It is a bit of a challenge, and, because the fern is so rare, there is seldom reward for the effort.

The primary range of the Appalachian filmy fern is centered in the southeastern U.S., with the greatest number of occurrences in the Cumberland Plateau. Overall, scattered populations can be found from West Virginia to Georgia, west to Arkansas and north to southern

Illinois, Indiana, and Ohio. Indiana is fortunate to have seven populations of filmy fern, all in Crawford, Martin, and Perry counties.

Filmy fern was first discovered in Indiana in Crawford County in 1977, by Mark Swayne and his father Julius. *Outdoor Indiana* readers may recall the article in the April 1986 issue that explained the Swaynes' discovery of another rare plant in Indiana, the French's shooting star. A second filmy fern population was discovered in 1984 by members of the DNR's Division of Nature Preserves. That population, located in Martin County, is very close to being the most northerly in the world (a few populations in Ohio occur farther north). Five additional populations have since been discovered, mostly in Crawford County. The species is officially listed as endangered by the Indiana Division of Nature Preserves.

Each of Indiana's filmy fern populations is small, so small in fact that all the leaves of some populations could easily fit in the palm of one's hand. Most of the leaves are 1 – 3 inches in length and about 1 inch wide. In the southern states they may reach 8 inches in length. Filmy fern leaves are evergreen and bear tiny, hair-like bristles on the tips of some of the teeth. These bristles are alluded to in the species' other common name, Appalachian bristle fern.

There are many other interesting aspects of the filmy fern's life history that could be discussed. Certainly a book could be written on the subject. Although many of the fern's secrets, such as how it got here in the first place, will undoubtedly remain, you can simply take delight in the fact that this botanical treasure is at home in Indiana.

Roger Hedge prepares to measure filmy fern in its cave-like sandstone shelter. Only in such protected areas can this relative of tropical epiphytes survive in Indiana.

Michael Homoya is a plant ecologist and botanist for the Indiana Division of Nature Preserves, a position he has held since 1982. Regarded as one of the finest field botanists of the Midwest, he is author of Wildflowers and Ferns of Indiana Forests: A Field Guide *(Indiana University Press, 2012) and* Orchids of Indiana *(Indiana University Press, 1993).*

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Editor's Note

In the Spring 2012 issue of this journal, I wrote about zebra swallowtail butterflies and their host plant, the pawpaw tree. Not being a scientist, I relied on the Internet and guide books for information. Butterfly expert Jeff Belth, author of *Butterflies of Indiana: A Field Guide,* wrote in to correct the record on several points. To see his informative comments, please visit inpaws.org.

Nancy Hill

Appendix O. Native Shrubs to Sustain Wildlife

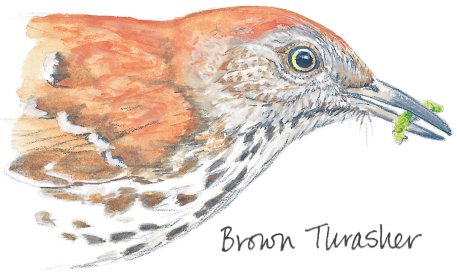
There are many cultivars of shrubs native to the Midwest, but below is a list of some of the "wild-type" species that adapt well to the garden. Where to obtain these plants? There are ever more nurseries devoted to selling natives, and mainstream nurseries that carry at least some native plants. A search on the Web for a particular shrub will reveal sources, and Web sites of native plant societies (such as the Indiana Plant and Wildflower Society at www.inpaws.org, and Wild Ones at www.for-wild.org) list places in the area that sell natives. These societies often host their own plant sales, as do state parks, water and soil conservation districts, and county extension agencies. Membership in native plant organizations will provide the gardener with greater access to natives through plant swaps and plant rescues. Most groups also sponsor tours of native gardens in their community and offer botanical walks that allow the gardener to see plants in their native habitats.

Species	*Benefits*	*Larval species hosted*
American hazelnut (*Corylus americana*)	Nuts and catkins for wildlife	polyphemus moth
Chokeberry (*Aronia* spp.)	Flowers provide nectar, fruit for wildlife	coral hairstreak butterfly
Blueberry/huckleberry (*Vaccinium* spp.)	Flowers provide nectar, fruits for wildlife	striped hairstreak, Henry's elfin, and spring azure butterflies, huckleberry sphinx moth
Buttonbush (*Cephalanthus occidentalis*)	Flowers provide food for insects and hummingbirds, seeds for wildlife	Saddleback caterpillar, hickory horned devil, promethea moth, hydrangea sphinx moth
Dogwood (*Cornus* spp.)	Flowers provide nectar, fruit for wildlife	spring azure butterfly, polyphemus moth
New Jersey tea (*Ceanothus americanus*)	Flowers provide food for insects and hummingbirds, seeds for wildlife	Various moths
Serviceberry (*Amelanchier arborea* or *laevis*)	Flowers provide early source of nectar, early fruit for breeding birds	striped hairstreak, viceroy, and red-spotted purple butterflies
Spicebush (*Lindera benzoin*)	Flowers provide early source of nectar, fruits for wildlife	spicebush swallowtail and promethea moth
Sumac (*Rhus* spp.)	Flowers provide nectar, persistent fruits for wildlife	showy emerald moth, hickory horned devil

Species	*Benefits*	*Larval species hosted*
Sweet pepper bush (*Clethra alnifolia*)	Flowers provide nectar for insects and hummingbirds, fruit for wildlife	various moths
Viburnum (*Viburnum* spp.)	Flowers provide nectar, fruit for wildlife	spring azure butterflies, hummingbird clearwing moths
Winterberry (*Ilex verticillata*)	Nectar for insects, persistent fruit for wildlife	Harris' three-spot moth

OTHER NATIVE SHRUBS TO GROW IN THE MIDWESTERN GARDEN:

American beautyberry (*Callicarpa americana*)
Common ninebark (*Physocarpus opulifolius*)
Common snowberry (*Symphoricarpos albus*)
Coralberry (*Symphoricarpos orbiculatus*)
Juniper (*Juniperus communis*)
Leatherwood (*Dirca pallustris*)
Mock orange (*Philadelphus inodorus*)
Mountain laurel (*Kalmia latifolia*)
Sweet shrub/Carolina allspice (*Calycanthus floridus*)
Virginia sweetspire (*Itea virginica*)
Wahoo (*Euonymous atropurpureus*)
White meadowsweet (*Spiraea alba*)
Witch-alder (*Fothergilla*)
Witch-hazel (*Hamamalis virginiana* or *vernalis*)



The Peace of Wild Things

Wendell Berry

When despair for the world grows in me
and I wake in the night at the least sound
in fear of what my life and my children's lives may be,
I go and lie down where the wood drake
rests in his beauty on the water, and the great heron feeds.
I come into the peace of wild things
who do not tax their lives with forethought
of grief. I come into the presence of still water.
And I feel above me the day-blind stars
waiting with their light. For a time
I rest in the grace of the world, and am free.

Butterfly Weed with Monarch butterfly

Got Sun? *is illustrated not only with photographs of plants, people, and landscapes, but also with illustrations like the one above by artist Jean Vietor.*

Book Review

Got Sun? – *from back cover*

(*Mimulus ringens*) is "the larval host plant of the Common Buckeye and Checkerspot butterflies and the Chalcedony Midget Moth" and that New Jersey tea (*Ceanothus americanus*) is "larval food host for the Mottled Duskywing and the Spring and Summer Azure butterflies."

This book lists many more plants than *Go Native!* and most are accompanied by a lovely drawing by Jean Vietor, another long time friend of INPAWS'. There are also dozens of four-color photographs of specific plants and beautiful blooms, as well as landscaping ideas such as a large bed of natives that have a seasonal succession of bloom, native grasses accenting a waterfall, the use of texture and height in a bed, how a small tree provides an accent, and even how to use plastic milk jugs as mini-greenhouses.

Those INPAWS members who know and miss Carolyn since she moved to Minnesota ten years ago will be pleased to see how much she is enjoying herself: "I love to raise Monarchs from egg to butterfly on my kitchen counter in a big, glass, gallon jar. My grandchildren come faithfully to check on the progress, watching with delight as the tiny winged creature finally emerges, pumping its wings to full size."

Got Sun? is a unique and information-rich third volume in Carolyn Harstad's continuing effort to preserve our native plants, enrich our biodiversity and give more and more pleasure to the lucky gardeners who have discovered, with her help, these versatile beauties.

Nancy Hill is a past president and long-time member of INPAWS. She gardens in Indianapolis and enjoys the wildflowers of Owen County, Indiana.

Taxonomy – from page 7

you can find that pair of names in many other manuals and field guides.

There is a rich history of publications arguing one way or the other as to the proper name

In Linnaeus' herbarium, the name Euphorbia maculata *was applied to two different species of spurge. To this day manuals and field guides differ as to which is which.*

of these species. Finally, in 1966, a paper was published that seems to settle the matter, concluding that creeping spurge is properly called *Euphorbia maculata*. However, some manuals published since then continue to use the other set of names (prominent among them the most recent edition of Swink and Wilhelm's *Plants of the Chicago Region*). To make matters worse, these two species belong to a group of species within the large worldwide genus *Euphorbia* that has often been separated out as the genus *Chamaesyce*, and many manuals use one or the other of these two sets of specific epithets coupled with the genus name *Chamaesyce* instead of *Euphorbia* (for example, Kay Yatskievych's *Field Guide to Indiana Wildflowers*). Current studies, however, indicate that keeping those species within *Euphorbia* best reflects the overall classification.

Michael Huft received his Ph.D. in Botany from the University of Michigan in 1979, and subsequently studied the plants of Mexico and Central America at the Missouri Botanical Garden in St. Louis and the Field Museum in Chicago, where he is currently a research associate.

Fruits of our Labor: Restoration of Prairie Creek Barrens

Hike

When: Saturday, July 27, 2013, 10:00 am-12:00 noon EDT

Where: Prairie Creek Barrens Nature Preserve, Daviess County, Indiana.

Leaders: Harold Allison, naturalist and columnist; and Michael Homoya, botanist/plant ecologist, Indiana DNR Division of Nature Preserves.

Trail Conditions: Terrain is hilly and no trails present. Briers and brush in places, and ticks and chiggers likely. There will be no shade for most of the hike. No restroom facilities available.

What to See: The preserve hosts one of the last remnants of sand barrens in southwest Indiana. Many uncommon and rare species are present, including sand hickory, Maryland meadow beauty, and tube beard tongue. Ten years ago restoration efforts were undertaken and thousands of plugs were planted by volunteers, including many INPAWS members. Although recovery has been slow, many of the plants are now established and reproducing. Here's an opportunity to see and appreciate restoration in progress.

Directions: Located in Daviess County, the preserve is approximately 5 miles north of Washington, Indiana. Specific directions provided upon registration (see below).

Questions: Contact Mike Homoya at mhomoya@dnr.in.gov or 317-232-0208 to register. Except for thunder and lightning storms, we will hike rain or shine.

Grants – from page 9

climatic patterns.

Research conducted by Lauren M. Smith: ***Which light environments result in the most destructive garlic mustard invasions?*** (Bloomington) The project's purpose is to determine how light environment influences garlic mustard allelopathy. These results will tell us where garlic mustard has its greatest negative impact on native species, and therefore which invasions require the greatest control efforts.

Research conducted by Adam Thada: ***Testing in Avis Prairie*** (Taylor University) The goal is to increase floral species diversity in a grass-dominated prairie restoration by interseeding new forb species. Two biomass removal pre-treatments (haying and burning) and two grass-specific herbicide treatments will be tested for their effectiveness as disturbance mechanisms to aid the germination and survival of new seeds.

Indiana Native Plant
& Wildflower Society
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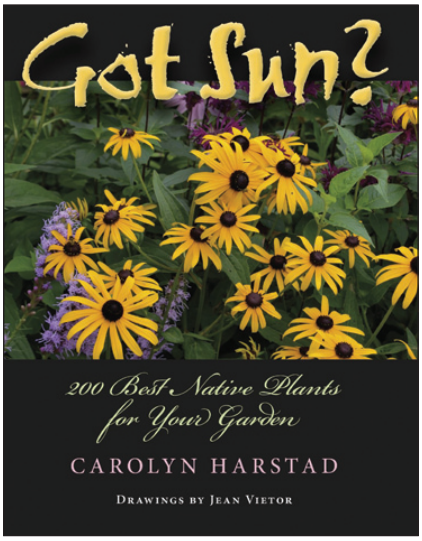
Got Sun? 200 Best Native Plants for Your Garden

by Carolyn Harstad

Reviewed by Nancy Hill

"Would I buy this book?"

This is what I asked myself when I was given a review copy of Carolyn Harstad's new book *Got Sun? 200 Best Native Plants for Your Garden*, released April 2013 by Indiana University Press. I have her two previous books on my shelves, both of them dog-eared with multiple pencil underlining. "What can she tell me in this volume that she hasn't already," I thought. The answer is…lots. Would I buy it? Absolutely.



Carolyn was one of INPAWS' founding members in the early 1990's. Her first book, *Go Native! Gardening with Native Plants and Wildflowers in the Lower Midwest*, was published in 1999. Fourteen years later, in this volume, Harstad reflects back: "…in 1999 few gardening books touted native plants as a preferred option for gardeners. Purchasing them was next to impossible…'It will look like a weed patch,' was the most common observation."

Today, we've been converted. We've listened to Doug Tallamy, we walk through garden centers that have prominent displays of native plants, we've seen hundreds of books and magazine articles that have convinced us that using natives not only brings us the immediate pleasure of watching butterflies and birds, but contributes in very real ways to the health of our entire ecosystem. On top of that, we've used these plants in our own gardens for years now and have real affection for many of them – loving their beauty, hardiness and self-sufficiency.

So today Harstad is preaching to the choir and has the challenge of making her sermon interesting. She succeeds. In *Got Sun?* she focuses on specific trees, shrubs, perennials, ground covers, ferns, vines and grasses with which she has personal and decades-long experience. As in *Go Native*, she lists planting requirements and propagation under each plant, but this go-round, she gives us much more information, including growing zones, height, and bloom time. She tells the reader if a plant is drought tolerant, deer resistant, or suitable for a rain garden. Something I especially enjoyed is that she lists relevant species and describes the attributes of exceptional cultivars.

For example, fourteen years ago in *Go Native!* she provided a one-paragraph description of gayfeather (*Liatris spicata*). In her current *Got Sun?* Carolyn gives this versatile native a full page, starting with *L. spicata* and going on to dense blazing star (*L. punctata*), meadow blazing star (*L. ligulistylis*), rough blazing star (*L. aspera*) and prairie blazing star (*L. pycnostachya*).

She places specific plants within their larger biological systems. She doesn't just say "butterflies love it." She says that monkey flower

Got Sun? – *continued on page 14*