

**Spore-bearing plants
of
Utah, Nevada,
and adjacent regions
A compact guide**

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Preface

This treatment is a derivative work. Its purpose is to make available a compact treatment of the ferns of the Intermountain Region that reflects current taxonomic opinion and directs users to the works that, because they provide detailed descriptions and illustrations, make working with the region's plant much easier than would otherwise be the case. It is based on two primary sources, volume 1 of the *Intermountain Flora* (Cronquist et al. 1972) and volume 2 of the *Flora of North America north of Mexico* (Flora of North America Editorial Committee 1993). The family treatments are based on Smith et al. 206. The footnotes credit the authors of individual portions in these two references.

Preparation of this treatment would have been impossible if it were not for the enormous amount of detailed field, herbarium, and laboratory study that is reflected in the three works cited below. Having said which, I am responsible for all the errors and misinterpretations that are present. Please let me know about them by emailing mary[at]biology.usu.edu.

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Primary references

- Cronquist, A., A.H. Holmgren, N.H. Holmgren, and J.L. Reveal. 1972. *Intermountain Flora*, vol. 1. New York Botanical Garden, The Bronx, New York.
- Flora of North America Editorial Committee. 1993. *Flora of North America north of Mexico*, vol. 2. Oxford University Press, New York.
- Smith, A.R., K.M. Pryer, E. Schuettpelz, P. Korall, H. Schneider, and P.G. Wolf. 2006. A classification for extant ferns. *Taxon* 55: 505–731.

Lycopodiophyta

Species homosporous or heterosporous. **Plants** perennial, herbaceous. **Gametophytic** and **sporophytic phases** free-living, sporophyte dominant. **Sporophyte: Stems** unbranched or with dichotomous or monopodial branching; **leaves** microphyllous, with only one vein; **sporophylls** sometimes aggregated into distinct strobili, sometimes morphologically distinct from leaves. **Sporangia** adaxial on or axillary to the sporophylls, reniform, dehiscent transversely.

The *Lycopodiophyta* appeared shortly after the first tracheophytes. They reached their peak in the Carboniferous, around 350–300 MYA, at which time they included many arborescent species. Today they include only three families and 1200 species, most of which are tropical.

1. Leaves and sporophylls 2–100 cm; stems erect, short, not evident, unbranched; sporangia embedded in the leaves. *Isoëtaceae* (p. 5)
1. Leaves and sporophylls 0.2–2 cm long; stems trailing, elongate, trailing, branched; sporangia not embedded in the leaves.
 2. Plants usually 5–20 cm tall, homosporous; strobili not differentiated or dense and cylindrical *Lycopodiaceae* (p. 3)
 2. Plants usually less than 3 cm tall, heterosporous; strobili often weakly differentiated, 4-sided or open and cylindrical *Selaginellaceae* (p. 3)

Lycopodiaceae¹

Plants 5–20 cm tall, homosporous. **Stems** elongate, horizontal, anchored by rhizophores, branching dichotomously or monopodially. **Leaves** 1.5–20 mm, flat, thin, not ligulate, margins spinulose. **Sporophylls** like vegetative leaves or non-photosynthetic and smaller, sometimes forming distinct, cylindrical, terminal strobili. **Sporangia** solitary, adaxial or axillary.

There are 350–400 species of *Lycopodiaceae* in the world. They are most common in tropical montane and alpine habitats.

Lycopodium annotinum L. Bristly clubmoss [FNA 2:25, 26]

In swampy or moist coniferous woods and exposed grassy or rocky sites. Presence in IMR needs verification; included by FNA, not IMF. Following FNA, no varieties are recognized.

Selaginellaceae²

Plants usually shorter than 2 cm, heterosporous. **Stems** elongate, horizontal, often anchored by rhizophores, branching dichotomously or monopodially. **Leaves** 2–10 mm long, flat, thin, ligulate, margins dentate to spinulose, at least in part. **Sporophylls** often more densely packed than the leaves and forming distinct strobili; **strobili** usually terminal and 4-sided, if cylindrical the strobili open; **sporangia** adaxial or axillary, either or both megasporangia and microsporangia present within a strobilus, if both, the megasporangia proximal and the microsporangia distal within each strobilus.

Selaginellaceae tend to grow in wet places. Those of the Intermountain Region are associated with rocky habitats.

1 Based on W.H. Wagner and J.M. Beitel (FNA 2: 18–37)

2 Based on A. Cronquist (IMF 1: 178–180) and I.A. Valdespino (FNA 2: 38–63).

1. Sporophylls loosely packed, strobili cylindrical; rhizophores not present; leaf margins shortly spiny *S. selaginoides*
1. Sporophylls densely packed; strobili 4-sided; rhizophores developed; leaf margins dentate, serrate, or ciliate, not spiny.
 2. Leaves on main stem differing in color from stem, bases usually rounded, sometimes slightly decurrent and cuneate. *S. mutica*)
 2. Leaves on main stem similar in color to stem, bases cuneate or oblique, decurrent.
 3. Leaves on upper and lower sides of stem unequal in size, their bases decurrent and oblique.
 4. Leaf tips with a bristle 1–2 mm long; sporophyll margins ciliate throughout *S. densa*
 4. Leaf tips with a bristle 0.4–1.3 mm long; sporophyll margins with cilia 0.02–0.15 mm long or denticulate on lower half, smooth distally *S. underwoodii*
 3. Leaves usually all similar in size, if slightly unequal the leaf bases decurrent cuneate.
 5. Lateral branches 1–3-divided; dry stems not readily fragmenting *S. watsonii*
 5. Lateral branches 1-divided; dry stems readily fragmenting.
 6. Leaf tips with a bristle 0.2–0.6 mm long; leaves not in well-defined pseudowhorls *S. leucobryoides* (p. 4)
 6. Leaf tips without a bristle or with bristle to 0.4 mm long; leaves in defined, alternate pseudowhorls *S. utahensis*

Selaginella densa Rydb. Prairie club-moss, Rocky Mountains spike-moss [IMF 2:178–179, FNA 2: 56]

Rocky, exposed sites, at high elevations, often in the alpine zone.

Selaginella leucobryoides Maxon Mojave spike-moss [FNA 2:55; not in IMF]

Rock crevices or exposed rocky sites. Often confused with *S. utahensis*, having an overlapping range].

Selaginella mutica D.C. Eat. ex L. Underw. [IMF 1:180, 181; FNA 2: 51]

Crevices and ledges on igneous, limestone, or sandstone rocks, usually below the forest zone. IMR plants belong to *S. mutica* (L.) Link var. *mutica*.

Selaginella selaginoides (L.) Link Northern spike-moss, prickly mountain moss [IMF 1:178, 179; FNA 2: 39, 41]

Wet places, often on mossy stream banks.

Selaginella underwoodii Hieron. Underwood’s spike-moss [IMF 1:180,181; FNA 2: 53]

Moist or shaded cliffs, rocky slopes, and crevices on granite, sandstone, or limestone.

Selaginella utahensis Flowers Utah spike-moss [FNA 2:55; IMR 180, 181]

Dry sandstone crevices or sandy or clay soils. Often confused with *S. leucobryoides* and having an overlapping range].

Selaginella watsonii L. Underw. Alpine spike-moss, Underwood’s spike-moss [IMF 1: 179–180, 181; FNA 2: 54]

Exposed or shaded rocky sites or in gravel or sandy soil, sometimes in alpine regions.

Isoëtaceae¹

Stems condensed, 2-lobed. **Leaves** 2–50 cm long, more or less cylindrical, narrowing distally, bases thick. **Sporangia** adaxial, embedded in the base of the leaves, partly to wholly covered from above by a thin membrane, the *velum*; inner leaves with megasporangia, outer leaves with microsporangia.

Isoëtaceae tend to grow at the edges of seasonal fresh water pools such as the vernal pools of California.

1. Megaspore surface spiny *I. echinospora*
1. Megaspores surface cristate, reticulate, rugulate, tuberculate, or smooth.
 2. Plants terrestrial or becoming so, growing in seasonally saturated soils such as temporary streams and vernal pools; leaf bases pale to brown or lustrous black.
 3. Velum covering less than 3/4 of the sporangium; megaspore girdle obscure; massed microspores gray *I. melanopoda*
 3. Velum covering less than 1/2 of the sporangium; megaspore girdle smooth; massed microspores brown *I. howellii* (p. 5)
 2. Plants submerged or emergent aquatics or persistent lakes or pools; leaf bases pale to pale brown.
 4. Megaspores averaging less than 0.5 mm diameter *I. bolanderi*
 4. Megaspores averaging 0.5–0.75 mm in diameter
 5. Leaves gradually tapering to the tip; sporangium wall not pigmented; massed microspores brown *I. occidentalis*
 5. Leaves abruptly tapering to the tip; sporangium walls re or less brown-streaked; massed microspores gray *I. lacustris*

Isoëtes bolanderi Engelm. Bolander's quillwort [IMF 1:182–183; FNA 2: 71, 73]
Subalpine to alpine lakes and pools.

Isoëtes echinospora Durieu Spiny-spored quillwort; [IMF 1:183, as *I. echinospora*; FNA 2: 65, 68,]

In oligotrophic, non-calcareous lakes and ponds. Primarily a northern species; known from the Uinta Mountains and, possibly the northwestern IMR. North American plants belongs to *I. echinospora* subsp. *muricata* (Durieu) Å. Löve & D. Löve differ from European plants, which belong to *I. echinospora* subsp. *echinospora*, in having stomates.

Isoëtes howellii Engelm. Western quillwort [IMF 1:182–183; FNA 2: 71, 74]

Wet depressions and lake margins in the mountains. IMF gives reasons for excluding Utah plants from *I. melanopoda*.

Isoëtes lacustris L. [FNA 1:184]

In lakes at middle elevations in the mountains, often submerged in deep water. Very similar to, and sometimes including *I. occidentalis*.

Isoëtes melanopoda Gay & Durieu Black-footed quillwort [IMF includes in *I. howellii*; FNA 2:73]

In non-calcareous soil, primarily east of the Rocky Mountains but, according to FNA, known from the Uinta Mountains. See comments under *I. howellii*.

Isoëtes occidentalis L.F. Henders. Western quillwort; [FNA 2:74, 71, IMF 6: 24, as *I. lacustris* L.]

¹ Based on A. Cronquist (IMF 1: 182–184) and W.C. Taylor, N.T. Luebke, D.M. Britton, R.J. Hickey, and D.F. Brunton (FNA 2: 64–75).

In lakes at middle elevations in the mountains, often submerged in deep water. Very similar to *I. lacustris*. IMF includes in *I. lacustris* L.

Monilophytes¹ (Ferns)

Plants herbaceous or arborescent, usually homosporous, aquatic genera often heterosporous. **Stems** often subterranean and horizontal, sometimes surficial, sometimes vertical. **Leaves** usually compound, large, and with many veins, sometimes small and lacking veins or with 1 vein. **Sporangia** usually on the abaxial surface of leaves, sometimes terminal on specialized branches or modified leaves, if axillary to a reduced leaf, sporangia 3-lobed. Sporangia eusporangiate (with walls 2 or more cell layers thick) or leptosporangiate (with walls only 1 cell layer thick).

Monilophytes encompass, in addition to the plants traditionally considered ferns, the *Psilotaceae* and *Equisetaceae*, two families that used to be called "fern allies". There are about 300 genera and 9,000 species of monilophytes.

1. Stems conspicuous; leaves scale-like, unlobed, 1-veined or without veins; plants terrestrial.
 2. Leaves whorled, connivent; sporangia on sporangiophores that are clustered together into a terminal strobilus; plants native, growing outside
.....*Equisetaceae* (p. 9)
 2. Leaves alternate, not connivent; sporangia axillary to short branches, not in strobili; plants not native, grown in greenhouses*Psilotaceae* (p. 9)
1. Stems inconspicuous, subterranean or, in floating aquatics, less than 5 mm long; leaves conspicuous, usually lobed or compound with multiple veins, if unlobed, plants emergent aquatics; plants terrestrial or aquatic, sometimes emergent.
 3. Plants floating or emergent aquatics, heterosporous; sporangia formed in specialized sporocarps.
 4. Plants free-floating aquatics; leaves 1–25 mm long; sporocarps containing either microsporangia or megasporangia, not both . . . *Salvinaceae* (p. 11)
 4. Plants emergent aquatics, rooted in mud; leaves (including petioles) 1.5–15 cm long; sporocarps containing both mega- and microsporangia
..... *Marsileaceae* (p. 11)
 3. Plants terrestrial, homosporous; sporangia borne on the leaves, not in sporocarps.
 5. Sporangia about 1 mm in diameter, thick-walled, without an annulus; leaves not circinate. *Ophioglossaceae* (p. 7)
 5. Sporangia less than 0.5 mm in diameter, thin-walled, usually with an annulus; leaves circinate in bud.
 6. Rhizomes and leaves with hairs but not scales; sori marginal, protected by the reflexed leaf margins; petioles with several vascular bundles. . . .
..... *Dennstaedtiaceae* (p. 12)
 6. Rhizomes and often the leaves with scales, often also with hair; sori variously located, sometimes protected by the reflexed leaf margins; petioles often with only 1 or 2 vascular bundles.
 7. Petioles with a single vascular bundle, always slender, often dark and wiry; indusium formed by the reflexed leaf margins or indusium absent.*Pteridaceae* (p. 11)

¹ Family treatment based on Smith et al. (Taxon 55: 705–731). No name for the monilophyte lineage has been formally published as yet.

- 7. Petioles with 2 or more vascular bundles, at least towards the base, sometimes slender and dark; indusium, if present, not formed by the reflexed leaf margin.
- 8. Sori elongate, parallel to the midvein of the pinnae; veinlets anastomosing, forming closed ovals on each side of the pinnae midveins *Blechnaceae* (p. 23)
- 8. Sori variously shaped, not parallel to the midvein; all veinlets free.
 - 9. Leaves evergreen, merely pinnatifid, pinnae broadly attached to the rachises; indusium absent. *Polypodiaceae* (p. 25)
 - 9. Leaves annual, 1–4 times pinnate, pinnae narrowly attached to the rachises; indusium present..
 - 10. Sori elongate, parallel to primary veins of pinnae; indusia flap-like attached along the vein that bears the sorus *Aspleniaceae* (p. 19)
- 10. Sori round; indusia radially symmetric.
 - 11. Indusia attached centrally. *Dryopteridaceae* (p. 24)
 - 11. Indusia attached on the side *Woodsiaceae* (p. 20)

Ophioglossaceae¹

Vernation nodding, not circinate. **Rhizomes** and **petioles fleshy**; **fertile leaves** each with a single sporophore arising along or at the base of the trophospore (photosynthetic portion of leaf) stalk or at the base of the trophophore blade. **Sporangia** large, with walls 2 cells thick, lacking an annulus.

There are four genera in the *Ophioglossaceae*, but only one, *Botrychium*, is present in the IMR.

Botrychium Sw.

Roots 0.5–2 mm thick. Stems upright, forming caudices up to 5 mm thick. Trophophores usually pinnately or ternately-pinnately compound or dissected, sometimes simple; veins forked and free. Sporophores usually 1 per leaf, 1–3-pinnate, long-stalked. Sporangia borne in 2 rows on pinnate sporophore branches.

The distribution of *Botrychium* is generally rather poorly known because the plants are inconspicuous and grow early in the season. There is disagreement between the FNA and IMF accounts as to how many species are present in the IMR. This may reflect, at least in part, the extensive searches for *Botrychium* in the IMR that took place in the late 1990s.

- 1. Leaf blades deltate, usually 5–25 cm, usually sterile, sporophores absent or misshapen; plants usually over 12 cm tall.
 - 2. Trophophore blade thin; leaf sheaths open; sporophores, when present, arising from the base of the trophophore blade high on the common stalk; leaves absent during winter. *B. virginianum*
 - 2. Trophophore blade thick to leathery; leaf sheaths closed; sporophores, when present arising near the ground from the basal portion of the common stalk *B. multifidum*
- 1. Leaf blades oblong to linear, usually 2–4 cm long, all fertile, sporophores always present; plants to 15 cm tall, usually shorter than 10 cm.

1 Based on W.H. Wagner and F.S. Wagner (FNA 2: 85–106).

3. Trophophores present or replaced by sporophore, if present, venation of basal pinnae or segments pinnate; midrib present; basal pinnae or segments oblanceolate to linear, lanceolate, or ovate.
4. Leaves with 2 sporophores and no trophophore *B. paradoxum*
4. Leaves with 1 sporophore and 1 trophophore.
 5. Trophophore blades deltate; sporophores divided proximally into several equally long branches. *B. lanceolatum*
 5. Trophophore blades oblong-linear or nearly deltate; sporophores with single midrib or 1 dominant midrib and 2 smaller ribs.
 6. Large trophophore blades nearly deltate, basal pinna pair elongate; pinnae distal to basal pair close together or overlapping; segments and lobes with rounded tips. *B. hesperium*
 6. Large trophophore blades oblong-deltate; basal pinnae not elongate; apices truncate to somewhat acute. *B. pinnatum*
 3. Trophophores present; basal pinnae or segments with venation like ribs of fan; midrib absent; basal pinnae fan-shaped to spatulate.
7. Trophophore blades ovate to deltate *B. simplex*
7. Trophophore blades oblong to oblong-lanceolate.
 8. Basal pinnae broadly fan-shaped.
 9. Plants herbaceous; trophophores usually smaller than 4 x 1.5 cm; pinnae 2–5 pairs, well separated; margins usually crenate to dentate; sporophores 1.3–3 times length of the trophophores *B. crenulatum*
 9. Plants fleshy; trophophores on most plants larger than 5 x 2 cm; pinnae 4–9 pairs, close together, sometimes overlapping; margins usually entire to undulate, rarely dentate; sporophores 0.9–2 times length of trophophore *B. lunaria*
 8. Basal pinnae narrowly fan-shaped, cuneate, lanceolate, or linear.
 10. Pinnae strongly ascending; margins conspicuously dentate-lacerate *B. ascendens*
 10. Pinnae spreading or only moderately ascending; outer margins usually entire to crenate, rarely dentate. *B. minganense*

Botrychium adscendens W.H. Wagner Upswept Moonwort [FNA 2: 95]
 Leaves appearing late spring to midsummer; grassy fields. According to FNA (2: 95), grows in southern Nevada, an area not covered by the IMF.

Botrychium crenulatum W.H. Wagner Dainty Moonwort [FNA 2: 95]
 Leaves appearing in mid to late spring, dying in late summer; local in marshy and springy areas. FNA 2: 95 shows the species as widespread in the IMR; it is not mentioned in the IMF.

Botrychium hesperium (Maxon & R.T. Clausen) W.H. Wagner & Lellinger Western Moonwort [FNA 2: 96]
 Leaves appear in mid-spring, die in late fall; grassy mountain slopes, snow fields, ditches with willows, and sand dunes. IMF does not mention the species as such but states that *B. matricariifolium*, in which *B. hesperium* is sometimes included as a subspecies, is reputedly in the IMR.

Botrychium lanceolatum (S.G. Gmel.) Ångström Triangle Moonwort [IMF 1: 191–192; FNA 2: 96–97]
 Leaves usually drying in midsummer; open fields. Plants from the IMR belong to *B. lanceolatum* (S.G. Gmel.) Ångström subsp. *lanceolatum*.

Botrychium lunaria (L.) Sw. Common Moonwort [IMF 1: 190, includes *B. manganense*; FNA 2: 97]

Leaves appearing in spring, dying in late summer. Moist to wet places at middle to high elevations in the mountains.

Botrychium manganense Vict. Mangan Moonwort [FNA 2: 98]

Leaves appearing in spring through summer; widely scattered. IMF includes this species in *B. lunaria*.

Botrychium multifidum (S.G. Gmel.) Rupr. Leather Grape-fern [FNA 2: 92, 93]

Leaves remain green overwinter; mainly in fields. IMF (1: 189) states that it does not grow in the IMR; FNA 2: 93 shows it as widespread in the IMR.

Botrychium paradoxum W.H. Wagner Paradox Moonwort [FNA 2: 99]

Plants usually under other vegetation, in snowfields and secondary growth pastures. Not mentioned in IMF; one record from south-central Utah in FNA 2: 99.

Botrychium pinnatum H. St. John Northwestern Moonwort [IMF 1: 191–192 as *B. boreale*; FNA 2: 100]

Leaves appearing June to August. Grassy slopes, stream banks, and woods. IMF treats this species as *B. boreale* Milde.

Botrychium simplex E. Hitchc. Least Moonwort [IMF 1: 189–190; FNA 2: 101]

Leaves appearing mid spring to late fall; meadows at middle elevations, not above timberline.

Botrychium virginianum (L.) Sw. [Rattlesnake Fern, Common Grape fern; FNA 2: 86, 91]

An early spring species that dies in late summer; shady forests and shrubby second growth. IMF (1: 189) states that it does not grow in the region; FNA 2: 91 shows it as being widespread within the IMR.

Psilotaceae¹

Plants perennial, terrestrial, with branched, rhizoid-bearing, subterranean axes. Stems erect, simple or dichotomously branched; appendages leaf-like or bract-like, alternate. Sporangia fused into synangia of 2–3 homosporous eusporangia, solitary in axils of appendages.

There are two genera in the Psilotaceae. The one treated here, *Psilotum*, is native in Florida and often grown in greenhouses.

Psilotum Sw.

Stems branched distally, ridged. Appendages 0.7–2.5 mm long; sterile appendages subulate, those subtending synangia 2-lobed. Synangia 3-lobed, globose.

Psilotum nudum (L.) Beauv.

Native habitat is low to mesic woods, thickets, swamps, hammocks, and rocky slopes. It is often grown in greenhouses for teaching purposes.

Equisetaceae

Plants perennial, rhizomatous. **Aerial stems** jointed, with distinct nodes, annual or perennial, with hollow centers; **internodes** ridged, ridges continuing into the fused leaves and terminating in the leaf tips; **branches**, when present, borne at the

1 Based on J.W. Thieret (FNA 2: 64–75).

nodes and breaking through the base of the subtending leaves. **Sporangia** borne on peltate sporangiophores; **sporangiophores** clustered into distinct, terminal strobili.

There is only one extant genus of the *Equisetaceae*, *Equisetum*.

Equisetum¹ L.

For the generic description, see the family description.

Of the approximately 15 species in the world, four species and one hybrid grow in the IMR. They grow in moist to wet places.

1. Aerial stems persisting one year or less, usually with regular whorls of branches; stomates on surface, scattered or in bands; strobili with rounded apices
..... *E. arvense*
1. Aerial stems usually persisting more than a year, usually unbranched; stomates sunk, in single lines; strobili usually with pointed apices.
 2. Spores white, misshapen *E. ×ferrissii*
 2. Spores green, spherical.
 3. Leaves at most nodes with a dark band across their base; leaf tips 14 or more, usually deciduous, articulation line visible *E. hyemale*
 3. Leaves green or those at the base of the stems with inconspicuous bands; leaf tips 3–32, usually persistent, sometimes deciduous, articulation line not visible.
 4. Leaf tips usually deciduous; strobili with rounded to apiculate but blunt tips; stem ridges flattened or ± convex. *E. laevigatum*
 4. Leaf tips usually persistent; strobili with sharply apiculate tips; stem ridges minutely grooved *E. variegatum*

Equisetum arvense L. Common horsetail [IMF 1: 188; FNA 2: 78, 81]

Strobili mature in early spring. In disturbed areas, river banks, fields, and tundra. Widespread.

Equisetum ×ferrissii Clute [FNA 2: 83]

Strobili maturing in late spring to early summer but spores not shed. *Equisetum ×ferrissii* is a hybrid between *E. hyemale* and *E. laevigatum* that grows in a wide range of open, moist areas such as lake shores, riverbanks, and roadsides. It is discussed, but not described or illustrated, on IMF 1: 186.

Equisetum hyemale L. Scouring rush [IMF 185–187; FNA 2: 78, 82]

Strobili maturing in summer, old stems sometimes developing branches with strobili in the fall. Moist roadsides, riverbanks, lake shores, and woodlands. Treated as *E. hyemale* subsp. *affine* (Engelm.) Calder & R.L. Taylor; IMF agrees, but with considerable doubt expressed as to whether or not it really is distinct from subsp. *hyemale* which is supposedly restricted to Eurasia.

Equisetum laevigatum A. Br. Smooth scouring rush [IMF 1: 186–187; FNA 2: 82]

Strobili maturing in spring to early summer. Grows in moist prairies, riverbanks, and road banks.

Equisetum variegatum Schleich. ex F. Weber & D. Mohr [Variegated scouring rush; IMF 1: 186–188; FNA 2: 83]

1 Based on FNA treatment by R.L. Hauke

Strobili maturing in late summer or overwintering and shedding spores in spring. Grows on lake shores, river banks, and in ditches and woods. Plants from the IMR belong to *E. variegatum* Schleich. ex F. Weber & D. Mohr subsp. *variegatum*.

Marsileaceae

Plants emergent aquatics, rhizomatous, heterosporous. **Stems** growing on soil surface or subterranean, main stems horizontal; **roots** arising at nodes and along internodes. **Leaves** with circinate vernation, distichous, with 0, 2, or 4 terminal pinnae. **Sori** bisexual, enclosed in a nutlike sporocarp.

Two of the three genera in the family grows in the IMR.

1. Leaves composed of a petiole and a blade divided into four pinnae . . . *Marsilea*
1. Leaves about 0.5 mm wide, without a blade *Pilularia*

Marsilea¹ L. [Four-leaf clover fern]

Leaves deciduous in temperate regions heteromorphic, floating leaves usually larger than land leaves; petioles filiform, stiffly erector procumbent on land leaves, lax on floating leaves; blades divided into 4 wedge-shaped pinnae. Sporocarps ovoid, borne on branched or unbranched stalks at the base of the petioles, usually above ground.

There are 45 species in the world, with two being known from the IMR. Sporocarps are essential for accurate identification. The English name reflects the appearance of the genus.

1. Each sporocarp with a broad, blunt distal tooth up to 0.4 mm long or with no distal tooth. *M. oligospora*
1. Each sporocarps with an acute distal tooth 0.4–1.2 mm long. *M. vestita*

Marsilea oligospora Goodd. [FNA 2: 333–234]

Sporocarps produced June to October. Around ponds and marshes and in wet depressions in sagebrush communities, sometimes on river margins. In IMF, this species is included in *M. vestita*. As described in FNA, its distribution and range of variation in all but the characters used in the key fall within that of *M. vestita*.

Marsilea vestita Hook. & Grev. [IMF 1: 220–221; FNA 2:333–334].

Sporocarps produced April–October. In ponds and wet depressions along the shores of lakes, streams, and vernal ponds.

Pilularia L. Pillwort

Plants emergent aquatics. **Leaves** filiform, with a single midvein, without a blade. **Sporocarps** globose, subterranean.

There is only one species in North America.

Pilularia americana A. Braun [American pillwort; IMF 1:220–221]

Sporocarps produced spring–fall. In shallow water around ponds, reservoirs, and temporary pools. Probably often overlooked.

Salviniaceae²

Plants floating aquatics, heterosporous. **Stems** filiform. **Leaves** sessile or nearly so, simple and to 1.5 cm long or lobed and about 2mm long. **Sporocarps**

1 Based on FNA treatment by D.L. Johnson

2 Based on IMF treatment by A. Cronquist

containing one unisexual sorus, soft-walled; **microsporocarps** about half the size of megasporocarps.

Only one genus, *Azolla*, is present in the IMR. The other, *Salvinia*, can be grown in greenhouses.

1. Leaves to 2 mm long, unequally bilobed, one lobe submersed and forming a float, the other smaller, emersed, and turning red in fall *Azolla*
1. Leaves 3-15 mm long, simple, not turning red in fall *Salvinia*

Azolla Lam.

Plants moss-like, heterosporous. **Leaves** bilobed, one lobe submersed and functioning as a float, other lobe emersed, containing a symbiotic blue-green bacterium, *Anabaena azollae*. **Sporocarps**, when present, borne in pairs on the first leaf of a branch.

There is only one species in the IMR.

Azolla mexicana Presl [IMF 1: 222; FNA 2: 340–341]

Stagnant or slow flowing ponds and backwaters, often with *Lemna* from which it differs in turning red in the fall.

Salvinia Ség.

Plants floating aquatics, heterosporous. **Leaves** simple, to 15 mm long. **Sporocarps** unisexual, borne in bisexual clusters, sometimes submersed.

Salvinia includes about 10 species, of which one, *S. minima*, is native to the southeastern U.S. The genus is included here because it is frequently grown in college greenhouses as a demonstration plant. It is not known which species is involved.

Dennstaedtiaceae¹

Plants terrestrial, colonial. Rhizomes bearing jointed hairs, without scales; petioles often with epipetiole buds, with several vascular bundles; blades often large, usually 2–3 or more times pinnate or ternately-pinnate, veins free, forked, or pinnate, rarely anastomosing and then without included veinlets; sori marginal or submarginal continuous or discrete; indusia linear, cuplike at blades margins or sori protected by the rolled leaf margin on one side and a delicate, concealed indusium on the other side.

There are several genera in the family, but only one is present in the IMR.

Pteridium² Gled. ex Scop.

Plants terrestrial, often covering large areas. Rhizomes horizontal, long-creeping, without scales. Leaves widely spaced, 50–450 cm long; petioles glabrous or hairy, with numerous vascular bundles; blades 2–4-pinnate; pinnae pinnately divided. Sori more or less continuous, covered by recurved false indusium formed by the leaf margin; true indusium inconspicuous, concealed by false indusium.

Pteridium is treated in FNA and here as having only one species.

Pteridium aquilinum (L.) Kuhn [Bracken; IMF 1: 195–196; FNA 2: 202–203]

Dry to moist woods and open areas, in partial to full sun. The species is found in temperate regions throughout the world, often forming extensive colonies.

1 Based on Cranfill (FNA 2:198–205).

2 Based on Jacobs and Peck (FNA 2: 2-1–204).

Plants in the IMR belong to *P. aquilinum* var. *pubescens* L.. They are distinguished from other varieties in North America by their abundant, spreading hairs on the underside of the blades.

Pteridaceae¹

Plants terrestrial, epipetric, or epiphytic. Rhizomes long or short, ascending to erect, usually bearing scales, sometimes only hairs. Leaves monomorphic to dimorphic, usually pinnate, sometimes pedate; veins free and forming or anastomosing and forming a reticulate pattern without included veinlets; sori marginal or submarginal and without a true indusium although often protected by the reflexed blade margin or sporangia along the veins; sporangia with an interrupted vertical annulus.

The *Pteridaceae* constitute one of the largest fern families, having around 50 genera and 950 species worldwide. In the IMR, it is represented by six genera and 23 species.

1. Sporangia along the veins, exposed, without an indusium; blade margins narrowly inrolled; lower surface of the blades usually appearing powdery because of the presence of tiny wax scales. *Pentagramma* (p. 18)
1. Sporangia submarginal, usually covered when young by the reflexed blade margin; lower surface of the blades usually not powdery-waxy.
 2. Leaves deciduous; sori on the reflexed margin of the blade segments; indusium formed by the individually reflexed tips of the lobelets of the ultimate leaf segments. *Adiantum* (p. 13)
 2. Leaves usually evergreen; sori marginal and covered by the continuous reflexed margins of the leaves.
 3. Fertile leaves with relatively narrow and elongate ultimate segments 1–3 mm wide; leaves glabrous, often dimorphic.
 4. Leaves weakly or not dimorphic, either all alike and fertile, or with a few sterile leaves that are not very different from the fertile leaves; petioles dark brown *Aspidotis* (p. 15)
 4. Leaves strongly dimorphic, the sterile leaves well developed but obviously shorter than the fertile leaves and with shorter and relatively wider ultimate segments; petioles greenish to yellowish at least distally *Cryptogramma* (p. 15)
 3. Fertile leaves with ultimate segments either relatively or absolutely wider than in *Cryptogramma* and *Aspidotis*; leaves all alike or only slightly dimorphic, usually scaly or hairy on the lower surface, sometimes glabrous.
 5. Leaf blades glabrous or sparsely hairy, not conspicuously woolly or scaly, often with ultimate segments longer than 5 mm *Pellaea* (p. 17)
 5. Leaf blades evidently woolly or covered in scales, at least on the lower side, the ultimate segments shorter than 5 mm.
 6. Petioles glabrous above the base; leaf blades glabrous and glaucous on the lower surface. *Argyrochosma* (p. 14)
 6. Petioles sparsely to densely hairy and/or scaly above the base; leaf blades with abundant hairs or scales at least on the lower surface

1. Family description from Smith et al. (2006; Taxon 55: 705–731); key from A. Cronquist (IMF (1: 192).

..... *Cheilanthes* (p. 15)

Adiantum L. [Maidenhair fern]

Plants medium-sized to small, mesophytic. **Rhizomes** covered with yellow to dark reddish brown to blackish scales. **Leaves** deciduous (IMR taxa); **petioles** slender, dark, shiny, with a single vascular bundle; **blades** usually glabrous, 1-several times pinnate or pinnate and dichotomous; **ultimate segments** petiolulate, usually wide and often more or less flabellate; **veins** free; **sori** on the reflexed margins; **true indusium** not present, sori protected by the reflexed tips of the ultimate segments.

There are 150–200 species of *Adiantum*; only two are known from the IMR.

1. Leaf blades 2–4 times as long as wide, rachis dichotomously branched at the base; pinnae attached to the convex side of the central axes, longest pinnae with 15–35 pairs of pinnules; basal pinnae..... *A. aleuticum*
1. Leaf blades 1–2 times as wide as long, with an elongate rachis bearing pinnae on both sides; longest pinnae with about 6 pairs of pinnules
..... *A. capillus-veneris*

Adiantum aleuticum (Rupr.) Paris [Western maidenhair fern; IMF 1:127, as *A. pedatum*; FNA 2:129]

Sporulating in summer-fall. Wooded ravines and shaded banks and cliffs. IMF includes *A. aleuticum* in *A. pedatum* Paris (FNA 2: 126) states that the two are reproductively isolated and morphologically distinct, *A. aleuticum* having segments at the middle of the penultimate blade divisions that are being longer in proportion to their width, have more sharply denticulate, angular lobes and shorter petiolules.

Adiantum capillus-veneris L. [Southern maidenhair; IMF 1: 196; FNA 2: 125, 127]

Sporulating spring-summer. Dripping cliffs and seeps, especially on calcareous or basic rocks.

Argyroschisma (J. Sm.) Windham¹

Plants usually on rock. Rhizomes short, usually unbranched; covered with tan to brown, rarely black, scales. Leaves monomorphic, 3–30 cm tall; petioles brown or black, glabrous apart from a few scales near the base, with a single vascular bundle; blades 2–6-pinnate, leathery to herbaceous, lower surface glabrous, sometimes covered with waxy scales; ultimate segments stalked or sessile, usually less than 4 mm wide, margins flat or recurved and forming false indusia. Sporangia scattered along veins, often submarginal, usually intermixed with glands.

Argyroschisma is restricted to the Americas. It includes about 20 species. The IMF includes it in *Notholaena*.

1. Leaves 2–3-pinnate toward the base, not conspicuously waxy..... *A. jonesii*
1. Leaves 4–5-pinnate towards the base, conspicuously waxy below
..... *A. limitanea*

Argyroschisma jonesii (Maxon) Windham [Jones' cloakfern; IMF 1:206–207 as *Notholaena jonesii*; FNA 2: 170, 174]

¹ Description based on Windham (FNA 2:172–172); key and habitats on Cronquist (IMF 1:206–207).

Rocky crevices in mountains within sagebrush and pinyon-juniper zones.

Argyroschisma limitanea (Maxon) Windham [Waxy cloakfern; IMF 1:207, as *Notholaena limitanea*; FNA 1:173–174]

Rock ledges and crevices from valleys to middle elevations. Plants from the IMR belong *A. limitanea* (Maxon) Windham subsp. *limitanea*.

Aspidotis Copeland

Plants terrestrial, sometimes on rock. **Rhizomes** short, densely covered with dark brown scales, these sometimes with lighter margins. **Leaves** 8–35 cm monomorphic to somewhat dimorphic; **petioles** usually dark reddish brown, grooved adaxially, with a single vascular bundle; **blades** 3–4(5) pinnate, glabrous abaxially and adaxially; **ultimate segments** short-stalked or with narrow decurrent bases, veins obscure free, unbranched. **Sporangia** in marginal, submarginal or continuous sori.

Terrestrial, often at the bases of boulders or in rock crevices, *Aspidotis* has four species. Three grow in the U.S. and one in Mexico. Only one species grows in the IMR.

Aspidotis densa (Brackenb.) Lellinger [Indian's dream; IMF 1:199–200; FNA 2:173]

Rocky crevices and moist rocky slopes, at upper elevations to timberline.

Cheilanthes¹ Sw.

Plants usually on rock. Rhizomes short to long, with linear-subulate to ovate-lanceolate, brown to black or bicolored scales; Leaves 4–60 cm, monomorphic; petioles brown to black or straw-colored, rounded, flat, or with a groove, hairy, scaly or glabrous, with a single vascular bundle; blades pinnate-pinnatifid to 4-pinnate, leathery or somewhat herbaceous, lower surface hairy and/or scaly, rarely glabrous, margins usually recurved to form false indusia, continuous or only on lobes, veins usually free. Sporangia submarginal on vein tops or scattered along veins near margins, n intermixed with farinose-producing glands.

Cheilanthes is the largest xeric-adapted fern genus in the world.

1. Lower surface of blades without multicellular scales, sometimes hairy, sometimes glabrous; vernation usually circinate.
 2. Ultimate segments of fertile leaves 1–3 mm long, nearly round, beadlike; blades 3-pinnate near the base; blades not densely hairy on the upper surface. *C. feei*
 2. Ultimate segments of fertile leaves 3–5 mm; blades 2-pinnate-pinnatifid near the base; blades densely hairy on the upper surface *C. parryi*
1. Lower surface of blades with multicellular scales over the veins, intermixed with hairs in some species; vernation not circinate, expanding leaves hooked but not coiled at the tips.
 3. Largest scales on lower surface of blades 0.1–0.4 mm wide, linear, inconspicuous *C. gracillima*
 3. Largest scales on lower surface of blades 0.4–1.5 mm wide.
 4. Scale margins entire, erose, or denticulate, occasionally with 1 or 2 cilia *C. eatonii*
 4. Scale margins ciliate, usually more so near the base.
 5. Blade scales lanceolate with truncate or subcordate bases, basal lobes, if present, not overlapping, margins often ciliate throughout; rhizomes usually long, the leaves scattered. *C. wootonii*

1 Based on treatment by Windham & Rabe (FNA 2: 110-160).

5. Blade scales ovate-lanceolate with deeply cordate bases, basal lobes usually overlapping, distal margins usually not ciliate; rhizomes short, leaves in dense clusters.
6. Blade scales ciliate on the basal lobes only; ultimate segments glabrous or with a few entire to weakly ciliate scales, without branched hairs; stem scales usually dark brown or black throughout, rarely with light margins. *C. covillei*
6. Blade scales conspicuously ciliate over most of the lower 1/2; ultimate segments of with branched hairs on the lower surface and ciliate scales on the lower surface; stem scales usually bicolored *C. intertexta*

Cheilanthes covillei Maxon [Coville's lipfern; IMF 1: 295; FNA 2:161]

Sporulating late spring-fall. Rocky crevices in desert mountains and canyons, from the *Larrea* to Pinyon pine zones, usually on igneous rock. In dry weather, the blades curled up so that only the scales are visible.

Cheilanthes eatonii Baker [Eaton's lipfern; IMF 1:204; FNA 2: 160]

Sporulating late summer-fall. Rocky slopes and ledges, on a variety of substrates.

Cheilanthes feei Moore [Slender lipfern; IMF 1: 203–204; FNA 2: 168]

Sporulating late-spring-fall. Cliff crevices, usually on limestone or sandstone, usually above the *Larrea* zone.

Cheilanthes gracillima D.C. Eaton [Lace lipfern; lace fern; IMF 1: 204--205; FNA 2: 158–159]

Sporulating summer-fall. Crevices, cliffs, and rocky slopes, usually on igneous substrates.

Cheilanthes intertexta (Maxon) Maxon [Coastal lipfern; IMF 2:161]

Sporulating late spring-fall. Rocky slopes and ledges, usually on igneous substrates. *Cheilanthes intertexta* has sometimes been treated as a subspecies of *C. covillei*. Preliminary isozyme evidence supports the suggestion that it is an allotetraploid hybrid between *C. gracillima* and *C. covillei* (Windham and Rabe in FNA 2:161). It is not mentioned in IMF.

Cheilanthes parryi (D.C. Eaton) Domin Parry's lipfern; IMF 1: 106, as *Notholaena parryi*; FNA 2: 133]

Sporulating late spring-fall. Cliffs, ledges, and crevices in desert mountains, usually in the *Larrea* zone.

Cheilanthes wootonii Maxon [Wooton's lipfern; FNA 2: 163]

Sporulating summer-fall. Rocky slopes and ledges, usually on igneous substrates. Excluded from IMF because it excludes southern Nevada.

Cryptogramma¹ R. Br.

Plants on rock. **Rhizomes** little to much branched, covered with scales; **scales** colorless, brownish, or mixed, with entire margins. **Leaves** dimorphic, scattered or densely tufted; **fertile leaves** 5–25 cm; **sterile leaves** 3–20 cm, shorter than the fertile leaves; **petioles** dark brown proximally, light brown to green distally, grooved, with one vascular bundle; **blades** 2–4 -pinnate, lower surfaces glabrous, upper surfaces glabrous to sparsely hairy; **ultimate segments of sterile blades** shortly stalked or sessile, usually less than 4 mm wide, with flat, dentate to deeply lobed margins; **ultimate segments of fertile leaves** usually less than 2 mm wide, margins reflexed to form false indusia around the whole segment, often becoming

1 Based on Alverson (FNA 2:137–139)..

flat at maturity. **Sporangia** scattered along veins, often intermixed with farinose producing glands.

- 1. Rhizomes (including persistent leaf bases) 10–20 mm thick, many branched; leaves densely tufted, blades of sterile leaves somewhat leathery, overwintering; petioles dark for no more than 1/8 their length. *C. acrostichoides*
- 1. Rhizomes (excluding leaf bases) 1–1.5 mm thick, little branched; leaves scattered, blades of sterile blades delicate, not overwintering; petioles dark brown up to 1/2 their length. *C. stelleri*

Cryptogramma acrostichoides R. Br. [American parsley fern; IMF 1:198–199 as *C. crispa*; FNA 2:137, 139].

New growth starts in spring, sporulation is in summer, sterile leaves overwinter, senescing in their second spring. Non-calcareous crevices, rocks, and talus, up to timberline. Cronquist (IMF) included *C. acrostichoides* in *C. crispa* as *C. crispa* var. *acrostichoides* (R. Br.) C.B. Clarke.

Cryptogramma stelleri (Gmel.) Prantl [Delicate cliff-brake; IMF 1: 198–199; FNA 2: 138]

New growth develops in spring, withers by late summer. Sheltered crevices and ledges on calcareous substrates, usually in coniferous zone.

Pellaea¹ Link

Plants usually on rock. **Rhizomes** compact to elongate, usually branched, covered with scales; **scales** brown to tan or with a dark central stripe, margins entire, erose or dentate. **Leaves** monomorphic to somewhat dimorphic, clustered or scattered; **petioles** pale to dark, straw-colored to brown or gray to blackish, mostly glabrous or hairy, usually with a few scales at the base, with one vascular bundle; **blades** 1–4 pinnate, usually leathery, sometimes somewhat herbaceous, lower surfaces glabrous, hairy or with hairlike scales along the veins, upper surfaces usually glabrous; **ultimate segments** usually wider than 4 mm, usually stalked, margins reflexed, forming confluent false indusia extending around the whole segment. **Sporangia** scattered along veins near the segment margins.

Pellaea includes about 40 species, most of which grow in the Western Hemisphere. There are six in the IMR.

- 1. Some rhizome scales bicolored, with a dark central region and lighter, brown margin.
 - 2. Blades 3-pinnate proximally or, if 2-pinnate, pinnae strongly ascending; ultimate segments with greenish borders; sporangia shortly stalked *P. mucronata*
 - 2. Blades 2-pinnate proximally, pinnae perpendicular or slightly ascending; ultimate segments with whitish borders; sporangia long-stalked.
 - 3. Blades 4–18 cm wide; pinnae with 9-25 segments; borders of ultimate segments almost entire. *P. truncata*
 - 3. Blades 1.5–5 cm wide; pinnae with 3-9 segments; borders of ultimate segments crenulate *P. wrightiana*
- 1. Rhizome scales uniformly reddish brown or tan.
 - 4. Petioles reddish purple to nearly black, without prominent articulation lines; rachises densely hairy on the upper surfaces. *P. atropurpurea*
 - 4. Petioles brown, sometimes with prominent articulation lines near the base;

1 Based on Windham (FNA 2: 175–186).

rachises glabrous or nearly so.

5. Pinnae at the base of the leaves usually deeply 2-lobed; veins of ultimate segments evident *P. breweri*
5. Pinnae at the base of the leaves usually with 3–7 lobes or ultimate segments; veins of ultimate segments usually obscure *P. glabella*

Pellaea atropurpurea (L.) Link [Purple cliffbrake; FNA 2: 175, 185]

Sporulating summer-fall. Calcareous, usually limestone, cliffs and rocks.

Pellaea breweri D.C. Eaton [Brewers cliffbrake; IMF 1: 200–201; FNA 2: 183]

Sporulating summer-fall. Cliffs, ledges, and talus slopes from the foothills to treeline.

Pellaea glabella Mett. ex Kuhn [IMF 1:201–202 as *P. glabella* subsp. *simplex*; FNA 2: 183–185]

Sporulating summer-fall. Calcareous cliffs and ledges, usually on limestone. There are four subspecies of *P. wrightiana*. According to the FNA account (2: 184), two of these are present in the IMR: subsp. *simplex* and subsp. *occidentalis*.

1. Sporangia containing 64 spores; spores averaging 35–52 μm
 *Pellaea glabella* subsp. *occidentalis* (E.E. Nelson) Windham
1. Sporangia containing 32 spores; spores averaging 60–70 μm
 *Pellaea glabella* subsp. *simplex* (Butters) Á. Löve

The distributions of these two subspecies overlap in northeastern Utah. From there, subsp. *simplex* extends through southeastern Utah into northern Arizona and Colorado, subsp. *occidentalis* through eastern Idaho to Manitoba and Wyoming. When the IMF account was prepared, only subsp. *simplex* had been found in the IMR.

Pellaea mucronata (D.C. Eaton) Windham

There are two subspecies in *P. mucronata*. According to the maps in the account FNA (2: 183), subsp. *mucronata* grows in southern Nevada whereas subsp. *californica* grows in southern California., extending to the Nevada border. They differ as follows:

1. Blades 3-pinnate near the base; pinnae usually more or less perpendicular to the rachises, not overlapping; usually below 1800 m subsp. *mucronata*
1. Blades usually 2-pinnate near the base; pinnae ascending and overlapping, particularly distally; usually above 1800 m subsp. *californica*

Both subspecies grow on cliffs and rocky slopes. *Pellaea mucronata* (D.C. Eaton) Windham subsp. *mucronata* sporulates in late spring-summer and grows on acidic to mildly basic substrates. *Pellaea mucronata* subsp. *californica* (Lemmon) Windham sporulates in summer-fall and usually grows on granitic substrates.

Pellaea truncata Goodd.

Sporulating late spring-fall. Crevices in cliffs and on open rocky slopes, from the **Larrea** to the oak and juniper zones.

Pellaea wrightiana Hook. [Wright's cliffbrake; FNA 2: 175, 181–182]

Sporulating summer-fall. Cliffs and rocky slopes, on both limestone and sandstone. At the time the IMF account was written, *P. wrightiana* had not been found in the IMR.

Pentagramma¹ Yatsk., Windham & E. Wollenw.

Plants terrestrial, sometimes on rocks. **Rhizomes** short, covered with scales; **scales** sharply bicolored with a black, hard central stripe and tan margins. **Leaves**

1 Based on Yatskievych and Windham (FNA 2: 149–151) and Cronquist (IMF 1:194–195).

monomorphic, clustered; **petioles** chestnut brown to black, rounded or nearly so at the base, glabrous, farinose or viscid-glandular, with 1 vascular bundle; **blades** triangular-pentagonal, 1–2-pinnate-pinnatifid proximally, pinnatifid distally, usually farinose on the lower surface, glabrous or glandular on the upper surface; **ultimate segments** sessile, margins not recurved, veins free. **Sporangia** borne along the veins, intermixed with farin-producing glands; **indusium** none.

Pentagramma used to be included, on the basis of superficial morphological characteristics, in *Pityrogramma*, a genus that is now included in the Pteridaceae. *Pentagramma* is restricted to western North America, including northwestern Mexico. One species grows in the IMR.

Pentagramma triangularis (Kaulf.) Yatsk. [Goldback fern, Silverback fern; IMF 1: 194–195, as *Pityrogramma triangularis*; FNA 2: 146, 150–151]

Sporulating ??? Rock crevices and open, rocky slopes in pine, and oak woodlands. Plants in the IMR belong to *P. triangularis* (Kaulf.) Yatsk. subsp. *triangularis*. They have pale to bright yellow farina on the lower surface of the blades. Some of the plants from Nevada and Utah that key here may represent hybrids with subsp. *maxon* whose range lies to the south of the IMR (Yatskievych and Windham FNA 2: 151).

Aspleniaceae¹ Newman

Plants terrestrial, often on rock. **Rhizomes** usually short, scaly at the apices, scales lattice-like in appearance. **Leaves** monomorphic; **petioles** with 1 X-shaped vascular bundle; or 2 back-to-back C-shaped bundles; **blades** simple to 4-pinnate, usually with glandular hairs, veins pinnate or forking, usually free. **Sori** along the veins, lunar to linear; **indusia** usually present, originating on one side of sorus. Sporangia stalked; **annulus** vertical.

There is one genus in the family. Many of the species readily hybridize and many species are polyploids with a hybrid origin.

Asplenium L.

Stems (rhizomes) usually erect, rarely creeping in the IMR, consequently the leaves clumped. **Petioles** with 1 vascular bundle, this X-shaped in cross-section, petiole bases with scales having a lattice-like appearance; blades 1–4-pinnate, of diverse size and shape. Indusia present, originating along one side of the sori.

There are about 700 species of *Asplenium* in the world. Many of them hybridize naturally. Many of the species are polyploids having a hybrid origin.

1. Blades simple, not divided; plants requiring a greenhouse in winter *A. nidus*
1. Blades divided; plants native.
 2. Blades not evidently pinnate, frequently forking into segments 1 – 2 cm long, 2 – 3 mm wide, with a few teeth; sorus elongate, extending along the segments. *A. septentrionale*
 2. Blades clearly pinnately compound for all or most of their length; pinnae with several sori.
 3. Blades 2 –4 pinnate or pinnatifid, lower pinnae evidently larger than the middle pinnae. *A. adiantum-nigrum*
 3. Blades 1-pinnate, the pinnae undivided, lower and middle pinnae similar in size.
 4. Pinnae 6 – 11 mm long, to 5 mm wide, length of middle pinnae 3 or more times width. *A. resiliens*
 4. Pinnae 2.5 – 9 mm long, to 7 mm wide, length of middle pinnae up to twice width.

1 Based on Wagner, Moran, and Werth (FNA 2: 229–245)

- 5. Rachises dark reddish to purplish brown throughout their length
..... *A. trichomanes*
- 5. Rachises mostly green, reddish brown only at the base
..... *A. trichomanes-ramosum*

Asplenium adiantum-nigrum L. [Triangular spleenwort; IMF 1: 212–213, FNA 2: 240–241]

On sandstone cliffs at 1675 – 2300 m, rare.

Asplenium nidus L. [Bird’s-nest fern]

Frequently grown in greenhouses, *A. nidus* is a common species on trees in rain forests of the Old World tropics.

Asplenium resiliens Kunze [Black-stemmed spleenwort; IMF 1:212–213, FNA 2:239]

Rock crevices, usually on limestone, sometimes on sandstone at 100–1500 m.

Asplenium septentrionale (L.) Hoffm. [Forked spleenwort; IMF 1: 214; FNA 2:235-236].

Cliffs and rock crevices at 700–2900 m.

Asplenium trichomanes L. [Maidenhair spleenwort; IMF 212–213, FNA 2: 239]

Usually on sandstone, granite or basalt at 0–3000 m. Plants in the IMR belong to **Asplenium trichomanes** L. subsp. *trichomanes*. They differ from those on the west and east coasts of North America in being tetraploid rather than diploid.

Asplenium trichomanes-ramosum L. [Green spleenwort; IMF 1:21–213, as *A. viride*, FNA 2: 240]

Rocky cliffs and crevices in limestone or other basic rocks, to 4000 m.

Woodsiaceae¹

Plants usually terrestrial. **Rhizomes** ascending, erect, or horizontal, apices with scales; **scales** usually not lattice-like in appearance. **Leaves** monomorphic; **petioles** with 2 elongate or lunar vascular bundles, united distally; **veins** pinnate or forking, usually not anastomosing. **Sori** round, J-shaped, or linear; **indusia** absent or reniform to linear.

The Woodsiaceae is essentially global in its distribution. It includes around 700 species, most of which are in Athyrium and Diplazium. Its limits are still uncertain; it is likely that it will eventually be split into more, smaller families, but it is not yet clear what these families should be.

- 1. Indusia attached at the center of the sori, radially symmetric, composed of a central circular portion with radiating filaments or ribbons. *Woodsia*
- 1. Indusia absent or attached on the sides of the sori, forming a half-cup or composed of ribbons that cover the sorus from the sides.
 - 2. Indusia absent or small, paralleling the veins, and soon deciduous
..... *Athyrium*
 - 2. Indusia present, cup-shaped, lying across the veins, persistent but sometimes inconspicuous *Cystopteris*

¹ Description based on Smith et al. (2006); key on Smith (FNA 2:246–249) for *Dryopteridaceae*

Athyrium¹ Roth

Plants terrestrial. **Rhizomes** short, often ascending. **Leaves** monomorphic, usually not overwintering. **Petioles** up to about 1/2 the length of the blades; **blades** lanceolate to elliptic or oblanceolate, 1–3-pinnate or pinnatifid; **pinnae** gradually reduced distally, margins serrulate or crenate. **Sori** in 1 row between midrib and margin;; **indusia** absent or attached on one side, horseshoe-shaped or cuplike and almost round to elongate.

There are about 180 species of *Athyrium*.

1. Sori round, submarginal; indusia absent or highly reduced; veinlets obscure on underside of pinnae. *A. alpestre*
1. Sori elongate, , medial; indusia usually present; veinlets evident on underside of pinnae. *A. filix-femina*

Athyrium alpestre (Hoppe) Ryl. Alpine ladyfern [IMF 1: 215–216 as *A. distentifolium*; FNA 2: 256]

Wet rocky slopes, talus, and alpine meadows. North American plants belong to **Athyrium alpestre** var. **americanum** Butters. It differs from var. *alpestre* in several qualitative features.

Athyrium filix-femina (L.) Roth

Moist woods, meadows, and stream banks below timberline. Two varieties grow in the IMR. They grow in similar habitats but different, but overlapping, geographic regions.

1. Lobes of pinnae narrowly deltate to oblong-lanceolate, base about as long as the sides. var. *cyclosum*
1. Lobes of pinnae linear-oblong to linear lanceolate, base shorter than the sides var. *californicum*

Athyrium filix-femina var. **californicum** Butters Southwestern ladyfern

This variety grows in the southwestern US, extending north through southern Washington and Idaho.

Athyrium filix-femina var. **cyclosum** Rupr.

This variety grows in northwestern North America, extending from Oregon, Idaho, and Montana to Alaska and Yukon Territory.

Cystopteris² Bernh.

Plants terrestrial or on rock. Rhizomes short or long. Petioles 1/3–3 times the length of the blades; blades ovate-lanceolate to deltate, gradually narrowing distally, axils or pinnae and/or lower surface sometimes with uniseriate, multicellular hairs or unicellular glandular hairs, sometimes without hairs. Sori in 1 row between midrib and margin, lying across the veins; indusia cuplike, attached on side of sorus nearest pinnule midvein.

There are about 20 species of *Cystopteris*.

1. Rachises, costae, indusia, and midribs or ultimate segments sparsely to densely covered with glandular hairs; blades deltate to ovate, usually widest at or near the base.
 2. Rachises and costae frequently with bulblets; rachises, costae, indusia, and midribs usually densely covered with glandular hairs; early blades lacking sori;

1 Based on Kato (FNA2: 255–258) and Cronquist (IMF 1:215–216).

2 Based on Haufler, Moran, and Windham (FNA 2: 263–270)

- petioles reddish when young, becoming green or straw-colored when mature
 *C. bulbifera*
2. Rachises and costae frequently with bulblets; rachises, costae, indusia, and midribs usually sparsely covered with glandular hairs; all blades with sori; petioles green to straw-colored throughout or darker at the base
 *C. utahensis*
1. Rachises, costae, indusia, and midribs of ultimate segments without glandular hairs; leaf blades elliptic to lanceolate, usually widest at or just below the middle; rachises and costae without bulblets.
3. Blades 2–3-pinnate; lowest pinnae pinnate-pinnatifid to 2-pinnate, pinnules on the lower side usually stalked; spores 33–41 μm *C. reevesiana*
3. Blades 2-pinnate-pinnatifid; lowest pinnae pinnatifid to pinnate-pinnatifid, pinnules on lower side sessile or stalked; spores 39–60 μm .
4. Pinnae usually forming an acute angle with the rachis, often curving towards the blade tip; distal pinnae usually ovate to narrowly elliptic, the margins usually crenate or with rounded teeth *C. tenuis*
4. Pinnae perpendicular to the rachises, not curving towards the blade tip; distal pinnae deltate to ovate, the margins with sharp teeth
 *C. fragilis*

Cystopteris bulbifera (L.) Bernh, Mountain bladder-fern [IMF 1: 217–218, FNA 2: 265–266]

Sporulating summer-fall. Usually on moist soils at low elevations, sometimes on calcareous rocks.

Cystopteris fragilis (L.) Bernh. Brittle fern [IMF 1: 217–218, FNA 2: 269–270]

Sporulating summer-fall. Usually on cliff faces or in thin soil over rocks. It has been confused with *C. reevesiana* but tends to grow at higher elevations and, because its rhizomes have short internodes, its more densely clumped leaves and petiole bases. The description in IMF may have encompassed what are treated here as *C. reevesiana* and *C. tenuis*, with both of which *C. fragilis* hybridizes.

Cystopteris reevesiana Lellinger Southwestern brittle-fern [FNA: 2: 266, 268–269]

Sporulating summer-fall. Terrestrial or on rock, usually at lower elevations and further south than *C. fragilis*. It was not recognized as distinct until after publication of IMF 1; in that work, specimens would key to *C. fragilis*. It can usually be distinguished from *C. fragilis* by its more widely spaced leaves but plants growing in rocks may have strongly clustered leaves.

Cystopteris tenuis Michx.) Desv. Mackay’s brittle-fern [FNA 2: 269]

Sporulating summer-fall. In shade, usually on rock or cliffs, sometimes on forest floor. The presence of this species (which used to be known as *C. fragilis* var. *mackayi* G. Laws.) in western North America was not recognized when IMF 1 was published. Specimens would key to *C. fragilis* in that work.

Cystopteris utahensis Windham & Lauffer Utah brittle-fern [FNA 2: 267]

Sporulating summer-fall. Cracks and ledges on sandstone, limestone and calcic cliffs. The species was not recognized as distinct until after publication of IMF 1. In that work, specimens would probably be identified as *C. bulbifera* if they had bulblets and as *C. fragilis* if they did not.

Woodsia¹ R. Br.

Plants usually on rock. **Rhizomes** usually ascending or erect. **Leaves** monomorphic, usually dying back in winter; **petioles** 1/5–3/4 the length of the blades; **blades** linear to lanceolate or ovate, 1–2-pinnate-pinnatifid, glandular hairs usually present on both surfaces, sometimes absent; **pinnae** with entire to dentate margins, lowest pinnae somewhat smaller than the adjacent pinnae. **Sori** in 1 row between midrib and margin, round; **indusia** with several to many radiating filamentous or scale-like segments, often obscure in mature sori.

- 1. Both surfaces of pinnae with flattened, multicellular hairs along the midrib; mature petioles relatively brittle and easily shattered. *W. scopulina*
- 1. Neither surface of pinnae with flattened, multicellular hairs along the midrib; mature petioles somewhat pliable and resistant to shattering.
 - 2. Rachis with scattered glandular hairs and occasional hairlike scales; indusia composed of numerous filamentous segments that are uniseriate most of their length. *W. oregana*
 - 2. Rachis with abundant glandular hairs; indusia composed of relatively few, broad segments that are multiseriate at the base, often dividing into uniseriate segments distally
 *W. plummerae*

Woodsia oregana D.C. Eat. Oregon cliff-fern [IMF 1:218–219, FNA 2: 274, 278–279]

Sporulating summer-fall. Cliffs and rocky slopes.. There are two subspecies that tend to have separate, but overlapping ranges. They differ in chromosome number as well as in the characters used in the key. Cronquist (IMF 1: 219) did not distinguish the two and was not aware of the existence of tetraploids in the region.

- 1. Pinnae margins appearing entire; spores averaging 39–45 µm. . . .subsp. *oregana*
- 1. Pinnae margins usually minute and appearing ragged; spores averaging 45–50 µm.subsp. *cathcartiana*

Woodsia oregana subsp. **cathcartiana** (B.L. Rob.) Windham

On both acidic and basic rocks. $2n = 152$. Widely distributed in the IMR.

Woodsia oregana D.C. Eat. subsp. **oregana**

Usually on granitic or volcanic substrates. $2n = 76$. Extending from the west coast south to northern California and Utah and east to western Wyoming.

Woodsia plummerae Lemmon Plummer’s cliff-fern [FNA2: 274, 276]

Sporulating late-fall. Rocky slopes and cliff, usually on granitic or volcanic soils. It grows just south of the region covered by the IMF and was, therefore, not included in that work.

Woodsia scopulina D.C. Eat. Mountain cliff-fern [IMF 1:219–219, FNA 2: 274–276]

Sporulating summer–fall. Rocky slopes and cliffs, both basic and acidic. Since publication of IMF 1, two subspecies have been recognized in the IMF. They grow in similar habitats and have similar ranges but differ in their chromosome numbers ($2n = 76$ in subsp. *scopulina*, $2n = 152$ in subsp. *laurentiana*) as well as the characters shown in the key. Hybrids between the two are sterile.

- 1. Scales of stems and petioles usually all of one color, sometimes with a few dark cells; spores averaging 42–50 µm
 **Woodsia scopulina** D.C. Eat. subsp. **scopulina**

1 Based on Windham (FNA 2: 270–280).

1. Scales of stems and petioles with clusters of dark cells forming a narrow, discontinuous stripes; spores averaging 50–57 μm
 **Woodisia scopulina** subsp. **laurentiana** Windham

Blechnaceae¹

Rhizomes short and vertical or long and horizontal, often with stolons, apices scaly, scales not lattice-like. **Leaves** monomorphic or dimorphic; **petioles** with numerous round vascular bundles arranged in a ring; **blades** usually pinnate or pinnatifid, sometimes simple or 2-pinnate, with scales on the surfaces, scales not lattice-like. **Sori** in chains or linear, often parallel and adjacent to midribs; **indusia** linear, opening towards the midveins of the pinnules **sporangia** stalked.

There are about nine genera in the Blechnaceae, but only one is known from the IMR.

Woodwardia² Sm.

Plants usually terrestrial, rarely on rock. **Rhizomes** horizontal, not climbing; **scales** brown. **Leaves** monomorphic or dimorphic, clustered or separated. **Petioles** and veins scaly, scales not lattice-like; **blades** pinnate or pinnatifid. **Sori** discrete, in chain-like rows along midveins of pinnules; **indusia** flap-like, opening towards the midveins of the pinnules.

One species of *Woodwardia* grows in Nevada.

Woodwardia fimbriata Sm. Giant chainfern [IMF 208–209, FNA 224, 227]

In mesic to wet places along stream banks in coniferous woods. Primarily a coastal species, *W. fimbriata* also grows at disjunct locations in Nevada and Arizona.

Dryopteridaceae³

Plants growing on the ground, rocks, or trees. **Rhizomes** short or long, erect to horizontal, sometimes climbing or scrambling, with scales at the apices; **scales** not lattice-like. **Leaves** usually monomorphic, sometimes dimorphic, overwintering or not, sometimes bearing scales or glandular hairs; **petioles** 1/4–2/3 the length of the blades, with numerous, round, vascular bundles arranged in a ring; **blades** usually 1–2-pinnate. **Sori** usually round; **indusia** absent or, if present, round to reniform, sometimes peltate; **sporangia** stalked.

There are 40–45 genera and 1700 species in the *Dryopteridaceae*. Two genera grow in the IMR. The indusia in both genera in the IMR tend to fall off rapidly so care must be taken to search for them on young sori.

1. Indusia attached on one side of the sori, round-reniform; blades widest near the middle; pinnae pinnatifid *Dryopteris*
1. Indusia attached in the center, round; blades widest near the base; pinnae entire or pinnatifid only at the base *Polystichum*

Dryopteris⁴ Adans.

Plants usually terrestrial, rarely on rock. **Rhizomes** short, not developing stolons., **Leaves** monomorphic, clustered; **petioles** 1/4–2/3 blade length; **blades** deltate-

1 Based on Smith et al. (2006).
 2 Based on Cranfill (FNA 2: 226–227).
 3 Based on Smith et al. (2006).
 4 Based on Montgomery and Wagner (FNA 2: 280–2880).

ovate to lanceolate, 1–3-pinnate-pinnatifid, lower pinnae as long as or shorter than those at midlength, lower surfaces with linear to ovate scales. **Sori** in 1 row between margins and teeth, round; **indusia** round-reniform, attached at a narrow sinus, persistent or rapidly deciduous.

There are about 250 species of *Dryopteris* but only one grows in the IMR.

Dryopteris filix-mas (L.) Schott Male fern [IMF 1: 215–217, FNA 2: 284]

Dense woods and thickets, often along streams.

Polystichum¹ Roth

Plants terrestrial. **Rhizomes** horizontal to erect, **Leaves** usually monomorphic, overwintering; petioles 1/9–1 times the length of the blades; **blades** linear to broadly lanceolate, 1–3-pinnate, with linear to lanceolate scales on the lower, sometimes also the upper, surfaces. **Sori** usually in 1 row between the midribs and the margins, usually round and distinct, sometimes confluent; **indusia** peltate, persistent or not.

Polystichum includes about 180 species; three grow in the IMR.

1. Leaves 1-pinnate, the pinnae entire apart from one basal lobe *P. lonchitis*
1. Leaves 1-pinnate-pinnatifid or 2-pinnate.
 2. Tips of the pinnae with spreading, teeth, the subapical teeth about equaling the apical tooth *P. kruckebergii*
 2. Tips of the pinnae with incurved teeth, the subapical teeth much smaller than the apical tooth *P. lonchitis*

Polystichum kruckebergii D.H. Wagner Kruckeberg's swordfern [IMF: 210–211, FNA 2: 296]

Crevices and talus slopes in subalpine to alpine habitats.

Polystichum lonchitis (L.) Roth Holly fern [IMF 1: 210–211, FNA 2: 297]

Rock crevices and at the base of boulders in boreal, subalpine coniferous forests and in subalpine regions.

Polystichum scopulinum (D.C. Eat.) Maxon Rock swordfern [IMF 1: 210–211, FNA 2: 297–298]

Rock crevices and open rocky slopes, usually in full sun, at middle and upper elevations but below timberline.

Polypodiaceae²

Plants usually epiphytic or epipetric [on rocks], sometimes terrestrial. **Rhizomes** horizontal, bearing scales. **Leaves** monomorphic or dimorphic; **petioles** often breaking off near their bases; **blades** usually simple to pinnatifid or 1-pinnate, sometimes 2- or more pinnate, surfaces sometimes with hairs or scales, sometimes glandular. **Sori** usually round to oblong or elliptic, sometimes elongate or dense and not clearly distinguished; **indusia** absent, young sori sometimes covered by scales that rapidly fall off; **sporangia** stalked, often intermixed with paraphyses.

Smith et al. (2006), whose family treatment is adopted here, include about 56 genera and 1200 species in the *Polypodiaceae* but, in older works (such as IMF) it included almost all leptosporangiate ferns. Only one genus grows in the IMF.

1 Based on Wagner (FNA 2: 290–299).

2 Based on Smith et al. (2006).

Polypodium¹ L.

Plants usually on rock, sometimes terrestrial or epiphytic. **Rhizomes** horizontal, usually branched, scaly; **scales** uniformly colored or bicolored, lanceolate to ovate-acuminate, sometimes lattice-like. **Leaves** monomorphic, clustered or not, to 90 cm long; **petioles** straw-colored, winged distally, readily breaking off; **blades** broadly ovate to deltate, pinnatifid or 1-pinnate at the base, usually with fewer than 25 pairs of pinnae, rachises sometimes sparsely scaly on lower surface, scales ovate-lanceolate to linear; **segments** entire to erose, apices rounded to attenuate. **Sori** often restricted to distal portion of leaves, circular to oval, borne at the tips of single veins, in 1–3 rows on either side of the midrib.

There are about 100 species of *Polypodium*; only one grows in the IMR.

Polypodium hesperium Maxon Licorice fern, Western polypody [IMF 1:208–209, FNA 320]

Sporulating summer-fall. Wet crevices and ledges on cliffs, rarely on limestone.

1 Based on Cronquist (IMF 1: 208–209)..