



Hardy Fern Foundation
Quarterly



Winter 2015

1. Introduction

The purpose of this study is to explore the ethical implications of the implementation of a new technology in a business context. The research is based on a case study of a company that has recently introduced a new software system. The study aims to identify the ethical challenges that arise from the implementation of the technology and to propose strategies to address these challenges.

The research is structured as follows. Section 2 provides a background on the company and the technology. Section 3 discusses the ethical challenges identified during the implementation process. Section 4 presents the proposed strategies to address these challenges. Section 5 concludes the study and discusses its implications for future research.

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Editor- Sue Olsen



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PTERIDOTRIVIA

In the latin name *Polystichum polyblepharum*, what does
"blepharum" mean?

Visit our website at hardyferns.org to find out!

President's Message ~ Winter 2015

Best Wishes to all for 2015. This early winter has started out much as it did in 2014. In early December, temperatures descended into the teens for a week or so. The Himalayan maidenhair ferns, *Adiantum venustum*, in the garden have browned out a bit and look tattered, but I do expect them to bounce back as usual when spring growth resumes. The potted *Pyrrosia lingua* on the patio looks surprisingly unscathed. The rest of winter weather so far has been fairly typical for the Pacific Northwest, with intermittent winter rains and grey skies and temperatures in the 30's and 40's.

The Pacific Northwest Horticultural community has recently lost a 'giant'. Sylvia Duryee passed away on December the 20th. Sylvia was one of the founding members of the Hardy Fern Foundation. Her commitment, dedication, generosity and no nonsense approach to moving forward, helped make HFF what it is today. Ferns were pretty much a neglected plant group 25 years ago. Most nurseries and garden centers offered no more than five or six species of ferns. Today most nurseries and garden centers offers a wonderful assortment of ferns that fit into various garden and landscape conditions, and Sylvia played a major role in making this so. Sylvia's long time association with the Northwest Horticultural Society, the University of Washington Botanical Gardens and Arboretum and the Elisabeth Miller Horticultural Library, inspired many people in the gardening community. Her reputation was a great asset in the establishment and growth of HFF and its acceptance in the greater horticultural community. Her interest in all plants was inspiration to many. We will greatly miss her unique personality and guidance.

The Northwest Flower and Garden Show takes place the second week of February and as always takes place at the Convention Center in the heart of Seattle. This year HFF is sharing an informational and educational booth with the Northwest Horticultural Society (NHS). This show has been the harbinger of spring for Northwest gardeners for over twenty five years. Wonderful display gardens, new ideas, and new and old plants and products are on display and for sale. This association between HFF and NHS would have very much pleased Sylvia.

This past year, two of HFF's board members, Susie Egan and Nancy Strahle, have undertaken the formidable task of an Organizational Assessment for the Foundation. Part one - Financial Assessments and Recommendations has just been recently presented and reviewed by the board. This important work is essential for the future security and sound operation of the Foundation. A sincere Thank You, Susie and Nancy, for your commitment, time and effort in putting this forth. The findings and recommendations will be a major piece of work to carry out by the board for the Foundation through the course of the year.

We look forward throughout 2015, to HFF's schedule of activities, such as

HFF's representation at the Northwest Flower and Garden Show, the Fern Fest, the Fall Social, fern classes, presentations and field trips, that offers a host of activities for HFF members and fern enthusiasts. HFF continues to work with the development of Fern Display Gardens and introduction of new ferns into horticulture. At the Rhododendron Species Botanical Garden, home of HFF, the Victorian Fern Stumpery looks fantastic, with associated plantings of fern species throughout this wonderful and important Botanical Garden that encompasses one of three of the greatest collections of Rhododendron species in the world.

Fern croziers are tightly coiled in their winter sleep. Evergreen ferns, especially the genus *Polystichum*, hold up well and show off their often shiny fronds for our winter delight. I sit in my comfy chair researching and contemplating ferns that I would like to add to my garden. I consider ways of moving plants around that may better suit their needs and to situate them in subtle and dramatic ways to enhance their overall effect. I read and find out about their paleo botanical past, their important place in the evolution of plants, their relationships to present ferns and how that came to be. I am never bored.

Happy Fern Gardening, John van den Meerendonk

Polystichum tripterum
Trifid holly fern,
Winged holly fern

James R. Horrocks ~ Salt Lake City, UT

This unusual species is described as “splendidly distinctive” by Richard Rush, its dull green fronds displaying a curious pair of elongated basal pinnae that give it a “winged” look in the shape of a dagger or an inverted letter T. The species name “tripteron”, literally translated “three wings” is aptly descriptive of this unique member of the genus. According to Ohwi, *P. tripterum* is commonly encountered in cool, moist, mountainous areas, the damp soil being rich in organic matter. It is native to Japan, Korea, China, the southern Kuriles, Manchuria, and eastern Siberia. Its zone hardiness is at least to zone 5 and probably zone 4 if the plants originated from further north. There are two varieties noted: “Pedatiforme” and “Subbipinnatum” according to Rush and Iwatsuki. *P. tripterum* is not likely to be confused with other species in the genus *Polystichum*, although *P. hancockii*, also from Japan and China, is similar in outline and has the same curious elongated basal pinnae, except they are rather diminished and not as pronounced as in its more well-known cousin. *P. hancockii* is evergreen whereas *P. tripterum* is deciduous.



Description:

The rhizome is described variously as erect to ascending (Ohwi) to short-creeping and clump forming (Olsen, Hoshizaki, Mickel). The fleshy rhizome is clothed with the basal stubs of old fronds. The stipes are one-half the length of the frond, erect and pale green with moderate membranous brown scales. The deciduous fronds in the upper portion are simply pinnate and lanceolate in outline and one to two feet long. The rachis is pale green with sparse scales. The herbaceous pinnae are lanceolate and often falcate toward the apex. There may be 20-35 pairs of pinnae which display coarse dull teeth and the apex of each pinna has a soft slender tip. The lower most pinnae are extended out to nearly half the length of the frond itself and are again divided into narrowly triangular pinnules, the pinnae similar in appearance to the upper portion of the frond, although somewhat reduced in length. The whole effect, as has been mentioned, is that of an upside-down T, although the basal pinnae are held at a somewhat less than 90 degree angle. The sori are found in two series on the pinnules, often slightly closer to the costa than the margin. The indusia are membranous with jagged uneven edges and orbicular in outline.

Culture:

P. tripteron is a medium sized fern for a cool moist setting with higher humidity and a rich organic soil. Hoshizaki considered it “moderately difficult” to grow whereas others are a bit more optimistic. It is not suitable for a dryer climate with hot summers. The author found it difficult at best in northern Utah and with what meager growth it had, this was set upon by slugs and snails eating it nearly to the ground. Sue Olsen notes this problem and suggests, perhaps tongue-in-cheek, surrounding the planting with a moat. (The author would add some slug and snail-eating frogs or turtles.)

This is certainly an interesting and charming fern to have in the garden but the humus-rich soil must be kept moist and well mulched and pests must be kept at bay. This *Polystichum* certainly presents a challenge to even the well-seasoned gardener but is well worth the effort.

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Grand Tour 2013 ~ US Fernists to UK ~ Part II **Continued from page 53, Volume 24 No. 3, Summer 2014.**

Richie Steffen

Federal Way, WA

1/8 – Laugharne to Aberglasney House and Garden

First stop of the day was Aberglasney House and Gardens. (see photo page 15) In 2007 their past director was the speaker for the 13th Annual Miller Memorial Lecture, so I was excited to see the garden. Aberglasney is a partial ruin with some restoration in progress. The former manor house was partially restored with a large section left in ruins, but covered with glass that serves as a unique conservatory. Behind the house was a large stone wall with a raised bed in front of it. The bed and wall were filled with ferns. We did not have much time there so I took a quick walk in the upper wooded section taking photos as I went. I met one of the part time gardeners and chatted with her for a few minutes then had to meet the others for a quick lunch. After lunch dashed around taking a few quick photos met the others at the mini-bus and left for the next stop.



Brian and Sue Dockerill's was the next garden. They run the BPS spore exchange and have a garden filled with interesting plants both ferns and other green stuff. The garden was built over several years and various sections of ground were purchased over a long period of time. Time created several unique and distinct garden rooms to accommodate their varied plant tastes. Had tea and sweets then off for the hotel.

2/8 – Dewstow, Roger and Sue Norman, Tenbury Wells

Tenbury Wells is, of course, the centre of the universe!

I was excited to see Dewstow Gardens and Grottos first thing this morning. Dewstow is

a quirky Victorian garden with a lot of Pulmanite rock. Pulmanite is a man-made stone developed during the Victorian era that was often made to look like stone. The entry to the garden is unimpressive and the first garden you enter has rather ordinary plant material and design, but you can start to see the extensive use of Pulmanite and the work is superb! Once you enter the grottos it is unbelievable that someone spent so much money and time creating a partially underground fantasy world with caves, waterfalls, pools, columns and planting beds mostly filled with ferns. It is a total wonderland and a testament to the obsessions of the Victorians. We searched the entire garden for all of the mostly hidden Pulmanite structures.



On to Roger and Sue Norman's home. They are alpine gardeners with a wide array of ferns on about 5 acres. It is a very interesting garden with several very different areas. Alpine gardens surround their house inside a hedge. Once you slip through the hedge you enter a large open field with wide planted areas along the edges and with small hidden gardens tucked behind hedges and woody plants. I lagged behind taking photos and had a difficult time keeping up. I felt like I was always running to the next bit of garden to catch up. Great garden!



Last stop of the day was Martin's home. He has a small garden that was quite young the last time we saw it, but now has started to fill in with his amazing fern collection. Envision lots and lots of polypodiums (the national collection) and many very rare ferns. A fab small *Polystichum aculeatum* 'Plumosum' caught my fancy. Went inside for tea and coffee and looked at Martin's huge fern book collection. Wish we had more time! Bought a few of his rare fern books.



3/8 –Tenbury Wells to Fibrex Nurseries, Pebworth

Today is the BPS Cultivar Meeting at Fibrex Nursery. We arrived at 11:00 and met the other BSP members in the nursery stock plant house. They have row after row of cultivar and species ferns. We went through the prop house and sales area with an amazing assortment of ferns for sale, I wish there were something like this at home! Fibrex also houses the national collection of Pelargoniums (geraniums) and Hedera (ivy). I walked through both. If there is a national collection you must see it! The Pelargonium collection was huge!! And beautiful. One house was all species then the other houses were divided up into different horticultural groups, zonals, dwarfs, fancy leaf, scented and ivy-leaf. Found all types of flowers from those with deeply cut petals to rose-bud doubles. I did not think I would enjoy the ivy collection as much, but it was equally fabulous! Large pots with ivy cascading over the edge. Ivy grown up as 6 foot tall pillars and maybe 50 ivy plants trained as small trees. In the back of the greenhouse were 6 inch pots on tiered tables, each pot with a different cultivar and hundreds of pots. It makes me want to collect ivy! After lunch I gave a presentation on the Miller Garden with a few photos of my home garden. Angela one of the owners of Fibrex gave a presentation on propagation. There was a short question and answer period with a round robin of cultivar chat then we packed up and left for Stratford, the birthplace of Shakespeare.



Stratford is a very old town and very touristy with lots of old exposed timber buildings including our hotel I do not think there was a single straight level wall in the place. After dinner I took a walk around the city, very pretty. I walked down the River Avon and looked at the narrow boats lined up for the night. Went out the next morning to take pictures.



4/8 – Stratford to Wisley, RHS gardens

We arrived at Wisley and had about 2 ½ hours there. It is a huge and amazing garden. You could spend days here. Martin had an unusual form of *Osmunda regalis*, royal fern, to show us so we went there first. It was the same size as typical, 6 to 8 feet tall, but the fronds were narrow with congested leaflets. It is very different, although not necessarily beautiful. No one knows yet where it is from or how it ended up at Wisley, but I must get a piece at some point....Martin and I wanted to see the trial gardens so we trekked across Wisley to the trial location. Many trials going on - *Ribes sanguineum*, tall phlox, *Euphorbia*, clematis, and many others. Interesting to see, but didn't have enough time to really look at them. Off we went to the new conservatory. Took a quick walk through then off to the next stop - Julian Reed's garden.



Julian Reed set up the BPS cultivar meeting last Saturday and was really keen to have us visit. He has a small suburban garden, but it is filled with ferns, especially cultivars. Took lots of photos. He is doing quite a bit of spore growing and is selecting out some very interesting variations.

5/8 – London: Jennifer Ide, Roger Golding, Pat Acock

The first stop was at Jennifer Ide's. I met her when the BPS came to tour Washington. Small garden and not a lot of ferns, but she is a collector of fern décor, especially Mauchline ware. She showed us her collection and explained the history of the pieces. Jennifer joined us for lunch at a small café on Shooter's Hill in London. The café is on top of a hill in the middle of a park and has sweeping views over the countryside.

Roger Goulding's was the next garden. He has a small row house in London with a very steep narrow garden in back of the house. When he opens his back door it looks like you are walking off a cliff. There are a series of steep steps with terraced areas heavily planted with ferns and stuff plus a lot of cleverly placed containers and a couple of small greenhouses for propagation and growing small plants on. Inside the house every window is filled with indoor ferns and house plants, particularly in the bathroom. His basement kitchen window looks out on to a narrow window well filled with ferns in pots. Everything in the back garden had to be taken through the house and down his slope to get there.

Pat and Grace Acock's garden was the last of the day and where we could clean up plants procured during the trip. I have been to Pat's garden before, he holds the nation collection of horsetail and is very interested in native British ferns. He has several *Dryopteris affinis* subspecies and varieties and now they have all hybridized, but I would have to say, they all look identical to each other. As we finished cleaning plants a thunderstorm came rolling through and dumped.

6/8 – Hastings to Kent: Stephen Munyard, Hastings; Mark Border, Bexhill-on-Sea, East Sussex; Jude Lawton, West Malling, Kent

Long drive today to Hastings on the south coast. First garden was that of Stephen and Karen Munyard. They also live in a row house with a very steep narrow garden in the back. Stephen's garden was a wilder style and created to enhance the wildlife habitat. Lots of birds. He has badgers that come every night to be fed and the occasional fox. One of his specialties is filmy ferns. They are difficult to grow small ferns that grow on trees or rocks in very damp high humidity locations. The fronds are so thin you can read a newspaper through them. The filmy fern collection was at the bottom of the garden. Very dark and moist, and also housed newts!

The second garden was the newly planted garden of Mark Border. We were running late so we did not spend much time there, but there were several interesting cultivars. He had just planted the garden last fall so the plants were just starting to establish, but they included a nice collection of odd *Asplenium scolopendrium* cultivars (weird Hart's-tongue fern) and some uncommon selections of *Polystichum setiferum*.

The last stop was at Jude Lawton's a regional Plant Heritage person. She has a small garden and house with most of her plants in containers. We just had a quick look around before we had to get back to the hotel to prepare for the farewell dinner.

16 people were at the farewell dinner Pat and Grace brought two guest fern experts from France Rémy Prelli and his wife. The hotel set up a banquet room for us and all had a good time. I gave a farewell speech thanking the garden owners and Martin for all of their hard work. See everyone when I return!

All photos courtesy of Richie Steffen

Vignettes

Jo Laskowski ~ Seattle, WA

We showed up at the Miller Garden for their last seasonal tour on Thursday, October 9, 2014. Lucky ones had been enchanted earlier this year by spring ephemerals, impressed by the summer glory of ferns, and now we came to gorge on color.

We got coffeed up, and coated up, and followed curator Richie Steffen outside. The sky was gray, with a high and good light. Over the next hour we crisscrossed, climbed up, and descended the steep, five-acre slope where this garden makes its home. Much work is done at the Garden testing the hardiness, growing requirements, and merit of a wide variety of plants, distilling observations down into manageable mental nuggets that are quite freely dispensed. (see photo page 15)

Vitis vinifera ‘Purpurea’, is a joyful vine that scrambled a moderate 20 feet into a tree and flaunted luscious purply-reds. A hybrid between *V. vinifera* and the native California grape (*Vitis californica*), named ‘Roger’s Red’, was bold in crimson. Plant these vines so they’ll be back-lit to really show them off. *Hydrangea anomala petiolaris* scaled a Western red cedar. And speaking of hydrangeas, it seems an inter-generic hybrid is being developed between Dichroa and Hydrangea, to be called...Didrangea!

Rhamnus californica, is much used in California but rarely used in the Northwest. Known as coffeeberry, it lofts dark green leaves as the backdrop to ripening berries that propel themselves from lime green through rose, red, and finally burgundy and almost black. Some 50 *Fothergilla major* flamed on the slope, with their dusty blue leaves turned screaming scarlet. *Actaea pachypoda*, an East coast native, does well here. Thick red petioles carried crisp white berries, each one dotted with the black stigma scar, or “eye,” that gives it the common name of doll’s-eyes. Manzanitas are here—*Arctostaphylos densiflora* ‘Howard McMinn’ coyly revealed flashes of peeling, coppery bark, with glossy green leaves and red stems.

The light pink flowers of *Bergenia* ‘Herbstblute’ appear in both spring and fall. Many peony species have reliable fall foliage color, too. Then there were veritable carpets of *Cyclamen hederifolium*, with silvery tracings on green leaves and shades-of-pink flowers.

A lot of plants in the Miller Garden have come from England. We know how crazy the Brits are when it comes to scandalously self-ornamentatious ferns—as is the current curator. So we piled up abruptly at the sight of *Athyrium filix-femina* ‘**Setigerum Cristatum**’, surrounded by some of its grotesquely and equally ostentatious offspring—an odd exclamation point in this field of fall interest. Easier on our sensibilities, senescing **Osmunda** wove a soft, straw yellow into the landscape. *Polypodium cambricum* was rooting through the soil, sending up fronds with a lot of variation. It can be hard to remember if a particular polypody is a summer grower or wintergreen, but you know when you see it pushing new fronds that its time has arrived. So *P. cambricum*—wintergreen.

The crimson foliage of *Acer japonicum* ‘**Aconitifolium**’ generously splashed the hillside, and the foliage of a cut-leaf vine maple, *Acer circinatum* ‘**Monroe**’, suffused a pale primrose-yellow glow. (see photo page 15) To guarantee such a subtle autumnal infusion, grow this vine maple cultivar in the shade. So many of the true firs have really arresting cone colors—*Abies koreana* ‘**Starker’s Dwarf**’ sported ones in the magnificent shade of dusty desert purple. Brick-reds were orchestrated by the spiky foliage of **Cryptomeria**, the incomparable Japanese cedar. Because of this color, and in common with many of the orange sedges, the uninitiated often assume the plants are dead. Steely-blue came courtesy of a *Sequoia sempervirens* cultivar. The rare *Wollemia nobilis*, the Wollemi pine? There are five here, one from National Geographic, and four stock plants from the nursery that propagated them for National Geographic. Until 1994, the Wollemi pine was only known by its fossil record. Then—hard to believe—a single grove of living plants was discovered in Australia. National Geographic took part in the earliest introduction and distribution, and today Wollemi pines are being trialed throughout the world.

The tour ended. We got into our cars and crawled up the steep drive. At that point my eyes were so sensitized to color and hue that I could have gotten lost in the pattern on a banana slug—what a great time!

Annual AFS Fern Foray McCall, Idaho ~ 26 July 2014

Ed Alverson ~ Eugene, OR

Where can you go to see ferns when you happen to be in Boise in the middle of summer? The answer, it turns out, is to do what Boiseans do – go to McCall on Payette Lake. Unlike Boise’s dry hills, Payette Lake is nestled in a forested basin at about 5000 feet above sea level, and is a popular area of summer cabins and campgrounds.

A bus load of fern enthusiasts departed downtown Boise at 8 AM to begin the journey, following the often winding highway up the Payette River drainage. Our destination was the Sylvan Creek drainage on the western shore of Payette Lake, about 3 miles north of McCall. After a round of introductions, the group headed up the trail along Sylvan

Creek, through a forest of ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), western larch (*Larix occidentalis*), and Engelmann spruce (*Picea engelmannii*). Wild huckleberries were abundant along the trail, and slowed our progress toward fern habitats. Both bracken (*Pteridium aquilinum* ssp. *pubescens*) and lady fern (*Athyrium filix-femina* ssp. *californicum*) were common in the forest, especially along Sylvan Creek.



Payette Lake

Photo courtesy of Ed Alverson

About ¼ mile up the trail we veered on to the right to ascend a series of granite rock outcrops. Because the ridge had been smoothed by ice-age glaciers, access to rock outcrop habitats was actually quite easy. Nearly all of the genera of “rock ferns” that occur in the Pacific Northwest were found here. Except for fragile fern (*Cystopteris fragilis*), which had mostly gone dormant, we were able to find fresh green plants despite the dry summer. The most common fern in this habitat was probably lace fern, *Myriopteris (Cheilanthes) gracillima*, but we also saw parsley fern (*Cryptogramma acrostichoides*), Indian’s dream (*Aspidotis densa*), and Rocky Mountain woodsia (*Woodsia scopulina*). A special treat was Bridge’s cliff-brake (*Pellaea bridgesii*), (see photo page 14) which is found mostly in the Sierra Nevada of California, but is also disjunct on granite rocks in central Idaho and northeastern Oregon. Also, forming mats on the rock outcrops here was a spike-moss, *Selaginella densa*. (see photo page 14)

After lunch on the rocks, we returned to the trail and continued upstream to a pond, actually an old reservoir. On the bank of the dam we found a few small plants of leathery grape fern, *Sceptridium (Botrychium) multifidum*. Then, in a nearby moist shady spot, we found a colony of very robust leathery grape ferns, with both the current year’s new growth and very fresh looking year-old growth on the same plants. We did not, however, see the moose that was said to reside in the Sylvan Creek area – and perhaps that was a good thing.

After the hike, we were invited by Chris Davidson and Sharon Christof to tour nearby “Charlie’s Gardens”, a historic garden that has been in the ownership of Chris’ family for many generations. We noted the frequent use of ostrich fern (*Matteuccia struthiopteris*) in the naturalistic garden plantings. Ostrich fern is native to the Pacific Northwest (south to southwestern British Columbia) but not to Idaho.

We ended the trip by relaxing and socializing along the shore of Payette Lake at Chris and Sharon's cabin. Word on the street was that there were quillworts (*Isoetes*) growing in Payette Lake, which was enough to get Carl Taylor into the water to gather some plants. Assisted by the diving skills of Wes Testo, quillworts were procured for all to see; however, the spores were not sufficiently mature to provide a definite species identification.

Sylvan Creek turned out to be an excellent location to provide an introduction to Idaho's fern flora, as well as the flora as a whole – the plant list for the area has over 200 species of trees, shrubs, forbs, and ferns. Thanks to local guides Alma Hansen and Alexa DiNicola for helping to guide the group, and to Chris and Sharon for their hospitality. In all it made for a pleasant and memorable outing.

Welcome New Members!

Asher Decker	Carol Linden
Kelly Dodson & Sue Milliken	Fran McGee
Loyd Jacobs	Larry Snyder
Trevor Johnson	Dianne Koch Stefanko
Todd Kelley	Debbi Wilson
	Susan Yamins



THANK YOU TO OUR GENEROUS DONORS

We would like to thank our following members for their generous support ~

Donations to the endowment fund since 10/23/2014
John DeMarrais and George Sanko

Donations above their membership level since 12/31/2014
Loyd Jacobs

Appeal letter response as of 12/31/2014

Suzanne & Marvin Anderson	Pat Kennar	Pat Riehl
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Sue Haffner	Sam Pattison	John van den Meerendonk
Sarah Johnston	Rosemary Read	Roz Horder Williams



Pellaea bridgesii

Photo left courtesy of Ed Alverson

Selaginella densa

Photo right courtesy of Ed Alverson



Gasala

Photo left courtesy of Arlen Hill

Luoji Shane

Photo right courtesy of Arlen Hill



**Aberglasney
Garden**

Photo right courtesy
of Richie Steffen



***Lygodium
palmatum***

Photo left courtesy of
Joan Gottlieb

Miller Garden house

Photo right courtesy of
Richie Steffen



***Acer japonicum
'Aconitifolium'***

Miller Garden

Photo left courtesy of
Richie Steffen

The Joy of Responsible Fern Gardening

Joan Eiger Gottlieb ~ Pittsburgh, PA

A garden is a personal connection to the natural world. For “fernatics” like me it is a connection back to the Devonian period of the Paleozoic era, 360 million years ago. That is when the first vascular plants were finding their land roots and evolving into the varied pteridophyte flora that nurtured Mesozoic dinosaurs and towered over early seed plants. Those pioneer seed plants perfected plant adaptation to life on land by retaining the desiccation-vulnerable, free-living gametophyte stage of the fern life cycle within the sporophyte’s cones or flowers. The seed-bearing gymno- and angiosperms came to dominate terrestrial floras over the past 100 million years, but ferns are still a vital, evolving, exciting, and beautiful component of landscapes, both natural and in gardens on all continents except Antarctica.....(*where they once were....Ed.*)

Gardens have become increasingly valuable sanctuaries for our flora, including ferns, now facing habitat loss, fragmentation, pollution, and the warming effects of climate change. All these environmental impacts threaten genetic exchange within and among far-flung populations, and produce more inbred species with diminishing variation (the sine qua non for adaptation and long term survival). Most of us live on land that was developed for residential use after it was farmed, lumbered, or mined. But, before those disturbances, my quarter acre building lot in western Pennsylvania was part of the **temperate deciduous forest**, a natural ecosystem that stretches in a circum-global belt around North America, Europe, and Asia. Climate in this “Goldilocks” zone is moderate - not too hot, not too cold (seldom below 10° or above 100° F). Rainfall averages 25 - 60” per year - not too dry, not too wet. As a lovely bonus, in late autumn the dying foliage of many woody plants turns from green to bronze, red, orange, and yellow, elevating the mood of countless human leaf “peepers” prior to the drab dormancy of winter.

I believe it is our responsibility as gardeners, and as guardians of the land, to capture the character of the local ecosystem and to preserve its biodiversity. For me that means re-creating the layered design of a deciduous forest starting at the top with an assortment of tall, native, **canopy trees (40’ or higher)** like American beech, sugar maple, hickory, tulip poplar, sweet birch, and others. For evergreen interest hemlock and white pine can be added, although they do best in cool ravine conditions. Larch, spruce, sour gum, and red maple are wetland lovers, but all three do well in garden conditions. I have five of these native species around the periphery of my garden, providing high canopy shade (free air conditioning) without any impact on the house foundation. They were carefully selected for modest adult size, in scale with the property, and for disease/pest resistance. If you don’t want to deal with a deluge of fall leaves, select small or thin-leaved trees, e.g. larch or thorn-less locust. Be aware that some otherwise attractive trees produce and drop prodigious crops of large, smelly, or prickly fruits (legumes, seed-bearing *Ginkgo*, sweet gum).

The woody **understory layer (20-30’ heights)** of a forest or garden exists wherever

the canopy opens up to some sunlight (e.g. the edges of canopy trees or in the break created by a downed tree). The selection of small trees for this niche is huge. Sweet-bay magnolia, flowering dogwood, hop hornbeam (*Ostrya*), musclewood (*Carpinus*), sassafras, and witch hazel are a few of my local favorites, and all thrive in my personal “forest.” Despite the “natives are best” admonition for trees and shrubs, I cannot resist the sculpted and tinted leaves of a few Japanese maples in my woody understory. They provide perfect, dappled shade for ferns. **Shrubs** complete the woody layers, with an even greater selection of species. I have Carolina allspice (*Calycanthus floridus*), a botanically interesting, beetle-pollinated shrub, with maroon-petaled flowers, and Appalachian icons like mountain laurel, pinxter azalea, and native rhododendrons. A garden for all seasons should be amply endowed with winter color, and my collection of dwarf conifers (propagated by specialists from naturally mutated branch tufts called “brooms”) provides snow-time appeal in shades of green, gold, and blue-gray.

Go easy on the kind of sheared trimming that alters the natural shape of a woody plant. Shrubs should not have flat, snow and ice-trapping tops, nor do they benefit from being sculpted into unnatural topiaries. Shrubby stems can be cut back on a slight angle above a bud by about a third of their length each year if desired. Trim shrubs and hedges so they are widest at the base and taper toward the tip. Trees should not be “topped” and therefore, should not be planted under utility lines where electric supply companies will eventually “scalp” them. When removing tree limbs leave the basal branch collar intact. Exposed surfaces of woody plants are sealed by natural saps and resins; commercial sealants are not necessary and may even be harmful by locking in microbes and moisture. Suspend pruning of shrubs and trees from August through November to allow for winter bud hardening, but dead, diseased, and crossed branches can be removed anytime. Spring bloomers should be trimmed right after they flower. Consult a good book or Internet reference on pruning or hire a trained arborist.

Finally there is **ground level** where a dizzying array of herbaceous annuals and perennials awaits the creative gardener. In addition to ephemerals like trillium, may-apple, jack-in-the-pulpit, bloodroot, and so many other harbingers of spring, this is where fern enthusiasts can indulge their passions. Choices range from damp soil denizens like cinnamon, royal, ostrich, and log ferns to calciphilic and epipetric species like walking fern, cliff brake, spleenworts, and hart’s tongue (including those enticing British cultivars—with the caveat that not all are equally hardy). Seemingly endless species and varieties of *Dryopteris*, *Polystichum*, *Thelypteris*, and *Athyrium* find fern Shangri-la in the shade of shrubs and trees everywhere in my garden. Wherever you live I recommend starting with native fern species both for the relative ease of growing them and our collective responsibility for preserving them. However, gardens are personal expressions of their owners, and I enjoy the beautiful architecture, color, and form of many hardy Asian and European taxa. The plumose types of *Polystichum setiferum* are particularly irresistible, as are the Victorian varieties of lady’s fern (*Athyrium filix-femina*) and the colorful cultivars of Japanese painted fern (e.g. *A. niponicum* ‘Pictum’ Silver Falls and Red Beauty). I can grow many Zone 6 species (Pittsburgh is in Zone 5) by planting them in protected locations and mulching with several inches of chipped leaves in the fall, taking care not to bury dormant apical bud(s).

The ecologically “correct” garden should have the natural form and diversity described above, but several additional components and considerations are worth noting.

SMALL PONDS, FOUNTAINS, and BIRDBATHS. Aside from aesthetic appeal, these sources of clean water are necessities for wildlife, especially birds. Mosquito control is mandatory. Any pump that provides a constant drip or movement of water will do. If the water is stagnant, introduce a few feeder goldfish or minnows to eat juvenile mosquitoes, or toss in a piece of “Dunks” (pelletized Bt (*Bacillus thuringiensis*) every two months (safe for pets and fish; lethal to insect larvae). Change the water in birdbaths twice a week. Where raccoons, dogs, or other mammals cause damage, a rapid discharge (high impedance) electrified wire can be installed (by a professional) to surround the pond about 6-8 inches above the ground. A quick, non-lethal shock to marauders will deter repeat visits. Alternatively, do not stock fish (they attract messy raccoon feeding activity); instead, use “Dunks” (described above) regularly. Do NOT use the electrified wire technique if young children are around.

FEEDING BIRDS is a \$3 billion/year industry. Keep hummingbird feeders clean using 1 part chlorine bleach to 9 parts water once a month. Rinse thoroughly. Feed 1 part sugar (not honey) to 3 parts water every few days. Hang the feeder in a shady spot, near shrubs or trees, visible from the house for enjoyment. Feeders for seed-eating birds should have effective squirrel baffles. Fill them with a one- or two-day supply of a black-oil sunflower mix. If rodents become a problem below the feeder (birds are not fastidious eaters) cease feeding for several weeks or longer. Do not feed birds in the fall unless you plan to continue through the winter. Birds accustomed to a reliable food source may not migrate as they would otherwise. Plant berry-producing shrubs like *Ilex*, *Sorbus*, *Amelanchier*, and *Vaccinium* for natural bird feeding.

GARDEN or ‘GREEN WASTE’ is collected at the curb and composted at managed sites in some communities. It may then be distributed in season to residents as a dark, fibrous compost (“black gold”) and is an excellent soil dressing around garden plants, especially for ferns that tend to be shallow-rooted and dry out quickly (the crispy frond effect). My goal is zero garden waste leaving the property. I try to compost all my vegetable scraps, garden prunings, and other plant material in a simple pile enclosed on three sides by durable wood slats. No animal material (except rinsed, calcium-rich eggshells) goes on the mound. Every few weeks a little all-purpose fertilizer can be tossed onto the pile, and a pitchfork employed to turn and aerate it. Composting occurs naturally; it may just take a little longer if you skip the additives and aeration. If you have a lot of lawn clippings, add them to the pile gradually, spaced with fibrous garden waste to avoid a slimy mess. Fall leaves can be added to the compost pile, but I prefer to chop them coarsely (in a simple whip-line chipper) and apply the fresh, fluffy product generously around all my ferns (and other plants too when I have enough). This insulates root zones against the killer freeze-thaw cycles that heave our plants up and out of the ground. Over winter, as the leaf bits decompose, their minerals and organics are released, providing all the nutrients ferns need. In mid-March I scatter a little all-purpose, generic or organic fertilizer over the root zones of trees and shrubs (even if they are still covered by snow). In mid-May evergreens benefit from a light feeding of a fertilizer formulated for acid-

loving plants (e.g. Hollytone). Use all commercial fertilizers sparingly (less than half the recommended amount).

BIODIVERSITY. Many “gardens” feature an expansive lawn, a tree or two, and some foundation shrubs to soften the angular edges of the house. Often the plants are selected from the same eye-glazing, limited assortment you see at any big box garden center. Most are non-native and poorly adapted to local conditions. Lawns are diversity dead zones, supporting mostly high-maintenance, alien grasses, and easily invaded by weeds. Incredible amounts of land, labor, water, fertilizer, pesticides, and mower fuels are wasted in a perverse desire to attain a completely unnatural, manicured monoculture. The responsible gardener should reduce the lawn’s size gradually, replacing (or at least minimizing) it over a number of years. Mark out the grassy area to be removed and treat it with an organic herbicide like EcoSmart or with glyphosate (“Round-up”) - a biodegradable glycine derivative that kills actively growing plants by inhibiting a vital enzyme). When all signs of green growth are gone, cover the ground with a generous layer of compost. Restoring the canopy-layered look and boosting species diversity should be the goals of replanting the space. A variety of mulches, wood chips (avoid cypress), and small-size gravel will control weeds and create attractive pathways. The grass will never be missed and there will be all that extra space for growing ferns. Ground cover plants are a good solution to bare ground weedy areas. I have an exquisite, spreading colony of New Zealand’s little hard fern (*Blechnum penna-marina*) bordering my rear garden path among other fern and flowering ground covers.

An important caution is needed for those who acquire new species for a more biodiverse garden. Although most **exotic (non-native)** plants (e.g. Queen Anne’s lace, common yarrow) fit into our natural landscapes without harm, some are “biological pollution.” They can spread rampantly (one is aptly called “mile-a-minute weed”) and damage whole ecosystems irreversibly. Avoid planting these alien, invasive species and work to eliminate them from local parks, public places, and nurseries. Our Western Pennsylvania flora is being overwhelmed and endangered by aggressors like Japanese knotweed, English ivy and garlic mustard, and East Asian multiflora rose (not to mention a long list of insect and microbial invaders from which our natives have no evolved protection. Never plant tree of heaven, Norway maple, or princess (*Paulonia*) trees. Avoid non-native *Euonymus* and Japanese honeysuckle shrubs or vines. Refuse perennials like purple loosestrife and goutweed. Their rapid growth in a new garden space may be welcomed initially but it will lead to years of frustrating eradication efforts. Check with your state Department of Natural Resources for a list of problem plants in your area.

RESISTANCE, PESTILENCE, CHEMICALS. All gardens suffer from time to time from the ravages of pest species. Garden centers have become chemical supermarkets, with whole aisles devoted to lethal herbicides, pesticides, insecticides, fungicides, and more. The suffix “cide” means “killer,” and from time to time the avid gardener may need one or more of these products (or their organic counterparts) for limited use to maintain an attractive garden space. Outbreaks of hemlock wooly adelgid, gypsy moth, oak wilt, and emerald ash borer are among the recent plagues on the trees of Penn’s woods. In the vegetable garden squash borer, cabbage butterfly, potato and asparagus beetles,

corn earworm, and many other herbivorous insects, chomp away happily in their larval stage. They rarely create serious crop losses, and often can be hand picked or controlled with spot treatments of biological-based pesticides like rotenone or pyrethrum. Use products containing Bt (see the “SMALL PONDS...” section above) on plants harboring pest caterpillars, borers, and grubs. Bear in mind that our beloved butterflies also have a caterpillar stage. Aphids can be blasted away with a cold shower from the garden hose. Scale insects on woody plants (but not evergreens....*or ferns....Ed.*) can be treated with dormant oils in winter or early spring before leaf emergence. Fungi, if discovered very early, may be controlled by emulsions of sulfur and copper (Bordeaux Mix), zinc (Zineb), or manganese (Maneb).

Ferns are not subject to many pest problems although a few fern genera (e.g. *Asplenium*) can suffer significant slug damage. Good air circulation, morning-only watering, and a scattering of granular iron phosphate (“Ortho Elementals,” “Sluggo,” “Es-Car-Go,” “Safer’s Slug Bait”) can lower, and even eliminate, populations of these pests. Try not to use broad-spectrum pesticides like Diazanone or Sevin on insects. Early detection, accurate identification of the offending species, tight targeting of chemicals, and strict adherence to package directions are key to responsible control measures. That will conserve wildlife, prevent accumulation of toxics in our water resources, and keep soil healthy. I am not ideologically opposed to using pesticides within the guidelines above, but, in most cases they should not be a first or panic choice. Non-toxic measures should be considered when possible. Most critters, including insects, do little or no damage, especially at low population levels. Some are beneficial (e.g. lady beetles, lacewings, mantids) and even beautiful (everyone loves butterflies!). Edward O. Wilson, a Pulitzer Prize-winning author, educator, evolutionary biologist, and ant specialist, was asked what to do if a group of ants is seen in the house. Without hesitation, Dr. Wilson replied he would advise the homeowner to get a magnifier, the better to observe and marvel at the amazing anatomy of these exquisitely adapted insects. May we all come to possess such tolerance and appreciation of the creatures with which we share the planet. See the “**Additional Reading**” section below for Olkowski’s comprehensive book on environmentally sound ways to control critters that can be pests.

Nurseries feature plants that have **genetic “resistance”** to various viral, bacterial, and fungal infections. Look for these when buying seeds or seedlings for the garden. If ground hogs, deer, and other herbivorous mammals are a problem, products like “Liquid Fence” or similar concoctions containing rotten eggs, garlic, and capsaicin (from “hot” peppers) work well, although they need to be re-applied throughout the growing season and deer can grow accustomed to their pungency. Watch for plants labeled “deer resistant;” nothing is “deer proof.” Here again, ferns are your friends. Most ferns are at least mildly toxic and naturally herbivore resistant. Even deer try to avoid bellyaches so they eat ferns only if they are starving, and then only in very small amounts. If you eat ostrich fern fiddleheads be sure to boil them thoroughly to leach out most of their toxic content. For me, eating ferns is just a step below cannibalism; besides, there are too many people, too few ferns.

SOIL is not dirt. Dirt is what your mom told you to wash off your face. Soil is a complex

mixture of air (20-30% by volume), water (20-30%), minerals like N, Ca, Mg, Fe, S from the breakdown of rock (45%) and organic matter (live or parts of once living organisms like leaves, twigs, roots, earthworms, nematodes, bacteria, etc. (2-5%). Soil is also an important carbon sink (storage area). All this is important for well-established plants, but, if you are starting your own plants from spores or seeds, always use a soil-less “seed starter” mix made of peat moss, perlite, fertilizer, and a surfactant (to help in wetting). This will suppress algal or moss overgrowth in cultures of slow-growing fern prothalli (young gametophytes) and stop fungal damp-off of fragile seedlings. Garden and forest soils have diverse textures depending on their composition and the size of their mineral particles. **Sand** has the largest particle sizes and is coarse and gritty - providing excellent drainage and aeration - a must for succulents and desert ferns. However, sandy soils dry out quickly and tend to be infertile (nutrients drain away). **Silt** soils are dominated by intermediate-size particles as in most farm and garden topsoils. **Clay** soils have the smallest particles - silky and slippery to the feel and crystalline in nature. They drain poorly, remain soggy, and tend to harden when dry. Fern gametophytes thrive on moist clay banks – great places to find “nurseries” of young sporophytes (sporelings) in the wild.

Soil conservation includes preventing compaction, particularly when the ground is wet, and avoiding tilling which releases carbon dioxide from soil, enhances erosion, and has been found to be unnecessary. It is best to prepare and dig a hole, row, or bed immediately prior to setting out plants or seeds. To find out more about your soil and whether it needs some remediation, have it analyzed by your state agricultural extension service. Most ferns will thrive in good garden loams, augmented by lots of compost and some sand or grit for drainage. For “lime-loving” (calciphilic) species add some mashed eggshells or agricultural lime (the pelletized type is easiest to disperse). Many of these plants (including ferns) grow quite nicely in the garden, provided the soil is not too acidic, but they do not compete well with faster spreading species. Alkalinity (to which some are tolerant) gives them a competitive edge in nature. See “How to Build a Limestone Cobble” in the “**Additional Reading**” section below.

WATER. This precious, increasingly costly resource is especially important for a fern garden, since most ferns are shallow-rooted and shrivel easily in droughts. Crispy fronds are unlikely to undergo resurrection (some desert species excepted), but the plants will often send up new crosiers from their apical buds. Too much of that behavior will eventually weaken and may even kill plants. Instead of planting fern beds by genera (e.g. all *Dryopteris* species in one area), try grouping ferns (and other plants as well) by their water requirements. Ferns that thrive in wet or marshy soils (*Osmunda*, *Onoclea*, *Matteucia*, *Woodwardia*, *Thelypteris*) can be placed near spring openings, and around ponds or **rain gardens** (see below). At the very least they will be easier to water with a soaker hose or even by hand. Mesic woodlands are natural habitats for most forest species of *Dryopteris* and *Polystichum*. Dry land, sun tolerant ferns like *Dennstaedtia* and *Pteridium* can be beautiful ground covers on sunny banks where their somewhat rampant, invasive growth habits can be contained. Water that runs off the house roof can be captured, stopping it from entering overloaded sewer systems, and using it instead for watering the garden. Simply connect a **rain barrel** to each downspout. A good one

can be purchased at many garden centers for about \$100 and is an easy do-it-yourself project. It should have a mosquito-proof lid on top and a spigot for filling watering cans near the base). Rainwater is usually best for plants. It is an absolute requirement for certain species like our native climbing fern (*Lygodium palmatum*). (see photo page 15) If watering is necessary during summer droughts, do so infrequently (about once a week) but thoroughly (1" applied to the surface gives a 4" soil penetration). Water early in the morning to thwart slugs. Keep ferns and other shallow-rooted plants mulched with fibrous compost or chipped leaves to slow drying.

A **rain garden** is another option for water conservation and sewer overflow prevention—basically a 4 – 8' ditch on a slight slope with a berm along the lower edge. Water trapped by the depression should evaporate or be absorbed within 3 days to avoid breeding mosquitoes. Because there are implications for the house foundation, septic tank, and the roots of large trees, the design and installation of a rain garden is best left to professional landscape services. They are splendid, however, for water-adapted ferns (named above), and for beautiful flowering perennials like cardinal flower, Virginia bluebells, bee balm, turtlehead, and many more. Check the website www.raingardenalliance.org

In Voltaire's *Candide* we are admonished (metaphorically) to "cultivate our own garden." I would add "in partnership and harmony with nature." At its best a garden is a reflection of our individual taste within a simulation of nature. A garden can be a green space sanctuary, a waste reducer, re-user, and recycler, a water saver, a carbon dioxide sink, and a pollution controller for the air, water, and land. Best of all, it can be part of a wildlife corridor, re-connecting fragmented populations of species to avoid the inbreeding that threatens their genetic diversity and survival.

I like to think we can help solve these complex and growing environmental problems by **acting responsibly in our own back yards**. And, we can enjoy our favorite ferns at the same time. Few things are better than that.

ADDITIONAL READING

Burrell, C. Colston. *Native Alternatives to Invasive Plants*, Brooklyn Botanic Garden Handbook #149, 2006. <www.bbg.org/gardengiftshop>

Gottlieb, Joan E. "How to Build a Limestone Cobble," *HFF Quarterly*, Spring, 2009, pp.48-51.

Olkowski, William et al. *The Gardener's Guide to Common Sense Pest Control*, Newtown CT, Taunton Press, 2013.

Stein, Sara. *Noah's Garden, Restoring the Ecology of Our Own Back Yards*, Boston MA, Houghton Mifflin, 1991.

What got you hooked?

Jo Laskowski ~ Seattle, WA

Saturday, October 11, 2014—the day of Hardy Fern Foundation’s annual Fall Social. Beginning this year, the Social will be held at new digs, the Bellevue Botanical Garden. BBG’s main buildings, parking lots, and their associated landscapes were just radically overhauled. Now there’s a spiffy new wing that can be re-configured into three smaller rooms—you can rent one or all of the spaces that you need for your event. We took all three for this gathering!

This was a potluck—amazing food flowed in. This was a display—a line of vases marched down two long rows of tables, each holding a fern frond identified by botanical name. This was a sale—with ferns from HFF, and plants from Keeping It Green nursery. This was a presentation—Arlen Hill, owner of Keeping It Green, was highlighting his fall 2013 collecting trip in China. Woodland plants and ephemerals had long ago snagged Arlen, and he was smitten enough to open a nursery. Now he’s hooked so much he has to go on collecting trips in another country. He’s got it bad.

Most of the time was spent in Guizhou province, with a couple trips outside of it. Arlen was a first-timer to the collecting scene in China. Oh, the candid admissions! Such stuff, such juicy details, that you usually only get after persistent prying. The rain was overwhelming at times, causing the blues and delays. Pack horses, and more usually their handlers, were balky and uncooperative. Of one place he remarked off-handedly that “dog is eaten here.” Oh, and don’t forget the forest leeches.

Arlen figured out a lot from this first trip. It wasn’t good for plant material that time, but he learned about the right elevation for finding perennial material. He realized he should go a month earlier in the year for better collecting. He saw the context of plants with each other, which is good information for someone who propagates. And he saw...

Bailing, 4159 meters (13,645 ft)

This is an area rarely entered by Westerners; lots of tea cultivation; soil so intensely cultivated that vegetables were growing in cracks in the asphalt; a rose specie with fabulous tear-drop shaped hips.

Gasala, 3300 meters (10,826 ft) (see photo page 14)

Ragged prayer flags fluttering in the pass; stone slab-faced conical structures; *Abies fargesii*; pine trees nearly buried under prayer flags; *Abies forestii*, showing off the rugged silhouettes that come with existing only in China at these high, cold, windy elevations; *Pinus densiflora* var. *pygmaea*.

Ding Dong Mountain, 3300 meters (10,826 ft)

Trees dripping with lichen.

Luoji Shan, 4359 meters (14,301 ft) (see photo page 14)

Mixed conifer and hardwood forests, dominated by rhodies and firs; a lot of water—lots of lakes, lots of streams, lots of water tumbling down terrace faces; prolific *Osmunda claytoniana* dominating heavily grazed areas.

Dafengding, 3800 meters (12,467 ft)

Pandas still in the wild here, maybe 30 or so; *Acer campbellii* with shiny, palmate leaves.

Jinfo Shan, 2238 meters (7,342 ft)

Heavily eroded limestone cliffs; bamboo forest, with oaks and conifers—if you like oaks, go to China; lots of clematis species; walls hidden under the cover of arching Woodwardias.

Fanjinshan, 3000 meters (9,842 ft)

Bulbil-tipped *Asplenium*; weather-carved sandstone spires; *Metapanax delavayi*; six-inch long caterpillars that looked like rose thorns.

Leigongping, 1850 meters (6,069 ft)

Steep hillsides with tumbledown wooden shacks clinging to them in sheer terror; intense terracing and rice growing; hairless, warty kiwi fruits; *Pyrrosia* growing on hydrangeas; drying rice piled into intricate stacks.

Arlen will go back to China wiser and more focused for sure, and hooked bad.

The Fall Social was a success! The sound system worked! The lights worked! No techno glitches! Plenty of room! And the food, and the sociability, the warm feeling from meeting new people and spending time with old—incomparable.

Author addendum

For me it was a *Woodwardia unigemmata*. Knowing nothing about ferns, familiar only with sword ferns (*Polystichum munitum*), when I saw it I was driven to possess it. I found it overlooked and forgotten when I went to my first-ever Fern Fest sale—after it was over... I was able to buy it. I was hooked. Thank you, Sylvia Duryee.

Fresh Spore Donations Requested

HFF would like to extend our thanks to the members who have taken the time and made the effort to donate to our Spore Exchange. We try to offer a wide diversity of offerings, but can only do so if members help us.

If you have not contributed spore before, but have some interesting possibilities, please consider doing so next time the spore are harvestable. It is appreciated if they are cleaned and carefully labeled. Please try to avoid using tape as the spore tends to stick to it. Some species such as Blechnums and Osmundas have short viability so should be replenished regularly.

Please send your spore to: Carolyn Doherty, Director of the Spore Exchange, 1905 43rd St. SE, Puyallup, WA 98372. You can also communicate with me at: fernspores@hotmail.com.

SPORE EXCHANGE LIST 2015

Species	Year	Donor
<i>Adiantum aleuticum</i>	'14	Doherty
<i>Adiantum aleuticum</i> 'Subpumilum'	'10, '11, '14	Jeddeloh and RSF
<i>Adiantum aleuticum</i> 'Imbricatum'	'12	Duryee
<i>Arachnoides davalliaeformis</i>	'10	Olsen
<i>Arachnoides</i> aff. <i>simulans</i>	'13	Steffen
<i>Arachnoides simplicior</i>	'11	Steffen
<i>Arachnoides simplicior</i> 'Variegata'	'11	RSF
<i>Asplenium incisum</i>	'13	Gassner
<i>Asplenium trichomanes</i>	'12	RSF
<i>Athyrium atkinsonii</i>	'13	Gassner
<i>Athyrium attenuatum</i>	'13	Gassner
<i>Athyrium clivicola</i>	'13	Gassner
<i>Athyrium filix-femina</i> 'Frizelliae'	'11	RSF
<i>Athyrium niponicum</i> 'Pictum'	'11	RSF
<i>Athyrium otophorum</i>	'11, '14	Jeddeloh and Doherty
<i>Athyrium</i> sp. <i>yokoscense</i> ?	'12	Gassner
<i>Athyrium</i> sp. narrow-red stemmed	'12	Gassner
<i>Blechnum australe</i>	'13	Olsen
<i>Blechnum mochaenum</i>	'14	Fredermann
<i>Blechnum niponicum</i>	'14	RSF
<i>Blechnum novae-zelandiae</i>	'11	EMBG
<i>Cheilanthes lanosa</i>	'10	Peachey
<i>Cryptogramma</i> sp	'11	Duryee
<i>Cyrtomium fortunei</i>	'10	Peachey
<i>Cyrtomium lonchitoides</i>	'11	RSF

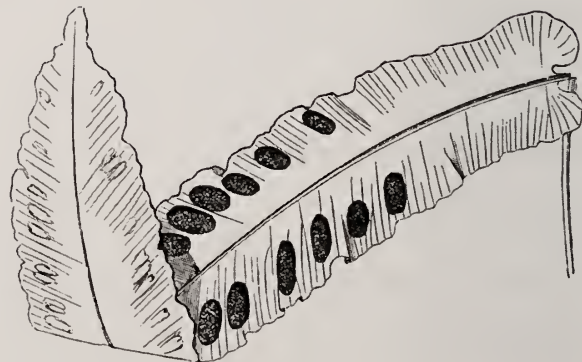
<i>Cyrtomium macrophyllum</i>	'11, '14	RSF
<i>Cyrtomium macrophyllum</i> var. <i>tukusicola</i>	'10, '11	RSF
<i>Deparia pseudoconilii</i>	'13	Gassner
<i>Diplazium pycnocarpon</i>	'13	Gassner
<i>Dryopteris aemula</i>	'12	Gassner
<i>Dryopteris arguta</i>	'07	RAS
<i>Dryopteris bissetiana</i>	'11	RSF
<i>Dryopteris carthusiana</i> unknown cultivar	'14	Perasso
<i>Dryopteris carthusiana</i> 'Cristata'	'11	Carl
<i>Dryopteris caucasica</i> (Eastern Europe & Russia)	'14	Horrocks
<i>Dryopteris championii</i>	'12	RSF
<i>Dryopteris chrysocoma</i>	'13	Gassner
<i>Dryopteris clintoniana</i>	'11, '12	Carl and Gassner
<i>Dryopteris corleyi</i>	'12	Gassner
<i>Dryopteris crassirhizoma</i>	'11	RSF
<i>Dryopteris decipiens</i>	'10	RSF
<i>Dryopteris dickinsii</i> 'Incisa'	'12	Gassner
<i>Dryopteris erythrosora</i>	'11	Riehl and RSF
<i>Dryopteris expansa</i>	'12	Perusso
<i>Dryopteris expansa</i> var. <i>willeana</i>	'12	Gassner
<i>Dryopteris intermedia</i>	'11	Rickard
<i>Dryopteris marginalis</i>	'08, '11	RSF
<i>Dryopteris muenchii</i>	'12	Gassner
<i>Dryopteris polylepis</i>	'12	Olsen
<i>Dryopteris remota</i>	'13	RSF
<i>Dryopteris sacrosancta</i>	'05, '11	RSF
<i>Dryopteris sieboldii</i>	'14	RSF
<i>Dryopteris sublacera</i>	'11, '13	RSF

<i>Dryopteris wallichiana</i>	'11	Duryee
<i>Gymnocarpium oyamense</i>	'12	RSF
<i>Matteuccia orientalis</i>	'14	Olsen
<i>Onychium japonicum</i>	'13	Olsen
<i>Osmunda japonica</i>	'12	Gottlieb
<i>Phyllitis scolopendrium</i>	'11	Doherty
<i>Phyllitis scolopendrium</i> Crested	'11	EMBG
<i>Polypodium glycyrrhiza</i>	'10, '11	Doherty
<i>Polypodium interjectum</i>	'14	RSF
<i>Polypodium scolopendrium</i>	'12	RSF
<i>Polypodium vulgare</i> 'Bifidum'	'11	EMBG
<i>Polypodium vulgare</i> 'Cornubiense'	'12	RSF
<i>Polystichum aculeatum</i> Cristata Group	'13	EMBG
<i>Polystichum braunii</i> (Alaska and Japan)	'11, '14 '14	Peachey, J. Taylor Horrocks
<i>Polystichum draco-montenum</i>	'12	Duryee
<i>Polystichum x illyricum</i>	'14	RSF
<i>Polystichum lonchitis</i> cw Scotland	'10	Olsen
<i>Polystichum makinoi</i>	'10, '14	Peachey, RSF
<i>Polystichum mayebarae</i>	'13	Gassner
<i>Polystichum munitum</i>	'11	Doherty
<i>Polystichum neolobatum</i>	'11, '14	RSF
<i>Polystichum retroso-paleaceum</i>	'10	RSF
<i>Polystichum scopulinum</i>	'12	Duryee
<i>Polystichum setiferum</i> 'Lineare'	'12	Olsen
<i>Polystichum squarrosum</i>	'12	Gassner
<i>Polystichum tsus-simense</i>	'11	RSF
<i>Polystichum wilsonii</i>	'12	Gassner

<i>Pteris cretica</i> 'Albo lineata' (tender)	'11	Doherty
<i>Thelypteris limbosperma</i>	'12	Gassner
<i>Thelypteris palustris</i>	'11	Baxter
<i>Woodsia fragilis</i>	'11	RSF
<i>Woodsia pseudopolystichoides</i>	'13	Gassner
<i>Woodwardia unigemmata</i>	'13	Mandeville

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