NATIVE PLANT SOCIETY OF NORTHEASTERN OHIO

Founding Chapter Of

THE OHIO NATIVE PLANT SOCIETY

6 Louise Drive
Chagrin Falls, Ohio 44022
(216) 338-6622

On the Fringe

THE JOURNAL OF THE OHIO NATIVE PLANT SOCIETY

Vol. 7 November/December 1989 No. 5/6

DUES INCREASE FOR 1990

As you all know, DUES ARE DUE FOR RENEWAL ON JANUARY 1, 1990. Our membership year runs from January 1 to December 31 of each year and dues are not pro-rated during the year.

Because of the cost of printing the Journal this last year, the Executive Board has reluctantly come to the conclusion that we must increase the Active membership to $10.00. Even this modest increase may not be sufficient, but we will ride with it for 1990 in the hope that we may find other means of offsetting the printing costs. It has always been the philosophy of the Society to keep the dues to the utmost minimum to that no one is prevented from becoming a member because of their financial situation.

PLEASE RENEW AT THE HIGHEST LEVEL POSSIBLE. In the past, this appeal has met with success. Last year more of you than ever became Sustaining members, and we even had an increase in Patron members. We hope that you, our members, get such pleasure and reward from the Society that you will support the Society with your memberships and your contributions.

MANSFIELD IS NEW CHAPTER

On September 12, 1989, State President Malmquist traveled to Mansfield's Kingwood Garden to attend a meeting of a newly formed group of native plant enthusiasts. Glenna Sheaffer, one of the founding members of the Wilderness Center group, has been working at Kingwood Gardens and last spring proposed starting a new chapter there. During the summer she attracted a core of about 35 people and wrote that they were ready to have a presentation made to them. They are an enthusiastic and knowledgeable group. At the end of the meeting they voted to become our ninth chapter. You will see their program in this issue for the first time. WELCOME, MANSFIELD!

PROGRAMS AND EVENTS:

November 3 (Friday) **Cleveland Chapter - 5:30 p.m. - The Cleveland Museum of Natural History** - Dr. Larry E. Morse, chief botanist at the national office of The Nature Conservancy in Washington, D.C. will be our guest and our featured speaker at the Annual Dinner. Dr. Morse will highlight the Conservancy's work with rare plants in the Appalachian forests and along the east coast of the United States.

November 5 (Sunday) **Lisbon Chapter - 1:30 p.m.** - We will take a general natural history walk,w ith an emphasis on tree identification at Highlandtown. Meet at the courthouse in Lisbon.

November 5 (Sunday) **Dayton Chapter - 1:30 p.m.** - Tour the Englewood Reserve with Stan Stine. Meet at the parking lot at the overlook at the east end of the dam.

November 10 (Friday) **Cincinnati Chapter - 7:30 p.m. - Avon Woods Outdoor Education Center** - "Wild Edibles" Suzanne Peter, Naturalist, Hamilton Co., Park District.

November 18 (Saturday) **Wilderness Chapter - 1:00 - 5:00 p.m.** - Field trip to **Van Sicle Woods,** located south of Millersburg just off US 62. Take US 62 south of Millersburg to Twp 48 (where US 62 bears west). Turn S on Twp 48 and after 1/2 mile turn left (east) on a lane. The woods is 1/4 mile down the lane. Leader, Pam Demmer.

November 19 (Sunday) **Mansfield Chapter - 2:00 p.m. - Ohio State University, Mansfield Campus** - Hike surrounding woods. Bring back plant samples to the Botany Lab for closer look under microscopes. Emphasis on learning to key twigs.

November 20 (Monday) **Dayton Chapter - 6:30 p.m. - Cox Arboretum** - Annual dinner and business meeting. The program will be Guy Denny speaking about Ginseng.

December 3 (Sunday) **Cincinnati Chapter - 3:30 p.m. - Hardy Soul's Hike, Winton Woods.** Northern Hills Fellowship, Fleming Road. **6:00 p.m.** - Covered Dish Supper, **7:15 p.m.** - "Flora of Central China", Jun Wun, O.S.U.

December 16 (Saturday) **Lisbon Chapter - 5:00 p.m.** - This is our tenth annual Christmas Bird Count. We will meet at Kerr's house for a wrap-up and dinner. Bring a few of your best slides for a club slide show at **7:30 p.m.**

December 16 (Saturday) **Wilderness Center - 2:00 - 4:00 p.m.** - Indoor meeting at TWC. Speaker, **Bob Howes** on **The Little People.**

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TROPICAL FERNS, OR THEIR RELATIVES, IN OHIO by Robert M. Lloyd

There are about 9000 species of true ferns in the world. Of these, about 235 species occur within the continental United States and over 50 are found in Ohio. They are almost as diverse as flowering plants and range from those which are floating and extremely minute (a few millimeters in diameter) to tree ferns over 16 meters tall. Most of them are tropical or subtropical where they occur in all kinds of habitats from mangrove swamps and marshes to bogs and lakes, rock crevices, streamsides, forest floors, and upon trunks and branches of trees. Some of them are notorious weeds, such as bracken fern (**Pteridium aquilinum**) and floating fern (**Salvinia molesta**); others are among the first invaders of lava flows (Boston fern, **Nephrolepis exaltata** and its relatives) and disturbed roadsides (forking fern, **Dicranopteris** and **Gleichenia**).

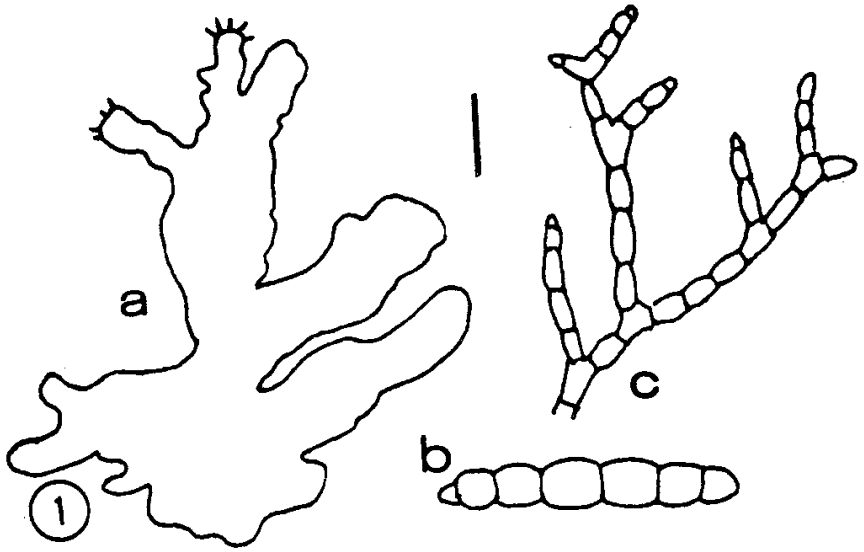
Although not mountainous, Ohio is blessed with a diversity of soil types and climate. The glaciated areas of western and northern Ohio, providing basic limestone, can be contrasted with the acidic sandstones and shales of the unglaciated regions of the eastern and southeast. The southern portion of the state has a moderate climate, allowing more southernly species to exist. This diversity in climate has led to some northern ferns reaching their southernmost distributions in Ohio (ostrich fern, **matteuccia struthiopteris**) and some tropical and southern species reaching their northern limits (resurrection fern, **Polypodium polypodioides**).

"Tropical ferns, or their relatives" of Ohio are few and may be rare. They are best split into five categories: (1) those that are truly tropical and occur here only as gametophytes (shoestring fern, **Vittaria**, and the filmy or bristle fern, **Trichomanes**), (2) those that are tropical and distributed commonly in the southeastern United States, reaching their northern limits in Ohio (resurrection fern) or Pennsylvania (black-stemmed spleenwort, **Asplenium resiliens**: South America, West Indies, north), (3) single outlying temperate species related to larger strictly tropical groups (climbing fern, **Lygodium palmatum**; hay-scented fern, **Dennstaedtia punctilobula**); and the Appalachian filmy fern, **Trichomanes boschianum**), and (4) those that are widely distributed in both tropical and temperate regions and which might best be considered temperate species or parts of larger temperate groups which make it into the tropics (lady fern, **Athyrium filix-femina**: Europe, Asia, tropical America, Africa, North America; fragile fern, **Cystopteris fragilis**: most regions of the world; royal fern, **Osmunda regalis**: Europe, tropical America to Canada; cinnamon fern, **Osmunda cinnamomea**: Mexico, West Indies to Canada; purple cliffbrake, **Pellaea atropurpurea**: Guatemala to Canada; and bracken fern: worldwide).

Undoubtedly, the most peculiar of these ferns are the Appalachian gametophytes. Fern gametophytes are that portion of the life-cycle which produce the gametes, participate in sexual reproduction, and produce new, larger "leafy" fern plants (sporophytes) which we normally see in the forests,

Gametophytes are produced from spores. Spores are produced by the millions on the lower side of the fern frond in specialized structures called sporangia. Sporangia, in turn, are usually clumped together into round, oblong, or variously shaped patches called sori (sing. = sorus). Spores are about the size of pollen grains. They are released and carried by air currents away from the sporophytes. When they land in an appropriate moist habitat, they germinate and grow into gametophytes. Mature fern gametophytes are small (rarely over a centimeter in diameter), flat, usually heart-shaped, free-living, and can be found in shaded moist areas on the forest floor, stream banks or around rocks. They have their own microhabitat in and around the mature larger plants and sometimes occur where the larger plants do not occur. The overall distribution of many ferns may be controlled by the ability of the spores to disperse as well as by the abilities of the gametophytes to survive.

The Appalachian **Vittaria** gametophyte is a sporophyteless fern of the eastern United States (Fig. 1a, b). Its nearest relative geographically is the shoestring fern of southern Florida (**V. lineata**). The remaining 80 species of the group occur further south in the subtropics and tropics. These tiny Appalachian plants have intrigued and fascinated botanists since their first discovery in 1930. They are tiny, ribbon-like plants, one-cell thick, and much branched, frequently with a larger basal branch and several smaller aerial branches. Upon the margins of the aerial branches are small, budlike structures which are called gemmae. These are 2 of 12 cells long and they break off and serve to disperse and reproduce new plants. As these plants are perennial, they proliferate and grow over one another year after year, producing mats. These mats are found almost exclusively on outcrops of non-calcareous rock, including sandstone, shale, gneiss, slate and quartzite. They usually occur in areas of low light intensity and high humidity which are protected from temperature extremes, e.g. northfacing overhanging rock outcrops, crevices, ledges and deeply recessed grottos, frequently near springs or seepage. In the eastern United States, they occur up to 6000 ft., from northern Alabama and Georgia to southern Indiana and north to



Appalachian gametophytes. a. Shoestring fern (Vittaria) with several very small gemmae at tip of upper lobes. b. Close-up of gemma of Vittaria gametophyte. c. Filmy fern gametophyte, Trichomanes, with 5-celled gemma at tip of central, upper branch.

Chautauqua County, New York. In Ohio, they are currently known from four counties in the southern part of the state, including Hocking, Jackson and Fairfield, and in 1982 were found by Allison Cusick on Little Mountain, in Geauga and Lake counties, only 6.5 kilometers south of Lake Erie. The specific identity and origin of these **Vittaria** gametophytes is unknown. They are genetically distinct from the Florida shoestring fern. Donald Farrar of Iowa State University suggests that these tiny plants may represent all that's left of a species which formerly existed here but whose sporophytes no longer survive due to the changing climates of the Pleistocene.

Equally intriguing are the free-living, sporophyteless gametophytes of the filmy fern, **Trichomanes** (Fig. 1c). These are tiny filamentous plants which may be mistaken for a green alga. The filaments are a single linear strand of cells which may be frequently branched. They produce gemmae about 4 to 6 cells long which arise from the branch tips. The plants form small, green "cottony" tufts of an intertwined network of branched filaments. In Ohio, they are found from Jackson to Licking counties and recently were discovered in Hawk Woods, Sells Park in Athens by Herb Wagner of the University of Michigan, and a group of students from the Botany Department of Ohio University. In the eastern United States, filmy fern gametophytes have been found from Missouri and northern Alabama to southern Illinois, and north to the New England states. They may co-occur with **Vittaria** gametophytes, in moist rock crevices, or deeply recessed grottos under rock outcrops on non-calcarous soils. We do not know their specific identity. They are genetically distinct from the other filmy ferns which occur in the United States and represent a species whose sporophytes are either extinct or living in the tropics south of the United States.

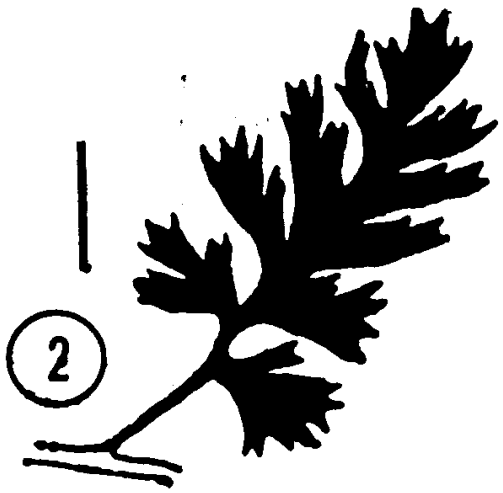


Fig. 2 Appalachian filmy fern, Trichomanes boschianum.

[Note: these two species of sporophyteless gametophytes are not the only two found in the eastern United States, but they are the only two found in Ohio. Other gametophytes of tropical species include **Grammitis nimbata**, a Cuban species found in Macon Co., North Carolina; and Tunbridge filmy fern, **Hymenophyllum tunbrigense**, found in and around Pickens Co., South Carolina. In Alaska, gametophytes of Wright's filmy fern, **H. wrightii**, have been reported. All of these fern gametophytes are probably more common than we now know. If you want to go looking for them, take a flashlight. Although

they may be more easily accessible, be prepared to crawl on your bellies to the deepest recesses!]

The remaining tropical species which occur in Ohio are no less interesting but certainly less perplexing! They appear to represent species which are common to the south and which are on the fringe of their northern distribution in Ohio.

the Appalachian filmy fern (**Trichomanes boschianum**) is a member of a group of over 275 species which occur in the humid lowland tropics, although a few species extend into warm, but less tropical regions. This fern is rare in the eastern United States. It is known from Missouri, extreme southern Illinois and Indiana, and sporadically along a band from northern Alabama, to the Highlands region around the convergence of South Carolina, North carolina and Tennessee, and north through Kentucky and extreme western West Virginia into Ohio. In Ohio, the fern has been listed as an endangered species. It is known from only a single drainage system in Hocking County, grows in deep shade on moist, non-calcareous rocks, and may be hanging from the roofs of recessed caves. These plants have long-creeping rhizomes with scattered, delicate and translucent fronds which are usually one-cell thick between the veins. The fronds are small and up to about 15 cm long. They may be once-lobed or rarely twice-lobed (pinnate-pinnatifid) with deeply incised segments (Fig. 2).

Resurrection fern (also known as the little gray polypody, **Polypodium polypodioides** var. **michauxianum**) resembles the common eastern polypody (**P. virginianum**) except for the presence of little gray scales on the lower surface of the fronds. This variety is common in the southeastern United States and south to Guatemala, with the typical variety extending into South America. It reaches its northern limit in Ohio, where it is an endangered species. Since 1960, it has been collected only from Adams and Hocking counties, on dolomite or sandstone soils. In much of its range, it grows upon tree branches or rocks, walls, or sometimes roadbanks, and may even form large mats. The fern has been called "resurrection fern" because it is drought resistant, appearing to dry out and be lifeless by curling up its fronds, only to unroll and turn green again after a rain. Fronds are small, from about 4 to 20 cm long (Fig. 3). Polypodies are a large group of about 1000 tropical species, with only a handful of these entering into temperate regions.

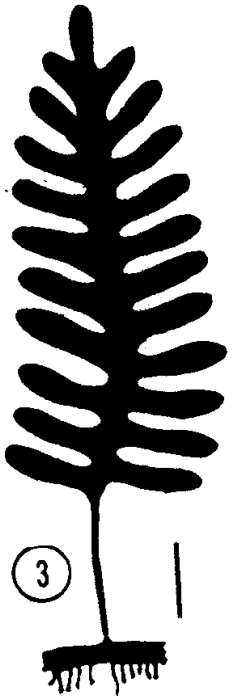


Fig 3 Resurrection fern, Polypodium polypodioides.

The American climbing fern (also known as climbing fern and Hartford fern, **Lygodium palmatum**) and hay-scented fern (**Dennstaedtia punctilobula**) are temperate ferns which are related to large tropical groups. There are about 40 species of climbing ferns, almost all of which are tropical or subtropical in both the Old and New World. Three of these ferns occur in the eastern United States. Two of these, Japanese climbing fern (**L. japonicum**) and the small-leaved climbing fern (**L. microphyllum**) are native to southern Japan and eastern Asia, respectively, and have been introduced into Florida where they have escaped from cultivation. Although the small-leaved climbing fern remains in just a few populations in southern Florida, the Japanese climbing fern now extends along the coastal plains, from Texas to North Carolina.

The American climbing fern is rare and sporadic in its distribution, mostly east of the Appalachian Mountains, from Texas to Florida and north to the Vermont, New Hampshire region. On the western slope of the mountains, it is more common to the south, in Kentucky and Tennessee. In Ohio, it is local and sporadic and has been collected in about nine counties (Athens, Columbiana, Gallia, Hocking, Jackson, Pike, Ross, Scioto, Vinton), virtually all in unglaciated Ohio, east of a line running from Portsmouth to Chillicothe to Canton and Youngstown. This fern is a plant of very acid soils and is frequently found in open areas of the forest, in marshes, seepages, along creeks and streams or near waterfalls. It frequents clay soils and may become established after disturbance. Populations may consist of just one or two clumps or may be extensive. It is very easy to recognize as it has slender, twining and climbing fronds with attached palmately-lobed leaflets. At first, these appear as climbing stems with attached leaves, but don't be mistaken. The stems (rhizomes) are underground! The fronds are also evergreen and in the late fall and winter this fern is relatively easy to pick out (Fig. 4).

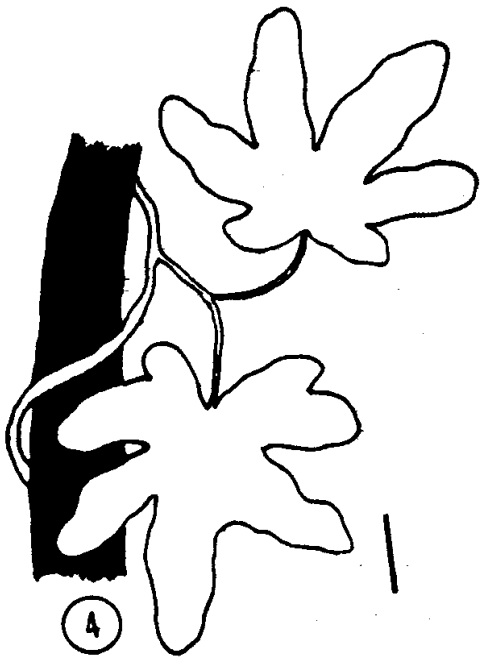


Fig. 4 American climbing fern, Lypodium palmatum.

Climbing ferns are an old, old group, originating at least 100 million years ago. Fossils dated as late Eocene (about 40 million years ago) are extremely similar to the American climbing fern of Ohio. These fossils are the most widely reported fossils in the group and are known as **Lygodium kaulfussi.** They have been found in Oregon, Utah, Colorado, Wyoming, North Dakota, Alabama, Mississippi and Tennessee, and in Europe in England, France and Switzerland. They have also been

collected in northeastern China. It is possible that the American climbing fern and this fossil fern are one and the same species, much restricted from its former worldwide distribution until it now only survives in the eastern United States.

Finally, there is our hay-scented fern, **Dennstaedtia punctilobula.** This is a temperate woodland species related to a tropical group of about 70 species. With the exception of our temperate species and a few Southern Hemisphere species which grow in Chile and Tasmania, all others occur in the wet tropics or subtropics as large forest ferns or ferns which form thickets. In the United Sates, hay-scented fern is the only native of the group. Two others grow in Texas and extreme southern Florida and are thought to be established from spores or small plants blown in periodcially from the Caribbean or Central and South America.

The fronds of the hay-scented fern grow up to one meter long and are somewhat arching. They are oval-oblong in shape and bipinnate and appear to be thin and delicate due to the numerous finely cut leaf segments, which are hairy. Perhaps their most distinguishing features are their yellow-green color and their fragrance. After crushing, the leaves smell like newly mowed hay. They arise from very thin, long-creeping rhizomes, which grow extensively and aggressively. As such, this fern may form large clumps or even thickets, especially on acid or strongly acid soils in open, sandy meadows, stony hillsides and pastures, or in forest clearings or the edges of forests where it is well lighted. The fern is described as weedy and grows in a somewhat similar fashion to its relative, bracken fern.

Hay-scented fern is common in the eastern United States. It is found from eastern Canada to Wisconsin and Michigan and south through Ohio to southern Indiana and Illinois, Missouri and the mountains of Alabama, Georgia and South Carolina. It is usually a plant of the upland regions with sporadic occurrences westward.

On the Cultivation of Ferns: A good, general text full of information about the cultivation of ferns is one by Barbara Joe Hoshizaki, **Fern Growers Manual,** published in 1975 by Alfred A. Knopf, Inc., New York. You might also see **Ferns** by Philip Perl, published in 1977 as part of the Time-Life Encyclopedia of Gardening Series. Of the ferns discussed above, some are more appropriate to cultivate while others are not. Appalachian gametophytes can be grown in moist terrariums on appropriate soils (drained moist-wet potting mix) or rocks and subdued light. They probably grow best in lowered temperatures of about 60°F. As small clumps can reproduce by gemmae, if conditions are right, only very small starter colonies are needed. I discourage collection and cultivation of these plants from Ohio material as they are potentially threatened species in our state. Resurrection fern and Appalachian filmy fern are endangered and living plants must not be collected within Ohio. As they are extremely rare in Ohio they are not reproducing well in nature and every effort must be made

to conserve them. However, if you obtain resurrection fern from other sources, it is semi-hardy, and grows well on a well drained, acidic potting mix which is kept moist. American climbing fern is very difficult to grow. Hoshizaki recommends a moist, acidic potting mix and low light. This species is also listed as potentially threatened in Ohio. Hay-scented fern is a weed. It grows in low to high light intensities, in garden soil or potting mix which is kept moist, and does best outside in moist, well drained locations with acid pH. Beware, although this fern is easy to transplant, it grows aggressively and may crowd out other plants. It is also considered undesirable as its fronds turn brown and look ragged early in the fall, and once established, may be impossible to eradicate. However, as it does well under a variety of conditions, it is useful as a ground cover on steep slopes or barren places where other plants may not grow.

On Scientific Names: Every species of plant or animal has a single scientific name. As these are Latin or latinized words from other languages, they are foreign and at first, difficult to understand, and difficult to learn. They always have a meaning which may relate to a morphological feature of the plant, its location, or to a person. Scientific names are important as they provide a single, universally used name for each species. In reality, this means that we can communicate and retrieve information about organisms without being burdened by the diversity of common names which are applied to the same species in different areas. Species names are composed of two parts, the first name (genus) is a "general" name referring to the larger group, the second (specific epithet) refers to the individual species within the genus. The meanings of some of the genus names used in this article are given below:

Asplenium: is from Greek, **a** = without, **splen** = spleen, in reference to the supposed medicinal properties of the plant.

Athyrium: is from Greek, **a** = without, **thureos** = shield, referring to the lack of a covering (sorus) over the sporangia.

Cystopteris: is from Greek, **kustis** = bladder, **pteris** = fern, referring to the inflated bladderlike covering (sorus) over the sporangia.

Dennstaedtia: names for August W. Dennstedt, German botanist of the late 18th and early 19th centuries.

Lygodium, from Greek, **lugodes** = flexible.

Matteuccia, named for the Italian physicist, Carlo Matteucci, who lived from 1800-1868.

Osmunda, named for Osmunder, the Saxon god of war.

Pellaea: from Green **pellos** = dark, referring to dark petioles.

Polypodium: from Greek, **poly** = many, **pous** or **podion** = foot, referring to the "footprints" left on rocks where rhizomes have broken off, or to the branched rhizome.

Pteridium, from the Greek word, **pteris** = fern.

Trichomanes: from Greek **trichomanes** = soft hairs, which are frequently found near the sporangia.

Vittaria: from Greek, referring to the ribbon, shoestring-like narrow leaves.

P.S.: Herb Wagner (Fiddlehead Forum [1989] 16:26) of the Botany Dept. at the University of Michigan, Ann Arbor, recently commented that the Hartford Fern is of interest to the American Fern Society's Committee on Rare and Endangered Species because of its highly sporadic occurrence and its historical interest. He says it is perhaps the first fern protected by law. In 1869, a Connecticut law was enacted making it a misdemeanor "to pull or uproot the plant named after the capital of the state." The law stated that "Any person who shall wilfully and maliciously sever or take from the land of another any of the species of plant known as **Lygodium palmatum** or Creeping Fern growing and being thereon, shall be punished by a fine not exceeding seven dollars or imprisonment both at the discretion of the court. Herb would like to hear from anyone who has any more details about early laws protecting ferns as well as this particular law and effort to protect the Hartford Fern.

FOR FURTHER READING:

Cobb, B. 1963. **A field guide to the ferns and their related families of northeastern and central North America.** Peterson Field Guide Series, Houghton Mifflin Co., Boston, Mass.

Cranfill, R. 1980. **Ferns and fern allies of Kentucky,** Kentucky Nature Preserves Commission Scientific and Technical Ser. No. 1.

Cusick, A.W. 1983. **Vittaria** gametophytes discovered in a new physiographic province. American Fern Journal 73: 33-38.

Farrar, D.R. 1985. Independent fern gametophytes in the wild. Proceedings of the Royal Society of Edinburgh, 86B: 361-369.

Hopkins, L.S. 1907. The fern flora of Ohio, Fern Bull. 15: 1-13.

Mickel, J.T. 1979. **How to know the ferns and fern allies.** The Pictured Key Nature Series, Wm. C. Brown Publs. Dubuque, Iowa.

Tryon, R. 1986. The biogeography of species, with special reference to ferns. The Botanical Review 52: 117-156.

Vannorsdall, H.H. 1956. **Ferns of Ohio.** Published by the author, Wilmington, Ohio.

Yatskievych, G., M.A. Homoya, and D.R. Farrar. 1987. The fern genera **Vittaria** and **Trichomanes** in Indiana. Indiana Academy of Sciences 96: 429-434.

Robert Lloyd is Professor of Botany, Ohio University, Athens, a Past-President of the American Fern Society and a member of the Athens Chapter of Ohio Native Plant Society.

WHY PRESERVE NATURAL VARIETY? by Bryan G. Norton

"Norton's own, very original version of anthropocentrism makes a major contribution to current studies in environmental ethics. He presents his own view fully and systematically and provides thorough critical examinations of opposing views." — Paul W. Taylor, Brooklyn College, The City University of New York.

For all persons seriously concerned about the destruction of natural environments in the contemporary world, this book presents a comprehensive rationale for preserving wild species and ecosystems. Bryan G. Norton appeals most centrally to "transformative value," the power of human contacts with wild species to transform and uplift the human spirit. Until now species preservationists have found a theoretical basis for their policies in the "demand" value of wild species for fulfilling certain narrowly defined human needs or in controversial and badly understood proposals about the "intrinsic" values of species. This work examines such rationales and diverges from them by pointing to new sources of value for wild species: they have worth because they can transform human values.

Because of the central role of biological diversity in environmental concerns the book also provides a fresh perspective on environmental ethics more generally. Like The Preservation of Species: The Value of Biological Diversity (Princeton, 1986), which was edited by Professor Norton, Why Preserve Natural Variety? is sponsored by the Center for Philosophy and Public Policy at the University of Maryland.

Bryan G. Norton is Professor of Philosophy at New College of the University of South Florida.

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THE PRESERVATION OF SPECIES, The Value of Biological Diversity
Edited by Bryan G. Norton

Gathered at the Center for Philosophy and Public Policy at the University of Maryland, members of a multidisciplinary working group held extensive discussions on the preservation of biological diversity on earth. From these sessions emerged a book that addresses two related questions: first, why preserve species, and, second, what priorities should govern decisions when there are insufficient funds to save all species? This interdisciplinary volume is the first to occupy the middle ground between abstract discussions of species' value and field managers' guides to saving particular species in particular habitats. It illuminates the context in which managers must make policy decisions and provides insights into factors important to all who value biological diversity.

Contributors to the book are J. Baird Callicott, Robert L. Carlton, Jr., Stephen R. Kellert, Terry L. Leitzell, Thomas E. Lovejoy, Bryan G. Norton, Alan Randall, Donald H. Regan, Lawrence B. Slobodkin, Elliot Sober, and Geerat J. Vermeij.

NEW LIFE FOR OLD TREES by Dr. Michael Zimmerman

One of the saddest ecological disasters of this century was the destruction of the American chestnut. Although this great tree today is virtually extinct throughout its historic range in North America, our understanding of genetics, plant breeding and ecology has advanced to the point where we might be able to restore it to its former position in our forests. The story of the American chestnut, while providing a number of important ecological lessons, sets the stage for what might turn out to be an amazing scientific victory.

Economically and aesthetically, the American chestnut was one of this country's most important and magnificent trees. From Maine to Georgia and as far west as Illinois, it often comprised 25 percent of the forest. Ridges in the Appalachian Mountains were blanketed with pure stands of chestnuts, so in early summer, when these trees bore their large, white flowers, observers described the ridges as once again covered in snow. Adults typically towered to 100 feet, with trunks three to four feet across. It was not uncommon to find individuals with trunks of eight to ten feet in diameter.

Three factors made the American chestnut one of the best timber trees in the eastern hardwood forests: 1) its straight and tall trunk was often branchless for as much as 50 feet; 2) it grew in such great abundance that logging was not difficult; and 3) its wood was remarkably rot-resistant. Chestnut wood was used for everything from telegraph poles and heavy construction to furniture and musical instruments. The trees had two additional economic uses. They fruited abundantly and produced delicious nuts that were renowned around the world. Also, American chestnut trees were the nation's leading source of tannin for tanning leather.

Because of their abundant fruits, the chestnuts played an important ecological role in the forests, producing a large part of the diet for, among other animals, bears, deer, and wild turkeys.

And then in 1904 disaster struck. American chestnuts in the New York Zoological Gardens began to die. Botanists quickly discovered that the trees were infected with fungus that had been imported from Asia on nursery stocks of the much smaller, ornamental Chinese chestnut. Control measures were attempted but nothing could be done; trees died soon after infection and the wind-dispersed fungus moved on, creating an infection that spread 20 to 50 miles per year. Even an attempt to clear large areas of chestnut trees in the path of the fungus did not halt the spread of the disease. With no hope in sight, the Forest Service recommended that loggers cut all of the remaining trees before they too become infected and useless

as timber. By 1950 virtually no adults were left standing. As is so often the case, species introduced from abroad can have particularly dramatic effects on native plants and animals. In this respect the chestnut blight was similar to, but more severe than, the later arriving Dutch Elm disease.

The federal government took the blight very seriously and began early to fund research efforts to save the species. The Chinese chestnut displayed disease resistance and large-scale breeding programs were established with the hope of transferring that species' resistance to its American relative. The idea was a good one and, in fact, partial resistance was transferred. However, the short, bushy stature of the Chinese species was transferred as well. The newly produced individuals were a far cry from the towering giants that had dominated our forests. After years of unsuccessful breeding, the government gave up and admitted defeat. American chestnuts, it was thought, were gone forever.

Then, early in the 1980s, a number of scientists thought that they might successfully undertake a new breeding program using a few, scattered individuals surviving outside of the natural range of the species. In 1983, the American Chestnut Foundation was founded and work began in earnest. The Foundation, a mostly volunteer group operating predominately on private donations, began the new breeding program along with other ecological studies. Philip A. Rutter, president of the foundation, is convinced that our knowledge of genetics and tissue culture techniques has increased to the point where a fungus resistant variety of the American chestnut can be produced. Results to date have been quite encouraging. The trees produced seem to have a moderate amount of resistance and are more like the American rather than the Chinese chestnuts. It is hypothesized that continued selective breeding will increase both resistance and stature.

Mr. Ruttner's dream is to sow resistant seeds throughout the original range of the chestnut, then allow nature to take its course. He is convinced that the species will be able to reclaim its position as the dominant member of the eastern forest community. Although his dream may be nothing more than that, it is a dream worth believing in. I know that I will never have the chance to see the forests dominated by these spectacular trees but I applaud the American Chestnut Foundation for allowing me the hope that my grandchildren will have that opportunity.

Dr. Michael Zimmerman is from the Department of Biology at Oberlin College.

TRUST FUND FOR SAVING THE LAND FACES HARD FIGHT IN CONGRESS

All across the United States, open space for walking, birding, biking, and just enjoying the outdoors is vanishing under an onslaught of housing tracts, shopping malls, and highways. Land is going especially fast in urban and suburban areas. But development is also crowding in on wilderness areas, parks, and once-undisturbed wildlife habitat.

At the same time that land for wildlife and recreation becomes increasingly scarce, more Americans than ever are looking for recreation and spiritual refreshment in green and wild places.

The 1987 President's Commission on Americans Outdoors was charged with assessing our outdoor recreation needs for the coming years. After listening to people in all parts of the country, the commission found a deep commitment among the American public to preserving our natural heritage. "More than anything else, we found in Americans a love of the land, and a shared conviction that it is our legacy to the future," the commission wrote in its final report. The commission recommended that to adequately provide for our outdoor needs, the nation should increase spending for land to $1 billion a year "at an absolute minimum," and set aside an "identified, dependable source of money."

Spending Falls Short

At present, land acquisition for outdoor recreation and wildlife habitat is funded from the Land and Water Conservation Fund, which provides money to federal park and wildlife agencies as well as to state and local governments. The fund receives $900 million a year, largely from offshore oil drilling receipts, but in recent years, Congress has appropriated only a small portion of what was available—an average of $200 million a year during the Reagan Administration. Spending has been woefully short of what is needed.

The American Heritage Trust Act, sponsored by Rep. Morris Udall, would build a much stronger funding mechanism. It creates a dedicated trust fund that in five years would generate $1 billion a year in interest, which would automatically be appropriated for land acquisition. The appropriations committee would still decide how the money would be spent; however, legislators would only have the power to veto or reduce the overall yearly allocation and unspent money would be added back to the fund.

Last year, a similar bill gained 235 cosponsors in the House and was reported out of committee. But powerful appropriations committee members, displeased because the bill partially circumvented the appropriations process, prevented a floor vote.

This year, the bill was again approved by the House Interior Committee—but by a smaller margin, and after all but one of the Republican members walked out when three of their amendments were defeated. The acrimonious mark-up unfortunately may have set the stage for a partisan struggle on the floor.

Supporters expect that progress on the bill will be much tougher going this year. Opponents have had time since last fall to marshall their forces. Led by Charles Cushman of the National Inholders Association, they have unleashed a campaign to depict the act as a federal land-grab that would threaten the rights of private property owners.

During the presidential campaign, George Bush spoke in support of the concept of a federal trust for acquisition of wildlands and refuges, but has been backing away from those statements in recent months. It remains to be seen whether he will support the emerging legislation.

The next decade may be our last chance to preserve a significant amount of the open space and wildlife areas that remain. According to Cynthia Lenhart, an Audubon wildlife specialist who lobbies for wildlife-related appropriations, the federal budget is getting tighter and funds for buying land are drying up.

Says Lenhart, "The American Heritage Trust will be absolutely necessary if we are going to complete the Rio Grande Wildlife Corridor, protect sea turtle nesting beaches in Florida, and preserve the other remaining pieces of open space for wildlife and outdoor recreation."

What You Can Do

Lenhart urges all activists to write their senators and representative urging them to support a dedicated trust fund for the acquisition of land for recreation and wildlife. "We can't take any vote for granted," she says. Rep. Udall's bill, HR 876, has not yet been scheduled to go to the House floor, but at press time action was expected soon. If a bill passes the House, the Senate would probably hold hearings on its counterpart, S 370, in July.

This article is reprinted from the Audubon Activist, July/August 1989 issue.

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BELIZE TOUR — FEBRUARY 2 - 13, 1990

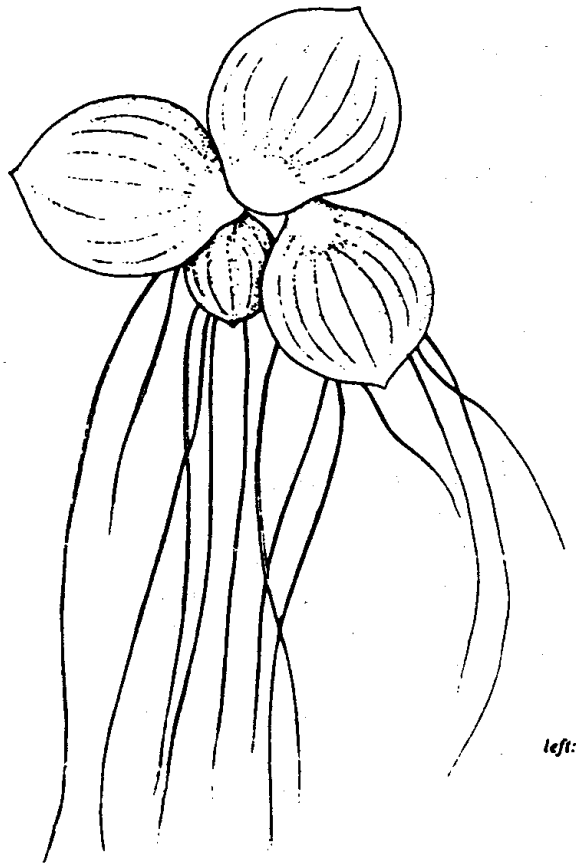
Visit the jungle paradise of Belize. Tour offers the traveler an excellent opportunity to experience a wealth of unspoiled tropical environments including exotic plants, many species of orchids and 300 species of birds. The tour will visit various habitats, the Jaguar Preserve, Tikal (a Mayan ruin) the Belize Zoo and Belize City. We will snorkel on the largest barrier reef in the Western Hemisphere. $780.00 includes room and board and transportation in Belize. Not including airfare from Cleveland to Belize and return. Deposit of 1/2 must be made by November 30, 1989. For information, call Sue Godfrey at work - 881-9582 or home - 932-0674.

DUCKWEEDS . . . Flowers in Miniature by Laima Kott

The duckweeds are tiny aquatic plants that have adapted to a habitat that very few other flowering plants have been able to invade. Of the Lemnaceae family, the duckweeks are small floating, vascular plants forming dense bright green carpets on the surface of ponds or among reeds in marshy places. At first glance, a population of duckweed appears as a superficial layer of scum, or is mistaken for a heavy bloom of filamentous green algae. Upon closer scrutiny, one can see small, individually, floating, leaflike thalli.

Their morphological simplicity and miniaturization are a result of severe reduction from a more complex ancestral organism. Modification of the vegetative body has been carried so far that the usual distinction between leaf and stem is no longer maintained and representatives of this family consist of undifferentiated thalli or "fronds" of various forms. These thalli, depending on the species, either float on the surface or are submerged just below the surface of the water. Simple roots may be present, dangling from the floating plants but do not reach the soil.

Among the three genera encountered in northeastern North America, **Spirodela**, water flaxseed, is the "largest", bearing obovate, floating fronds up to 8 mm long. **Lemna**, duckweed, is by far the most common and has smaller fronds, 2 to 5 mm in length. The former two types have flat ovate fronds, but members of the genus **Wolffia** water meal, are so miniature that their fronds are merely thickened, globose rootless thalli, very granular to the touch. **Wolffia arrhiza** is scarcely visible to the naked eye, being less than 1.5 mm long, and looks like scum on the surface of the water. These plants are noteworthy in that they are the smallest known flowering plants. About 12 individuals could be accommodated on a single frond of **Lemna minor.** Remnants of their reduced vascular system can be seen by a few barely discernable xylem vessel members running through the centre of the thallus.



left: Spirodela polyrhiza x4

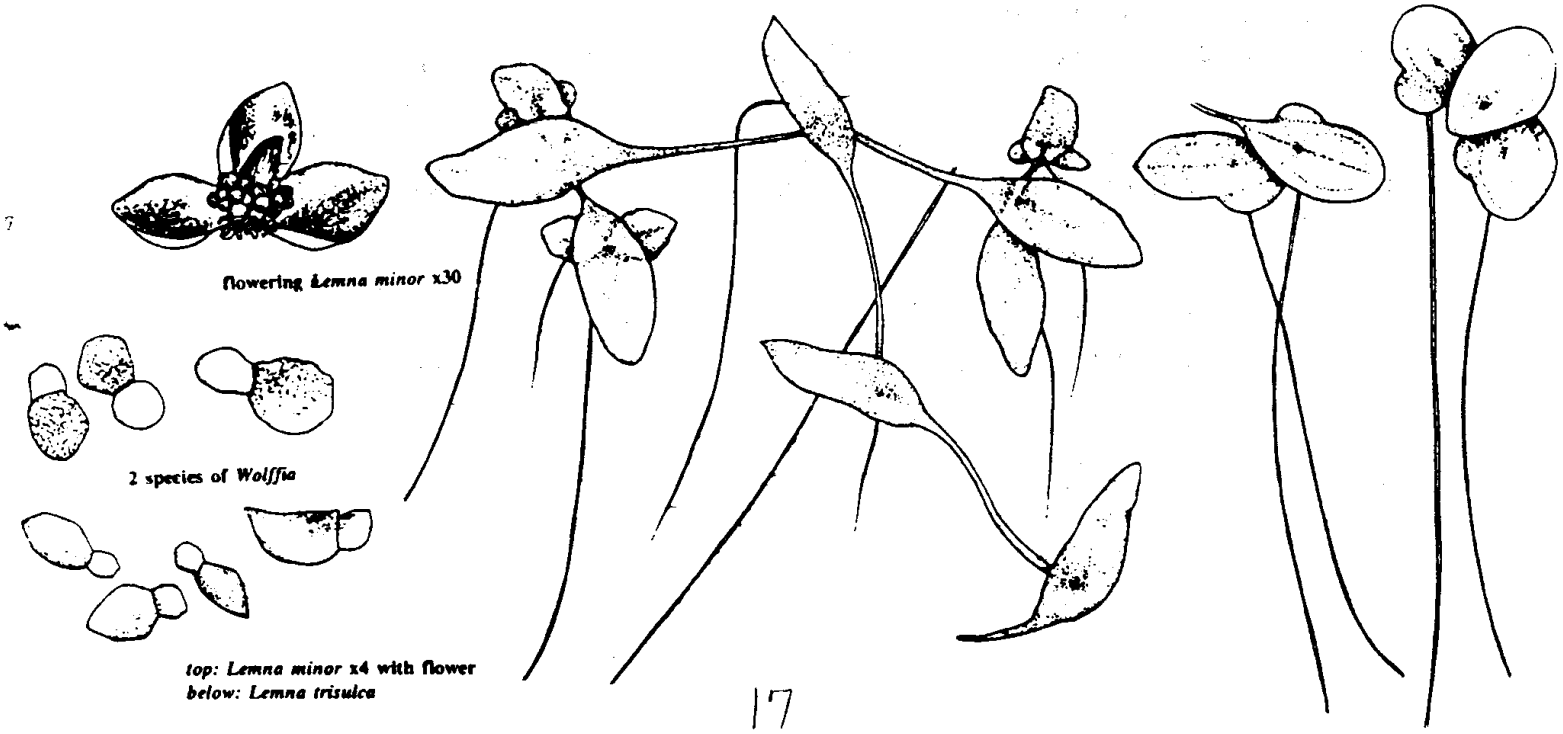
Reproduction among members of the Lemnaceae is, in general, vegetative cloning, through a process called budding. From reproductive slits, located at the margin of the frond, emerge new smaller thalli. Clones of related thalli of various ages remain attached for some time, appearing as a cluster of several smaller subunits.

In regions with cold winters, resting bulbets formed in the autumn may sink to the bottom of the pond but rise and begin to grow in the following spring.

Flowering individuals are encountered very rarely. The flowers, like the plant body itself, also have been simplied through evolutionary reduction to several stamens and one pistil. The free floating and rootless inflorescence of duckweed is produced from a cleft in the margin of the frond and consists of only one female flower and two male flowers, all surrounded by a basal sheath. Flowering is an extreme rarity and scientists have little data on flowering or pollination. The membership of one group of tiny plants in this family was in question for a time prior to the discovery of flowering individuals.

The **Lemnaceae** are found on all continents of the world in fresh waters and their distribution depends on dispersal of the plant thalli transported from site to site on the feet of water birds. In contrast to most other flowering plants where the dispersal unit is the seed or fruit, here the disseminule is the whole plant.

Most phylogenists agree that the duckweed family is closely related to the Arum family (Araceae: Jack-in-the-pulpit family), and that the adult structure of **Lemna** is very similar to that of seedlings of the aquatic genus **Pistia**, water lettuce (Araceae). It is accepted that these two families share ancestral stocks. It could be that **Lemna** may have been derived from **Pistia** through neoteny, a process in which sexual maturity is attained at a juvenile stage. It has also been suggested that members of the Lemnaceae have been derived from ancestral Araceae, and that through evolutionary adaptation have a very miniaturized structure showing a reduction series from **Spirodela**, through **Lemna** to the smallest **Wolffia**.



Members of this family are an important food source for waterfowl and fish. The recent discovery that duckweed contains an excellent array of amino acids could prove useful as an additive to human or livestock diets. Duckweed has been one of several plant groups used in the past in some tropical regions to deceive enemy airplanes in order to encourage them to land on a seemingly smooth grassy surface. But in many cases where the plants have been introduced they have become a serious hindrance in slowmoving waters.

Even though this mini-aquatic may on occasion become a human problem, its place in nature's cycles of life is unique. To be the smallest flowering plant in the global ecosystem is quite a claim to make!

Dr. Laima Kott is with the Dept. of Crop Sciences, University of Guelph, Ontario. She is a lecturer on plant taxonomy and her field of study includes the ferns and quillworts.

* * * * *

WILDFLOWER SEEDS: ECONOMICAL AND SATISFYING

Vivid wildflowers, adapted to a wide range of locations, are outstanding additions to home landscapes. Growing these wildflowers from seeds or spores is not only satisfying and economical, but gives gardeners a source of difficult-to-obtain plants. Therefore, the New England Wild Flower Society is offering for sale more than 150 varieties of wildflowers and ferns in their 1990 Seed List.

Included in the List are natives for woodland, wetland, and meadow gardens. Early blooming wildflowers add color to spring shade gardens while many of the sun-loving varieties are vibrant splashes in perennial borders.

Send $1.00 and a self-addressed, 45¢ stamped envelope (#10, business size) to Seeds, New England Wild Flower Society, Garden in the Woods, Hemenway Road, Framingham, MA 01701.

All requests for the 1990 Seed List must be received by March 1 because seed sales close March 15. Requests will be filled in the order received. The Seed List is an adjunct of the Society's world-wide distribution effort.

Members of the New England Wild Flower Society will **automatically** receive the Seed List in January 1990.

MOSSES by Deci Lowry

Many gardeners disdain moss because it is considered a sign of poor, acid soil in need of lime, fertilizer or other alchemies of grass growing. But in the right places, moss becomes a serene complement.

The Japanese use the word wabi to describe a taste for the simple and quiet. They have learned to use moss wisely. I believe that horticultural mosses should not be banished, but transplanted. They thrive in the shaded, moist and slightly acid soil of a wild garden. When used tastefully with native plants, mosses help to contribute to this sense of simplicity and quiet.

One of the mosses the Japanese prefer because it can be used on large areas and yet is tenacious enough to be swept free of leaves and debris is the haircap, **Polytrichum** commune. Its dark green color and soft, needlelike appearance belies its ability to withstand sun and drought. Another plus, it is not subject to insects or diseases.

Mosses abundant in rich woods are the pincushion moss, **Leucobryum glaucum**, and **Dicranum**, the broom moss. For moister locations there are the mat-forming moss, **Hypnum** and **Thuidium**, the fern moss. A good general-purpose one is cord moss, **Funaria.**

I use moss along a path of wild flowers and have been able to meet my needs by transplanting it from other parts of the garden and by weeding isolated tufts already present to encourage its spread. By using this method, I have not had to gather mosses from the woods or plant large areas.

The Japanese planting procedure for moss is to sweep the ground and remove weeds. They plant first around the bases of trees and stones. Then the ground is watered well, until it has a soft, muddy consistency and the moss is pressed down lightly on the muddy surface. Soil is dropped in the crevices between moss sections. (If the supply is limited, the moss is cut into small pieces and set in place at two-inch intervals to grow together.)

The Japanese suggest collecting moss right after a rain, lifting it with a knife or spade and taking care to include soil. Stored flat in a box in a shady space, and watered when dry, the moss can be held this way for many months.

Moss can also be propagated in a flat between two pieces of cheesecloth: Place the first cloth over the soil mix, dampen thoroughly, sprinkle evenly with dried, crumbled pieces of moss, then cover with the other piece of cheesecloth.

Keep evenly moist in a sheltered spot until the moss culture grows through the top layer and can be lifted. If it proves necessary, the cheesecloth mat can be cut into several strips for planting in six of eight weeks.

David E. Benner, associate professor of ornamental horticulture at Delaware Valley College, Doylestown, Pa., gave up fighting a "pathetic" grass lawn shortly after buying a shaded, north-facing property in 1962. He put in a moss lawn.

In a recent conversation, Mr. Benner said, "I wave at my neighbors spending their weekends on noisy, hot and uncomfortable lawnmowers, while I head off to go fishing." He recommended altering the acid level of soil as a way of encouraging moss to spread. He said that transplanting works best in early spring when the weather is cool.

To increase acidity, Mr. Benner suggested applying aluminum sulfate, or a water-soluble acid-type fertilizer such as Miracid, or sulfur to the soil. These will gradually lower the pH. At pH of 5.5 or less, the grass begins to die but the mosses will thrive.

Mosses will also prosper for applications of liquid cow manure. Because they lack roots and a vascular system, they have the ability to hydrate and dehydrate completely. They are known to be ancient plants, having anchored on shore some 500 million years ago.

The tenacity of mosses recently inspired landscape architect, Irwin Potter, of Sandy Hook, Conn., to use mosses to recover wetlands vegetation. "The mosses provide a tremendous variety in surface texture and color," he said. "We collect it, shred it, put it into a heavy slurry of cow manure and then spray it on."

This is a reprint from the New York Times.

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CHAPTER CONTACTS

Athens	Jean Andrews - (H) 614/593-7810
Cincinnati	Dr. Vic Soukup, 338 Compton Road, Cincinnati, OH 45215 (H) 513/761-2568
Cleveland	Tom Sampliner, 2561 Kerwick Road, Univ. Hts., OH 44118 (H) 216/321-3702 (W) 216/579-1272
Columbus	Dr. Jeanne Willis, P.O. Box 63, Westerville, OH 43081 (H) 614/882-4644 (W) 614/898-1617
Natural Areas & Preserves	Call: 614/265-6453
Dayton	Bob Gilbert - (H) 513/429-0255
Lisbon	Carol Bretz, P.O. Box 375, New Waterford, OH 44445 (H) 216/457-2385 (W) 216/424-7221
Mansfield	Glenna Sheaffer - (H) 419/289-6137
Toledo	Peter Montion, 6950 Providence St., Whitehouse, OH 43571 (H) 419/877-9261
Wilderness Center	Marvin Smith, 7236 Camp Road, West Salem, OH 44287 (H) 419/869-7575

PLANTS DON'T TAKE ENEMY ATTACK LYING DOWN by Jane E. Brody

In fields, forests, parks and suburban yards throughout the country, plants and trees are gearing up for an annual pitched battle against myriad enemies: predatory insects, pathogenic microbes, foraging animals and even other plants that try to invade their turf.

Though long thought to be passive victims in the face of attack, plants have been shown in recent years to be active, even agressive, warriors with an impressive arsenal of weapons. Some 10,000 compounds produced by plants in defense against insects and fungi have been identified, and many more are likely to exist. Until recently, these so-called secondary plant chemicals had no known use, although botanists aware of the economy of nature guessed that they had evolved for some purpose.

Several defensive strategies, such as plant mimics of insect hormones, have already been put to use by scientists seeking safer, more effective and less costly ways to control pests on crops, woodlands and ornamental plants. Other strategies, such as the use of weed-inhibiting plant residues, are coming into wider use. But in other cases, scientists either do not yet fully understand the defensive strategies or have not yet been able to develop practical methods of application to reduce dependence on synthetic pesticides.

Using chemicals in plants as pesticides is "a viable approach, especially for developing countries that lack the money to buy synthetic pesticides and the training to apply them safely," said Elroy L. Rice, a professor emeritus of botany at the University of Oklahoma. "In the United States, there is growing interest in the use of such natural plant chemicals because of all the enviromental problems caused by synthetic chemicals, many of which are not broken down."

At the same time, however, the study of plant defenses has clearly demonstrated that so-called biological methods of pest control can sometimes be as toxic to people as they are to the lower life forms that are plants' usual enemies. In fact, many plants—including some, like mushrooms and celery, that people eat—produce protective chemicals that can cause cancer in animals.

For example, comfrey, the medicinal herb often used as a tea, contains a pest-repelling alkaloid that is potentially more of a cancer threat than residues of carcinogenic pesticides in food. And when plant breeders developed a potato that could thwart insect predators, it turned out to be too toxic for people to eat.

Studies of plant defenses may also help explain the cyclical nature of some pest attacks, such as why a tree devastated by a pest like the gypsy moth one year may be virtually untouched by the same pest the next year. In response to an attack, some trees have been shown to produce chemicals that can inhibit the growth of later generations of pests.

This puts a damper on the size and health of the pest population and may render the pest vulnerable to attack by its own predators. In searching for still-undefended and more appetizing plants to feed on, the pest may migrate to other areas from time to time.

In the case of the gypsy moth, a virus is believed to cause periodic "crashes" of the moth population. When gypsy moth caterpillars feed on oak leaves, the neighboring leaves increase their production of tannins, which inhibit the growth of the caterpillars.

However, tannins also increase the caterpillars' resistance to viruses, which allows the gypsy moth population to slowly build. Eventually, the concentration of viruses in the caterpillars increases to a level that overrides the protection from tannins, and the gypsy moth population crashes.

As a detailed understanding of this kind of interaction unfolds, researchers expect to be better able to predict outbreaks of plant pest attacks and diseases and devise ways to head them off. Thus far, experts note, attempts to predict outbreaks based on weather patterns and food supplies have failed miserably, perhaps because the determining factor is the often ignored defensive action of the victimized plants.

But while pests searching for greener pastures can keep horticulturists and farmers guessing, many pests have come up with even more direct ways to dismantle plant defenses. Just as agriculture has been plagued by pests that develop resistance to synthetic pesticides, some pests have evolved the ability to detoxify natural plant chemicals that might otherwise impair their growth or reproduction.

At the New York State College of Agriculture and Life Sciences at Cornell University, Dr. Hans Van Etten, a plant pathologist, showed that fungi can disarm pea plant defenses by producing an enzyme that renders harmless the plants' natural fungicides. These antibiotic chemicals, called phytoalexins, are produced by the plants only after a fungal attack begins. Well over 100 such phytoalexins have been identified.

"A lot of research now is directed toward engineering plants genetically so they can outsmart the fungi by making new types of phytoalexins that the microbes can't detoxify, Van Etten said.

Unlike synthetic fungicides, the natural versions are less likely to cause environmental or health problems, he said, because these chemicals do not persist in the environment and because they are produced only by plants that are under attack.

"It's only rotting food that has high amounts of phytoalexins," Van Etten said, explaining that the ability to produce these chemicals persists even after the plant is harvested. "If you eat healthy food, the phytoalexins are not there or are at very low levels."

Agriculturally important plants also produce toxic chemicals in response to insect attack. For example, Richard Karban at the University of California at Davis showed that when spider mites are allowed to feed on the first few leaves of young cotton plants, the later leaves produce chemicals that render the plant resistant to further mite attack.

Squash plants produce a toxin to head off an attack by the cucumber beetle, which tries to protect itself by cutting a ring in the leaf to stop circulation of the toxin into its food supply.

Sometimes, however, a plant's chemical strategy can backfire in ways that directly aid the pest population. A plant toxin to which a pest has become immune may instead destroy parasitoids that prey on the pest and would otherwise keep it under control. Parasitoids are organisms, such as tiny wasps, that feed on other insects and eventurally kill them.

At the University of Maryland, Pedro Barbosa and colleagues found that noxious chemicals produced by trees after a gypsy moth attack seem to cause much more harm to the parasitoids that attack gypsy moth caterpillars than to the caterpillars themselves.

Barbosa also showed that while the tobacco hornworm caterpillar is immune to the toxic effects of nicotine from the tobacco plant, one of its parasitoids, a tiny wasp, is not. Caterpillars heavily laden with nicotine are thus protected from wasp predation, which allows the tobacco pest to flourish.

From an insect's perspective, this tactic of exploiting plants toxins for selfprotection is a highly efficient and economical strategy for survival. Researchers at the University of California at Irvine showed that salicin, a toxin produced by willows, so improves the survival of one kind of willow-eating beetle that the trees that produce the most toxin suffer the heaviest beetle damage.

On the other hand, some plants that might be said to use a "make love, not war" strategy employ insects for their own defense. At Cornell's Boyce Thompson Institute for Plant Research, Frank Messina, a researcher, showed that goldenrod infested with treehoppers fares better than neighboring plants that are free of these sap-sucking insects.

He discovered that the ants that feed on the treehoppers' honeydew protect the plant against other predators that are far more damaging than the treehoppers.

This article is a reprint from the Cleveland Plain Dealer, June 7, 1987.

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