Hardy Fern Foundation Quarterly

Summer 2018

THE HARDY FERN FOUNDATION

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The Hardy Fern Foundation was founded in 1989 to establish a comprehensive collection of the world's hardy ferns for display, testing, evaluation, public education and introduction to the gardening and horticultural community. Many rare and unusual species, hybrids and varieties are being propagated from spores and tested in selected environments for their different degrees of hardiness and ornamental garden value.

The primary fern display and test garden is located at, and in conjunction with, The Rhododendron Species Botanical Garden at the Weyerhaeuser Corporate Headquarters, in Federal Way, Washington.

Affiliate fern gardens are at the Bainbridge Island Library, Bainbridge Island, Washington; Bellevue Botanical Garden, Bellevue, Washington; Birmingham Botanical Gardens, Birmingham, Alabama; Coastal Maine Botanical Garden, Boothbay, Maine; Dallas Arboretum, Dallas, Texas; Denver Botanic Gardens, Denver, Colorado; Georgia Perimeter College Garden, Decatur, Georgia; Inniswood Metro Gardens, Columbus, Ohio; Lakewold, Tacoma, Washington; Lotusland, Santa Barbara, California; Rotary Gardens, Janesville, Wisconsin; Strybing Arboretum, San Francisco, California; University of California Berkeley Botanical Garden, Berkeley, California; and Whitehall Historic Home and Garden, Louisville, Kentucky.

Hardy Fern Foundation members participate in a spore exchange, receive a quarterly newsletter and have first access to ferns as they are ready for distribution.

Cover design by Willanna Bradner

HARDY FERN FOUNDATION QUARTERLY

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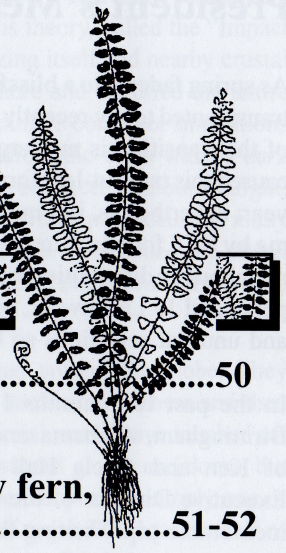

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President's Message

As spring fades into a blissful memory, I have been excited to see some of the ferns I have transplanted to my recently purchased property start to settle in and grow. One of the stars of the transition is my large *Osmunda regalis* 'Decomposita'. The transplanting stress caused this rare cut-leaf form of royal fern to only produce fully mature feathery fronds this year; nevertheless, it is quite a sight to behold. Although my plant was originally given to me by HFF founder Sue Olsen, HFF members had a chance to procure this through the membership distribution last year. The distribution program is one of our great membership perks and Jo Laskowski, our HFF Curator, has been working hard to offer some choice and unusual selections so keep an eye out for the availability email later this summer.

In the past few months I have had the opportunity to visit our affiliate gardens in Birmingham, Alabama and Louisville, Kentucky. I greatly appreciate the hospitality of Ken and Alicia Hall of the Birmingham Fern Society and Tom Underwood, Executive Director of the Birmingham Botanical Garden, for making Alabama such a memorable trip. Visiting the fern glade at the botanical garden and seeing the work the volunteers and the fern society have accomplished is an inspiration and I especially enjoyed visiting with Dan and Karen Jones, our HFF contacts for Birmingham.

I also must give a huge thank you to my friends Mike Hayman and Leslie Pancratz for their efforts to make my visit to Louisville enjoyable. This was my third visit to Whitehall historic home and gardens and it was exciting to see how much the garden has grown since my last visit. It was especially fun to have a chance to work with so many of their garden volunteers on fern identification. An added surprise was to have Ralph Archer, Whitehall's creator of the stumpery where our test ferns are located, attend my lecture. Ralph has been a long-time supporter of the HFF and I greatly admire what he started at Whitehall.

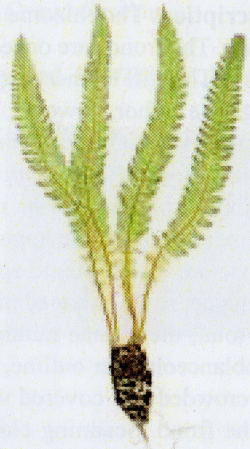
Friends like these are one of the top reasons I enjoy the HFF so much. It is always a pleasure to trade ideas with like minds and see what other gardeners and enthusiasts are doing with ferns. **A great opportunity for this is the Fall Fern Sale on September 8th, 2018 and at the Fall Fern Social on October 20th, 2018, both will be held at the Bellevue Botanical Garden.** Watch for future emails for the details of these events!

All the best, Richie ~ HFF President

2008 SUMMER HIKE

The HFF has been looking around the region for our summer hike. We plan on heading into the Olallie Meadows /Silver Peak area to look at ferns in their native habitat .We will be notifying our members once the details have been finalized. **We look forward to seeing you there. Mark your calendar for August 18th, 2018. For more info contact Forrest Campbell - Forrest.campbell2@comcast.net, 206-660-3127.**

Polystichum lonchitis Northern holly fern, Narrow holly fern (Wherry)



James R. Horrocks

Salt Lake City, Utah

While Jim is still recovering we continue our reprints of previous articles. Polystichum lonchitis ***is one of his favorite ferns. Reprinted from Fall 2013.***

The species epithet "lonchitis" is translated "narrow-leafed", an apt description, making this species easily recognized, although it could possibly be confused with *P. imbricans* in the Pacific Northwest. *P. lonchitis* is the quintessential montane-circumboreal species, found on every continent in the northern hemisphere. Its distribution is an interesting study, in and of itself. It grows near sea-level in southeastern Alaska, but is essentially confined elsewhere to sub-alpine forests in western Canada down through the western United States to northern California in the Sierra Nevada mountains, across Oregon to Idaho and Montana, down through northern Utah to western Colorado where it ranges a bit further south in the Rocky Mountains with a somewhat disjunct population in southern Arizona. To the east it is found in Greenland, Newfoundland, and Nova Scotia down to Quebec and Ontario, but only in Michigan and Wisconsin in the Great Lakes region of the eastern United States. In Europe and Asia it is native from the British Isles across Europe to northern China, Mongolia, Siberia, the Kuriles and south to Japan. This species is also found in the western Himalaya, the Caucasus, and Iran and even south to northwest Africa, which is about as far south as its range in North America.

Polystichum lonchitis inhabits north-facing talus slopes, rocky crevices and ledges, mostly of limestone. It is interesting to observe that as one walks up the trail above Alta in Little Cottonwood Canyon in the Wasatch Mountains of Utah, *P. lonchitis* frequents the limestone habitats in circumneutral soils, but on the other side of the trail, it is infrequent to rare or nonexistent in the metamorphic (quartzite) and igneous (quartz-monzonite) material, being replaced by *P. scopulinum* which finds the subacid soils to its liking.

Polystichum lonchitis is believed to be one of the parent stocks along with *P. lemmonii* of *P. kruckebergii* of western North America. *P. lonchitis* hybridizes with *P. braunii* to form *P. x meyeri* and with *P. acrostichoides* to form the sterile *P. x hagenahii*. It also crosses with *P. aculeatum* in Great Britain to form *P. x illyricum*, and on a more astonishing note, *P. lonchitis* has crossed with *Dryopteris goldiana* to produce a natural cross-genera hybrid called *Dryostichum x singulare*!

Description: The rhizome is short and thick, the numerous fronds arising from a central crown. The fronds are once-pinnate, evergreen and a "brilliant kelly green" as Sue Olsen puts it. The stiff leathery fronds are 1 to 2 1/2 inches wide and usually from 4 to 24 inches long. The author, however, encountered specimens in a sizeable colony along the trail on the north side of Mount Timpanogas (Wasatch Range of Utah) with fronds measuring 36 inches in length! The black stipe is very short, seemingly nonexistent in some specimens, exhibiting pale-brown or reddish brown concolorous scales. It has reduced triangular pinnae at the base that appear as mere wings and extend nearly to the rhizome. The upper pinnae are close-set and spiny-serrate, the small spines often so crowded they overlap. The upper scythe-shaped pinnae are sub-falcate with a superior auricle, and turn upward. All total, the pinnae number 20 to 30 or more pairs. The fronds are linear-lanceolate to oblanceolate in outline, ending in an acute or sometimes acuminate apex. The sori are crowded and covered with peltate indusia. They are borne chiefly on the upper half of the frond. Scanning electron micrographs of the spores of this species reveal that, quoting David Wagner: "*Polystichum lonchitis* is the only species of North American polystichum with a spiny perine." (the outer projections on the spores).

Culture: It goes without saying that this fern is very cold hardy. What is of interest is how varied the opinions are of how this fern responds to cultivation. Everything from easy to grow in potting mix to very difficult, if not impossible in any growing medium have been mentioned. It should never be removed from the wild as it does not re-establish well. It will not survive in hot valley gardens! This species requires mild temperatures and a cool, crumbly, constantly damp but well-draining soil to survive. It can be grown from spore and perhaps with some experimentation and a great deal of extraordinary luck, there just might be a niche for it in some garden rockery. The author, after many failed attempts, simply admires it in the cooler canyons several miles east of his hot valley garden.

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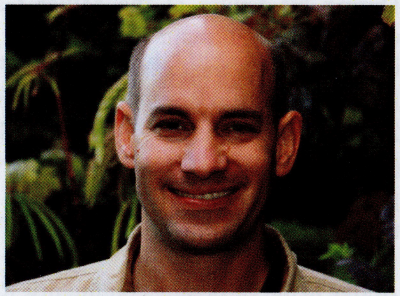
Richie Steffen receives 2018 Professional Citation Award from the American Public Gardens Association



On Tuesday, June 5, 2018, the American Public Gardens Association conferred the 2018 Professional Citation Award to Richie Steffen of the Elisabeth C. Miller Botanical Garden.

The Professional Citation recognizes the significant achievements in public horticulture of an individual member who has excelled in one of the disciplines generally associated with public gardens.

- Few people have a passion for plants or an excitement about gardening more than Richie.
- Richie joined the green industry 1989, then entered public garden service in 1994 at the Rhododendron Species Botanical Garden. He then joined Miller Garden in 2000 and worked in a series of increasingly responsible positions, becoming its director in 2017
- Richie has been a champion promoter of plants well suited for the unique climate of the maritime Pacific Northwest.
- A noted lecturer and horticultural personality, Richie is the co-photographer and co-author of "The Plant Lover's Guide to Ferns" and supervises the primary educational program of the Miller Garden: Great Plant Picks.
- Today, all of us in the public garden industry honor your dedication with this Citation.

Richie Steffen's extraordinary passion for plants and excitement for gardening is palpable and he shares his enthusiasm unreservedly. Richie is the director/curator for the Elisabeth C. Miller Botanical Garden, overseeing the development of the garden's classic Pacific Northwest aesthetic while celebrating the tradition of Elisabeth Carey Miller by discovering, displaying, evaluating, and disseminating information about plants suitable for landscape use in the Northwest. Starting at the Miller Garden in 2000, Richie was originally brought on board to care for and expand the rare plant collections. He was appointed curator in 2007, with the position expanding to include overseeing the educational and outreach programs of the Garden. In the spring of 2017 he was appointed director/curator.

Born and raised in Maryland, Richie's keen interest in plants and gardening was sparked by vocational horticulture programs and followed by studies at the University of Maryland, Institute of Applied Agriculture, earning an associate degree in greenhouse management with a strong focus on nursery management. After moving to Seattle in 1989, he embraced a career in the green industry working at retail nurseries and volunteering with regional gardening groups. In 1994 Richie entered the public garden world when he was hired as the nursery manager and propagator for the Rhododendron

Species Botanical Garden, where he remained until joining the Miller Garden staff in the fall of 2000.

During his tenure at the Miller Garden, Richie has traveled extensively focusing on regions and plant communities that particularly influence the Miller Garden's collections. He then enthusiastically shares his newfound knowledge in wide-ranging lectures as well as articles for numerous gardening journals, magazines and newsletters. As chair of the Garden's primary education and outreach program, Great Plant Picks (www.greatplantpicks.org), Richie works with an extensive network of green industry professionals to create and promote plants well suited for the unique climate of the maritime Pacific Northwest.

Active in the gardening community, Richie currently serves as president of the Northwest Horticulture Society, originally founded by Elisabeth C. Miller, and as president of the Hardy Fern Foundation. Indeed, ferns have held a particular interest, resulting in the co-authoring of *The Plant Lover's Guide to Ferns*. He also serves as a member of the Heronswood Garden Steering Committee, the Oregon State University Plant Breeding Advisory Board and Edmonds Community College Horticulture Program Advisory Board.

Hardy Fern Foundation Annual Meeting, Fall Social & Potluck Lunch Saturday, October 20, 2018

Members and their guests are invited to our Annual Meeting, Fall Social and Potluck Lunch 11 am to 3 pm at the Bellevue Botanical Garden Education Center 12001 Main Street, Bellevue, WA 98005

Featuring: Guest Speaker Susie Egan: Creating a Woodland Fantasy: Combining Fantastic Ferns with Great Plants for a Fabulous Effect. Learn creative and beautiful ways of using ferns in the garden by combining them with equally stunning companion plants.

- **A Fern Frond Showcase** by Richie Steffen of the Miller Garden
- **Fern Sale** with experts on hand to answer your questions
- **Book sales and signings** of *The Plant Lover's Guide to Ferns* By Richie Steffen and Sue Olsen

Potluck Lunch Please bring a favorite main dish, salad, or dessert to share.

RSVP To Jo Laskowski at hff@rhodygarden.org with the number of guests and the type of dish you plan to bring.

The Mystery of the Missing Ferns

Strange happenings at Seward Park turn neighbors into fern detectives.

Sarah Deweerdt

Seward Park in 2017 after the ferns disappeared. Photo courtesy of Paul Shannon

Four years ago, Catherine Alexander was sitting in one of her favorite spots in Seattle's Seward Park when a new observation rose to her consciousness: Something was wrong with the sword ferns.

At first, she couldn't figure out what had changed. But over the course of a week, she worked out the pattern. The ferns' shape was different. They sagged, as if they'd been flattened by a heavy snow.

"At first I couldn't get anybody to take me seriously," Alexander recalls. She mentioned her observations to park maintenance workers and a crew conducting a plant census, but they gave her the brush-off. Then she told Paul Shannon, a neighborhood friend who had been volunteering on maintenance and restoration projects in Seward Park for a decade.

Shannon had lived in Charlottesville, Virginia, during a period when invasive species and pathogens radically reshaped the landscape of the Blue Ridge Mountains. He had seen doomed shoots sprouting from the stumps of trees felled decades earlier by chestnut blight, and hemlock trees gradually invaded by the woolly adelgid, an invasive insect from East Asia. She also pointed out the ferns to another regular Seward hiker, an ecologist and a lecturer at the University of Washington named Tim Billo, who had studied the chestnut blight as an undergraduate.

The trio kept tabs on the ferns with a mixture of interest and concern. Billo, in particular, thought Alexander had made an interesting observation, but wasn't sure if it was a symptom of anything bad. Their worries increased the next spring, when the ferns failed to make new fiddleheads. Then the old fronds began to turn brown and die, until dead ferns covered about a quarter of an acre.

Sword ferns (*Polystichum munitum*) make up the majority of the understory of the lowland conifer forests that once blanketed the region. The area where the ferns had died is part of the last remnant of this ecosystem in Seattle. It was never logged and is home to trees as many as 500 years old. Without the ferns, the forest looked radically different. What was once a slope covered with lush, waist- or chest-high ferns was now bare, brown soil.

Billo, Shannon, and other park regulars formed an ad-hoc working group of professional

and citizen scientists to search for the cause. They considered and discarded numerous hypotheses: drought (the region's rain data didn't match up), hungry mountain beavers (those tend to clip fronds off at the base, not causing intact fronds to shrivel and die).

Marianne Elliott, a plant pathologist at Washington State University, collected soil and root samples from unaffected and affected ferns. Her suspect: Phytophthora, a group of soil-dwelling, fungus like microorganisms that includes many species harmful to plants. But analysis of the samples back in the lab revealed no more Phytophthora on affected ferns compared to unaffected ones.

Seward Park before the fern die off.
Photo courtesy of Jordan Jackson

The same area after the ferns disappeared.
Photo courtesy of Paul Shannon

In the fall of 2015, Billo and some of his students established 20 three-meter-by-three-meter monitoring plots in and around the affected area of the park and mapped the perimeter of the area where the ferns were dying.

"We were sort of hoping it might correct itself," Billo recalls. Maybe the dying ferns were simply reaching the end of their life-span. Maybe it was normal for them to suffer a temporary or even multiyear die-back due to drought or insect outbreaks. "We were also sort of wondering, second-guessing ourselves—is this thing getting worse or not?" he says.

That year, 3 percent of the ferns in the plots were completely dead. When they resurveyed the plots in fall 2016, over a third of the ferns had succumbed. The area where ferns were dying had expanded beyond the previous perimeter, doubling in size.

AS OF THIS SUMMER, 11 acres of sword ferns have died in Seward Park. Mysteriously, nothing is growing back on the bare ground left behind—not even weeds. "That's another thing that points to the fact that there's something weird going on here," says Patti Bakker, who directs restoration programs with the Seattle Parks Department.

Because no cause has been identified, it's difficult to be sure that the disappearing ferns represent a distinct phenomenon—a systematic die-off rather than just a patch of dead ferns. "Still," says David Barrington, a professor of plant biology at the University of

Vermont, "there's no record of anything like this in the sword ferns." The species has an extensive range in western North America and is known for its hardiness.

And Seward Park isn't the only place where sword ferns are dying. "We're starting to see things that look pretty darn similar in a bunch of places," Billo says.

The working group has strict criteria that other sites have to meet in order to be classified as part of the Seward Park mystery. A die-off has to cover at least 400 square feet, affect an area where the understory had previously been dominated by sword ferns, and spread in a similar pattern as at Seward Park.

Even so, the group has identified half a dozen likely or probable matches to what was happening in the park around the Puget Sound region, including one site in a park in the Seattle suburb of Mercer Island and another in the foothills of the Cascade Mountains.

The strongest match is a spot on the Kitsap Peninsula, directly across the Puget Sound from Seattle. Heidi Danilchik's family has owned the property since the early 1950s.

Danilchik noticed the problem there in early 2010. She realized the ferns looked different—"flat" rather than "fluffy" is how she puts it. For a while, the observation remained at the edge of her awareness. She was busy taking care of her dying mother, who was in an assisted-living facility in Seattle. A month after her mother passed away, Danilchik left the country for a year.

When she returned in late 2011, she turned into the driveway and saw what she describes as "brown dead ferns as far as the eye can see." The blight spread out for at least an acre and a half, she estimates.

She ordered soil tests, but the results found no poison or chemical that could be pinpointed as a cause. The affected area continues to expand, and, as in Seward, nothing is growing back to replace the ferns. Earlier this year, she came across the blog Paul Shannon keeps about the die-off mystery in Seward Park and was relieved to find that her own mystery wasn't unique.

The loss of sword ferns could permanently change the ecology of affected sites. That's because the ferns tend to establish in open areas after a fire and don't reproduce sexually under closed-canopy forest. The ferns that have died at Seward Park are likely to be as old as the trees around them—hundreds of years.

Elliott and others believe that some yet-unidentified pathogen must be involved, because the die-off is symmetrical and grows exponentially in an outward-radiating fashion. "It certainly looks like a soil-borne pathogen or biological agent of some type," says Elliott. If the die-off continues at its current rate, all the ferns in Seward Park could be gone in 10 years.

WE ARE LIVING IN AN ERA of disappearance. In July, researchers published an analysis in the journal Proceedings of the National Academy of Sciences showing that the current worldwide loss of biodiversity is not just a matter of species extinctions but declining populations as well.

And in fact, the sword fern story echoes those of other recent die-offs affecting disparate taxonomic groups—frogs, bats, bees, sea stars. It may offer a glimpse into how these events begin and how people make sense of these uncertain first stages.

The absence of the ferns is now so dramatic that no one can miss it. But if it hadn't been for Alexander's observations, "We'd be another two years behind on the monitoring and the solution to the problem," Billo says. In an age of die-offs, a key skill for a naturalist is being able to recognize not only the kinds of living things but also the unusual patterns of their deaths.

This fall, the Seattle Parks Department plans to hire a consultant to coordinate monitoring efforts, determine the next steps in looking for a cause of the die-off, and develop plans for replanting.

Shannon has already begun to test the possibility of restoration in an informal way. Three years ago, he planted two sword ferns near the spot where the die-off began; one has survived. This summer he put in an Oregon grape and an Indian plum, two other native understory plants. He points out a hemlock tree nearby with a curved base that gives it the elegant appearance of a ship's prow. Above the bare, dry ground, the branches of a hazelnut shrub interlace with a vine maple.

"One forgets, and the baseline shifts. You say, well, it's still kind of a pretty place," Shannon says. "But it's dead. Or it's dead for that one species."

This article was originally published in Sierra magazine August 17, 2017. Reprinted with permission.

Stumpery Renovation at Whitehall House and Gardens ~ Louisville, Kentucky

Michael Hayman ~ Landscape Director

The Ralph Archer Hardy Fern Foundation Display Garden at Whitehall dates back to 2002 when Ralph Archer moved a small fern plot from the back to the woodland in front of the mansion. He gradually expanded the garden to its present size of about half an acre.

Since that time, we discovered both visible and invisible problems with the infrastructure. The first issue was that the bones of the garden disappeared with exuberant summer growth. Some of the very successful ferns, such as *Dryopteris x australis*, grew so tall that they covered up the stumps. Likewise, the edges between the paths and the beds disappeared in the fall with the heavy leaf drop of our mature deciduous trees. We needed larger bones. Fortunately, we already had many of them stored on site.

A decade earlier, Whitehall acquired a large osage orange log from Louisville Parks and tucked it in the back of the property for future use. This past winter, one of our constant donors, Greenhaven Tree Care, moved that log to the top of an existing osage log pile to get it above the tallest *D. x australis*. We were pushed to the limit of the crane's reach. We placed the log on the old pile by swinging it on the crane cable and dropping it at the widest limit of the cable's arch. It was not easy nor particularly precise, but close enough to become the star log atop the old osage pile. With the renewal of ferns this spring, that log looks like it has always been there.

We needed something larger and more dramatic at our primary, underwhelming entrance. We acquired a large locust log, another gift from Louisville Parks, when they cleared wind-thrown trees for a tree nursery. Like the osage log mentioned above, I didn't know how we were going to use it when we got it, but I knew it was a dramatic stump destined for a prime site.

We had stored a pile of 12 large red cedar logs from a road clearing more than 20 years ago. Last winter we stacked in them in place with space for ferns and companion plants to weave through them.

I learned from birders that our local wrens love brush piles, but brush piles are typically messy so we created our own improved-look brush pile to both attract the birds and serve as garden sculpture.

With this project, we confirmed the importance of acquiring sculptural wood for future use. We created a bone yard where we will store that wood. The bone yard is conveniently close to the truck route into our garden.

We saved three giant taxus stumps from the back of Whitehall's property. I expected to cut them off at the ground, but the roots were so cool, I changed the plans and our diligent crew (not me!) dug them out by hand. They are stored for future use.

At the same time that we made these structural improvements, we expanded the garden into an adjacent area by suffocating invasive Euonymous with cardboard and a foot of wood chips. The cardboard and chips slowly decay but kill the Euonymous in the meantime. We are half way through the two-year process. We will begin planting next spring. We have moved in five large osage orange logs and three mulberry logs to anchor the site.

Gathering the edging logs has been a very slow process. It has been difficult to find durable logs in the quantity, shape, and the size (6"-10") that we need. Straight logs do us no good because we don't have a straight path in the entire garden. After two years we are about 60% finished with path edging.

For sculptural wood we use only non-rotting logs which, in our part of the country, are red cedar (*Juniperus virginiana*), osage orange (*Maclura pomifera*), and black locust (*Robinia pseudoacacia*). Rarely we get yew (*Taxus x media*) and bald cypress (*Taxodium distichum*). Honeylocust heartwood (*Gleditsia triacanthos*) appears to be long lasting but is still under observation. Mulberry (*Morus rubra*) is durable in the mid-term so we use it for middle-sized logs. Our most common trees, oaks and maples, rot quickly. Equally important as the visible issue of bones is the invisible issue of drainage…that is, invisible until we have a big rain. The fern garden is on a slope that drains most of the 10-acre property including a hard surface tent pad. Each large rain washes out the paths. It takes too many resources to build the paths to allow those washouts to continue.

We scrounged soil from various sources to build a deflecting berm with hand labor. After several large downpours this summer, we know the berm works. Storm runoff no longer washes out the paths.

We would like this water to percolate into our soil, so the next step will be to capture runoff in shallow weirs. We have space and we have fall to capture runoff from 5" rains which is the greatest extreme we normally get. We will do this task this coming fall and winter.

We did most of the work in winter when the structure of the garden was easy to see and the dormant plants tolerated minor disruption.

When we started, I believed we could do this work in one winter but, so far, we have been doing this for two years and aren't finished yet. Nevertheless, we are maintaining momentum and are moving in the right direction.

I approached the Jefferson County Master Gardeners and other friends of the woodland garden to collect about $6,000 over two years. That will be enough to collect logs, move soil, and pay for some of the labor.

All photos courtesy of Michael Hayman.

History of the Whitehall woodland garden

Ralph Archer ~ Louisville, KY

In 2000 I was asked by Donna Michael to provide a fern display near the existing Extension Service display garden at Whitehall.

1. I agreed and planted about a 12 ft by 12 ft garden with ferns in the area just west of the visitor parking lot in a cleared area provided by Donna.
2. In 2002 I was advised that the ferns should be dug as a major improvement to the grounds that was in progress and the ferns would be cleared out as part of the cleanup under the tree line.
3. While digging the ferns, a lady, who introduced herself as Susan Goslee the Whitehall House manager, told me about a new woodland area they were developing and she asked if I would take a look at it with her. I did so and during the conversation she requested that I take charge of the area. She said she would provide help in the form of part time helpers so that the gardener and assistant gardener would be free to work on the other areas involved in the grounds cleanup. (Rafe was made available for help in winter and he built paths, lined beds, moved wood for features, etc.) She was as good as her word and a number of young college students were made available in the summer to clean new areas as well as to plant and maintain a variety of beds. She also said that money was tight but that she would help with plant purchases as much as possible. I agreed to donate ferns

for the planting from my plant sale activities at farmers markets as well as my home. I usually had ferns left over.

4. In the fall of 2002, I started planting ferns in the original garden as well as the newly cleared main bed. The building of the garden then started to include cleaning of additional areas such as the northwest end of the main bed and the building and planting of the first stumpery.
5. I had been submitting articles on fern cultivation and performance in this area to Sue Olsen, who is the editor of the Hardy Fern Foundation publication. She became interested in the garden and the HFF decided to list it as a recommended garden. This resulted in publicity, but most important to me in terms of the garden development was that it made us eligible to receive ferns from their annual distribution of surplus ferns. Some of these were not available from normal nursery sites.
6. A year or two into the garden development, several master gardeners volunteered their time helping with maintenance and planting. Later on the garden became a Master Gardener project so the time worked was counted toward the individual's time contributions.

I would like to express my gratitude to all the people who have donated plants to the garden. I am sorry I did not keep records of donations. I also would like to thank the many people have worked in the garden over the years and I did not count their hours either. Some were provided by Susan as summer help at the start. Leslie, Mike Hayman's wife, took over the original area as a continuing project. The garden is still maintained by a group of lovely ladies and fine gentlemen.

Ferns? They all look alike! Help?!

Jo Laskowski ~ Seattle WA

By the time most of us arrive at an interest in ferns we've traveled the trail of annuals, perennials, shrubs, and trees. Vines, too, maybe. Maybe we've kept our interest in some or all of the aforementioned plant types, but boy, oh boy—we've arrived at ferns now. With all of our ID skills honed and second nature, we're ready to go!

But ferns seem to be a touch more complicated to ID than a lot of plant groups. There's a pretty straightforward way to get ferns identified to the genus level, though, and on Tuesday, June 12th, a class taught by Sue Olsen, consummate ferner, aimed to do just that. The class was held at Bellevue Botanical Garden, which was ideal for the walkabout planned to follow the indoor session.

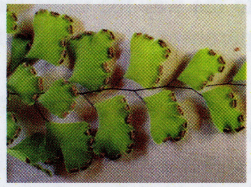
To start to sort ferns to the genus level, you need to know something about how ferns reproduce. The structures that ferns use to house and then release their spore, and their placement, are key to this. Spores are the tiny, dust-like reproductive units of the fern. They're housed in a structure called a **sporangium (spore AN gee uhm).** Sporangia

cluster in a group, called a **sorus (SORE uhs).** And usually the sorus is protected by an overlying structure called an **indusium (in DOOZ ee uhm).** What makes these sori diagnostic is where they lie on the frond, and how their indusia (if present) are attached and shaped.

Sue started with a brief overview of the parts of a fern frond, and the divisions of the frond that give it its description of entire or some boggling combination that involves the words pinnate, pinnatifid, once, bi-, tri-, and/or quadri-. If you think you know how to count to four, I'm here to tell you that arriving at the concept of a quadri-pinnate frond is a real exercise in mind expansion. Sori are usually carried on the underside of the frond. Some are di-or hetero-morphic More on that later. Now on to the sori and other juicy little tidbits that she sprinkled in periodically.

GENUS:

Adiantum



A relatively easy fern to identify to genus by sight. Of course its sori do something different from a lot of ferns, deciding to put themselves at the edge of the frond margin, on the underside, and instead of having an indusial cover, they're content to let the margin curl over them. The first time I really noticed it was when looking at an *Adiantum* and thinking it must need water because it looked like it was wilting. What I was seeing was margins rolled in so far that the shape of the leaflet was changed.

Arachniodes

When you look at the underside of the frond, the sori are covered by indusia that are kidney-shaped. (Author's comment: To my eye, a kidney bean typifies a kidney shape. These so-called kidney-shaped indusia curl around, with their ends nearly touching, and look more like a curled larva, or maggot, if you will. However, I do not think that saying sori are maggot-shaped would meet with an enthusiastic acceptance.)

Asplenium

Sori form a herringbone pattern; the indusium attaches to a vein, opening on the free side to release its spore.

Athyrium

Sori have a half-moon shape; the indusium attaches to a vein, opening on the curved side.

Blechnum

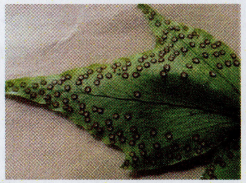
Here be an exception. A lot of blechnums produce two different types of fronds. One is called sterile because it doesn't have sori on it, and the other is called fertile, because it, well, does and that's all that it does. A fern that does this is said to be **dimorphic (dye MORF ick).** The two fronds look radically different, as a rule, with the fertile frond being stiff and strongly upright and skeletal in appearance. **TIDBIT:** *Blechnum chilense* is called costillas

de la vaca—"cow's rib"—in Chile. Meanwhile some taxonomists have recently separately blechnums into nine! different genera a discussion for some future date.

Cheilanthes

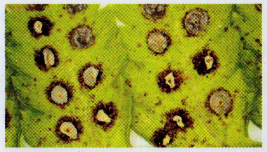
Nifty little xeric ferns that are challenging to grow in the Pacific Northwest! Usually intriguingly hairy and or scaly, the sori are on the margins, covered by an inrolled margin. This genus has likewise recently undergone reclassification with the American species now considered *Myriopteris*.

Cyrtomium



Sori in random pattern; indusium is like a little umbrella, with a central stalk rising from the center of the sorus and holding the papery covering aloft. This type of indusium is called **peltate (PELL tate). TIDBIT:** easy evergreens to grow; *Cyrtomium* means "arching," which is NOT descriptive of the way the fronds are held like I thought, but rather refers to the way the veins look. Veins can also be diagnostic for ID purposes, but are mercifully outside of the scope of this article.

Dryopteris



Sori are usually towards the center of the pinna, with kidney-shaped indusia. **TIDBIT:** *Dryopteris* frequently put out little offsets alongside the parent plant. These can easily be divided from the parent with the caveat to get the entire crown, or growing point.

Gymnocarpium

These are brave little ferns, putting out their sori with no indusia to protect them! These are naked, round sori.

Matteuccia

Dimorphic, meaning it produces two types of fronds, a sterile one and a fertile one. The fertile frond is a rigid, brown stalk that will over-winter to great visual effect after the plumy, deciduous foliage is gone.

Osmunda (and ***Osmundastrum***)

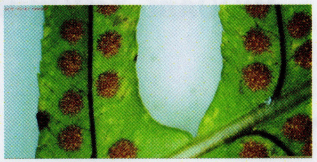
Here's an arrangement that makes this genus easy to identify. *Osmunda* produce fronds that have sterile parts and fertile parts. Sometimes the fertile part is at the very tip of the frond, and at other times it's farther down the frond, layered between sterile sections but the sori are not on the underside of the frond. The frond is said to be **heteromorphic (het uh row MORF ick).** *Osmunda* produce green spore, rather than the more typical brown or black. If you propagate from spore, you need to know that green spore needs to be sown as soon as possible after you harvest it. It doesn't store well, and freezing it is the only option for holding it. **TIDBIT:** *Osmundastrum cinnamomeum*, the cinnamon fern, covers its emerging fronds with such luxuriant downy hairs that hummingbirds seek it out to harvest for their nest-building. *O. cinnamomeum*, furthermore, was recently

re-classified out of the genus *Osmunda* into its own genus of *Osmundastrum*.

Phyllitis

The genus *Phyllitis* is hovering between *Asplenium* and *Phyllitis*, at least in common usage. I see a lot of material in the trade being called *Asplenium* now, at least for the most commonly known ferns like the *Asplenium scolopendrium*, or hart's tongue fern. Like *Asplenium*, *Phyllitis* sori are arranged in a linear, herringbone pattern—perhaps that's why *Phyllitis* is being pushed into *Asplenium*. BUT! (as Sue pointed out) their indusia open differently. *Asplenium* indusia open along one edge only, but *Phyllitis* open from two edges. Whatever this genus is called, its inhabitants are very fond of limey soils.

Polypodium



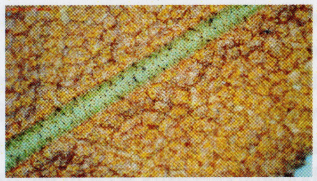
Round sori that are naked; *Polypodium* also produce yellow spore, rather than the more typical brown or black.

Polystichum

Sori (poly….many, stichum…stitches) are covered with a peltate indusium and outline the outer edges of the pinnae. Plants are frequently "spiny and shiny." Once you've identified your plant to the *Polystichum* genus based on the sori and indusia, and the spine and the shine, you can verify by checking to see if it also has an ear. This is an upright segment that typifies polystichums and is located adjacent to the rachis (stem) on each pinna. Look right next to the stem. Does the segment closest to the stem stick up pretty prominently? You've found the ear, or **auricle (ARE ick uhl).**

Pyrrosia

Yellow spore and tiny, naked sori. It's hard to believe this fern has only been in the US for about twenty years—how did we live without it? Known as felt ferns for their texture, which mimics the fabric. There are many Japanese cultivars of this normally simple, strap-like fronded plant, that has, however, a predilection for producing stable varieties that twist, crest, contort, congest, or crinkle.



Woodwardia

If you embroider, you know the chain stitch. Ferns of this genus are commonly called chain ferns on account of the pattern their sori make. If you don't know embroidering, an alternate description is that their sori lie in long lines looking like strings of sausage. I'm glad they used the concept of the stitch for the common name. Sori open along

a central split. **TIDBIT:** Some *Woodwardias* put out new growth that is a beautiful, rusty red. The frond unfurls and over time it becomes a dark, resolute green. What happened? This is an elegant strategy used by many plants to protect their new growth. The green chlorophyll is too tender when it first emerges into the insults of life. So a red pigment—an anthocyanin—overlays the chlorophyll while it toughens up. When it's hardened off sufficiently, the plant withdraws the anthocyanin for future use, and your green frond is revealed.

The lights came up and questions were answered. The weather had cooperated that day, so it was pleasant as we walked the paths of Bellevue Botanical Garden, botanizing on the ferns as we went. **TIDBIT:** Sue propagates from spore. A lot. She sterilizes her moistened potting mix in a 175° oven for three hours. *All photos courtesy of Sue Olsen.*

Come buy your ferns at our Fall Sale, September 8th, 9:00am~3:00pm at the Bellevue Botanical Garden!

The Fern Spike

Ed... John van den Meerendonk gave an outstanding thought-provoking presentation on the evolution of plants, especially ferns, at our HFF Fall Social last year. It inspired me to do more reading and A Natural History of Ferns *by Robbin Moran, Timber Press 2004, is an excellent resource. The following is an excerpt presented with permission.*

About 40 kilometers (25 miles) south of Copenhagen lies Stevns Klint, a chalky limestone bluff overlooking the Baltic. The bluff is uninterrupted in its whiteness except for a one- to ten-centimeter (0.4 to 4 inches) thick, horizontal band of grayish green clay. The Danes call this layer fisk ler fish clay because fish bones and scales are found in it. Geologists date its age at 65 million years and have designated it as the official boundary between two great periods of geological time: the Cretaceous and Tertiary.

The clay layer marks not only geological time but also one of the most prominent mass extinctions in the history of life on earth. This extinction occurred on land, air, and sea, dooming an estimated 65 to 70 percent of the world's species. Its most famous victims were the dinosaurs, but hordes of lesser-known creatures were also wiped out. Particularly hard hit were single-celled organisms: ninety percent of all genera of protozoans and algae disappeared, and most marine plankton vanished with such dramatic suddenness that they form an abrupt boundary—easily seen in the rocks—referred to by geologists as the "plankton line."

What caused the extinction is hotly debated by scientists from many fields. The evidence with which they wrangle comes from disciplines as diverse as ballistics, climatology, volcanology, mineralogy, paleontology, and astronomy. Particularly thought provoking has been evidence from palynology, the study of pollen and spores. This botanical sub discipline has uncovered extraordinary evidence about the mass extinction—evidence that's largely derived from fossil fern spores.

Before examining this evidence, it's necessary to review the theory that most researchers accept as the best explanation of what caused the extinction. This theory, called the "Impact Theory," claims that an asteroid slammed into the earth, pulverizing itself and nearby crustal rocks. Dust and smoke from the collision flew into the atmosphere and engulfed the entire planet for months or possibly years, blocking out sunlight. According to computer simulations by scientists at the National Aeronautics and Space Administration, the earth was so dark that for months you would literally not see your hand in front of your face. Without sunlight, photosynthesis shut down and vegetation perished. Food chains collapsed causing many animal species to become extinct. Upon settling, the dust cloud that enshrouded the planet formed the clay layer found at nearly all Cretaceous-Tertiary boundary sites around the world, such as the one at Stevns Klint.

In addition to darkness, scientists postulate that wildfires raged around the globe. They calculate that some of the impact's ejecta was hurled above the earth's atmosphere and then reentered the atmosphere hot enough to glow. Heat from this material would have touched off wildfires worldwide. Such a scenario might sound like unsubstantiated gloom and doom, but geologists have found soot in the clay layer which, if the soot were deposited in only one or two years, could only have been produced by a sudden burning of vegetation equal to half of the world's present forests.

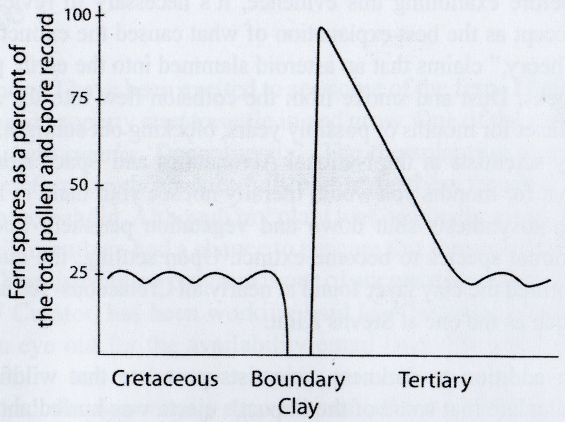
The impact theory is strongly supported by two kinds of geological evidence within the clay layer. The first is the abundance of iridium, a metal rare in the earth's crust but plentiful in asteroids. The second is the presence of "shocked" quartz grains—tiny quartz crystals with internal deformation bands caused by tremendous, sudden pressure. Besides the boundary clay, such quartz grains are found only at meteorite craters and nuclear test sites.

Geologists believe that they have found the impact crater where the asteroid hit. Called the Chicxulub crater (pronounced cheek-soo-LOOB), it lies off Mexico's Yucatán Peninsula and is of exactly the right age: 65 million years old. It measures about 175 kilometers (110 miles) wide, and to form a crater that big, scientists estimate that the asteroid must have been about ten miles in diameter. Upon impact, it would have released the energy of roughly 1000 times that of all the world's nuclear weapons exploded simultaneously. In short, according to the impact theory, the earth's vegetation at the close of the Cretaceous was decimated by wildfires and prolonged darkness. It looked like the charred landscape of a forest-fire prevention poster.

What plants came afterwards, at the beginning of the Tertiary, have been investigated by palynologists. By identifying the fossil pollen and spores entombed within Late Cretaceous and Early Tertiary rocks, these researchers get clues about what the vegetation was like before and after the impact.

Palynological studies of Cretaceous – Tertiary boundary rocks from around the world reveal a startling change. In the late Cretaceous, fossil fern spores account for 15 to 30 percent of the total pollen and spore microfossil record, with seed-plant pollen accounting for the rest. But immediately above the boundary, in the earliest Tertiary rocks, fern spores jump to as much as 99 percent of the total. Then, within the next 4-6 inches (10-15cm) of overlying rock, the percentages drop to previous levels. Palynologists refer to this jump as the "fern spike" because of the sharp upward-pointing "V" that results when the percentages are plotted

on a graph (see illustration). The spike indicates that the first plants to revegetate the early Tertiary landscapes were ferns. Later, the ferns were replaced by more slowly growing seed plants.



What could have caused such an explosion of the fern population? Ferns readily invade disturbed environments such as bare volcanic slopes or recently burned forests. They colonize quickly and in large numbers by producing billions of spores carried by the wind. It seems likely that when the land lay ravaged after the asteroid impact, the ferns formed an advance guard for plant succession. They moved in, established a foothold, and prepared the landscape for other plants. For a while (scientists cannot say how long with certainty), ferns dominated the vegetation, turning the landscape green once again with the lush growth of their leaves. Their abundance in the post-impact vegetation accounted for the high percentage of spores in the rocks of that age.

The fern spike gives scientists a rare view of the extinction. Most other biological evidence about the extinction is taxonomic—an accounting of the number of species, genera, and families that dropped out in the final stage of the Cretaceous. In contrast, the fern spike shows change at an ecological level. It tells of the reorganizations that occurred within plant communities and the fluctuations in the relative abundance of plants. Scientists rarely have this kind of ecological data in the study of extinctions.

In the public's mind, the end of the Cretaceous is associated with the demise of the dinosaurs; hardly anyone thinks about plants. But what revegetated the toasted terrains of the early Tertiary tells a story just as crucial to understanding what happened 65 million years ago as the extinctions themselves. Critical evidence comes not only from organisms with box-office appeal such as the dinosaurs, but also from more modest living things such as the ferns.

NEW HFF Website to be revealed SOON!
Watch your emails and our Facebook page for the announcement of the unveiling, of our beautiful updated site!

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