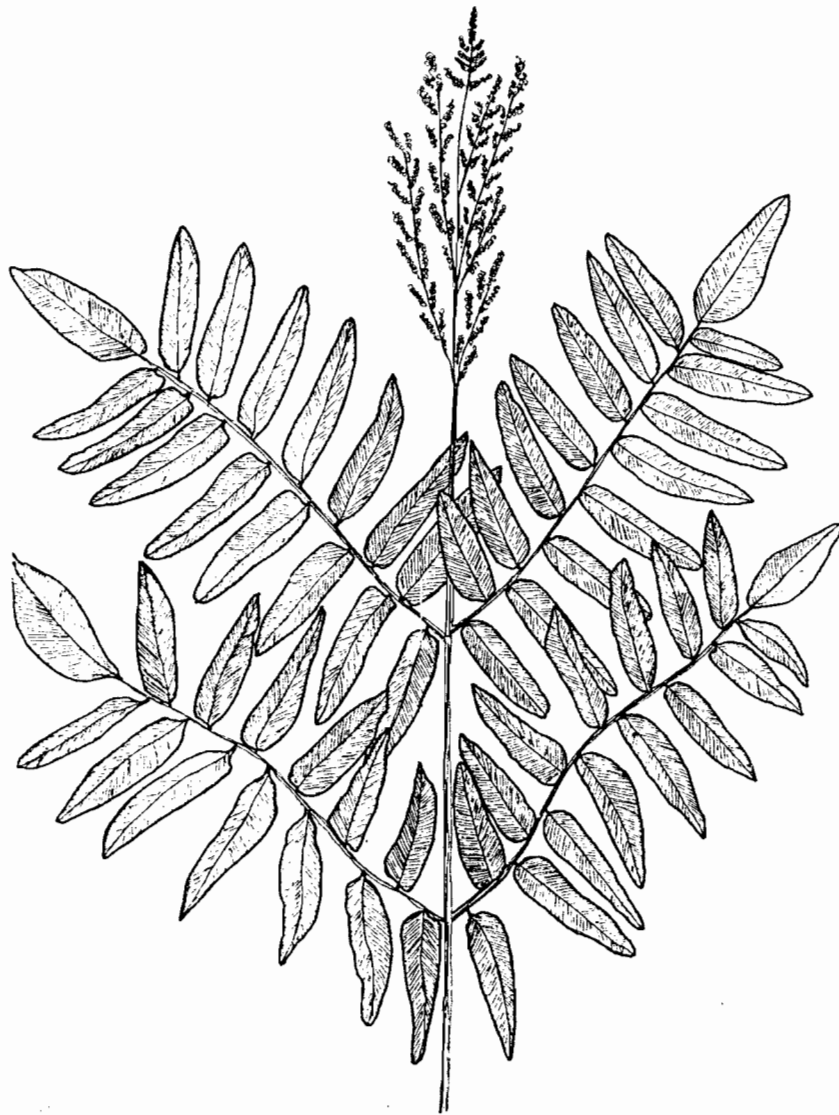


THE FERNS AND FERN ALLIES

OF LBL:

A CURRICULUM GUIDE



The *Miscellaneous Publication* series of the *Austin Peay State University Center for Field Biology* is a medium for disseminating educational, scientific, or technical information which, because of length or content, is not appropriate for scientific journals or as part of the Center's Symposium Proceedings. Papers generally relate to the natural history of the lower Cumberland and Tennessee River valleys of Kentucky and Tennessee; however, papers on similar topics from contiguous states are also appropriate.

Publications may be obtained, if available, from:

*Publications Manager
The Center for Field Biology
Austin Peay State University
Clarksville, Tennessee 37044*

Make checks payable to *Austin Peay State University*.

Persons interesting in publishing in this series should contact the Center Director at the above address.

Previous Papers

1. Chester, E. W., R. J. Jensen, L. J. Schibig, and S. Simoni. 1987. The Nut Trees of Land Between The Lakes.

(An illustrated guide to the species of beech, chestnut, hickories, oaks, and walnuts of LBL; 49 pp. 3.00 + 1.00 shipping).

2. Noel, S. M. 1987. A Curriculum Guide for Understanding the Woodland Community.

(Student and teacher activities for a unit on woodland ecology; 66 pp. Free to teachers, 3.00 + 1.00 shipping otherwise).

3. Noel, S. M., M. L. McReynolds, and E. W. Chester. 1990. The Ferns and Fern Allies of Land Between The Lakes: A Curriculum Guide.

(An illustrated guide with activities for secondary teachers and students; 67 pp. Free to teachers, 3.00 + 1.00 shipping).

THE FERNS AND FERN ALLIES
OF
LAND BETWEEN THE LAKES

A Curriculum Guide for Secondary Science Teachers and Students

Sallie M. Noel
Mary Lou McReynolds
Edward W. Chester

Illustrated By Sallie M. Noel



An Educational Service of
The Center for Field Biology

Austin Peay State University
Clarksville, Tennessee 37044

1990

CONTENTS

INTRODUCTION, For the Instructor	1
HISTORY OF THE REGION	3
WHAT IS A FERN?	7
FERN STRUCTURE	10
LIFE CYCLE OF A FERN	14
THE FERNS AND FERN ALLIES OF LBL, HOW TO IDENTIFY THEM	17
Field Horsetail	24
Giant Horsetail	25
Fan Club-moss	26
Meadow Spike-moss	27
Northern Maiden-hair	28
Ebony Spleenwort	29
Blackstem Spleenwort	30
Walking Fern	31
Wall-rue	32
Lady Fern	33
Glade Fern	34
Silvery Glade Fern	35
Eastern Mosquito Fern	36
Sparse-lobed Grape Fern	37
Lace-frond Grape Fern	38
Rattlesnake Fern	39
Hairy Lip Fern	40
Bulblet Fern	41
Lowland Brittle Fern	42
Sensitive Fern	43
Adder's-tongue	44
Royal Fern	45
Purple Cliff-brake	46
Resurrection Fern	47
Christmas Fern	48
Eastern Bracken Fern	49
Broad Beech Fern	50
Marsh Fern	51

Blunt-lobed Woodsia	52
APPENDIX	53
Preparing a Fern Study Set	54
Ferns and Fern Allies: A Magic Box Puzzle	56
History Can Be Puzzling: A Crossword Puzzle	58
Key to Puzzles	60
Ferns and Fern Allies of Land Between The Lakes Listed by Scientific Name	61
Ferns and Fern Allies of Land Between The Lakes Listed by Common Name	63
Glossary	65

LIST OF FIGURES

Figure 1. Parts of a fern	11
Figure 2. Degrees of frond dissection	12
Figure 3. Life cycle of a typical fern	16

INTRODUCTION

For The Instructor

Few teachers, even those specializing in botany, feel fully confident presenting a lab on ferns or taking a group of students out for impromptu field identification. Although there are thousands of kinds of ferns world-wide, with an unbelievably complex *morphology* and *taxonomy*, the relatively few species found locally makes it possible for you to master this branch of botany and broaden your expertise as a field biologist.

Land Between The Lakes (LBL), because of limited *mesic* habitat, has a relatively small number of fern species, which, with a few exceptions, occur in close association with one another. Though this may disappoint an avid *pteridologist*, it enables the field leader to become an accomplished guide in a satisfyingly brief time. If you plan to take students to LBL for fern study, the trail around Hematite Lake and the 1 3/4 mile road through Redd Hollow in Trigg County are excellent choices. Both have sanitary facilities and picnic areas as well as a large number of the ferns described in this guide. The Bear Creek area in Stewart County near the South Visitor Center also has excellent fern habitat, but a somewhat more rugged terrain.

When going afield, remember the need for tick protection from spring until after a hard frost. May would be an ideal month for field study since most fern species have appeared by then and the tick problem is not as severe as in early fall. As you prepare your students for a field trip, the more background

you can provide the more rewarding both you and they will find the experience. Since no life form, such as a fern, stands alone in its natural habitat, a little background study of the entire region is of value. Of course any trip to Land Between The Lakes provides an excellent opportunity to discuss history, geography, geology and sociology as well. For this reason, a brief section of historical background and enrichment material is included in the introductory section of the guide. One of the activities in the Appendix develops these facts and permits you to incorporate this material into a lecture if you so desire.

The drawings of the ferns and fern allies should enable you to identify most species encountered in the area. An illustrated key is provided to assist you further in identification. The additional information about ferns and the appended activities provide you with the option of using the material in the classroom rather than the field if you prefer. A few fern specimens you have collected, or a study set which can be prepared following the instructions in one of the activities, would make a perfectly adequate and enjoyable lab. *Do not collect ferns in LBL.*

Although many times ferns are allotted no more than a few lines in a high school science text (and the fern allies often totally omitted), it is hoped that this curriculum guide will stimulate interest as well as increase both confidence and competence in investigating this fascinating and important area of botany. A glossary defining all boldface words is included in the Appendix.

HISTORY OF THE REGION

Both Kentucky Lake and Barkley Lake are man-made. Long before the lakes were formed, the "Land Between the Rivers" had already developed a unique personality, much of which is retained today. Nowhere else in the United States do two such mighty rivers as the Cumberland and the Tennessee flow so close together without joining. These two great rivers arise in the Appalachians and flow to the southwest only to be diverted northward by the western barrier provided by the Highland Rim of the Nashville Basin. Beginning near Dover, Tennessee, and for about 40 miles northward, the rivers parallel each other on their journey to join the Ohio and ultimately the Mississippi River.

The geology of the region is characterized by a rather shallow, non-productive soil, infrequent limestone outcroppings, and an abundance of *chert*. This same cherty rock, known as Dover flint, which resulted in a land of limited value for agriculture, made the region a popular place for its aboriginal inhabitants to gather materials for tools. The bivalve mussels in the rivers were an additional attraction.

The earliest known inhabitants of the region were of the Archaic Culture, succeeded by people of the Woodland Culture, the "Mound Builders." Some remnants of their culture are still visible in LBL. The Mound Builders established ceremonial burial grounds on the high east bank of the Tennessee River in Stewart County. In this area they fished, hunted, and grew corn, their

chief crop.

The Indian population was never large in LBL. The Shawnee moved west across Kentucky and the Cumberland Valley and the Muskogean tribe, the Chickasaw, became plentiful in the south. Even the early white men established no large permanent settlement in the territory between the rivers before it became part of the United States. First came the Spanish seeking gold, followed by the French fur traders, who came to the area from their trading post at the site of Nashville via the Cumberland River, which they referred to as Louisa, in honor of their king. The English who visited the area named this river "Shawnee" because of that tribe's population along its banks. Not until Thomas Walker, the surveyor, suggested Cumberland in 1748 in honor of the royal duke, did a name become permanent.

In 1780, Walker re-entered Kentucky as a surveyor for the state of Virginia. A North Carolina surveying party headed by Colonel Richard Henderson and a small group led by Colonel John Donelson were commissioned to determine the North Carolina-Virginia boundaries, which at that time included the states of Kentucky and Tennessee. The final surveying was delayed while the parties stopped in the Land Between the Rivers to kill buffalo and collect herbs, no doubt gathering some succulent fern "fiddleheads" to supplement their depleted rations. The failure of the two parties to agree on a boundary led to a 63-year dispute persisting long after Kentucky and Tennessee had gained statehood.

Uncertain of what state they actually lived in, the residents of the Land Between the Rivers developed unusually strong local and community affiliations. The final agreement on the state boundaries was reached in 1860 with the resultant offset boundary between Kentucky and Tennessee which occurs in LBL.

The Revolutionary period was followed by development of the iron industry in the region, a result of the *hematite* ore which was discovered by Indians. This industry altered the vegetation of LBL dramatically as acres of trees were cut for charcoal to fuel the some half-dozen furnaces, such as Center furnace near Woodlands Nature Center in Trigg County and the Great Western furnace at Model in Stewart County.

Many trails, such as the one around Hematite Lake, were logging roads carrying trees used to make charcoal. At 20 pounds to the bushel, approximately 2000 bushels of charcoal were needed to fire the average furnace for a 24 hour period. Prior to the Civil War, slaves were leased from local farmers for these activities. Due to the loss of slave labor and better methods of processing ore, the LBL furnaces declined after the war.

Since the completion of Kentucky Dam in 1945, (creating Kentucky Lake from the lower portion of the Tennessee River), and Barkley Dam in 1966 (impounding the lower portion of the Cumberland to form Barkley Lake) the 170,000 acres known as Land Between The Lakes has been a unique recreational and educational experiment administered by the Tennessee Valley Authority

(TVA). No endeavor of such magnitude can be accomplished without conflict and the numerous cemeteries and the persisting dooryard roses speak eloquently of the love the former tenants bore for the homesites vacated to bring LBL into being.

Although surrounded by 300 miles of lakeshore fronting on two of the largest impounded lakes in the world, LBL contains limited natural interior waters. It has few year-round, free-flowing streams and the small ponds and waterholes, though numerous, provide little fern habitat. Many of the springs, for which the area was once famous, were inundated by the reservoirs or have dried up due to poor land management. To help remedy this, the 90-acre Hematite Lake was built in the late 1930s as a federal work relief project. Later, Energy Lake (370 acres), Honker Lake (190 acres), and Bards Lake (320 acres) were impounded by construction of dams. All serve recreational purposes and provide additional water for wildlife.

This distribution of interior water is one key factor in determining suitable habitat for ferns. Because of their form of reproduction, ferns must have adequate moisture for most of the year. This and the requirement of shade by most species limits the number of sites in LBL that are suitable for any but the hardiest of ferns.

WHAT IS A FERN?

Ferns are in a group known as cryptogams. The literal meaning of this term is "hidden wives" or "hidden marriage." Their reproduction is cryptic or hidden; they produce no flowers, seeds, nor fruit--and yet they obviously do reproduce. For many years some people believed that ferns must have seeds but produced them secretly and dropped them at midnight on St. John's Eve, June 24, each year. They further believed that if a person could possess such seeds, they would be invisible and also possess supernatural powers. Now a person with a microscope can actually see the spores, but the reproductive process is inconspicuous nonetheless.

Many plants which look like ferns are not, but simply have the lacy foliage associated with ferns. For example, the asparagus fern is not a fern but a member of the lily family, and many true ferns do not have the typical "fern-like" foliage. How then can one recognize a fern with any degree of certainty?

The technical definition for a fern is "a *vascular* plant having *megaphylls* and reproducing by *spores*." Although ferns do not produce seeds as do the more familiar *Angiosperms* (flowering plants) and *Gymnosperms* (pines, cedars and firs), they do share with these plants the presence of vascular tissue. A vascular plant is sometimes referred to as a "higher" plant because of its complex conducting system containing *xylem* and *phloem* tissue for transport of water and nutrients. Ferns are the simplest plants to possess vascular tissue; mosses and liverworts

do not contain this complex tissue.

This brings us to the second characteristic, the presence of megaphylls. Literally megaphyll means "large leaves," but in effect it refers to complex leaves with a branching vascular system such as that found in angiosperms, gymnosperms, and ferns--but not in the fern allies. The fern allies, plants such as the clubmosses, horsetails, and quillworts, have microphylls. Microphylls are leaves with a single, unbranched vein that does not alter the vascular pattern of the stem as does the megaphyll. Oddly enough, the complexity of the leaf structure has little to do with the size of a mature plant. Relatives of today's fern allies made up the coal-producing forests of the Carboniferous Period and were able to attain heights of 100 feet and yet they had microphylls.

The third fern characteristic, reproduction by spores, is probably the feature that most dramatically separates them from other vascular plants. Spores are usually produced on the underside of the fern's *frond* in small fruiting mounds call sori (*sorus*, singular). The location and structure of the sori is one of the most frequently used diagnostic features in fern identification. Spores may be produced by a specialized portion of a frond or on an entire frond modified for spore production. Many times sori are not present because the frond is "sterile," the plant is immature, or it is simply the wrong season. In this case identification must wait until a "fertile" frond can be found.

An additional distinction of the typical fern is the unusual manner in which its leaves expand. Fern leaves mature from the base to the tip, gradually unrolling from a fiddlehead or *crozier*, a form of development called *circinate veneration*. Although a few other plants may produce fiddleheads, it is fairly safe to identify a plant with a fiddlehead as a fern. The exceptions are that a few ferns, such as the grape ferns and the adder's-tongue fern, do not form distinct fiddleheads, whereas a number of flowering plants such as sundews and many borages do have them. In spite of these exceptions, it is still a useful observation.

When these characteristics converge in one plant--a leaf having a complex network of veins, producing spores, and unfurling its fronds from a fiddlehead--count on it--you've found a fern.

FERN STRUCTURE

The mature fern plant has roots, stems, and leaves as do other more familiar plants, but they differ both in appearance and name. The name for the fern's leaf is a *frond*, which comprises the entire aerial portion of the fern (*Figure 1*, page 11). The stem of most ferns is subterranean, horizontal, and called a *rhizome*. The stem produces roots which anchor the plant and absorb water and nutrients. The rhizome may vary from short to quite long with the spacing of the fronds along the rhizome being a diagnostic feature in identification. The central axis of a divided frond is called the *rachis*. The primary divisions of the blade are called pinnae (*pinna*, singular) and pinna divisions are called *pinnules*.

The frond is divided into two main parts, the *stipe* (the leaf stalk or petiole) and the *blade*, which may be simple (undivided) or finely cut, each degree of dissection being described by an exact term (*Figure 2*, page 12). For example, a pinnatifid blade is cut nearly to the midvein. Pinnate blades are divided into leaflets with each leaflet narrowly attached to the main axis. Blades more divided are designated bipinnate or tripinnate, and for intermediate degrees of dissection the suffix pinnatifid is used; thus pinnate-pinnatifid is not quite divided enough to be called bipinnate, etc.

Sometimes the frond surfaces have scales and/or hairs varying in size and abundance. The texture of the frond may also vary substantially from thin to firm and leathery, usually depending on the fern's *evergreen* or *deciduous* nature.

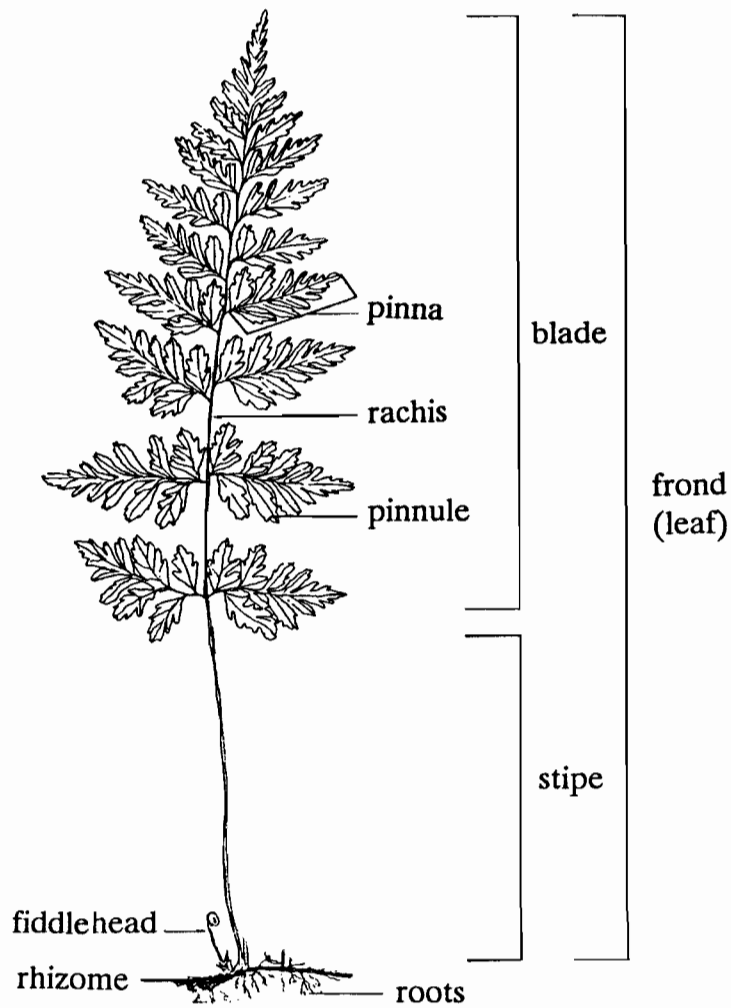
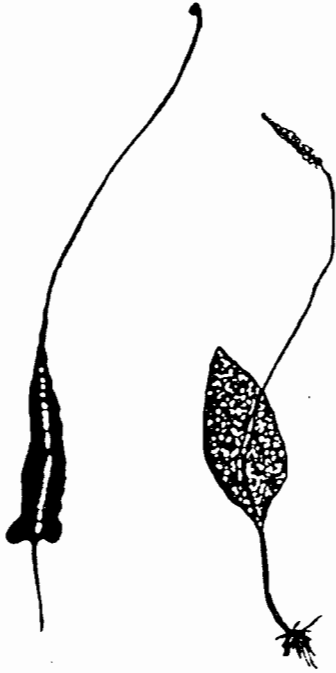


Figure 1. Parts of a fern

Observing the *venation* may be helpful in fern identification at times. Most ferns have veins which are free, that is, running from the midvein to the margin without forming a network. They may branch but do not anastomose or unite with other veins. However, when they do form a vein network, the pattern is often distinctive and may be helpful in identification of such ferns as *Onoclea*, *Thelypteris*, and *Polypodium*.

Figure 2. Degrees of frond dissection

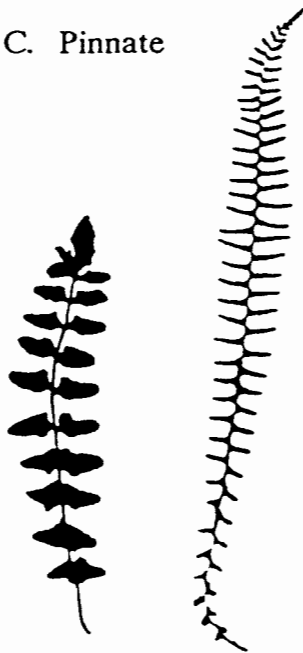
A. Simple



B. Pinnatifid



C. Pinnate



D. Pinnate-pinnatifid

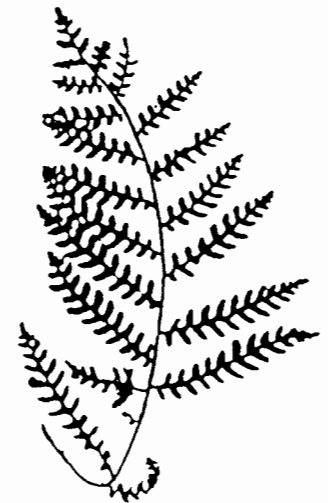


Figure 2. continued

E. Bipinnate



F. Tripinnate



G. Bipinnate-pinnatifid



H. Bipinnatifid



LIFE CYCLE OF A FERN

To follow the life cycle of a typical fern (*Figure 3* page 16), one must begin with a typical fern plant (A). This phase of the life cycle is known as the *sporophyte generation*, since this is the stage in which the spores are produced. When mature, a spore is released or literally catapulted (B) by a sudden opening and closing of a *sporangium* (sporangia, plural), usually present in large numbers in mounds called *sori* (sorus, singular), on the underside of the fertile frond.

Upon landing in a moist area, the spore germinates (C). Soon a small heart-shaped *prothallus* (D) about the size of a fingernail develops, with root-like structures called *rhizoids* anchoring it into the soil or damp moss. The prothallus is green and can manufacture its own nourishment through *photosynthesis*. This stage of the life cycle is the *gametophyte generation*, since the prothallus (or *gametophyte*) produces the reproductive organs which form the eggs and sperm, also call *gametes*. Note the reproductive organs, *archegonia* and *antheridia* on the underside of the prothallus. Although the archegonia and antheridia are shown greatly enlarged for clarity, the development described continues beneath the prothallus.

When the *antheridium* (antheridia, plural) or male reproductive structure is mature, sperm are released and swim in a spiral fashion toward the *archegonium* (archegonia, plural), the female structure containing the egg cell. Since both sperm and egg contain only one set of chromosomes (N), the resulting fertilized

egg has two sets (2N) and will develop into a new *sporophyte* or typical fern plant.

As the new sporophyte becomes self-sufficient, the prothallus withers. The first leaf of the young fern is frequently not typical of the adult and identification at this stage is difficult. The immature rolled-up stage is known as a crozier or fiddlehead. To successfully identify ferns it is usually necessary to examine a frond with sori, since their arrangement and shape are diagnostic features.

The life cycle described above should make the fern's water requirement apparent. The sperm are motile and require water to swim to the egg for fertilization to occur. An absence of water at this critical stage in the fern's development explains the limited number of ferns in many regions which are moist for only a portion of the year.

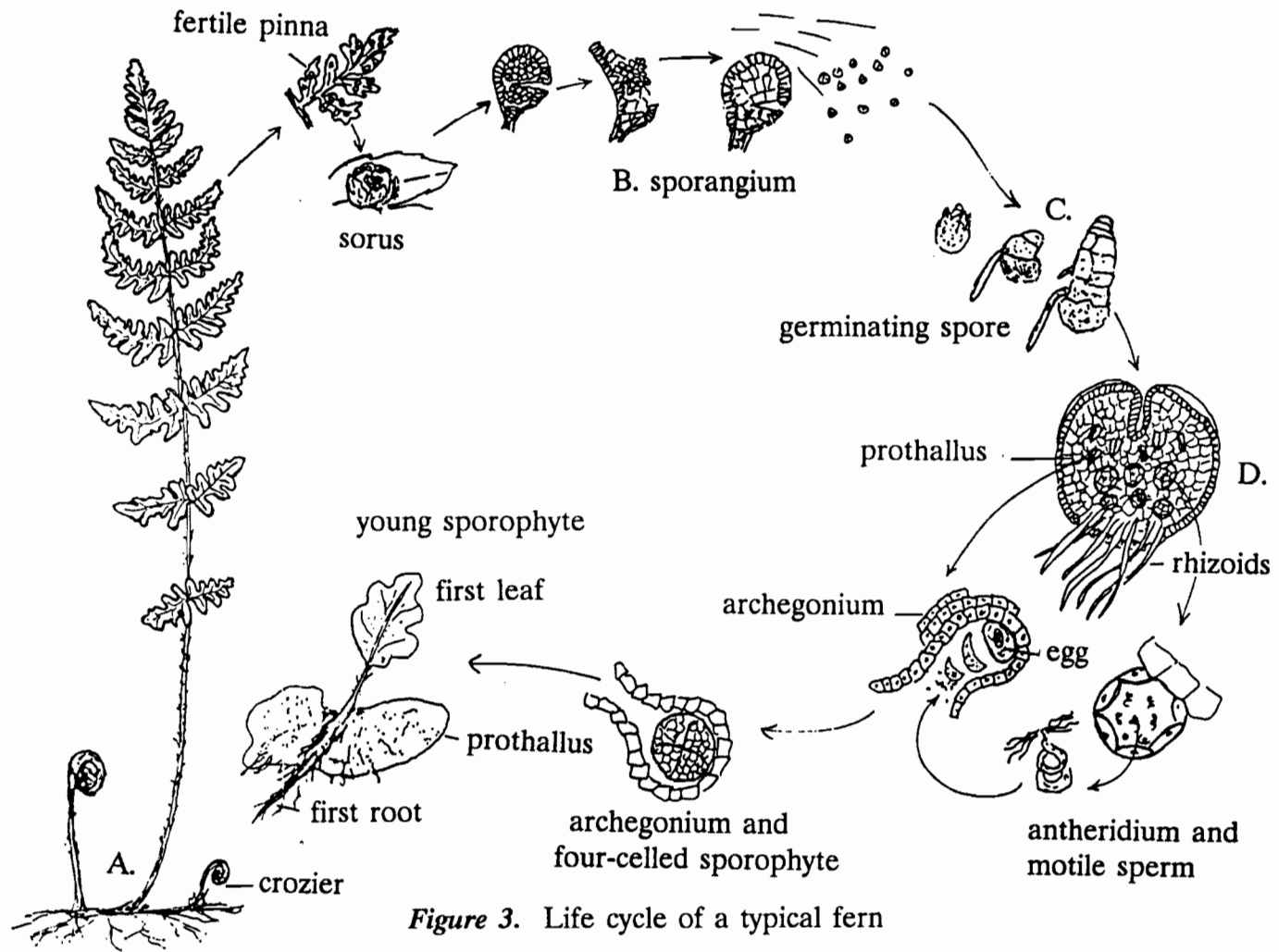


Figure 3. Life cycle of a typical fern

THE FERNS AND FERN ALLIES OF LBL

How to Identify Them

The following key is composed of group descriptions followed by a series of questions arranged in twos. As you examine the plant in question, select the best of the two questions. At the end of the question, the number of the next question will appear. If your choices are correct, you should arrive at a name and a small drawing of a plant which resembles your specimen. The drawings are not to scale. Consult the expanded description in which size information is given on the page number beside the name of the plant.

GROUP 1: FERN ALLIES

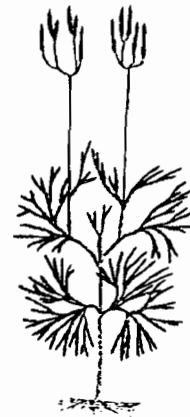
Plants producing neither flowers nor seeds; microscopic spores produced in terminal cones or in *axils* of leaves. "Leaves" scale-like and rudimentary, having one unbranched median vein. Some plants moss-like, rush-like or grass-like.

GROUP 2: TRUE FERNS

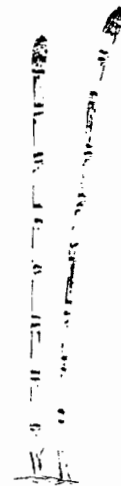
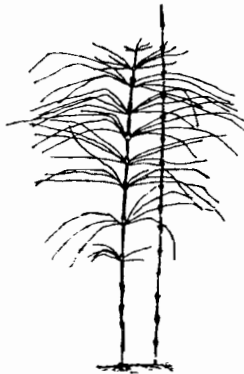
Plants producing neither flowers nor seeds; microscopic spores are produced on leaves or in specialized structures. Leaves, stems and roots present. Leaves simple to compound, having a well developed system of branching veins.

GROUP 1: FERN ALLIES

- 1. Plants creeping or branching from horizontal stems 2
- 1. Plants with erect jointed stems 3
 - 2. Plants minute and delicate. Examination with hand lens reveals two kinds of leaves Meadow Spike-moss, p. 27
 - 2. Plants with spreading, shiny evergreen branches; all leaves similar and scale like. Cones present at tips of some upright branches Fan Club-moss, p. 26



- 3. Fertile stems jointed and pinkish tan; sterile stems green, branched and under 18 inches tall Field Horsetail, p. 24
- 3. One type of stem only; evergreen (2-4 feet tall), bearing cone at apex Giant Horsetail, p. 25



GROUP 2: TRUE FERNS

1. Plants small, floating on water Eastern Mosquito Fern, p. 36

1. Plants not aquatic 2

2. Ferns with undivided fronds 3

2. Ferns with fronds once, twice or three times divided 4

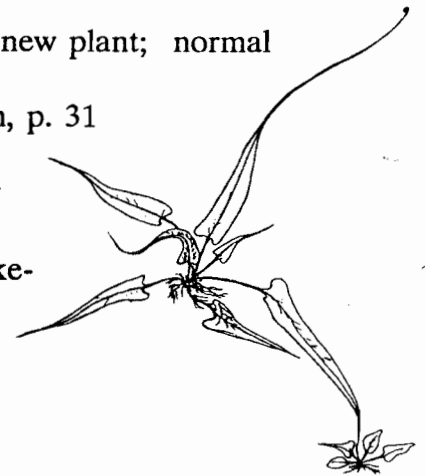


3. Fronds long-triangular, often rooting at tip producing new plant; normal habitat moist limestone ledges Walking Fern, p. 31



3. Fronds oval, sometimes long and slightly pointed. If fertile, producing a long spike-like structure bearing sporangia

. . . Adder's-tongue, p. 44



4. Fronds once-divided 5

4. Fronds more than once-divided 11

5. Pinnae not cut all the way to rachis, not attached by a separate short petiole (pinnatifid) 6

5. Pinnae attached by a short petiole; may be removed separately from rachis 7



6. Fronds large (14-30 inches), *dimorphic*; producing a persistent fertile frond. Usual habitat, terrestrial in moist shaded areas Sensitive Fern, p. 43

6. Fronds small (4-8 inches), forming dense colonies on tree trunks

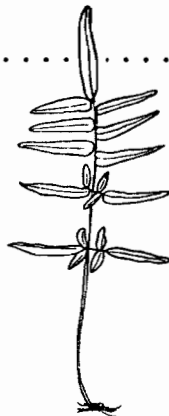
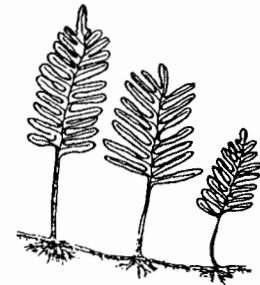
(*epiphytic*); infrequently on rocks (*epipetric*) . . . Resurrection Fern, p. 47

7. Pinnae on sterile frond all structurally similar 8

7. Pinnae structurally different with those lower on stipe being lobed at point of attachment

to stipe. Sori marginal. Ferns usually

epipetric Purple Cliff-brake, p. 46



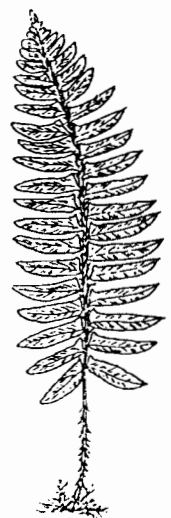
8. Most pinnae eared at point of attachment to stipe and finely toothed at margins; frond tough textured, not fragile. Sori forming a herringbone pattern on back

of pinnae are restricted to tips of tallest frond 9

8. Pinnae not eared, or only slightly eared; most pinnae opposite on stipe or nearly so; margins on pinnae smooth, not toothed 10

9. Stipe purplish-black; sori forming herringbone pattern on back of pinnae Ebony Spleenwort, p. 29

9. Stipe green and somewhat rough and scaly; sori confined to tips of some frondsChristmas Fern, p. 48



- 10. Stipe purplish-black; fern small (6-10 inches), usually on limestone bluffs Blackstem Spleenwort, p. 30

- 10. Stipe green, frond large and thin textured. Fertile pinnae narrower than sterile; usually in deep woods . . . Glade Fern, p. 34



- 11. Fertile fronds producing a spike of sporangia from apex of plant 12
- 11. Fertile fronds containing sori on back of pinnae, not bearing an *apical* spike 13

- 12. Fronds large, 3-5 feet; pinnules attached to pinnae by short petioles; normal habitat, swamps Royal Fern, p. 45



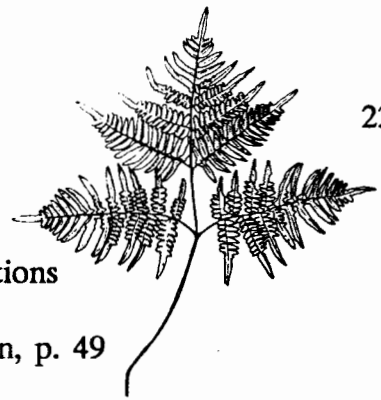
- 12. Fronds small, three times divided Grape ferns, pp. 37-39

- 13. Fronds somewhat leathery in texture, not thin and delicate 14
- 13. Fronds thin, do not appear to be evergreen 15

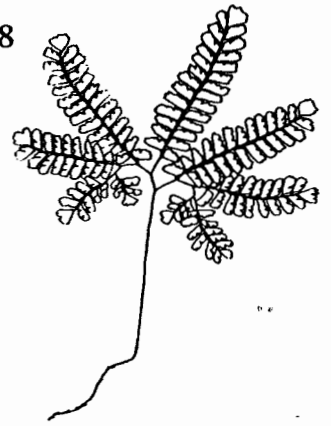
- 14. Fern small (2-4 inches); habitat, crevices of limestone Wall-rue, p. 32



- 14. Fronds large (15-30 inches), broadly triangular, and tough textured. Often forming dense populations along roadsides Eastern Bracken Fern, p. 49



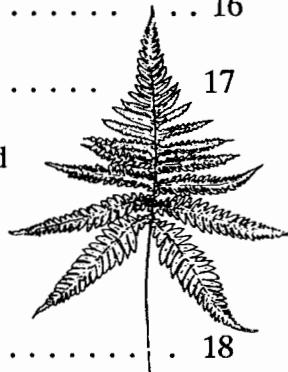
- 15. Fronds branching into separate pinnae fanned along top of smooth, purplish-black stipe Maiden-hair fern, p. 28



- 15. Pinnae either arranged evenly up and down stipe or forming a broad triangle 16

- 16. Basal pinnae not reflexed 17

- 16. Basal pinnae reflexed; frond a broad triangle . . . Broad Beech Fern, p. 50



- 17. Stipe smooth and *glabrous* 18

- 17. Stipe hairy, scaly, or scurfy 19

- 18. Fern tall, usually growing in swampy woods Marsh Fern, p. 51



- 18. Fern small, easily broken; habitat moist woods or limestone bluff; may have small green bulbs on back of frond; sori round Lowland Brittle or Bulblet Fern, pp. 41-42



19. Hairs confined to stipe and rachis; frond relatively free of hairs 20

19. Hairs dense on both stipe and pinnae Hairy Lip Fern, p. 40



20. Subdivisions of pinnae blunt; not irregularly toothed or notched 21

21. Subdivisions of pinnae having fringe-like edges; irregularly toothed or notched Lady Fern, p. 33



21. All pinnae pinnatifid; sori long and straight Silvery Glade Fern, p. 35



21. Some pinnae bi-pinnatifid; sori round Blunt-Lobed Woodsia, p. 52

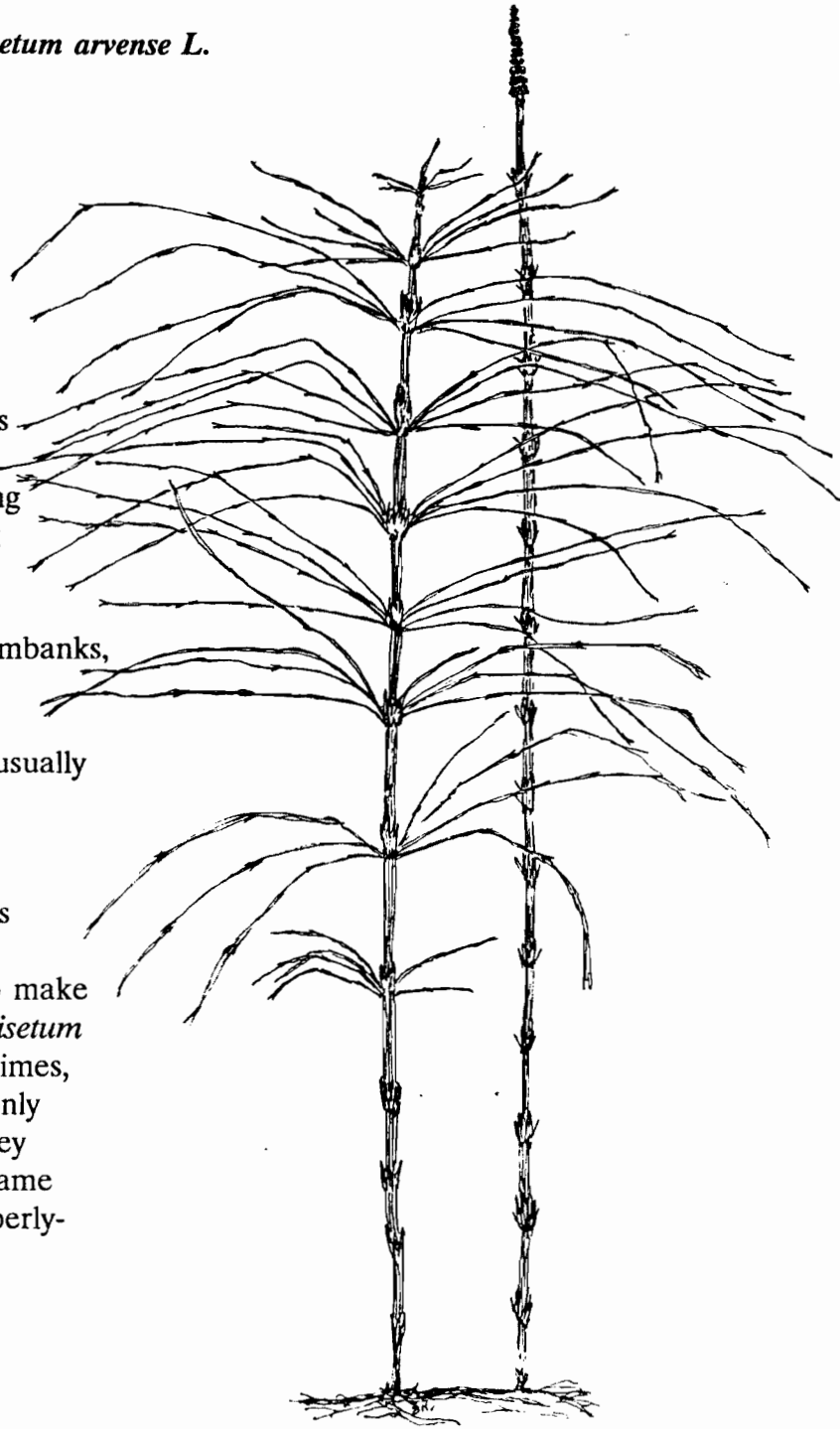
FIELD HORSETAIL, SCOURING-RUSH*Equisetum arvense* L.

DESCRIPTION: stem usually less than 18 inches tall, *dimorphic*: fertile stem pink to tan, appearing before sterile stem and vanishing soon after spores are shed.

HABITAT: open meadows, streambanks, and lakeshores.

LBL DISTRIBUTION: rare, but usually in large stands when found.

NOTE: the stems of *Equisetum* have a high mineral content; this quality was first noted by Indians who bound the stems together to make scouring brushes; the name *Equisetum* comes down to us from ancient times, for it was said the Romans not only ate these plants for the starch they contained, but gave them their name after their resemblance to a properly-tied horse tail.



GIANT HORSETAIL, SCOURING-RUSH

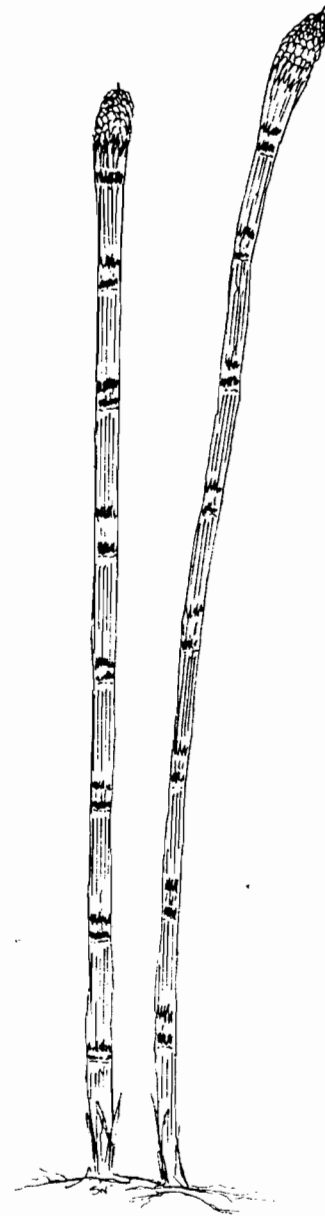
Equisetum hyemale var. *affine* (Engelm.) A. A. Eaton

DESCRIPTION: evergreen stems ridged, unbranched and jointed; joints surrounded by toothed sheaths; stems 2-4 feet tall, bearing cones at apex.

HABITAT: sandy streambanks.

LBL DISTRIBUTION: known only from Panther and Lost Creek in southern LBL.

NOTE: once used as an abrasive for scouring pots because of its high silica content; relatives of *Equisetum*, such as *Calamites*, grew 50 feet tall in ancient forests.



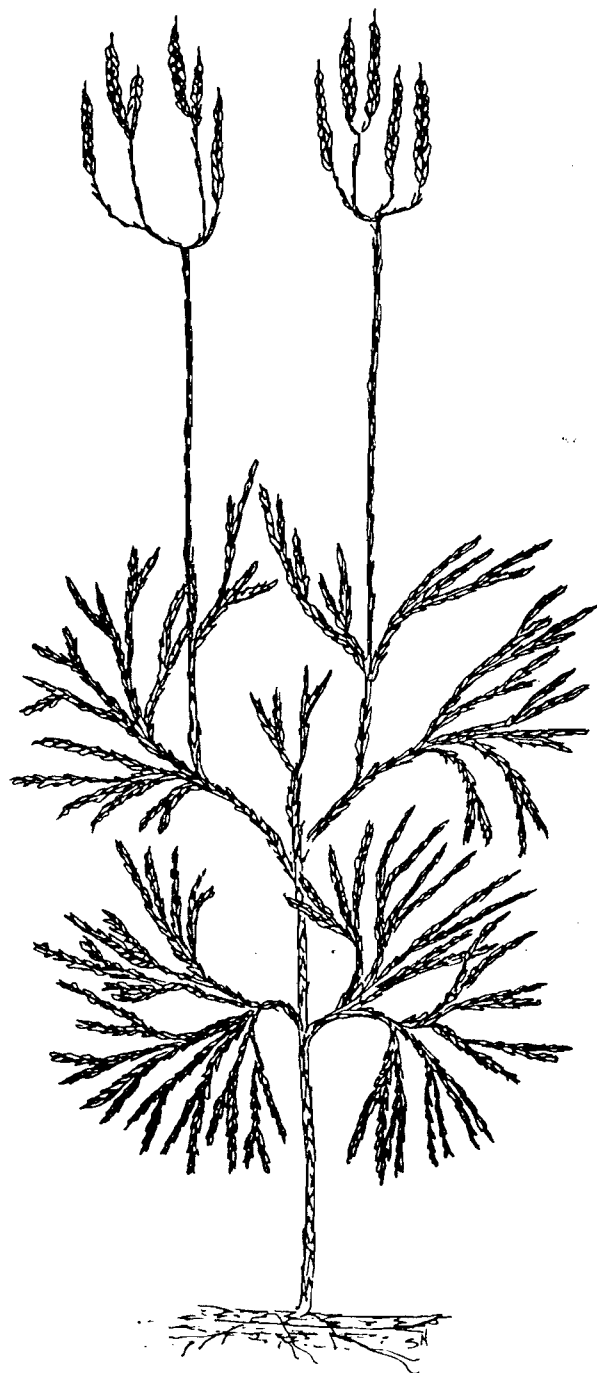
FAN CLUB-MOSS, GROUND-CEDAR*Lycopodium digitatum* Dillen. ex A. Braun

DESCRIPTION: flattened cedar-like evergreen branches (5-10 inches long) arising from a creeping horizontal stem; leaves scale-like and all of one kind; fertile branches bear slender spore-producing cones.

HABITAT: acid soil in mixed or hardwood forests; often but not always associated with pines or other evergreens.

LBL DISTRIBUTION: populations scattered throughout; infrequent.

NOTE: populations have been reduced by the use of ground-cedar as a Christmas decoration; ancient relatives of *Lycopodium* such as *Lepidodendron* and *Sigillaria* grew 100 feet high and were the giants of the coal-producing forests.

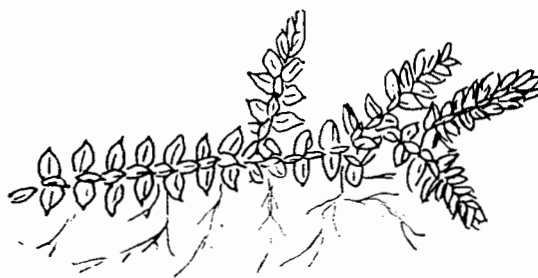


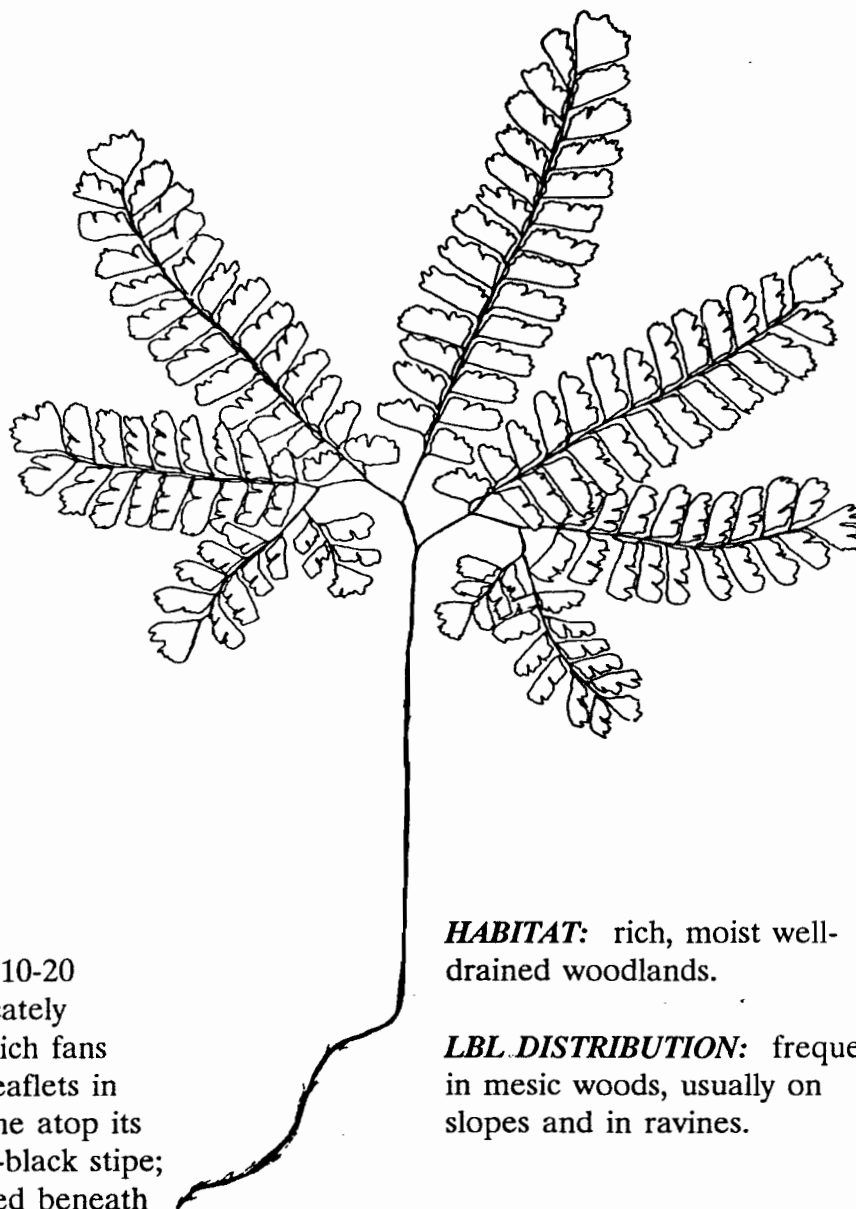
MEADOW SPIKE-MOSS***Selaginella apoda* (L.) Spring**

DESCRIPTION: a minute creeping moss-like plant with two types of leaves, each bearing a median unbranched vein; lateral leaves ovate (1.5 - 2 mm long), median leaves elliptical with acuminate apex; spores of two kinds are borne in loose flattened cones.

HABITAT: swamps, streambanks, damp meadows in neutral to slightly acid soil.

LBL DISTRIBUTION: along many streambanks, scattered throughout.



NORTHERN MAIDEN-HAIR*Adiantum pedatum* L.**DESCRIPTION:**

relatively large (10-20 inches) but delicately graceful fern which fans 8-10 bipinnate leaflets in a horizontal plane atop its smooth purplish-black stipe; sori are concealed beneath the incurled margins of the pinnae.

HABITAT: rich, moist well-drained woodlands.

LBL DISTRIBUTION: frequent in mesic woods, usually on slopes and in ravines.

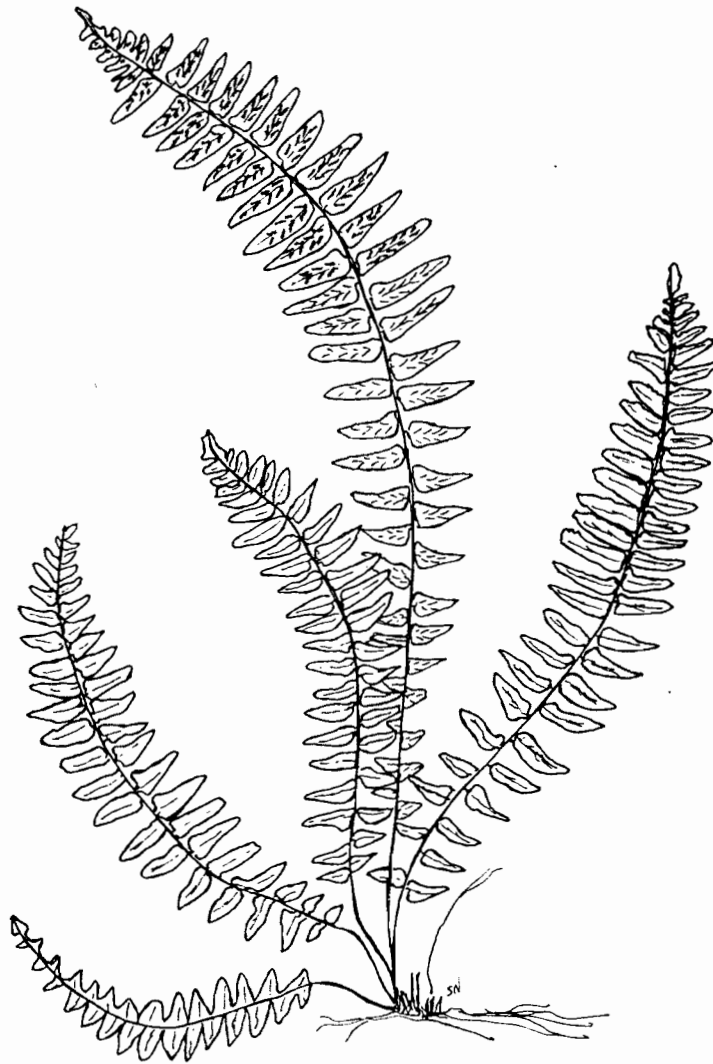
NOTE: the generic name *Adiantum* means "not wetted," referring to the shiny, glabrous fronds which shed raindrops readily.

EBONY SPLEENWORT

Asplenium platyneuron (L.) B.S.P.

DESCRIPTION: evergreen fronds up to 18 inches long; pinnae alternately placed along the purplish-black stipe; fronds upright and spreading, usually deeply incised but often nearly entire when immature.

HABITAT: *cosmopolitan*; grows best in moist woodlands, but can tolerate considerable dryness if shade is adequate.



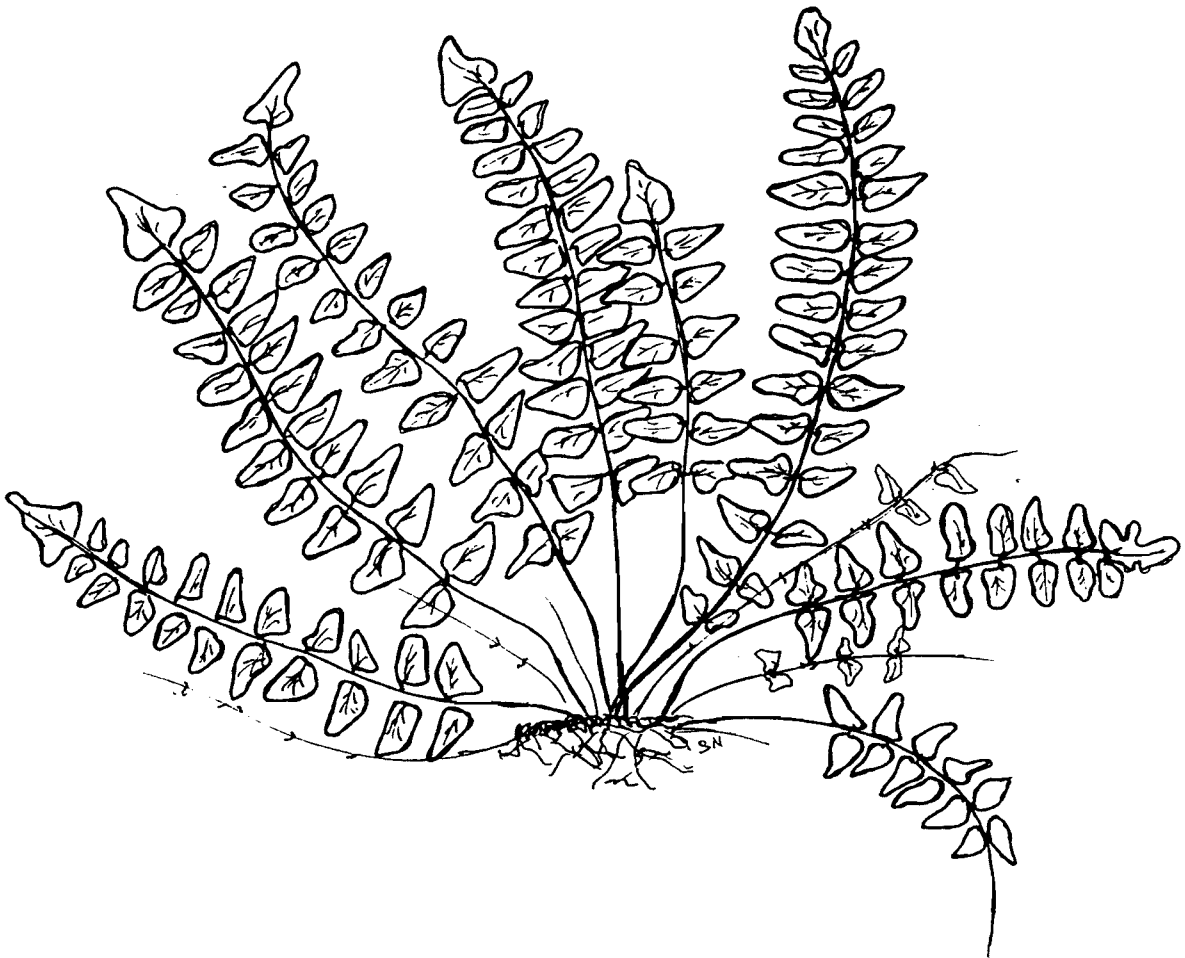
BLACKSTEM SPLEENWORT*Asplenium resiliens* Kunze

DESCRIPTION: small evergreen fern having upright pinnate fronds with stiff purplish-black stipe up to 10 inches long; pinnae opposite along the stipe.

HABITAT: shady, moist limestone outcroppings, frequently with northern exposure.

LBL DISTRIBUTION: infrequent to rare on limestone bluffs and outcroppings.

NOTE: slight resemblance to ebony spleenwort, which is far more commonly seen, but which has alternately arranged pinnae.





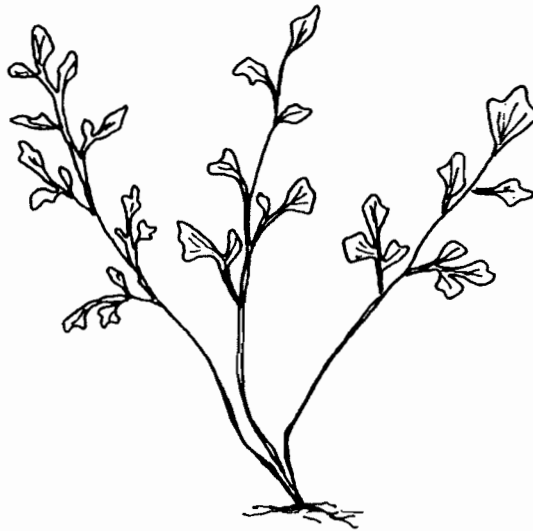
WALKING FERN

Asplenium rhizophyllum L.

DESCRIPTION: evergreen fronds (averaging 6 - 10 inches in length) undivided with a slender, long-triangular shape; rooting at tip to form new plants; sori long and straight following vein pattern on underside of leaf.

HABITAT: moist, shaded limestone bluffs.

LBL DISTRIBUTION: frequent on bluffs in mesic woodlands.

WALL-RUE***Asplenium ruta-muraria* L.**

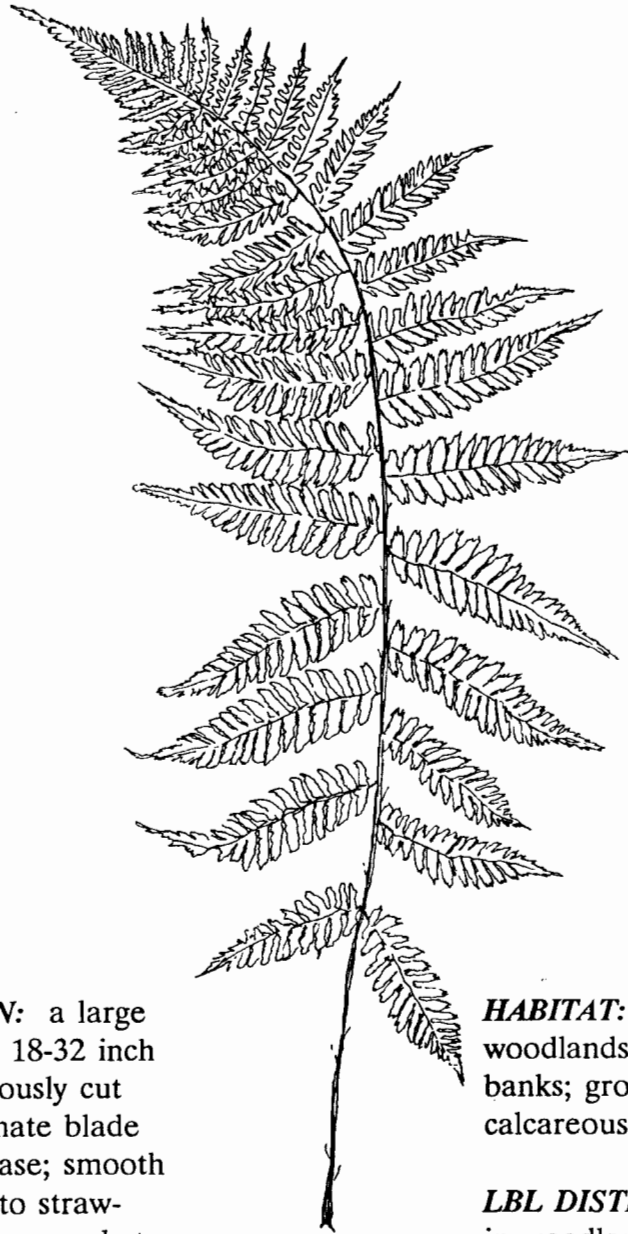
DESCRIPTION: a tiny fern with 2-4 inch twice-divided fronds; evergreen.

HABITAT: crevices in moist, shaded limestone bluffs.

LBL DISTRIBUTION: rare; known from only one site in LBL.

LADY FERN

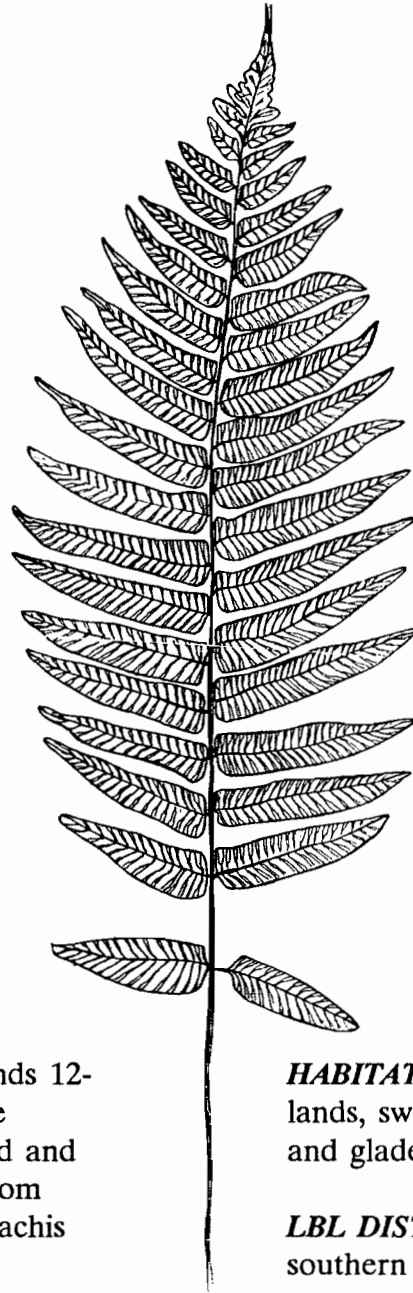
Athyrium filix-femina subsp. asplenioides (Michx.) Hulten



DESCRIPTION: a large graceful, lacy, 18-32 inch fern with variously cut pinnae; bipinnate blade widest near base; smooth stipe reddish to straw-colored; sori somewhat crescent shaped forming herringbone pattern on back of frond.

HABITAT: moist to swampy woodlands and wooded stream-banks; grows best in non-calcareous soils.

LBL DISTRIBUTION: frequent in woodlands and shaded stream-banks throughout.

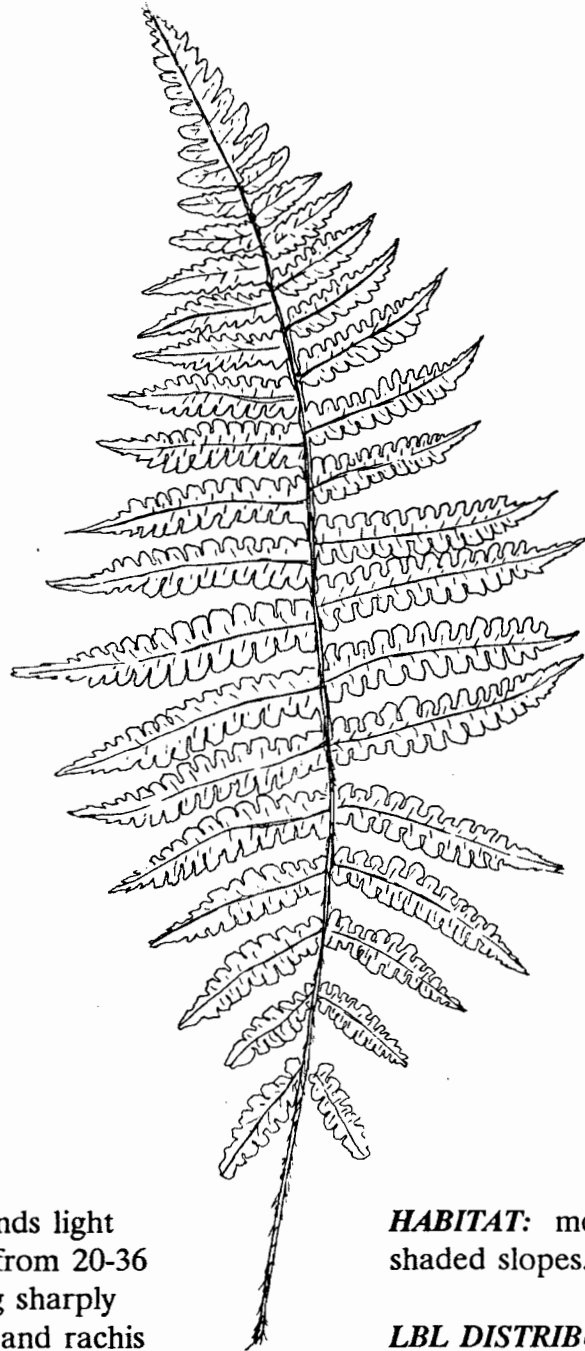
GLADE FERN*Athyrium pycnocarpon* (Spreng.) Tidestr.

DESCRIPTION: fronds 12-24 inches long; blade pinnate; thin textured and tapering toward bottom of blade; stipe and rachis green.

HABITAT: mesic woodlands, swampy thickets and glades.

LBL DISTRIBUTION: rare, southern areas only.

NOTE: glade fern has a superficial resemblance to Christmas fern, but its thinner texture and deciduous nature readily distinguish it.

SILVERY GLADE FERN***Athyrium thelypteroides* (Michx.) Desv.**

DESCRIPTION: fronds light green and delicate, from 20-36 inches long, tapering sharply at both ends; stipe and rachis green, covered with abundant fine hairs; sori long and straight with silvery coverings.

HABITAT: moist woods and shaded slopes.

LBL DISTRIBUTION: rare in streambank forests southward.

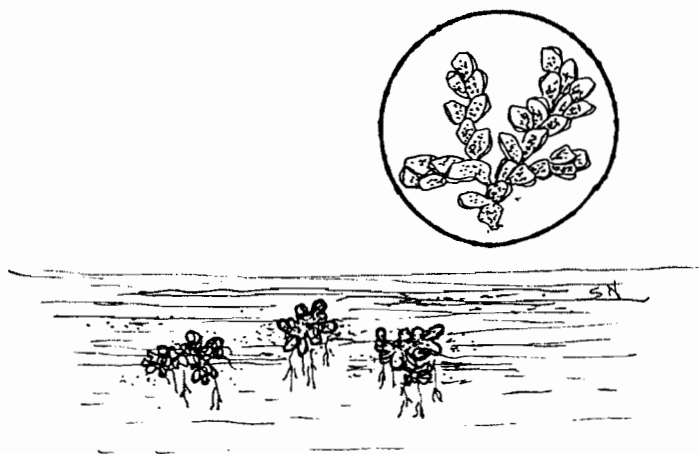
EASTERN MOSQUITO FERN*Azolla caroliniana* Willd.

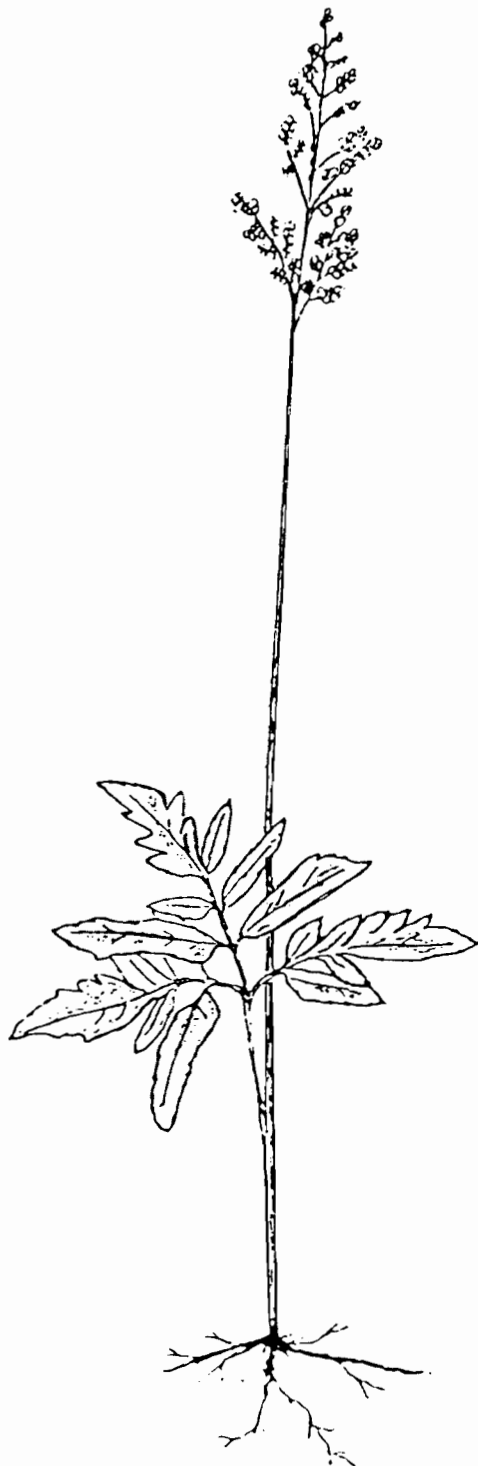
DESCRIPTION: plants small, mostly less than one-half inch long, aquatic, free-floating; fragile branched rhizome bearing alternate fronds; leaves minute (about one-thirty-second inch long) borne in two rows, each leaf composed of two round lobes, the upper green, the lower colorless; male and female *gametes* produced in separate round structures located in leaf axils; air trapped in small pockets between fronds keeps plants afloat.

HABITAT: quiet water or mud near the water's edge.

LBL DISTRIBUTION: found in a few swamps and lowland pools.

NOTE: no ferns should be confused with this species but small aquatic Angiosperms, such as duckweed, might be mistaken for it except in the fall when *Azolla* turns a distinctive red; cultivated for use in decorative aquaria, this fern can grow so densely in fresh waters that mosquitoes cannot penetrate the mass of fronds, hence the common name; the presence of *Anabaena azollae*, a blue-green alga which *fixes* atmospheric nitrogen, growing symbiotically beneath the surface of *Azolla*'s lower leaves, has led to its introduction into rice paddies.



SPARSE-LOBED GRAPE FERN***Botrychium biternatum* (Sav.) Underw.**

DESCRIPTION: bi-pinnate fronds appearing in late summer, triangular, 5-10 inches long; evergreen, somewhat bronze-colored in winter; sporangia borne on an aerial stalk arising from base of stipe.

HABITAT: mesic, usually low woods.

LBL DISTRIBUTION: scattered throughout; often in large numbers.

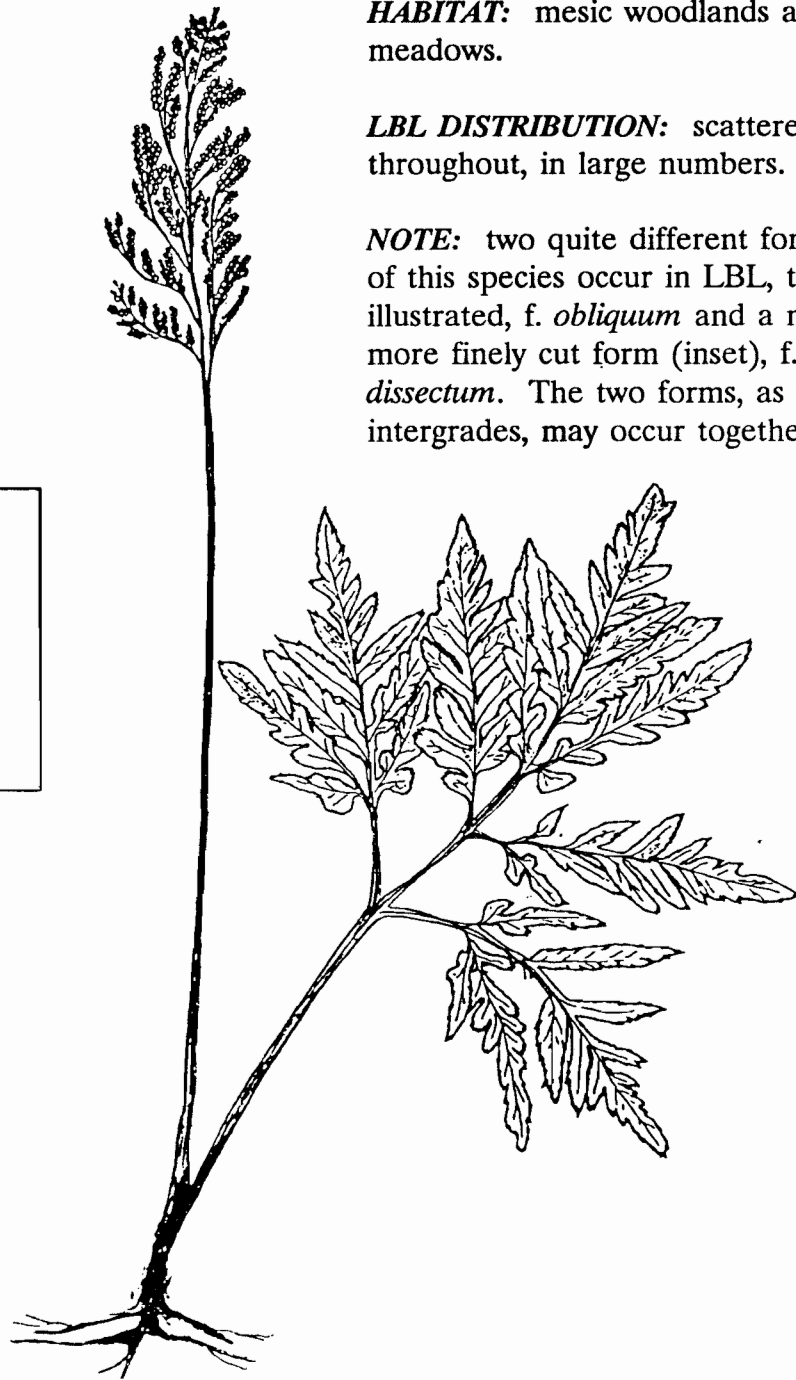
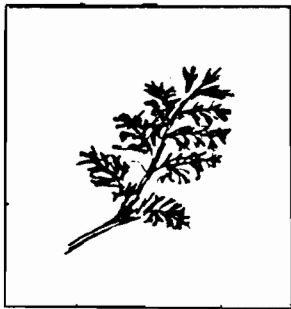
LACE-FROND GRAPE FERN***Botrychium dissectum* Spreng.**

DESCRIPTION: fronds triangular, 4-8 inches long, bi-pinnate, tripinnate at base; appearing in late summer, becoming bronze colored after frost; aurally borne sporangia arising from base of stalk.

HABITAT: mesic woodlands and meadows.

LBL DISTRIBUTION: scattered throughout, in large numbers.

NOTE: two quite different forms of this species occur in LBL, the one illustrated, f. *obliquum* and a much more finely cut form (inset), f. *dissectum*. The two forms, as well as intergrades, may occur together.

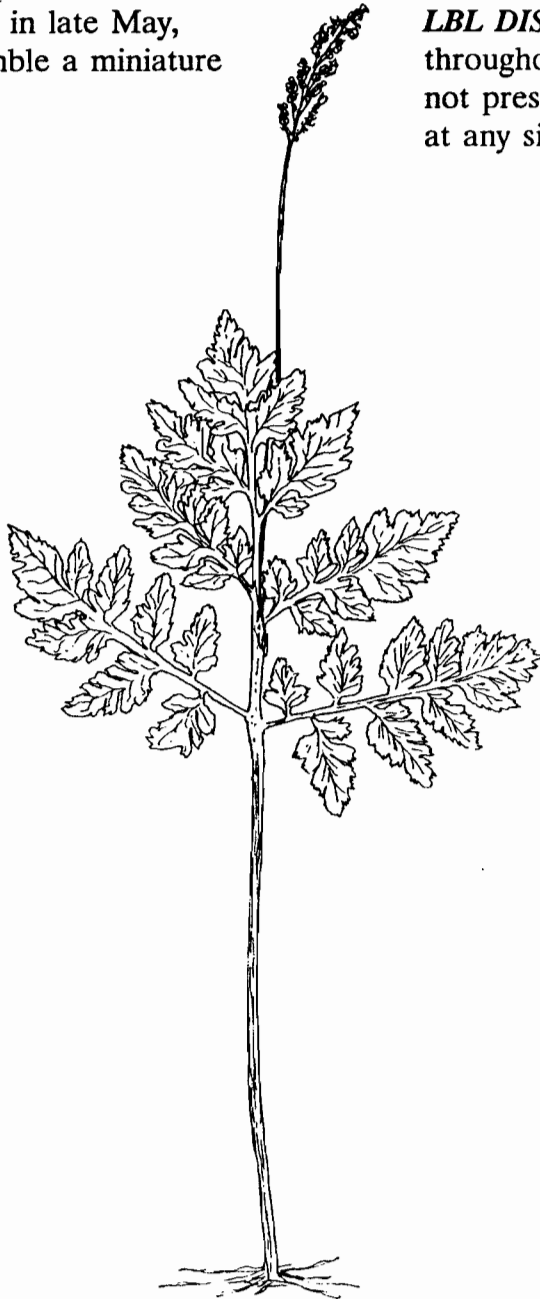


RATTLESNAKE FERN, VIRGINIA GRAPE-FERN***Botrychium virginianum* (L.) Swartz**

DESCRIPTION: stems producing one deciduous frond per season; fronds tripinnate-pinnatifid bearing sporangia in late May, maturing to resemble a miniature bunch of grapes.

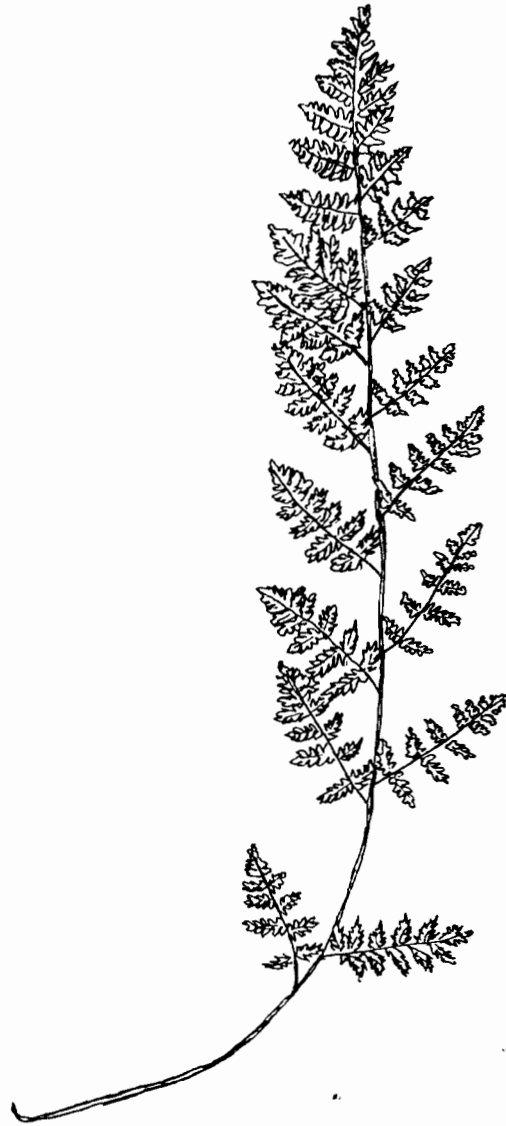
HABITAT: moist woods with deep humus.

LBL DISTRIBUTION: common throughout the area, though not present in large numbers at any site.



HAIRY LIP FERN

Cheilanthes lanosa (Michx.) D.C. Eaton



DESCRIPTION: fronds pinnate-pinnatifid to tripinnate with chestnut stipe (to 16 inches tall); a dense covering of soft hairs makes this species rather easy to recognize; inrolled edges of pinnules covering sporangia account for name, lip fern.

HABITAT: sunny, dry, limestone outcroppings.

LBL DISTRIBUTION: infrequent on bluffs throughout.

BULBLET FERN

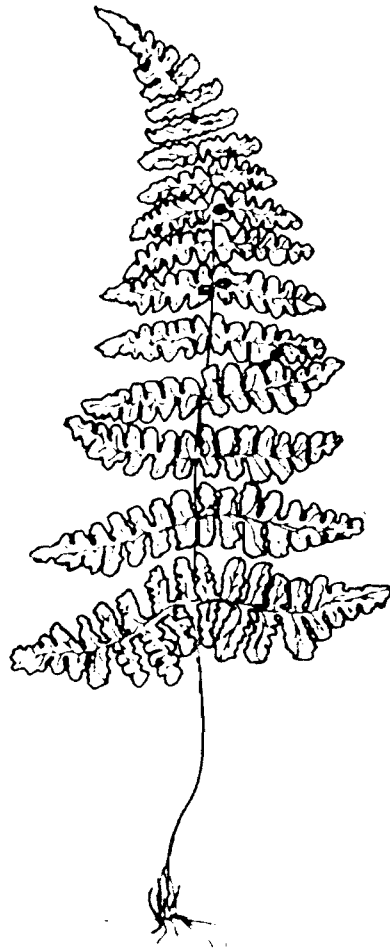
Cystopteris bulbifera (L.) Bernh.

DESCRIPTION: fronds are thin, light green and frequently *pendant* or reclining; small green bulblets may be present on underside of mature fronds; these bulblets, which drop off easily, are a means of vegetative propagation.

HABITAT: *epipetric* on limestone in moist shaded woodlands.

LBL DISTRIBUTION: rare on moist limestone bluffs southward.

NOTE: *Cystopteris* species may be distinguished from *Woodsia* by the invariable presence of hairs and minute scales on the stipe of the latter; a frond of bulblet fern without bulblets could not be distinguished from *C. protrusa* without microscopic examination.



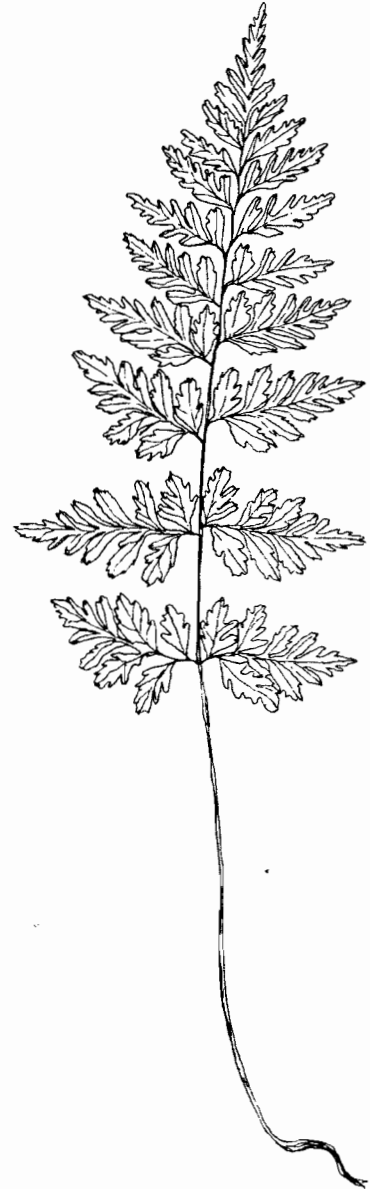
LOWLAND BRITTLE FERN***Cystopteris protrusa* (Weath.) Blasdell**

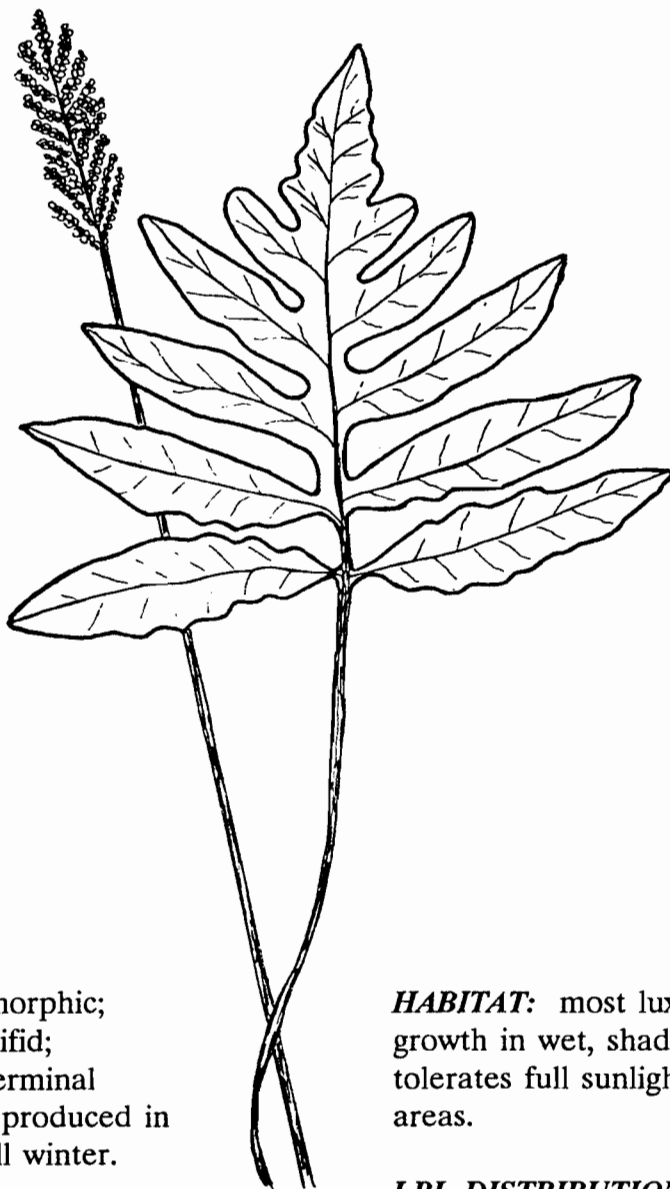
DESCRIPTION: a fragile fern breaking easily at base; fronds 6-14 inches long; stipe smooth and green without hairs.

HABITAT: terrestrial in mesic woodlands.

LBL DISTRIBUTION: abundant throughout.

NOTE: distinguished from *Woodsia obtusa* by the absence of scales on stipe, and from *Cystopteris bulbifera* by that fern's pendant growth habit, bulbs on underside of frond and more glandular surface.



SENSITIVE FERN*Onoclea sensibilis* L.

DESCRIPTION: dimorphic; sterile fronds pinnatifid; fertile fronds with terminal bead-like sporangia produced in fall and persisting all winter.

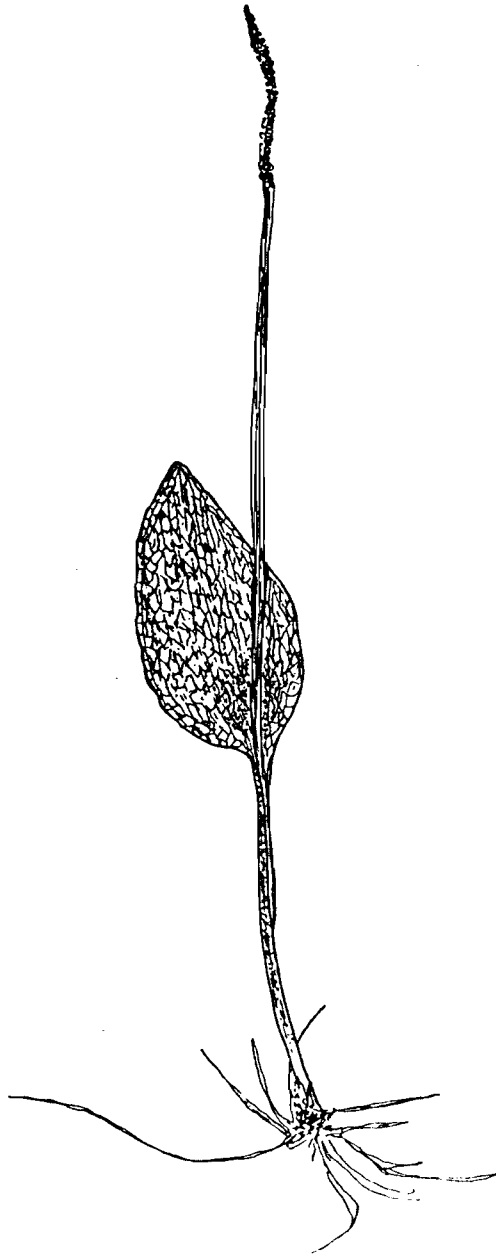
NOTE: the name "sensitive" derives from the fern's extreme sensitivity to frost and freezing temperatures.

HABITAT: most luxuriant growth in wet, shaded areas, but tolerates full sunlight in mesic areas.

LBL DISTRIBUTION: frequent in field edges, stream and swampy borders, and any shaded or open moist area.

ADDER'S TONGUE

Ophioglossum pycnostichum (Fern.) Love & Love

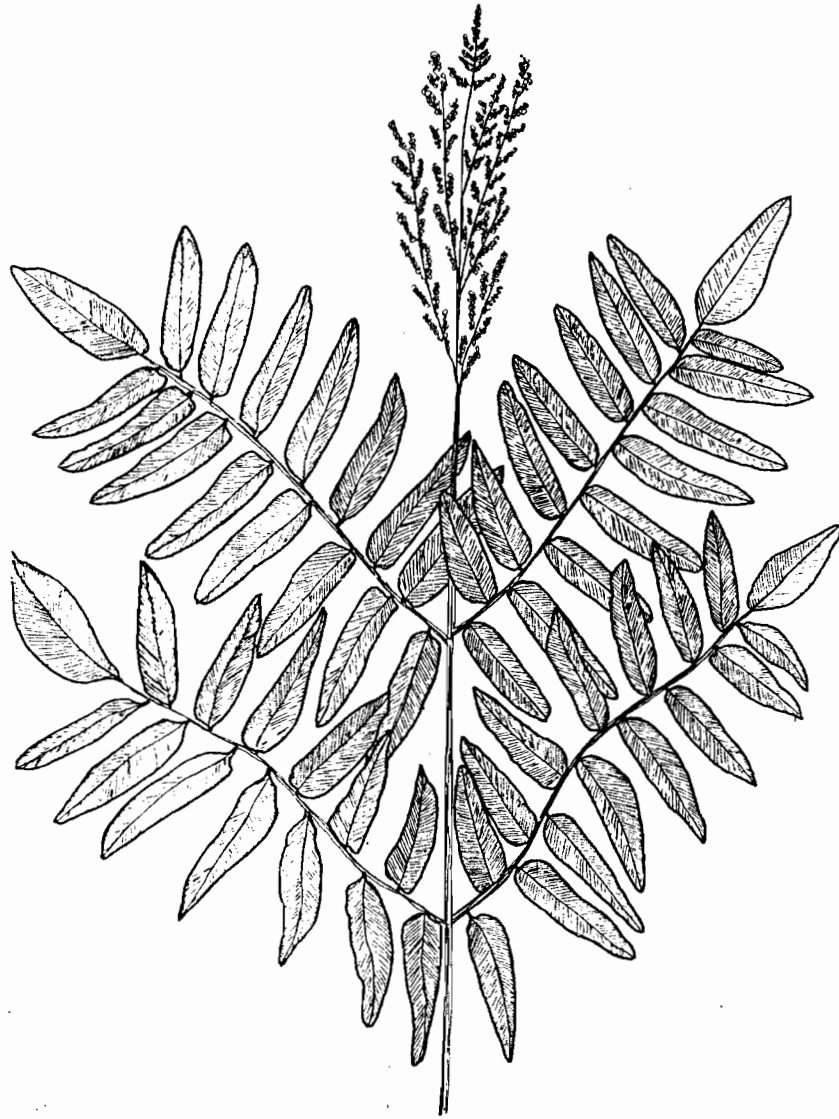


DESCRIPTION: tongue-like fertile stalk borne by thick broad blade appearing in May or June and vanishing in late summer.

HABITAT: wet lowlands.

LBL DISTRIBUTION: found in several localities as small colonies or isolated plants; infrequent.

NOTE: *Ophioglossum engelmannii*, a similar but very rare species, can be distinguished by a more narrow but longer blade which bears a spine-like tip at its apex (inset).



ROYAL FERN

Osmunda regalis var. spectabilis (Willd.) A. Gray

DESCRIPTION: bipinnate fronds 3-5 feet tall; dimorphic with highly modified terminal portion producing sporangia in May and June.

HABITAT: swampy woods.

LBL DISTRIBUTION: large stands occur in a few swampy areas.

NOTE: a giant among ferns, royal fern is in demand by orchid fanciers for *Osmunda* fiber, the wiry black root growth, an ideal potting medium for orchids.

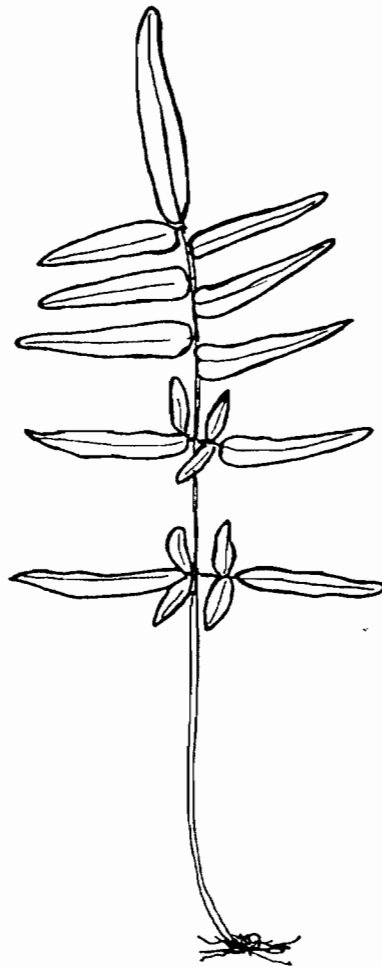
PURPLE CLIFF-BRAKE

Pellaea x atropurpurea (L.) Link

DESCRIPTION: evergreen fern with brittle, wiry purplish-black stipe covered by short hairs; leaflets dull bluish-green, bearing marginal sporangia on lower surface.

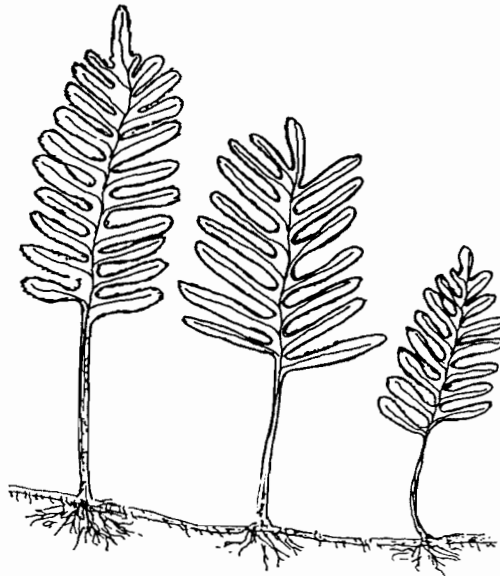
HABITAT: limestone cliffs and ledges, often *xeric*.

LBL DISTRIBUTION: infrequent.



RESURRECTION FERN

Polypodium polypodioides var *michauxianum* Weath.

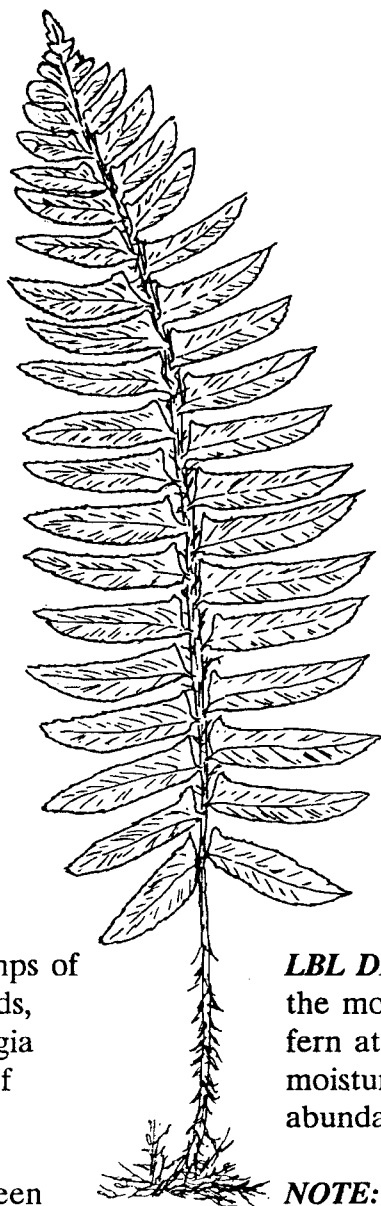


DESCRIPTION: fronds pinnatifid, tough and leathery, less than 6 inches long; sori in mounds on underside of fronds; surface is dotted with small scales; rhizomes forming dense mats on trees.

HABITAT: one of the more unusual ferns in the area in that it is *epiphytic* on the trunk and branches of rough-barked trees such as elm; also may be found *epitric* on limestone outcroppings.

LBL DISTRIBUTION: scattered throughout.

NOTE: in dry season, fronds appear dead, brown and curled up, but become fresh and green in a matter of hours after a rain, giving this fern its common name.

CHRISTMAS FERN*Polystichum acrostichoides* (Michx.) Schott

DESCRIPTION: dense clumps of 1-2 foot tall evergreen fronds, having scaly stipes; sporangia borne on terminal pinnae of taller fronds.

HABITAT: *cosmopolitan*; seen most frequently on rim of gullies or streambanks.

LBL DISTRIBUTION: probably the most frequently encountered fern at any site with enough moisture to support fern growth; abundant throughout the area

NOTE: the common name Christmas fern, may be derived from its availability for Christmas decorations because of its evergreen nature, or from the stocking-like shape of individual pinnae along the rachis.

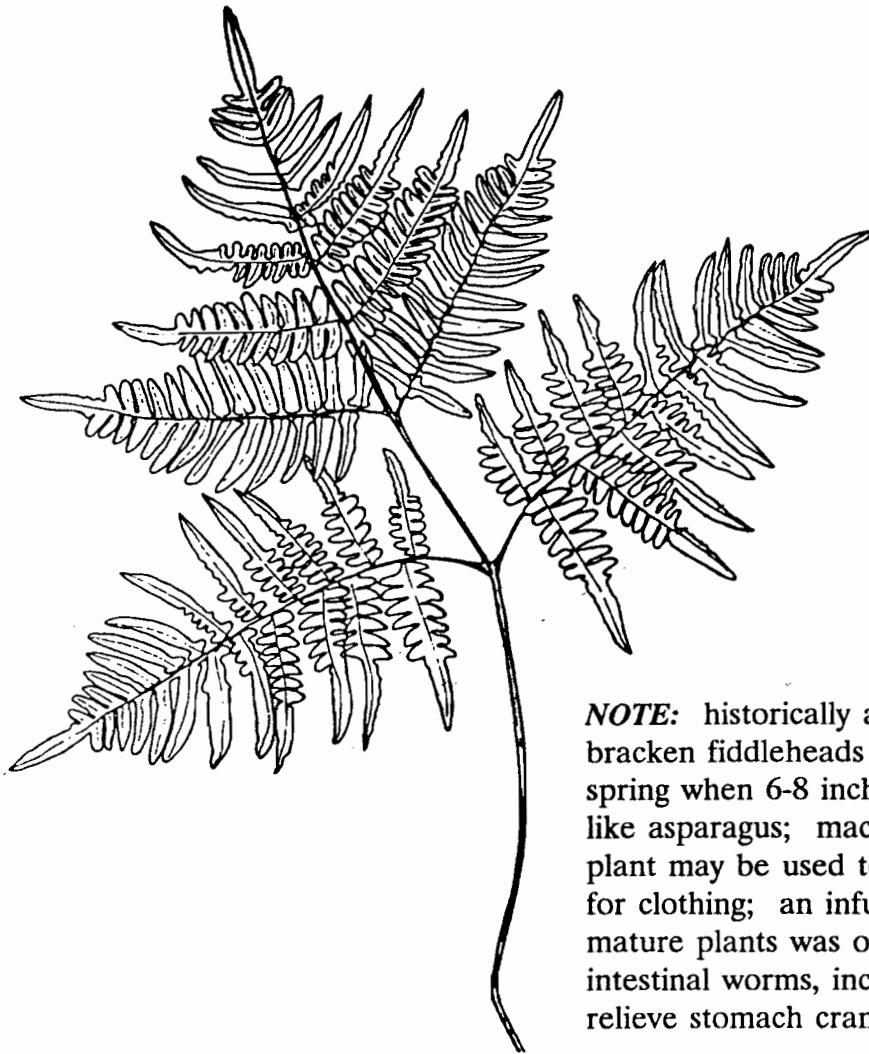
EASTERN BRACKEN FERN

Pteridium aquilinum var. latiusculum (Desv.) Underw.

DESCRIPTION: fronds coarse, medium to large, up to 30 inches tall; blade bipinnate-pinnatifid to tripinnate, broadly triangular, with marginal sori beneath recurved pinnae; winter-killed fronds often seen standing golden-brown along roadsides.

HABITAT: dry, sunny roadsides to partly shaded knolls and uplands.

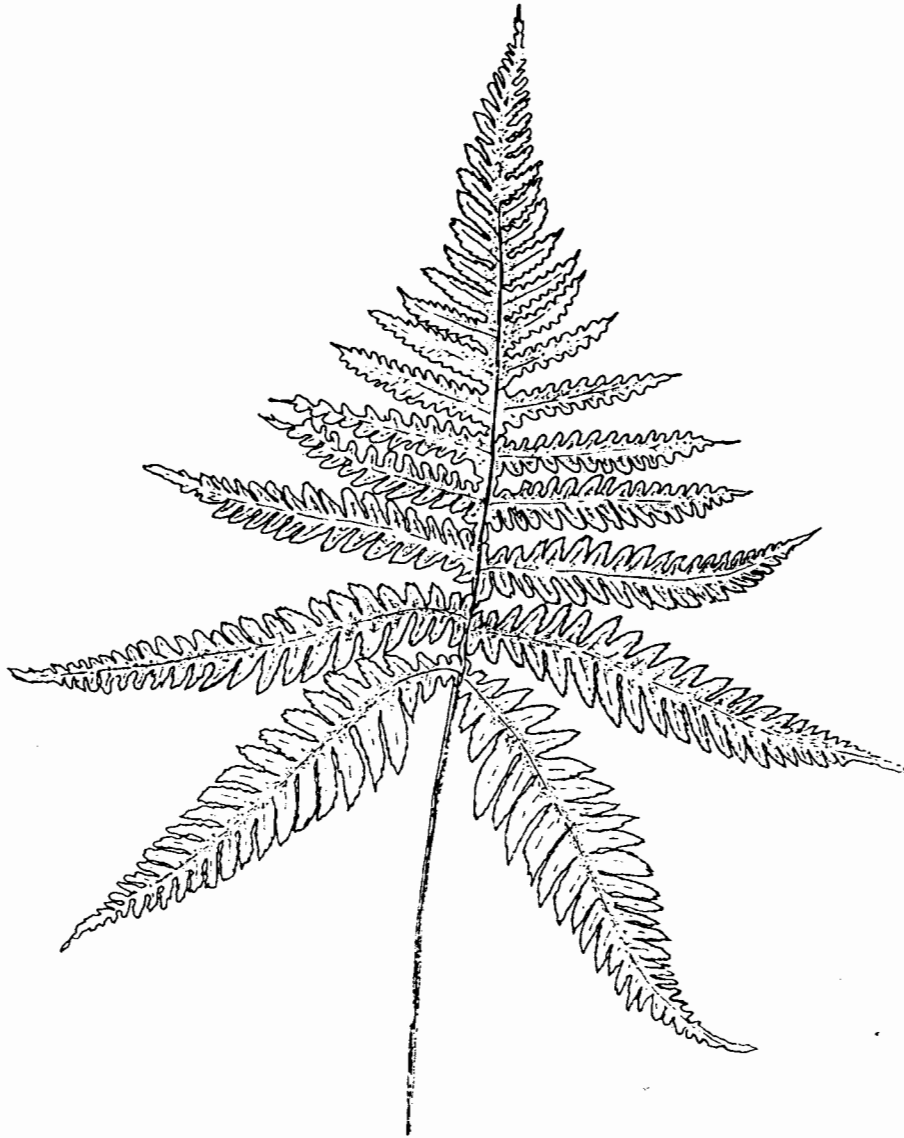
LBL DISTRIBUTION: frequent in large populations along roadsides and in dry woods throughout the area.



NOTE: historically a rather useful fern; bracken fiddleheads may be harvested in spring when 6-8 inches tall and cooked like asparagus; macerated pieces of the plant may be used to produce a yellow dye for clothing; an infusion made by brewing mature plants was once used to expel intestinal worms, increase urine flow, and relieve stomach cramps.

BROAD BEECH FERN

Thelypteris hexagonoptera (Michx.) Weath.



DESCRIPTION: deciduous fronds 15-20 inches tall; blade bipinnatifid, broadly triangular; all pinnae connected by wing on rachis; lower pinnae noticeably *reflexed*; sori small and round.

HABITAT: moist woods with deep humus.

LBL DISTRIBUTION: *cosmopolitan*.

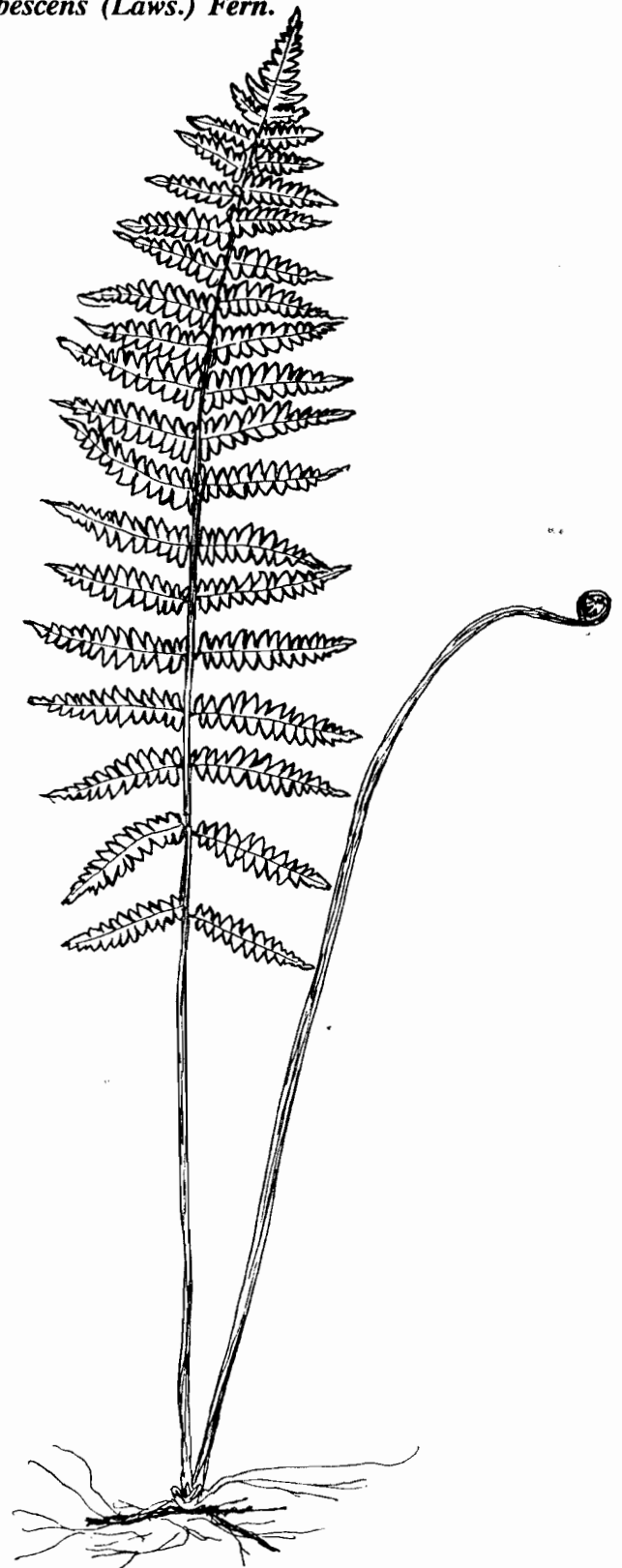
MARSH FERN

Thelypteris palustris var. *pubescens* (Laws.) Fern.

DESCRIPTION: deciduous fronds 18-30 inches tall; blade pinnate-pinnatifid; pinnae not tapering toward base of blade; fertile fronds with inrolled edges covering sori.

HABITAT: wet meadows and swamps.

LBL DISTRIBUTION: rare, though may be abundant where found.



BLUNT-LOBED WOODSIA***Woodsia obtusa* (Spreng.) Torrey**

DESCRIPTION: fronds 8-14 inches tall; blade bipinnate; rachis scaly; sori round.

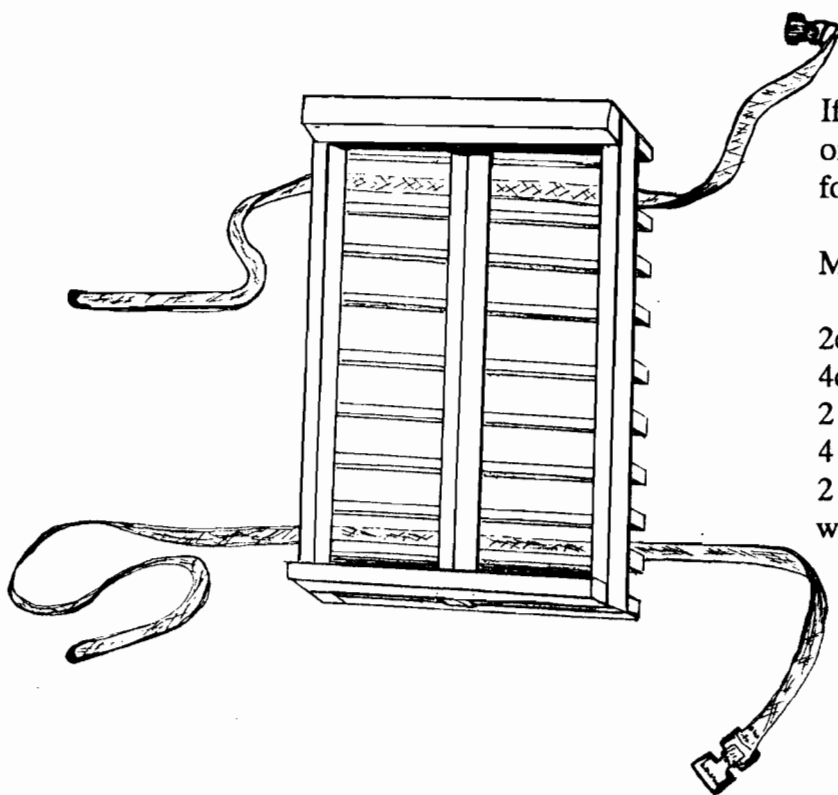
HABITAT: shaded cliffs and *calcareous* rock ledges as well as streambanks and base of shaded slopes.

LBL DISTRIBUTION: one of the most common ferns encountered in the area; dense populations are frequently found.

NOTE: except for its rougher texture and scaly rachis, *Woodsia obtusa* closely resembles *Cystopteris* species; a hand lens will reveal, however, that woodsia's small veins stop short of the leaf margin while those of the lowland brittle fern extend to the margin.

APPENDIX

PREPARING A FERN STUDY SET



If a plant press is not available, one may be constructed as follows:

Materials:

2d finishing nails
 4d common nails
 2 (8') 1" x 1 1/2" stock
 4 (8') 1" x 1/2" stock
 2 (60") webbing straps with fasteners

Directions: (for one side of the press)

From the 1" x 1 1/2" stock, cut three 24" strips and two 15 1/2" strips. From the 1" x 1/2" stock, cut ten 15 1/2" strips.

Arrange the three 24" strips in a parallel row with 6" between them. Using the 2d finishing nails, fasten a 15 1/2" strip of the 1" x 1/2" stock across each end. Space the other eight 15 1/2" strips of the 1" x 1/2" material evenly at approximately two inch intervals to complete the frame. Turn the frame over and using 4d nails, fasten a 15 1/2" strip of the 1" x 1 1/2" stock across each end.

To dry plants place a piece of cardboard the size of the press, then a sheet of newspaper, then the plant, followed by another sheet of newspaper and cardboard. Repeat the process for each plant to be dried. When the press is loaded, strap it tightly and allow the plants to dry for several days.

Since it is not always practical to take students into the field to identify plants in their natural habitat, preparation of a permanent study set of specimens

for use in the lab provides a follow-up reinforcement for students learning to recognize plants in the field as well as an excellent means of evaluating students' progress.

Simple study specimens of ferns may be prepared by mounting well-pressed dry fronds on posterboard and covering them with clear Con-tact. Four specimens may be made from a sheet of standard size 22" x 28" posterboard. Have a team of students lower a sheet of Con-tact onto a fern pre-positioned on posterboard. Trim edges.

Labels containing collection data such as name, date, and location should be placed on the back so students may review and test one another without seeing the label.

It is not necessary (or desirable) to collect the fern's rhizome when you prepare your specimens. Care should be taken not to deplete any population of a fern species at any given site, and ferns described as rare in this guide should not be collected at all. If available, place both fertile and sterile fronds on the same sheet. The sori retain their diagnostic features well and can be examined easily through the Con-tact by using a stereo-microscope. Mounted specimens may be photocopied with good results.

This technique of preparing study specimens can also be used for flowering plants and leaves and allows a teacher to build a very useful insect-proof and student-proof "herbarium" for the classroom.

Building the plant press, pressing the plants, and making the study specimens are all excellent in-class or special project activities and make taxonomy a rewarding experience for all involved.

FERNS AND FERN ALLIES

A MAGIC BOX PUZZLE: Choose from the answer list the word which best completes each of the statements A-P below and write its number in the box. If you select the correct answers, you will find that the total of the numbers in each row across, down, the four corners, the four center boxes, and the diagonals will add to the same sum! Place this magic number in the space beside the box.

- A. Rattlesnake fern belongs to this group of ferns.
- B. This fern's leaves take small "steps" across a limestone bluff forming new plants at frond tips.
- C. A cosmopolitan species which closely resembles the bulblet and lowland brittle fern.
- D. These ferns usually have dark, purplish-black stems.
- E. Look for this fern around beaver ponds; you may find it.
- F. Listen carefully and this very unfern-like little plant may "hiss" at you as you pass by.
- G. A "fuzzy" fern of the dry, rocky ledges.
- H. A fern ally with ancient relatives of the Coal Age.
- I. Find it before frost or all you will find is its brown fertile leaf.
- J. Rain makes this fern "come back to life".
- K. Is it a fern or is it a mermaid's tresses spread out to dry?
- L. You may find this fern ally creeping through stands of pine or cedar, forming a beautiful evergreen ground-cover.
- M. A fern of the dry, open roadside.
- N. At home in the swamp, this fern is so large one might mistake it for a shrub.
- O. This fern hangs its "stockings" along its rachis to prepare for a special season.
- P. The only aquatic fern of Land Between The Lakes.

Answers:

1. Wall-rue
2. Selaginella
3. Silvery Glade Fern
4. Bracken Fern
5. Northern Maiden-hair
6. Horsetail
7. Walking Fern
8. Blunt-lobed Woodsia
9. Marsh Fern
10. Resurrection Fern
11. Eastern Mosquito Fern
12. Adder's-tongue Fern
13. Spleenwort ferns
14. Christmas Fern
15. Sensitive Fern
16. Purple Cliff-brake
17. Lycopodium, Fan Club-moss
18. Royal Fern
19. Grape ferns
20. Hairy Lip Fern
21. Lowland Brittle Fern
22. Bulblet Fern
23. Glade Fern
24. Lady Fern
25. Broad Beech Fern

A	B	C	D
E	F	G	H
I	J	K	L
M	N	O	P

MAGIC NUMBER _____

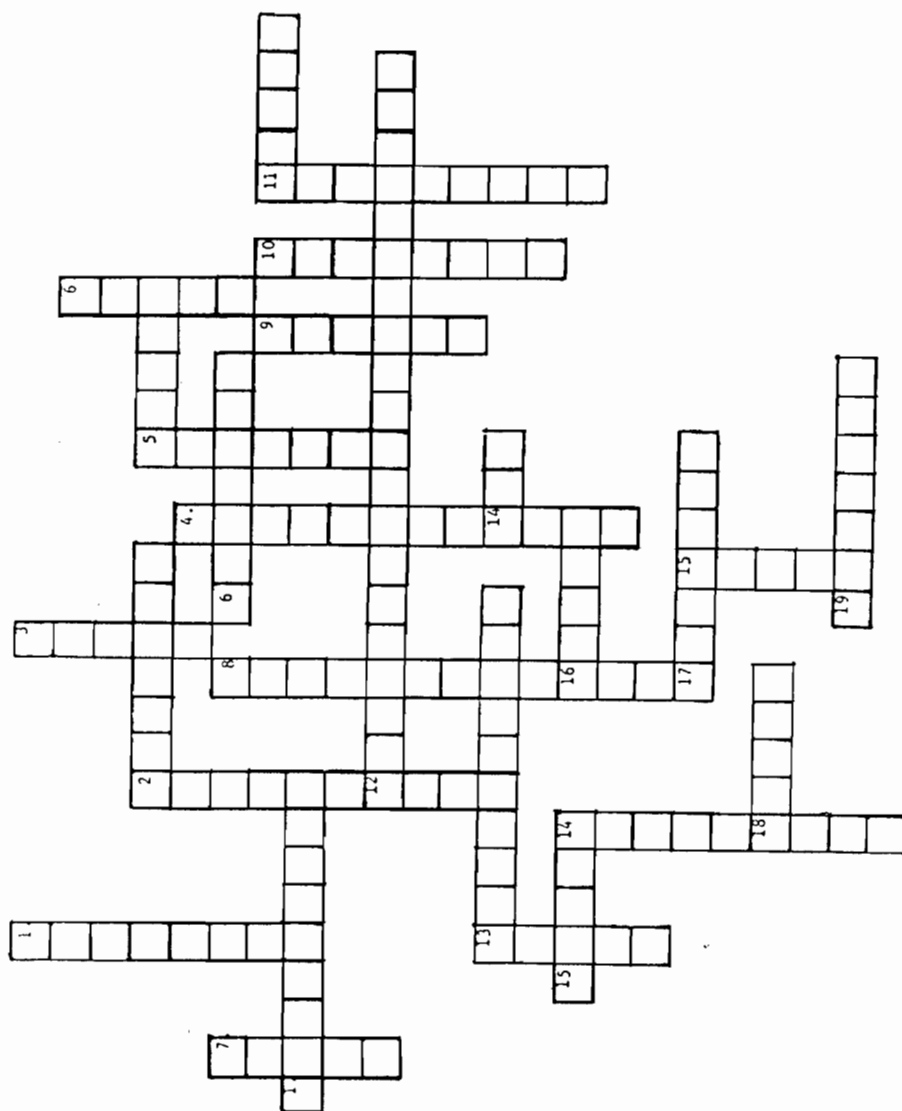
HISTORY CAN BE PUZZLING

ACROSS

1. Named for an Indian tribe, this river was impounded in 1945 to create Kentucky Lake.
2. The coiled end of an unrolling young fern leaf.
5. A cluster of sporangia on the underside of fertile fern fronds.
6. Fueled with charcoal, these constructions were used to obtain iron from ore.
11. An asexual reproductive cell produced by a fern.
12. Before it became LBL, the region between the Cumberland and Tennessee Rivers was called this.
13. The land dispute between KY and TN in the seventeen and eighteen hundreds involved state _____?
14. The agency which administers Land Between the Lakes.
15. The leaf of a fern.
16. The Tennessee city near the south end of LBL which marks the beginning of the Tennessee's and Cumberland's parallel course.
17. Early explorers who passed through LBL in search of gold.
18. The primary division of a fern frond.
19. The horizontal underground stem characteristic of most ferns.

DOWN

1. A lake and the type of iron ore found in LBL.
2. A river once known as Louisa and Shawnee, now impounded to form Barkley Lake.
3. Dry
4. The name of the iron furnace at Model, TN.
5. Indian tribe who settled the banks of the Cumberland River.
6. Moist woodland
7. Whitish, flint-bearing rock overlaying most of the limestone of LBL.
8. Ancient tribe who built ceremonial mounds overlooking the Tennessee River.
9. The central axis of a fern frond, to which the pinnae attach.
10. Produced by burning wood in limited oxygen; used to fire the iron furnaces.
11. The occupation of Thomas Walker and Col. Richard Henderson.
13. A lake located within the Brandon Springs Group Camp.
14. Ferns with two distinct forms, as in a fertile and a sterile frond.
15. The compass direction one travels along the Trace (main road through LBL) if traveling from Stewart Co., TN to Trigg Co., KY.

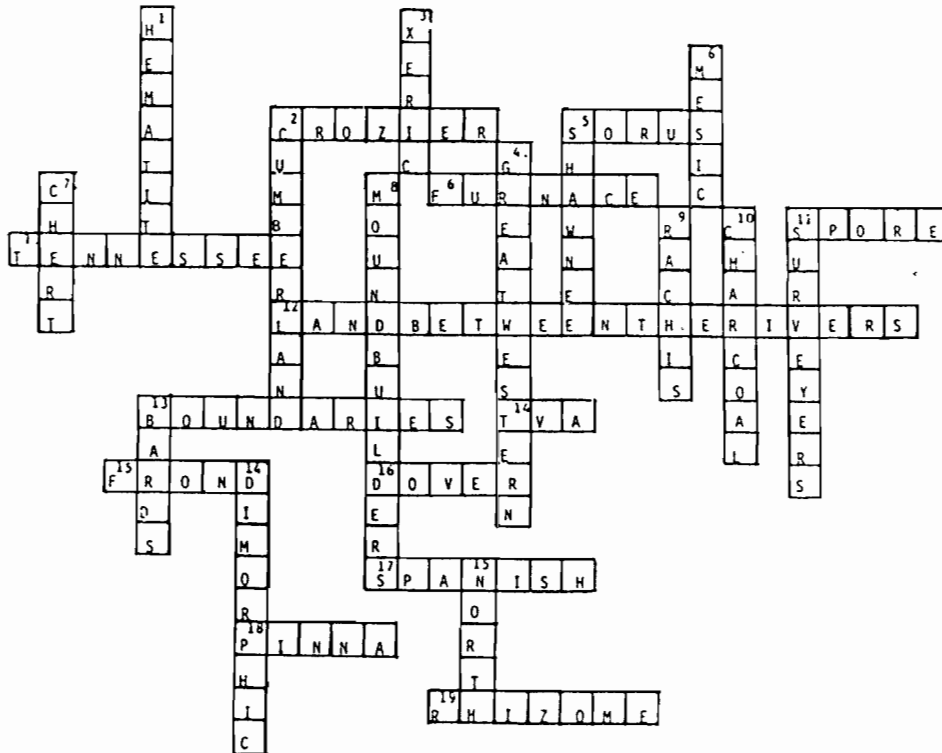


KEYS TO PUZZLES

Magic Box Puzzle

A 19	B 7	C 8	D 13
E 9	F 12	G 20	H 6
I 15	J 10	K 5	L 17
M 4	N 18	O 14	P 11

History Can Be Puzzling



FERNS AND FERN ALLIES OF LAND BETWEEN THE LAKES
LISTED BY SCIENTIFIC NAME

1. *Adiantum pedatum* L. subsp. *pedatum*: Northern Maiden-hair
2. *Asplenium platyneuron* (L.) B.S.P.: Ebony Spleenwort
3. *Asplenium resiliens* Kunze: Blackstem Spleenwort
4. *Asplenium rhizophyllum* L.: Walking Fern
5. *Asplenium ruta-muraria* L.: Wall-rue
6. *Athyrium filix-femina* subsp. *asplenioides* (Michx.) Hulten: Lady Fern
7. *Athyrium pycnocarpon* (Spreng.) Tidestr.: Glade Fern
8. *Athyrium thelypteroides* (Michx.) Desv.: Silvery Glade Fern
9. *Azolla caroliniana* Willd.: Eastern Mosquito Fern
10. *Botrychium biternatum* (Sav.) Underw.: Sparse-lobed Grape Fern
11. *Botrychium dissectum* Spreng.: Lace-frond Grape Fern
12. *Botrychium virginianum* (L.) Swartz: Rattlesnake Fern, Virginia Grape Fern
13. *Cheilanthes lanosa* (Michx.) D.C. Eaton: Hairy Lip Fern
14. *Cystopteris bulbifera* (L.) Bernh.: Bulblet Fern
15. *Cystopteris protrusa* (Weath.) Blasdell: Lowland Brittle Fern
16. *Equisetum arvense* L.: Field Horsetail, Scouring-rush
17. *Equisetum hyemale* var. *affine* (Engelm.) A. A. Eaton: Giant Horsetail, Scouring-rush
18. *Lycopodium digitatum* Dillen. ex A. Braun: Fan Club-moss, Ground cedar
19. *Onoclea sensibilis* L.: Sensitive Fern

20. *Ophioglossum pycnostichum* (Fern.) Love & Love: Adder's-tongue
21. *Osmunda regalis* var. *spectabilis* (Willd.) A. Gray: Royal Fern
22. *Pellaea X atropurpurea* (L.) Link: Purple Cliff-brake
23. *Polypodium polypodioides* var. *michauxianum* Weath.: Resurrection Fern
24. *Polystichum acrostichoides* (Michx.) Schott: Christmas Fern
25. *Pteridium aquilinum* var. *latiusculum* (Desv.) Underw.: Eastern Bracken Fern
26. *Selaginella apoda* (L.) Spring: Meadow Spike-moss
27. *Thelypteris hexagonoptera* (Michx.) Weath.: Broad Beech Fern
28. *Thelypteris palustris* var. *pubescens* (Laws.) Fern.: Marsh Fern
29. *Woodsia obtusa* (Spreng.) Torrey: Blunt-lobed Woodsia

FERNS AND FERN ALLIES OF LAND BETWEEN THE LAKES
LISTED BY COMMON NAMES

1. Adder's-tongue: *Ophioglossum pycnostichum* (Fern.) Love & Love
2. Blackstem Spleenwort: *Asplenium resiliens* Kunze
3. Blunt-lobed Woodsia: *Woodsia obtusa* (Spreng.) Torrey
4. Broad Beech Fern: *Thelypteris hexagonoptera* (Michx.) Weath.
5. Bulblet Fern: *Cystopteris bulbifera* (L.) Bernh.
6. Christmas Fern: *Polystichum acrostichoides* (Michx.) Schott.
7. Eastern Bracken Fern: *Pteridium aquilinum* var. *latiusculum* (Desv.) Underw.
8. Eastern Mosquito Fern: *Azolla caroliniana* Willd.
9. Ebony Spleenwort: *Asplenium platyneuron* (L.) B.S.P.
10. Fan Club-moss, Ground cedar: *Lycopodium digitatum* Dillen. ex A. Braun
11. Field Horsetail, Scouring-rush: *Equisetum arvense* L.
12. Giant Horsetail, Scouring-rush: *Equisetum hyemale* var. *affine* (Engelm.)
A. A. Eaton
13. Glade Fern: *Athyrium pycnocarpon* (Spreng.) Tidestr.
14. Hairy Lip Fern: *Cheilanthes lanosa* (Michx.) D. C. Eaton
15. Lace-frond Grape Fern: *Botrychium dissectum* Spreng.
16. Lady Fern: *Athyrium filix-femina* subsp. *asplenioides* (Michx.) Hulten
17. Lowland Brittle Fern: *Cystopteris protrusa* (Weath.) Blasdell
18. Marsh Fern: *Thelypteris palustris* var. *pubescens* (Laws.) Fern.
19. Meadow Spike-moss: *Selaginella apoda* (L.) Spring

20. Northern Maiden-hair: *Adiantum pedatum* L. subsp. *pedatum*
21. Purple Cliff-brake: *Pellaea X atropurpurea* (L.) Link
22. Rattlesnake Fern, Virginia Grape Fern: *Botrychium virginianum* (L.) Swartz
23. Resurrection Fern: *Polypodium polypodioides* var. *michauxianum* Weath.
24. Royal Fern: *Osmunda regalis* var. *spectabilis* (Willd.) A. Gray
25. Sensitive Fern: *Onoclea sensibilis* L.
26. Silvery Glade Fern: *Athyrium thelypteroides* (Michx.) Desv.
27. Sparse-lobed Grape Fern: *Botrychium biternatum* (Sav.) Underw.
28. Walking Fern: *Asplenium rhizophyllum* L.
29. Wall-rue: *Asplenium ruta-muraria* L.

GLOSSARY

1. **ANGIOSPERMS**- flowering plants; vascular plants producing seeds enclosed in an ovary.
2. **ANTHERIDIUM**- the sperm-producing organ on the prothallus
3. **ARCHEGONIUM**- the egg-producing organ on the prothallus
4. **AXIL**- the angle between a branch or leaf and the axis from which it arises
5. **BLADE**- the leafy expanded portion of the frond
6. **CALCAREOUS**- having high lime (calcium carbonate, CaCO_3) content
7. **CHERT**- a rock resembling flint, consisting mainly of cryptocrystalline quartz or fibrous chalcedony
8. **CIRCINATE VERNATION**- the coiled arrangement of an immature fern frond
9. **COSMOPOLITAN**- found throughout under varying ecological conditions
10. **CROZIER**- the coiled immature frond of a fern
11. **DECIDUOUS**- not persisting more than one growing season
12. **DIMORPHIC**- of two forms; ferns having sterile and fertile fronds differing morphologically
13. **EPIPETRIC**- growing on rocks
14. **EPIPHYTE**- a plant growing non-parasitically on the trunks or branches of trees
15. **EVERGREEN**- having fronds remaining green and functional through more than one growing season
16. **FIX** (as in nitrogen fixation)- to change atmospheric nitrogen (N_2) into NO_3 or NH_4 forms usable by plants

17. FROND- the leaf of a fern
18. GAMETES- reproductive cells, eggs and sperm
19. GAMETOPHYTE- the prothallus; the small gamete-producing structure developed from a fern spore
20. GAMETOPHYTIC GENERATION- the stage in alternation of generations which produces the gametes
21. GLABROUS- smooth, devoid of hairs
22. GYMNOSPERMS- woody, vascular seed plants producing seeds not enclosed in an ovary
23. HEMATITE- a mineral (Fe_2O_3) constituting an important iron ore, normally found in crystals or in a red earthy form
24. MEGAPHYLL- complex leaves with a branching vein system
25. MESIC- moderately moist
26. MORPHOLOGY- form and structure
27. PENDANT- hanging
28. PHLOEM- specialized food-conducting tissue
29. PHOTOSYNTHESIS- the food-making process of green plants in which they use light energy to synthesize glucose from carbon dioxide and water
30. PINNA- a leaflet or primary division of a compound fern frond
31. PINNULE- pinna divisions; secondary divisions of a compound fern frond
32. PROTHALLUS- the gametophyte; the small structure developed from a fern spore
33. PTERIDOLOGIST- one who studies ferns
34. RACHIS- the extension of the stipe through the blade
35. REFLEXED- bent, turned or directed back.

36. RHIZOIDS- root-like outgrowths from the prothallus
37. RHIZOME- the horizontal, underground stem of a fern
38. SPORANGIUM- the case in which the spores develop
39. SPORE- an asexual reproductive cell
40. SPOROPHYTE- the fern plant which bears spores; the familiar fern plant
41. SPOROPHYTIC GENERATION- the stage in alternation of generation in which the fern bears spores
42. SORUS- a cluster of sporangia
43. STIPE- the main axis of the fern frond, extending from the base of the lowest pinnae to the point of attachment on the rhizome
44. TAXONOMY- scientific classification
45. VASCULAR- having specialized conducting tissue
46. VENATION- the arrangement of the veins
47. XYLEM- specialized water-conducting tissue