The Pteridophyte Flora of Iowa

James H. Beck

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A floristic study of Iowa pteridophytes is presented based upon extensive herbarium and field work. Historical notes are included on the principal collectors, along with a summary of the accumulation of floristic records. Taxonomic notes are presented on seven taxa new to the state and on six excluded taxa. A flora of 57 species and 3 hybrids is recognized. Floristic notes are presented on the status of the state flora and county floras. The addition of 402 new county records increases the total of county occurrences by 47%. Statements of habitat and distribution are presented with dot maps for the entire flora. Records requiring new collections are identified, along with counties needing further field study and species that require special attention.


Iowa pteridophytes have received considerable attention from botanists over the last 130 years, including 12 state treatments. However, a comprehensive compilation of Iowa pteridophyte literature (Peck, 1976) revealed that many new state and county records might be added to the last treatment (Cooper, 1959). After conducting preliminary herbarium and field study, it became evident that a complete restudy of the flora was needed. Because accurate taxonomic and floristic data on Iowa pteridophytes is essential to my current research on pteridophyte reproductive biology, a comprehensive study of the state's pteridophyte flora was undertaken. This report summarizes present floristic information and identifies aspects that require further study.

PROCEDURE

The study was conducted through herbarium and field work. Approximately 5000 specimens in 19 Iowa herbaria were inspected and annotated. In order to resolve specific problems, selected specimens were also examined from four herbaria located outside the state. Published observations were not included unless vouchers could be located. Label and annotation data were recorded from each specimen. Space restrictions preclude citation of specimens in this report, but specific citations are available from the author.

The survey covered all 99 Iowa counties, except Fremont Co. Special field efforts were directed at counties with depauperate floras, at species whose Iowa distribution is poorly documented, at species rare in Iowa, at making new collections of old records, and at stations which might warrant some protective status to preserve the flora.

ACKNOWLEDGEMENTS

I thank the following collectors for permission to include their unreported county records: Kathryn A. Carvey, Donald R. Farrar, Thomas G. Lammers, David A. Niemann, Margaret E. Plouffe, Dean M. Roosa, Delmar Vander Zee, and James P. Vogler.

The curators of the following Iowa herbaria are thanked for allowing inspection of pteridophyte specimens: Central College (Pella), Coe College (Cedar Rapids), Dordt College (Sioux Center), Drake University (Des Moines), Grinnell College (Grinnell), Iowa Lakeside Laboratory (Milford), Iowa State University (Ames), Luther College (Decorah), Maharishi International University (Fairfield), Marshalltown Community College (Marshalltown), Northwestern College (Orange City), Putnam Museum (Davenport), Simpson College (Indianola), St. Ambrose College (Davenport), University of Dubuque (Dubuque), University of Iowa (Iowa City), University of Northern Iowa (Cedar Falls), Upper Iowa University (Fayette), and Wartburg College (Waverly). The curators of the following non-Iowa herbaria are also thanked for their assistance: Missouri Botanical Garden, Philadelphia Academy of Natural Sciences, United States National Museum, and the University of Minnesota (St. Paul).

I am grateful for the assistance of the following pteridophyte specialists who determined or verified difficult specimens: Joe Beitel, University of Michigan; Richard L. Hauke, University of Rhode Island; and Warren H. Wagner, Jr., University of Michigan. Dr. Wagner was especially helpful by clarifying the systematics of Equisetum and Cystopteris and by discussing the status of pteridophyte floristics in north-central United States.

Three workers were especially helpful and encouraging. Lawrence J. Eilers, University of Northern Iowa, discussed Iowa floristics and reviewed the manuscript. Donald R. Farrar, Iowa State University, advised the author throughout the study and reviewed the manuscript. Dean M. Roosa, Board Ecologist, Iowa State Preserve Advisory Board, collected many new records, established new stations for rare species, relocated old stations, and discussed Iowa collectors and Iowa floristics with the author. The assistance of these workers is gratefully acknowledged.

While many people have contributed and aided in the study, the responsibility for the identifications and the distributional data must rest solely with the author.

Readers aware of additional records or specimens that are in need of verification are encouraged to bring them to the attention of D. R. Farrar or me.

HISTORICAL NOTES

During the last 130 years, 50 principle collectors have contributed to the Iowa pteridophyte flora. These collectors, the duration of their pteridophyte collecting, and the regions of the state in which they made their studies are presented in Table 1. This floristic activity falls into four periods. While a few collectors were active in two periods, the majority of them can be readily assigned to one period.

The first period (ca. 1847-1899) was exploratory, with intensive collecting by a few workers in limited areas of the state. Collectors from this period include C. E. Bessey, G. W. Carver, R. J. Cratty, B. Fink, M. F. L. Fitzpatrick, T. J. Fitzpatrick, A. S. Hitchcock, T. H. Machbide, C. C. Parry, and F. Reppert. Their activities and collections resulted in six state floras (Arthur, 1886; Fitzpatrick, 1896; Fitzpatrick and Fitzpatrick, 1903; Greene, 1907; Pammel and King, 1902; Shimelk, 1901). During this 53 year period, 47 species and two hybrids were collected, supported by 290 county records.

The second period (ca. 1900-1939) was part of the first attempt to systematically collect the entire vascular flora and describe the vegetation throughout the state, an effort which also greatly enhanced the knowledge of Iowa pteridophytes. Collectors from this period include C. Gilly, E. W. Graves, U. A. Hauber, A. Hayden, C. M. King, M.
Table 1. Principal collectors of Iowa pteridophytes through 1976

<table>
<thead>
<tr>
<th>Collector</th>
<th>Duration</th>
<th>Region of Emphasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson, J. P.</td>
<td>1897-1905</td>
<td>Decatur, Fremont Co.</td>
</tr>
<tr>
<td>Augustine, D. W.</td>
<td>1938-1939</td>
<td>Mahaska Co.</td>
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<tr>
<td>Bessey, C. E.</td>
<td>1871-1876</td>
<td>Boone, Jones Co.</td>
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<tr>
<td>Carter, J. L.</td>
<td>1956-1959</td>
<td>Northwestern Iowa</td>
</tr>
<tr>
<td>Conard, H. S.</td>
<td>1907-1966</td>
<td>Central Iowa</td>
</tr>
<tr>
<td>Cooperider, T. S.</td>
<td>1955-1957</td>
<td>Eastern Iowa</td>
</tr>
<tr>
<td>Cratty, R. I.</td>
<td>1882-1931</td>
<td>Emmet Co.</td>
</tr>
<tr>
<td>Davidson, R. A.</td>
<td>1953-1955</td>
<td>Southeastern Iowa</td>
</tr>
<tr>
<td>Drexler, R. V.</td>
<td>1950-1975</td>
<td>Iowa, Lynn Co.</td>
</tr>
<tr>
<td>Easterly, N. W.</td>
<td>1949-1950</td>
<td>Iowa Co.</td>
</tr>
<tr>
<td>Eilers, L. J.</td>
<td>1962-1963</td>
<td>Northeastern Iowa</td>
</tr>
<tr>
<td>Fay, M. J.</td>
<td>1950-1952</td>
<td>Southwestern Iowa</td>
</tr>
<tr>
<td>Fitzpatrick, M. F. L.</td>
<td>1893-1904</td>
<td>Entire State</td>
</tr>
<tr>
<td>Fitzpatrick, T. J.</td>
<td>1893-1904</td>
<td>Hardin Co.</td>
</tr>
<tr>
<td>Frazier, C. B.</td>
<td>1896</td>
<td>Eastern Iowa</td>
</tr>
<tr>
<td>Graves, E. W.</td>
<td>1926-1933</td>
<td>Northeastern Iowa</td>
</tr>
<tr>
<td>Guirdner, L. F.</td>
<td>1938-1958</td>
<td>Eastern Iowa</td>
</tr>
<tr>
<td>Hartley, T. G.</td>
<td>1958-1960</td>
<td>Iowa Co.</td>
</tr>
<tr>
<td>Hauber, U. A.</td>
<td>1915-1932</td>
<td>Southeastern Iowa</td>
</tr>
<tr>
<td>Hayden, A.</td>
<td>1907-1940</td>
<td>Story Co.</td>
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<tr>
<td>Hitchcock, A. S.</td>
<td>1887-1889</td>
<td>Winnebke Co.</td>
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<tr>
<td>Holway, E. W. D.</td>
<td>1880-1882</td>
<td>Alamacke Co.</td>
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<tr>
<td>King, C. M.</td>
<td>1901-1921</td>
<td>Alamacke Co.</td>
</tr>
<tr>
<td>Lammers, T. G.</td>
<td>1975-1976</td>
<td>Entire State</td>
</tr>
<tr>
<td>Macbride, T. H.</td>
<td>1880-1890</td>
<td>Entire State</td>
</tr>
<tr>
<td>McDonald, M.</td>
<td>1893-1935</td>
<td>Delware Co.</td>
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<tr>
<td>Melhus, I. E.</td>
<td>1918-1933</td>
<td>Entire State</td>
</tr>
<tr>
<td>Merley, M.</td>
<td>1959-1940</td>
<td>Entire State</td>
</tr>
<tr>
<td>Olson, O. M.</td>
<td>1904-1907</td>
<td>Alamacke Co.</td>
</tr>
<tr>
<td>Orr, E.</td>
<td>1875-1905</td>
<td>Emmet Co.</td>
</tr>
<tr>
<td>Pammel, L. H.</td>
<td>1891-1930</td>
<td>Entire State</td>
</tr>
<tr>
<td>Reppert, F.</td>
<td>1878-1898</td>
<td>Muscatine Co.</td>
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<tr>
<td>Rickey, M. D.</td>
<td>1962-1963</td>
<td>Delaware Co.</td>
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<td>Roosa, D. M.</td>
<td>1973-1976</td>
<td>Central Iowa</td>
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<td>Russell, N. H.</td>
<td>1952-1956</td>
<td>Entire State</td>
</tr>
<tr>
<td>Shimke, B.</td>
<td>1881-1932</td>
<td>Webster Co.</td>
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<tr>
<td>Sones, M. P.</td>
<td>1905-1906</td>
<td>Chickasaw Co.</td>
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<tr>
<td>Spiker, W. D.</td>
<td>1925-1926</td>
<td>Entire State</td>
</tr>
<tr>
<td>Tolstead, W. L.</td>
<td>1933-1934</td>
<td>Southcentral Iowa</td>
</tr>
<tr>
<td>Wagenknecht, B. L.</td>
<td>1952-1953</td>
<td>Emmet Co.</td>
</tr>
<tr>
<td>Walden, B. O.</td>
<td>1918-1935</td>
<td>Emmet Co.</td>
</tr>
</tbody>
</table>

McDonald, J. E., Melhus, L. H., Pammel, B. Shimek, and B. O. Walden. Their activities resulted in four state floras (Cratty, 1933; Lyness, 1933; 1937-1938; Melhus, 1936). During this period of 40 years, an additional five species and one hybrid were collected, supported by 485 additional county records. This formed a pteridophyte flora of 52 species and three hybrids with 775 county records.

Special mention of L. H. Pammel and B. Shimek is warranted. They must be regarded as the most important contributors to the Iowa pteridophyte flora. They both made extensive collections and published prolifically on Iowa pteridophytes. Pammel lobbyed successfully for the preservation of natural areas rich in pteridophytes, many of which are today parks or preserves. Shimek is best known in pteridology for his pteridophyte flora of Nicaragua (Shimek, 1897), but in Iowa he should be known as the single most important collector. His specimens account for 60% of the county records known up to 1940.

The third period (ca. 1940-1969), part of a second effort to study the entire vascular flora of Iowa, has been well summarized (Eilers, 1970; 1975; Thorne, 1954). Important collectors during this period include J.L. Carter, T.S. Cooperrider, R.A. Davidson, R.V. Drexler, L.J. Eilers, M.J. Fay, M.L. Grant, T.G. Hartley, M.D. Rickey, R.F. Thorne, T. Van Bruggen, and B.L. Wagenknecht. The first 20 years are treated by Cooperrider (1955b; 1959). During this period, five new state records and 277 new county records expanded the flora to 57 species and three hybrids, based upon 1052 county records.

The fourth period (since 1970) was initiated by D.R. Farrar, Iowa State University, who through his own collecting, research and formal instruction, has stimulated interest in the Iowa pteridophyte flora. Collectors during this period include K.A. Carvey, D.R. Farrar, T.G. Lammers, D.A. Niemann, M.C. Plouffe, D.M. Roosa, D. Vander Zee and the author. During these seven years 202 new county records were collected, resulting in the present flora of 57 species and three hybrids with 1254 county records.

**Taxonomic Notes**

This section reports seven taxa new to the state, excludes six taxa from the flora, excludes five county records of rare and disjunct species, reports two important re-collections of rare species, and provides a checklist with synonyms commonly used in current Iowa floristic reports. Nomenclature follows Crabbe, Jermy, and Mickel (1975), Mickel (1975), and Wherry (1961).

**New State Records**


Three varieties of *Cystopteris fragilis* (L.) Bernh., var. *fragilis*, var. *mackayi* Laws., and var. *prostrusa*, were recognized by Cooperrider (1959), but the varieties were not plotted separately. The varieties were not determined on Iowa specimens. W. H. Wagner, Jr. annotated the Iowa *Cystopteris* specimens at the University of Iowa and selected specimens of Iowa State University in 1975-1976. Wagner followed Blasdell (1963), noting that var. *prostrusa* has specific rank as *C. protrusa* (Weath.) Blasdell, and that var. *mackayi* was present. A hybrid taxa, *C. × tennessensis* Shaver (C. *bulbifera × C. protrusa*) was also noted. The type variety was not seen in Iowa material.

*Dryopteris intermedia* (L.) Gray is reported here as new to Iowa. It was collected in 1903 by M. P. Sones from Woodman Hollow, Webster Co., and in 1959 by T. G. Hartley from Dubuque Co. These re-determined collections, previously identified as *Dryopteris spinulosa* (O. F. Mull.) Watt in Iowa literature, were verified by Wagner. I have extensively studied the Webster Co. station without finding the species. This site was a local source of ferns in the early 1900’s for horticultural use in Lincoln, Nebraska. A collection of *D. intermedia* from a greenhouse in Ft. Dodge, the county seat, suggests that the wild population may have been eliminated by removal to various greenhouses, a common activity at that time.

Hauke (1960) reported *Equisetum × ferrissii* Clute (*E. hyemale × E. laevigatum*) from specimens deposited in herbaria outside Iowa. While visiting Iowa Lakeside Laboratory in northwestern Iowa in 1975, Wagner confirmed the occurrence of this hybrid in Iowa. Subsequent investigation has determined that it occurs throughout the state. It had been previously identified as one of its parents, usually *E. laevigatum*. It should be noted that in northwestern Iowa the hybrid seems to occur in greater frequency and abundance than its parents.

*Equisetum scirpoides* Michx. was first collected in Iowa by T. G. Hartley in 1959 from Allamakee, Clayton, and Winneshiek counties (Hartley, 1962; 1966). The voucher for Hartley’s Winneshiek Co. station is missing, but I re-collected it there in 1976. Since then, D. M.
Roosa visited all of Hartley's stations and has located three additional stations of *E. scirpoidea* in Clayton Co.

J. Beitel verified that Iowa specimens previously identified as *Lycopodium selago* are actually *Lycopodium porophorum* Lloyd and Underw. Beitel also noted that a 1921 collection by Shimek from Clayton Co. was actually the hybrid *Lycopodium lucidulum × L. porophorum*. This is the first report of a hybrid club moss in Iowa.

**Excluded Taxa**


*Cystopteris fragilis* (L.) Bernh. var. *fragilis* was reported by Cooperrider (1959). A re-examination of Iowa *Cystopteris* specimens did not uncover specimens of this variety, and it is excluded.

*Dryopteris × uliginosa* Druce (*D. cristata × D. spinulosa*) was reported by Cooperrider (1959). The specimen was actually an immature plant of *D. spinulosa*. This identification was verified by Wagner. The hybrid is excluded.

*Equisetum × litorale* Kuhl. (*E. arvense × E. fluviatile*) was reported by Hartley (1966). The specimens were actually *E. fluviatile*. This identification was verified by R. L. Hauke.

*Lycopodium complanatum* L. was reported from the state by Cooperrider (1959); all specimens were assigned to *var. flabelliforme* Fern. Wilce (1965) recognized that variety as *L. flabelliforme* (Fern.) Blanch. All Iowa material is now referred to that name, except a collection of the typical variety that was collected by G. H. Berry from Linn Co. in 1907. Other records of rare plants and animals typical of more northern distributions have been reported by Berry from Linn Co., but they are considered to be erroneously attributed to Iowa, or at least, to Linn Co. (DuMont, 1933, p. 63; Hartley, 1962, p. 559). As no other collector found *L. complanatum* L. in Iowa, I exclude this species from the flora.

*Lycopodium selago* L. was reported by Cooperrider (1959), Eilers (1971), and Hartley (1966). All Iowa specimens previously identified as *L. selago* are actually *L. porophorum* or *L. lucidulum × L. porophorum*. *L. selago* was misapplied to Iowa material and is excluded.

*Polystichum munitum* (Kauff.) Presl was reported by Pammel and King (1902). That identification was verified by C. A. Weatherby in 1933. The specimen, however, bears only the vague locality data of "along the Des Moines River." The label appears to have been written by A. S. Hitchcock, and the specimen was originally identified as *Polypodium vulgare* L. It is unlikely that Hitchcock made that identification; it is more likely that a label became misplaced. *P. munitum* is far-western in its distribution, with the closest known locality a recently reported (Brooks, 1968) station in the Black Hills, South Dakota, 500 miles from central Iowa. As the South Dakota station is a 550 mile disjunct from the species in Montana, the Iowa specimen would be a 1000 mile disjunct. To accept such an important record on such tenuous evidence seems unwarranted. The specimen and the species is excluded.

Based upon a consideration of the floras of neighboring states, populations of some taxa not yet known from the state might yet be found: *Asplenium trichomanes* L., *Asplenium × eboenoides* R. Schott (*A. platyneuron × Camptosorus rhizophyllus*), *Cystopteris fragilis* (L.) Bernh. var. *fragilis*, various hybrids of *Dryopteris, Equisetum × litorale* Kuhl. (*E. arvense × E. fluviatile*), *Equisetum variegatum* Schlechter, and *Gymnocarpium × heterosporum* Wagner (*G. dryopteris × G. robertianum*).

**Checklist**

A checklist to the Iowa pteridophyte flora is presented in Table 2. The checklist presents the nomenclature now in use by pteridologists and follows Crabbe, Jermy, and Mickel (1975), Mickel (1975), and Wherry (1961). A flora of 60 taxa, 57 species plus 3 hybrids, is presented, distributed in 13 families and 27 genera. Synonyms are given to clarify recent Iowa usage; additional synonyms are given in Wherry (1961) and Cooperrider (1959).

Table 2. Checklist of Iowa pteridophytes

**ADIANTACEAE**

*Adiantum pedatum* L.

*Chelanthes feei* Moore

*Cryptogramma stelleri* (Gmel.) Prantl

*Pellaea atropurpurea* (L.) Link

*Pellaea globella* Mettenius ex Kuhn

**ASPLENIACEAE**

*Asplenium platyneuron* Oakes ex D. C. Eaton

*Athyrium angustum* (Willd.) Presl

[A. filix-femina (L.) Roth.]

*Athyrium pycnocarpon* (Spreng.) Tidestr.

*Athyrium thelypteroides* (Michx.) Desv.

*Camptosorus rhizophyllus* (L.) Link

*[Asplenium rhizophyllum* L.]

*Cystopteris bulbifera* (L.) Bernh.

*Cystopteris fragilis* (L.) Bernh. var. *mackayi* Laws.

*Cystopteris prostrata* (Weath.) Bladell

[C. fragilis* (L.) Bernh. var. *prostrata* Weath.]

*Cystopteris × tennesseensis* Shaver

[C. bulbifera × C. prostrata]

*Dryopteris cristata* (L.) Gray

*Dryopteris goldiana* (Hook.) Gray

*Dryopteris intermedia* (Muhl.) Gray

[D. *spinulosa* (O. F. Muell.) Watt var. *intermedia* Underw.]

*Dryopteris marginalis* (L.) Gray

*Dryopteris spinulosa* (O. F. Muell.) Watt

*Gymnocarpium dryopteris* (L.) Newn.

*Gymnocarpium robertianum* (Hoff.) Newn.

*Matteuccia struthiopteris* (L.) Tod.

*Onoclea sensibilis* L.

*Polystichum acrostichoides* (Michx.) Schott

*Woodia ilvensis* (L.) R. Br.

*Woodia obtusa* (Spreng.) Torr.

*Woodia oregana* D. C. Eaton

**AZOLLACEAE**

*Azolla mexicana* Presl

**DENNSTAEDTIACEAE**

*Pteridium aquilinum* (L.) Kuhn

**EQUISETACEAE**

*Equisetum arvense* L.

*Equisetum fluviatile* L.

*Equisetum hyemale* L.

*Equisetum laevigatum* A. Br.

*Equisetum pratense* Ehrh.

*Equisetum scirpoideum* Michx.

*Equisetum sylvaticum* L.

*Equisetum × ferrissii* Clute

[E. *hyemale × E. laevigatum*]

**ISOETACEAE**

*Isoetes melanoepoda* Gay and Dar.

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LYCOPODIACEAE
   Lycopodium clavatum L.
   Lycopodium dendroides Michx.
      [L. obscurum L. var. dendroides D. C. Eat.]
   Lycopodium flabelliforme (Fern.) Blanch.
      [L. complanatum L. var. flabelliforme Fern.]
   Lycopodium lucidulum Michx.
   Lycopodium porophilum Lloyd and Underw.
   Lycopodium lucidulum \times L. porophilum

MARSILEACEAE
   Marsilea quadrifolia L.
   Marsilea vestita Hook. and Grev.
      [M. mucronata A. Br.]

OPHIOGLOSSACEAE
   Botrychium dissectum Spreng. var. dissectum
   Botrychium dissectum Spreng. var. obliquum (Muhl.) Clute
   Botrychium multifidum (Gmel.) Rupr.
   Botrychium simplex E. Hitchc.
   Botrychium virginianum (L.) Sw.
   Ophioglossum pseudepodum (Blake) Far.
      [O. vulgatum L. var. pseudopodium Far.]

OSMUNDACEAE
   Osmunda cinnamomea L.
   Osmunda claytoniana L.
   Osmunda regalis L.

POLYPODIACEAE
   Polypodium virginianum L.
      [P. vulgare L. var. virginianum A. Eat.]

SELAGINELLACEAE
   Selaginella apoda (L.) Spring
   Selaginella rupestris (L.) Spring

THELYPTERIDACEAE
   Phegopteris connectilis (Michx.) Watt
      [Thelypteris phegopteris (L.) Slosson]
   Phegopteris hexagonoptera (Michx.) Watt
      [Thelypteris hexagonoptera (Michx.) Fee]
   Thelypteris palustris Schott

Excluded County Records
   County records were excluded if vouchers could not be found or
   the record was based upon mis-identified, mis-reported, or
   suspicious specimens. Five county records are excluded that
   documented disjunct stations of rare species. These exclusions
   warranted an explanation.

   Athyrium thelypteroides (Michx.) Desv. was reported by
   Cooperrider (1959) from Story Co., based on a specimen collected
   by A. S. Hitchcock in 1889. The specimen is actually a sterile,
   aberrant frond of Matteuccia struthiopteris (L.) Tod. that has a
   morphology intermediate between the typical sterile and fertile
   fronds. This identification, confirmed by Wagner, was suggested by
   stipe indument and stelar pattern.

   Lycopodium flabelliforme (Fern.) Blanch. was reported by Wilce
   (1965) from Warren Co., based on a specimen attributed to B.
   Shimek and collected from Cummington, Iowa. As the specimen
   label bears a University of Texas letterhead, as there is no town in
   Iowa named Cummington, and as Warren Co. lacks a suitable
   station for this species, the label data is considered erroneous.
   Cooperrider (1968) excluded two species from the Iowa flora that
   had similar label data. I concur with Cooperrider that these
   specimens were probably collected by someone other than Shimek
   at Cummington, Massachusetts and were subsequently mislabeled at
   the University of Texas before being deposited at the United States
   National Herbarium. Any other specimens so labeled and attributed
   to Iowa must be considered erroneous and excluded unless
   confirmed by other collections.

   Lycopodium selago L. was reported by Eilers (1964; 1971) from
   Chicksaw Co. Label data was mis-recorded from a mixed sheet of
   L. porophorum (then known as L. selago in Iowa) from Delaware
   Co. and L. lucidulum from Chicksaw Co. The Chicksaw Co. data
   was reported for the wrong specimen.

   Osmunda cinnamomea L. was reported by Cooperrider (1959)
   from Jasper Co. based on a specimen collected by E. W. Graves in
   1933. Cooperrider (1955a) considered his identification "doubtful,"
   but did not have the specimen verified. Wagner identified the
   specimen as Thelypteris palustris Schott. The very robust, sterile
   frond was easily identified by stipe indument and stelar pattern.
   The large size of the frond led to the erroneous report.

   Woodia oregana D. C. Eaton was reported by Hartley (1962)
   from Clayton Co. based upon a specimen with immature fronds.
   The specimen was actually Cystopteris fragilis var. mackayi. Wagner
   also verified this identification. The genera Cystopteris and Woodia
   have been problem genera for many Iowa workers, but they may be
   readily distinguished by the characters in Blasdel (1963) and Brown
   (1964). Important Re-collections

   Two species, each known from but a single station in Iowa, were
   thought to have been extirpated. Recent collections of these species
   indicate that the populations have persisted.

   Marsilea vestita Hook. and Grev. was originally collected by
   Shimek in 1899 from Lyon Co. In 1963 M. L. Grant, University of
   Northern Iowa, re-collected the species, but did not formally report
   this find. The species might be periodic in its appearance in Iowa,
   particularly as frequent droughts occur in northwestern Iowa.
   Unfortunately, this species may again be "probably extirpated," as
   the station is now used as a hog-lot. Additional field work is
   warranted.

   Selaginella apoda (L.) Spring was collected initially by R. F.
   Thorne and R. L. Hulbary in 1958 from a sandy seepage area along
   the Cedar River in Muscatine Co. The station was drained, ditched,
   and planted in corn. In 1976 I found that the population still persists.
   It is of interest that while the population was not fertile in 1958, it
   is now quite fertile, perhaps as a result of the disturbance.

FLORISTIC NOTES
   Considering the extensive literature and the many herbarium
   specimens that have accumulated for only 60 taxa in the last 130 years,
   the Iowa pteridophytes are better known than any other vascular plant
   group in the state. An ever increasing number of extirpated populations
   of rare species indicates the extent of human impact in Iowa which has
   gone unabated since settlement. Parks and preserves include many
   pteridophyte species, but not all are so protected. If the living flora is to
   be preserved, future floristic efforts must be directed toward
   distinguishing between the cumulative historical flora and the
   remaining living populations. Toward that end, the present status of the
   state flora and the county floras are discussed. The evaluation is not
   completed and remains an important task for further study.

Status of the State Flora
   Most Iowa pteridophyte species are known from relatively few of the
   99 counties; most counties have few pteridophyte species. This pattern
   of generally depauperate occurrence to some extent reflects the
   distribution of forest vegetation in pre-settlement Iowa. The flat upland
   landscape dominates 80-90% of Iowa, leaving only 10-20% of the state
   with varied terrain. The upland vegetation was prairie and wetlands.
   Gallery forests occurred along river valleys, but forests on the upland
   were only found in extreme northeastern and southeastern Iowa. As
   most Iowa species of pteridophytes are found in forested habitats, it is
   not surprising that two-thirds of the Iowa pteridophytes are known from

http://scholarworks.uni.edu/pias/vols3/iss4/7
15 or fewer counties.

The lack of suitable habitats on the upland has been further emphasized by the plowing of virtually all prairies and the draining of most wetlands. Since settlement much of the gallery forest along major river systems has been cut, cleared, or grazed, leaving only remnants. A comparison of forest in Iowa at the time of settlement (Fig. 1) and at present (Fig. 2) illustrates the reduction in acreage. Continued demand on Iowa forests will further reduce the availability of suitable sites for pteridophyte populations. Because of the drastic reduction in suitable sites, many herbarium vouchers may no longer reflect extant populations.

Human impact may have favored some species. The weedy taxa of Equisetum (E. arvense, E. × ferrissii, E. hyemale, and E. laevigatum) have certainly increased in abundance and possibly expanded their distribution by road and railroad construction, ditch maintenance, plowing of fields, and grading of secondary roads. Asplenium platyneuron and Botrychium dissectum are found on coal-mine spoils in central Iowa, but have not been found in habitats that are not man-made. Human impact may also have favored these two ferns.

On the other hand, some species were formerly known from more stations than the few that exist today. Osmunda cinnamonoea and O. regalis were recently reported from Delaware Co. (Rickey, 1964), but the locality for O. cinnamonoea was destroyed by cattle, while that of O. regalis was destroyed by road construction. Osmunda cinnamonoea, known from three counties, persists only in Muscatine Co. Osmunda regalis, known from five counties, persists only in Cedar Co. Dryopteris marginalis, known from three counties, persists only in Hardin Co. Ophioglossum pseudopodum, known from three counties, might soon be represented only in Chickasaw Co. because the Linn Co. station has suffered from road building and dredging in 1975 and 1976, while the Bremer Co. station consisted of one plant with two leaves in 1976. Lycopodium flabelliforme, known from eight counties, has recently been observed in only three counties, and one of these stations has been declining. Equisetum fluviatile, known from 18 counties, may persist in only eight counties.

Some species occur in eastern Iowa and have disjunct, or "outlier" populations reported from central Iowa. Many of these outlier populations have not been observed in the last 40 years. Loss of peripheral populations may have occurred in such species as Dryopteris intermedia, D. spinulosa, Equisetum pratense, E. sylvaticum, Gymnocarpium dryopteris, Lycopodium lucidulum, Pellaea glabella, Phegopteris hexagonoptera, Polypodium virginianum, Pteridium aquilinum, and Thelypteris palustris.

Further discussion of the persistence of the Iowa pteridophyte flora must await additional field work.

**Status of the County Floras**

The pteridophyte floras of the 99 counties of Iowa are presented in Fig. 3. Twenty-three counties, having five or fewer taxa, are considered depauperate. Twenty counties, having 20 or more taxa, are considered rich floristically. Counties with depauperate floras tend to have little habitat diversity, slight topographic relief, and many are in the Great Plains floristic region. These counties are also less well collected than counties in eastern Iowa. The rich county floras in eastern Iowa have considerable habitat diversity, extreme topographic relief, and large tracts of forest. These counties are also near the species-rich Great Lakes floristic region to the northeast and to the much richer Interior Highlands floristic region of Illinois and Missouri to the east and southeast.

The rich floras of Marion and Webster Co., isolated from the eastern counties, may be attributed to the many diverse micro-habitats afforded by the deep, river valley and tributaries of the Des Moines River system. Here the exposed sandstone bed rock and steep, north-facing slopes provide a relative constancy of moisture and temperature not encountered in other interior counties. The richness of the Hardin Co. flora, also an interior county, is even more astounding. Little forest existed in Hardin Co., and what does persist is located in the "Greenbelt" along the Iowa River. All 30 taxa are located in that zone. Topographic relief is less than that along the Des Moines River. An explanation might well involve an understanding of effects of Wisconsin glaciation on the vegetation. It is noteworthy that M. E. Plouffe (1977) observed 27 of the 30 taxa in a recent study of the Greenbelt vegetation. No other rich county flora is as well supported with recent observations of its pteridophyte flora.

**The Flora**

As a result of this study, so many changes in nomenclature and distribution have been added to the previous state pteridophyte flora (Cooperrider, 1959) that a restatement is warranted rather than a set of corrective notes. New dot maps were plotted to add 408 new county records to 846 records reported by Cooperrider (1959) and verified in this study, contributing to a 47% increase in total county collection records. New records were plotted with stars, while verified records in Cooperrider (1959) were plotted with dots. The occurrence of the species is presented based upon the following...
Fig. 3 Summary of county floras (species plus hybrids)

Depauperate  ●

Rich  ●

criteria: common = known from 46 or more counties, frequent = 31-45 counties, infrequent = 16-30 counties, and rare = 1-15 counties. Species in the flora which lack living populations are considered possibly extirpated. The occurrence of a species is presented with the number of counties in parentheses. Accordingly, eight species and one hybrid are designated as common, four species as frequent, ten species as infrequent, 32 species and two hybrids as rare. Three species are considered possibly extirpated. Nearly two-thirds of the Iowa pteridophytes are rare in Iowa, occurring in 15 or fewer counties. To clarify the abundance of species in populations across the state, the occurrence is restated in terms of regions of the state. Regional assessments are based upon my field experience supplemented with label data of other collectors.

Remarks are presented on habitat preferences as noted on label data and from my field experience.

Adiantum pedatum L.  
Northern maidenhair fern
Common (65): rare western third; frequent to common elsewhere
Moist woods and ravines; rocky slopes

http://scholarworks.uni.edu/pias/vol83/iss4/7
Asplenium platyneuron Oakes ex D. C. Eaton  
Ebony spleenwort  
Infrequent (16): rare central, southcentral, and northeast; infrequent southeast  
Shaded, sandstone out-crops and talus slopes; moist, wooded, sandy slopes; shaded ravines on coal-mine spoils

Athyrium angustum (Willd.) Prantl  
Northeastern lady fern  
Common (61): rare western third; frequent to common elsewhere  
Moist upland woods; wooded slopes and alluvium; margins and openings in woods

Athyrium pycnocarpon (Spreng.) Tidestr.  
Glade fern  
Rare (8): rare eastern third  
Moist alluvial woods; north-facing wooded slopes; shaded, sandy soil

Athyrium thelypteroides (Michx.) Desv.  
Silvery glade fern  
Rare (15): rare central; infrequent eastern third  
Moist upland woods, ravines, and slopes; north-facing bluffs and talus; sandstone out-crops

Azolla mexicana Presl  
Mosquito fern  
Rare (9): rare southwest and eastern third  
Shallow waters of ponds and backwaters; floating or stranded on mud or sand flats

Botrychium dissectum Spreng. var. dissectum  
Dissected grape fern  
Rare (10): rare eastern half  
Dry, upland woods; rich wooded slopes; coal-mine spoils
Botrychium dissectum Spreng. var. obliquum Clute Oblique grape fern
Infrequent (21): rare eastern third; infrequent southcentral
Dry, upland woods; rich wooded slopes; coal-mine spoils

Botrychium virginianum (L.) Sw.
Rattlesnake fern
Common (65): frequent western half; common eastern half
Upland woods; moist wooded slopes and alluvium

Botrychium multifidum (Gmel.) Rupr.
Leather grape fern
Rare (3): rare northeast
Sandy, dry, upland woods

Camptosorus rhizophyllus (L.) Link
Walking fern
Infrequent (25): rare western half; infrequent southeast; frequent northeast
Humus covered ledges and rocks in moist ravines

Botrychium simplex E. Hitchc.
Least grape fern
Rare (1): possibly extirpated from Linn Co.
Sandy pasture near marsh

Cheilanthes feei Moore
Slender lip fern
Rare (8): rare northeast
Cracks and crevices of exposed, dry, dolomite cliffs
PTERIDOPHYTE FLORA

Cryptogramma stelleri (Gmel.) Prantl
Slender cliff-brake
Rare (15): rare central and eastcentral; infrequent northeast
Moist, shaded cliffs, cool, rock talus slopes; sandstone and limestone

Cystopteris bulbifera (L.) Bernh.
Bulblet fern
Infrequent (19): rare central; infrequent southeast; frequent northeast
Moist rocky slopes and ledges; exposed outcrops; sandstone and limestone

Cystopteris protrusa (Weath.) Blasdell
Creeping fragile fern
Common (54): infrequent western third; frequent central; common eastern third
Moist wooded slopes and alluvium

Cystopteris × tennesseensis Shaver
Southern hybrid-bulblet fern
Rare (11): rare eastern half
Ledges in moist, wooded ravines; sandstone and limestone

Cystopteris fragilis (L.) Bernh. var. mackayi Laws.
Mackay's fragile fern
Frequent (39): common northeast; rare southwest; frequent elsewhere
Ledges and crevices; sandstone and limestone

Dryopteris cristata (L.) Gray
Crested wood fern
Rare (11): rare in eastern half
Sandy seeps and marshes; sphagnum bog; coal-mine spoils
Dryopteris goldiana (Hook.) Gray
Goldie's wood fern
Rare (11): rare eastern half
Moist humus at base of steep, north-facing slopes

Dryopteris intermedia Gray
Glandular wood fern
Rare (2): rare central and eastcentral
Moist humus at base of steep north-facing slopes

Dryopteris marginalis (L.) Gray
Marginal shield fern
Rare (3): rare central and northeast
Moist humus to sandy soil on wooded, north-facing slopes; sandstone outcrops

Dryopteris spinulosa (O. F. Muell.) Watt
Spinulose wood fern
Infrequent (20): rare central and southeast; infrequent northeast
Moist humus of north-facing slopes; sandstone ledges

Equisetum arvense L.
Field horsetail
Common (98): frequent to infrequent western half; common eastern half
 Variety of disturbed habitats: roadsides, railroad ballast, alluvial prairies, sandy soil, ditches, and stream banks

Equisetum fluviatile L.
Water horsetail
Rare (18): rare northern half
 Variety of wetland habitats: marshes, ponds, seeps, stream margins
**Equisetum hyemale** L.
Common scouring-rush
Common (98): infrequent western third; frequent to common elsewhere
Variety of disturbed habitats: roadsides, railroad ballast, moist prairies, shaded stream banks, along water courses

**Equisetum laevigatum** A. Br.
Smooth scouring-rush
Common (90): infrequent southern half; common northern half
Dry prairies and variety of disturbed habitats: roadsides, railroad ballast; loess bluffs and sandy areas

**Equisetum pratense** Ehrh.
Meadow horsetail
Rare (12): rare central and eastcentral; infrequent northeast
Moist, wooded, north-facing slopes; sandy to rocky

**Equisetum x ferrissii** Clute
Ferriss' hybrid scouring-rush
Common (75): common northwest and northcentral; frequent to infrequent elsewhere
Dry to moist prairies; disturbed habitats: roadsides and railroads

**Equisetum scirpoides** Michx.
Dwarf scouring-rush
Rare (3): rare extreme northeast
Openings on wooded, north-facing slopes; moss covered talus at seeps

**Equisetum sylvaticum** L.
Woodland horsetail
Rare (7): rare central and northeast
Sandy seeps on wooded, north-facing slopes; moist sandy areas
Gymnocarpium dryopteris (L.) Newm.
Oak fern
Rare (6): rare central; rare to infrequent northeast
North-facing cliffs and rocky slopes; cool, moist, moss-covered talus slopes

Gymnocarpium robertianum (Hoff.) Newm.
Limestone Oak fern
Rare (4): rare northeast
North-facing cliffs and rocky slopes; cool, moist, moss-covered talus slopes

Isoetes melanopoda Gay and Dur.
Midland quillwort
Rare (1): possibly extirpated from Clinton Co.
Prairies (no data on Iowa specimen)

Lycopodium clavatum L.
Running clubmoss
Rare (2): rare eastcentral
Disturbed, sandy, wooded slopes and embankments

Lycopodium dendroideum Michx.
Round-branched ground-pine
Rare (3): rare northeast
North-facing, wooded, sandstone bluffs; moist, cool, talus slopes

Lycopodium flabelliforme (Fern.) Blanch.
Crowfoot clubmoss
Rare (8): rare eastern third
North-facing, sandy, wooded slopes; sandy embankments
Lycopodium lucidulum Michx.
Rare (11): rare eastern half
Moist sandy soil and sandstone rocks at base of steep, north-facing slopes and bluffs

Marsilea quadrijolia L.
Rare (2): rare southcentral and southeast (Escape; now naturalized)
Muddy shallows of sheltered or lake margins

Lycopodium porophilum Lloyd and Underw.
Rare (3): rare northeast
Moist, wooded, north-facing sandstone cliffs and bluffs

Marsilea vestita Hook. and Grev.
Rare (1): rare and periodic (?) in northwest
Muddy depressions in rocky prairies

Lycopodium lucidulum × L. porophilum
(no common name)
Rare (1): rare northeast
Moist, wooded, north-facing sandstone cliffs and bluffs

Matteuccia struthiopteris (L.) Tod.
American ostrich fern
Frequent (35): rare western half; frequent southeast; common northeast
Moist, wooded, slopes and alluvium
Onoclea sensibilis L.  
Sensitive fern  
Common (52): infrequent southwest and northcentral; common eastern half  
Moist, sandy, open areas: marshes, woods, alluvium

Ophioglossum pseudopodum (Blake) Far. Northern adder's-tongue fern  
Rare (3): rare northeast  
Moist sandy soil and sedge tussocks; margins of woods

Osmunda cinnamomea L.  
Cinnamon fern  
Rare (3): rare eastern fourth  
Moist, sandy areas at base of wooded, north-facing slopes

Osmunda claytoniana L.  
Interrupted fern  
Frequent (40): infrequent central third; frequent eastern third  
Moist, wooded, north-facing slopes and alluvium

Osmunda regalis L.  
American royal fern  
Rare (5): rare eastern fourth  
Moist, sandy openings; sandy hillside seeps

Pellaea atropurpurea (L.) Link  
Purple cliff-brake  
Rare (2): rare extreme northeast and extreme southeast  
Dry, exposed sandstone outcrops
**Pteridophyte Flora**

**Pellaea glabella** Mett. ex Kuhn

Smooth cliff-brake

Infrequent (22): rare central third, infrequent eastern third
Crevices of exposed calcareous sandstone or limestone bluffs or ledges

**Polypodium virginianum** L.

Common polypody

Rare (14): infrequent extreme northeast, rare elsewhere
Moist, wooded, north-facing sandy slopes and sandstone cliffs; climbing base of tree (Des Moines Co.)

**Phegopteris connectilis** (Michx.) Watt

Northern beech fern

Rare (2): possibly extirpated from Delaware and Muscatine counties
Moist wooded sandstone talus and bluffs

**Polystichum acrostichoides** (Michx.) Schott

Christmas fern

Infrequent (17): rare northeast; infrequent eastcentral; frequent southeast
Moist, wooded, sandy north-facing slopes

**Phegopteris hexagonoptera** (Michx.) Fee

Southern beech fern

Infrequent (18): rare central and southeast; infrequent northeast
Moist humus at base of wooded, north-facing slopes

**Pteridium aquilinum** (L.) Kuhn.

Bracken fern

Frequent (31): rare central and southeast; infrequent east; frequent northeast
Sandy soil; disturbed margins of woods; embankments
Selaginella apoda (L.) Spring
Meadow spikemoss
Rare (1): known only from Muscatine Co.
Moist, sandy, open, pastured field

Selaginella rupestris (L.) Spring
Rock spikemoss
Rare (12): rare northwest and rare eastern third
Dry, exposed quartzite rocks; dry, exposed limestone and sandstone; dry, exposed, sandy soils

Thelypteris palustris Schott
Marsh fern
Infrequent (29): infrequent central and southeast; frequent northeast
Moist open places: marshes, ditches, seeps, sandy slopes, sphagnum bog

Woodsia ilvensis (L.) R. Br.
Rusty cliff fern
Rare (2): rare extreme northeast
Dry, exposed cliffs and ledges; sandstone crevices

Woodsia obtusa (Spreng.) Torr.
Blunt-lobed cliff fern
Infrequent (28): rare central; infrequent southeast; frequent northeast
Dry, exposed sandstone and limestone cliffs and ledges

Woodsia oregana D. C. Eaton
Western cliff fern
Rare (3): rare extreme northwest and extreme northeast
Shaded crevices of sioux quartzite rocks in west; shaded, dry crevices in sandstone out-crops in east
FUTURE CHALLENGES

While this study is the 13th state-wide treatment, floristic study of Iowa pteridophyte is not completed. Two taxonomic problems exist which need in-depth study and additional collecting. Some county records require new vouchers as the existing vouchers are too old. Furthermore, to adequately know the living flora, some records of rare species need to be supported with new vouchers. Deaparate county floras warrant further collecting as they are probably under-collected. Efforts should be made to locate populations of the three species considered possibly extirpated. This section provides notes that would assist these improvements.

Taxonomic Problems

Efforts to name Iowa material assignable to Cystopteris fragilis var. mackayi or to C. protrusa led to the conclusion that some specimens are inadequate for specific determinations. They often lacked a rhizome, which is useful in distinguishing between these species. New collections are needed. An ecological study is also needed to further clarify their distinctiveness in the field.

The genus Equisetum also presents some difficulty. Equisetum hyemale and E. laevigatum form a hybrid, E. × ferrissii. The species are readily distinguished from the hybrid if fertile material is at hand (Hauke, 1963; 1965). Vegetative characters are less distinct. The spores of the species are green, possess elaters, and are uniform in size and shape. Spores of the hybrid are clear, lack elaters, and are highly variable in size and shape. In 1976 I made extensive collections of these taxa. I noticed that damaged aerial stems of the parents form new stems that closely resemble typical hybrid stems, but viable spores are still produced. To adequately know the living flora, some records require new vouchers as the existing vouchers are too old.

Records Requiring New Vouchers

Three types of records require new vouchers: those missing vouchers, records known only from the 1800's, and records of rare plants not seen in the last 25 years. At the beginning of 1976, 32 records were identified as lacking their reported vouchers. During 1976, 18 records were substantiated with new collections. The remaining 14 records are excluded from the flora plotted on maps, but they might have occurred as named and reported. The records are presented to aid in either relocation of the specimen or to suggest a new collection. Five records noted by Cooperider (1959) were thus excluded:

- Equisetum fluviatile: Cerro Gordo Co. (Shimek, 1917, IA)
- Osmunda claytoniana: Benton Co. (Knupp, 1910, IA)
- Wood sia obtusa: Jasper Co. (citation not given); Dallas Co. (Van Bruggen #908, IA); Greene Co. (citation not given).

Nine additional records have been reported, but now lack their vouchers:

- Cystopteris bulbifera: Howard Co. (Eilers #2120, 1962, IA)
- Cystopteris fragilis: Howard Co. (Eilers #2121, 1962, IA); Floyd Co. (Eilers #3142, 1963, IA); Benton Co. (Eilers #2791, 1963)
- Lycopodium flabelliforme: Washington Co. (Griffin, 1963, IA)
- Onoclea sensibilis: Howard Co. (Eilers #3159, 1963, IA); Benton Co. (Eilers #2642, 1962, IA)
- Pellaea glabella: Howard Co. (Eilers #2122, 1962, IA)

Old Records

Records documented by vouchers collected only in the 1800's may now reflect extirpated stations. At the beginning of 1976, 94 old records were identified. In 1976, 55 old records were re-collected, leaving 39 records still needing new vouchers:

- Asplenium platyneuron: Muscatine Co. (1897)
- Athyrium thelypteroides: Delaware Co. (1897)
- Azolla mexicana: Louisa Co. (1897)
- Botrychium multifidum: Fayette Co. (1893)
- Cystopteris rhizophylla: Harrison Co. (1892); Scott Co. (1888)
- Cheilanthes feei: Dubuque Co. (1888)
- Cryptogramma stelleri: Johnson Co. (1880)
- Cystopteris bulbifera: Floyd Co. (1874); Poweshiek Co. (1886)
- Cystopteris fragilis: Dallas Co. (1897); Pottawattamie (1897)
- Cystopteris protrusa: Emmet Co. (1882); Ringgold Co. (1890)
- Cystopteris × tennesseensis: Cerro Gordo Co. (1899); Decatur Co. (1898)
- Dryopteris goldiana: Jackson Co. (18—?)
- Equisetum arvense: Pottawattamie Co. (1896)
- Equisetum × ferrissii: Shelby Co. (1894); Union Co. (1892)
- Equisetum fluviatile: Hamilton Co. (1882); Hancock Co. (1896); Story Co. (1889)
- Equisetum laevigatum: Dallas Co. (1897); Lee Co. (1897)
- Equisetum pratense: Webster Co. (1897)
- Equisetum sylvaticum: Jasper Co. (1886); Winneshiek Co. (1880)
- Gymnocarpium dryopteris: Johnson Co. (1892); Winneshiek Co. (1899)
- Isoletes melanopoda: Clinton Co. (1863)
- Lycopodium flabelliforme: Muscatine Co. (1894)
- Phegopteris connectilis: Delaware Co. (1878); Muscatine Co. (1897)
- Polystichum acrostichoides: Jackson Co. (18—?); Scott Co. (18—?)
- Selaginella rupestris: Dubuque Co. (1885).

Records of Rare Plants

Some records of rare taxa have not been verified in the field during the last 25 years. In 1976, 71 records of rare plants were identified for field verification. Twenty-four records were verified, leaving the following 47 records still in need of new vouchers:

- Asplenium platyneuron: Iowa Co. (1924); Jefferson Co. (1935); Scott Co. (1905)
- Azolla mexicana: Allamakee Co. (1901); Clayton Co. (1934); Fremont Co. (1905)
- Botrychium dissectum: Van Buren Co. (1932)
- Cryptogramma stelleri: Cerro Gordo Co. (1917)
- Cystopteris × tennessensis: Hardin Co. (1949); Jefferson Co. (1933); Webster Co. (1920); Winneshiek Co. (1933)
- Dryopteris cristata: Chickasaw Co. (1925); Clay Co. (1921)
- Dryopteris goldiana: Mahaska Co. (1938)
- Dryopteris intermedia: Webster Co. (1903)
- Dryopteris marginalis: Allamakee Co. (1905); Dubuque Co. (1922)
- Equisetum fluviatile: Chickasaw Co. (1926); Dubuque Co. (1901); Emmet Co. (1922); Palo Alto Co. (1939); Tama Co. (1933); Webster Co. (1906)
- Equisetum sylvaticum: Boone Co. (1932); Linn Co. (1928)
- Lycopodium flabelliforme: Buchanan Co. (1917); Chickasaw Co. (1925); Clayton Co. (1923); Delaware Co. (1940)
- Lycopodium lucidulum: Cedar Co. (1941); Boone Co. (1933); Chickasaw Co. (1926)
- Lycopodium porophorum: Delaware Co. (1930)
- Lycopodium lucidulum × L. porophorum: Clayton Co. (1921)
- Osmunda cinnamomea: Jackson Co. (1905)
- Osmunda regalis: Muscatine Co. (1932)
*Pellaea atropurpurea*: Van Buren Co. (1932)
*Polypodium virginianum*: Jones Co. (1948); Mahaska Co. (1921)
*Polystichum acrostichoides*: Allamakee Co. (1927)
*Selaginella rupestris*: Bremer Co. (1930); Blackhawk Co. (1937); Chickasaw Co. (1930); Muscatine Co. (1916).

### County Floras
Further efforts to collect in the counties noted in Fig. 3 as depauperate are expected to be rewarding. At the beginning of the 1976 collecting season, 38 counties were rated as depauperate, having five or fewer taxa in their floras. With help, I was able to collect enough to remove 15 counties from the list. Of the 23 remaining counties, 18 also had records added to their floras. This indicates that to some degree the “depauperate” counties are “under-collected.” All remaining 23 counties might yield new county records, and many might eventually be removed from the list of depauperate floras.

At the beginning of 1976, 18 counties were considered to have rich floras. By the end of 1976, two additional counties (Chickasaw and Floyd) were added (Fig. 3), while the floras of 13 of the original 18 were also increased. The counties with rich floras have been heavily collected, but they still continue to yield new records. Field work in eastern Iowa is expected to continue to provide additional records.

### Possibly Extirpated Species
Special mention of three species possibly extirpated in Iowa may aid in their rediscovery. The location of these species anywhere in the state would be of considerable importance.

*Bryochilum simplex* was collected by R. F. Thorne, R. L. Hulbary, and T. S. Cooperrider in 1954 from a sandy pasture near Coggen, Linn Co. The species has not been observed since. I have visited the station six times without relocating the species. The station was disturbed by road building in 1975 and was further disturbed by dredging in 1976. The plant is quite small and will require patient searching on hands-and-knees.

*Isoetes melanopoda* has not been observed in Iowa since its original collection by A. Vasey in 1863 from Clinton Co. The drastic changes in wetland habitats along the Mississippi River brought about by agriculture, industry, and construction of lock-and-dam systems may have lessened the likelihood of its persistence in Clinton Co. The species has also been collected in Rock Co., Minnesota, a few miles from Lyon Co., Iowa. As that collection was found near Sioux quartzite rocks in prairies, and as similar habitats occur in Lyon Co., the species might be located there. Its rediscovery is hampered in that *Isoetes melanopoda* has emergent leaves, 10-25 cm tall, which resemble a sedge tussock.

*Phegopteris connectilis* was collected once in Delaware Co. and once in Muscatine Co., in the 1800’s. Dr. L. F. Guldner made many trips to the Muscatine Co. station, near the area of Wild Cat Den State Park, but was unsuccessful in relocating the species. No locality was given for the Delaware Co. specimen. The species resembles *P. hexagonoptera*.

### Literature Cited
