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The Flora of the Cedar Creek Forest Area

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this mycelium eventually fruited, and *Aspergillus* and *Penicillium* sporophores on the material could be observed with the naked eye.

Assays of approximately 30 samples of used furniture stuffing obtained from furniture repair shops in Minneapolis and St. Paul gave mold counts from 150 to almost 115 thousand molds per gram, and in the samples tested to date for bacteria the counts ranged from 17 thousand to a little over a billion bacteria per gram.

The fungal flora of a foam rubber cushion changed both quantitatively and qualitatively with several months use. The moisture content of the cushion also increased 3% in the three months which may account, at least in part, for the change in micro-flora.

As in house dust, the fungi most commonly cultured from new and used furniture stuffing were species of *Penicillium* and *Aspergillus*, except in some of the cotton samples where *Fusarium* predominated. These same fungi are most common in the air within the home while *Alternaria* and *Cladosporium* predominate in the outside air during the heavy mold months from May to November. *Aspergillus* and *Penicillium* are present in limited numbers in the outside air the year around.

The identification of the bacteria commonly encountered in these materials is now in progress. Many of the bacteria isolated from these materials appear to be those common in soil and plant debris.

THE FLORA OF THE CEDAR CREEK FOREST AREA

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The present study brings up to date our knowledge of the vascular plants of the Cedar Creek Forest area, especially as these are represented in the Herbarium of the University of Minnesota.

The Cedar Creek Forest is located 30 miles north of Minneapolis about one and one-half miles east of Cooper's Corner,¹ Anoka County, Minnesota. A general discussion of the development of the area has recently been given by Wilcox (1950).

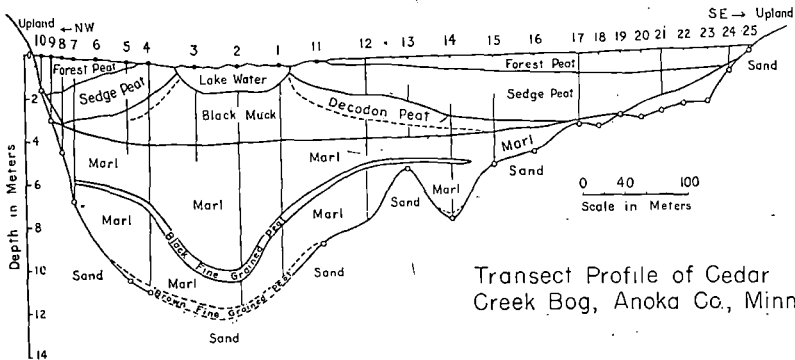
The Cedar Creek Forest area falls within the Anoka Sand Plain which was formed during the last stages of the Late Wisconsin Glaciation (Cooper, 1935). This glacier retreated perhaps 10,000 to 20,000 years ago; since that time the topography has changed but little. Upon the denuded, sandy surface a rather diverse vegetation, characteristic of the Canadian Province of North America (Dice, 1943), has been reestablished.

The Cedar Creek Forest area first received serious attention in 1929 when N. L. Huff visited the Isanti County portion of the bog. On the twenty-fourth of June, 1929, he obtained pictures of *Pyrola asarifolia*

¹ This can be reached by State Highway No. 65. From Cooper's Corner the area is accessible by State Aid Roads Nos. 8 and 33 in Anoka County and by Nos. 36 and 37 in Isanti County.

and on the nineteenth of August, of *Bidens coronata*. In May, 1930, Robert R. Humphrey, one of C. O. Rosendahl's graduate students, encountered an "orchid-like" plant growing on a sandy ridge adjacent to Cedar Bog Lake. This proved to be *Polygala paucifolia*, the fringed polygala. At that time the floristic significance of Cedar Creek Bog began to emerge. Here was a southern outlier of the northern coniferous forest, with a bog lake and a cedar swamp. The following year W. S. Cooper, the late F. K. Butters, and C. O. Rosendahl examined the area and discovered the swamp loosestrife, *Decodon verticillatus*, as a zone encircling Cedar Bog Lake. This was, however, not the first discovery of this attractive and curious plant, since in the 1890's Miss Eloise Butler had reported it verbally from Hennepin County near Robbinsdale. From 1929 to the present many botanists and zoologists have visited the Cedar Creek Forest to study its biota. Those who have done collecting, photographing, and observational work include:—N. L. Huff, 1929; Robert R. Humphrey, 1930; W. S. Cooper, 1931- ; F. K. Butters, 1931; C. O. Rosendahl, 1929- ; Murray and Helen F. Buell, 1932- ; Samuel Eddy, 1932- ; Etlar L. Nielsen, 1934; John W. Moore, L. J. and M. A. Forbes, 1933; R. L. Lindeman, 1937-40; John B. Moyle, 1935- ; Olga Lakela, 1934- ; D. B. Lawrence, 1937- ; Virginia Lee Malone, 1946; R. M. Schuster, 1950.²

Papers pertaining to the area will be found listed in the appended bibliography.



After Lindeman, Jan. 1941

The accompanying chart is a modification of one prepared by Raymond L. Lindeman (1941a). He made soundings and borings in the lake and in the surrounding sedge-mat and adjacent bog forest. The pit, or lake basin, was apparently formed by the melting of a great ice block left as the last glacier retreated. Sand had washed in around this block,

² Others who may wish to do scientific work in the Cedar Creek Forest may apply for a study permit to Dr. A. N. Wilcox, the Chairman of the University Administrative Committee of the Cedar Creek Forest Research Area.

and when it finally melted a lake basin remained. Since its creation most of the basin has filled with peat and marl in alternate layers. From the bottom upward, brown peat of very fine texture is overlaid by fine grained marl. The latter is covered by a layer of dark peat, and this with a thick layer of flaky marl. On top of the marl is deposited a layer of black slimy ooze of partially decomposed odoriferous organic matter. In the center there is the open water of the lake, which now represents only a fraction of the original lake area. Toward the edge of the bog is Decodon-peat, overlapped by a sedge-peat, and this in turn by forest-peat, of mixed composition. Lindeman (1942) designated this body of water a "Senescent Lake." He estimated that the bog forest, at the present rate of accumulation and decay of organic plant and animal remains, would completely cover the open water area in about 250 years.

Three general types of vegetation are found in the area. One is bog forest with associated meadows and ponds and lakes. A second is sand prairie, and the third, upland forest. The latter is represented by two phases: oak savanna, and coniferous forest.

BOG FOREST:

The open-water plants at present found in the lake are *Potamogeton pusillus*, *Potamogeton zosteriformis*, *Najas flexilis*, *Lemna trisulca*, *Spirodela polyrbiza*, *Ceratophyllum demersum*, *Nuphar variegatum*, and *Utricularia vulgaris* var. *americana*. In dry years, the mucky lake bottom supports a nearly complete cover of wild rice, *Zizania aquatica* var. *angustifolia*. There is a number of plankton forms, both plant and animal (Lindeman, 1941b) as well as macroscopic forms of animal life in the open water.

The peripheral Decodon and sedge mats normally rise and fall with the yearly rise and fall of the water level in the lake (Buell & Buell, 1941). The average difference in level from spring, when the water is highest, to fall or early winter is about two feet. The vegetation that makes up this mat consists mainly of sedges, accompanied by a number of vascular plants: *Osmunda regalis* var. *spectabilis*, *Dryopteris Thelypteris* var. *pubescens*, *Phragmites communis*, *Carex Bebbii*, *Carex lasiocarpa* var. *americana*, *Carex hystericina*, *Betula pumila* var. *glandulifera*, *Spiraea tomentosa* var. *rosea*, *Impatiens capensis*, *Decodon verticillatus* var. *laevigatus*, *Asclepias incarnata*, *Lobelia siphilitica* var. *ludoviciana*, *Bidens coronata*, and *Eupatorium maculatum*.

The white cedar zone which surrounds the sedge mat supports a luxuriant growth of bog-loving plants. The white cedar, *Thuja occidentalis*, has given its name to the small creek³ on the west border of the forest.

In this zone one finds *Osmunda Claytoniana*, *Eriophorum viridicarina-tum*, *Calla palustris*, *Sarracenia purpurea*, *Rhus vernix*, *Lysimachia thyr-sifloria*, *Menyanthes trifoliata* var. *minor*, and *Viola incognita*. On hummocks in the bog forest one encounters *Coptis groenlandica*, *Drosera rotundifolia*, *Mitella nuda*, *Vaccinium oxycoccus*, *Trientalis borealis*, and

³ Cedar Creek flows southward from Isanti County along the west border of Cedar Creek Forest and enters the Rum River a few miles north of the city of Anoka.

in the more open spots the ericaceous shrubs *Andromeda glaucophylla* and *Ledum groenlandicum*.

The richest association in number of species is the black ash swamp. Here we see in great abundance *Osmunda cinnamomea*, as well as *Botrychium virginiana* var. *europaeum*, *Dryopteris spinulosum*, *Taxus canadensis*, *Maianthemum canadense* and its var. *interius*, *Cypripedium arietinum* and our state flower, *Cypripedium reginae*, *Aralia racemosa*, *Cornus canadensis*, *Pyrola asarifolia*, *Fraxinus nigra*, *Linnaea borealis*, *Helianthus giganteus*, and *Solidago gigantea*. The whole association is frequently overgrown with alder, *Alnus rugosa* var. *americana*.

UPLAND FOREST:

The upland forest is a mixed forest of *Pinus Strobus*, *Populus tremuloides*, *Quercus alba*, *Quercus ellipsoidalis*, and *Ulmus americana* as well as *Amelanchier humilis*, *Amelanchier intermedia*, *Amelanchier laevis*, and *Cornus rugosa*. The herbaceous flora is made up of *Anemone quinquefolia*, *Arabis lyrata*, *Aralia nudicaulis*, *Galium trifolium*, *Mitchella repens* and *Prenanthes alba*.

SAND PRAIRIE:

On the elevated sandy ridges there are jack pine, red oak, and pin oak. The herbaceous vegetation of the sand ridges consists of *Cyperus filiculmis*, *Potentilla argentea*, *Polygala paucifolia*, *Ceanothus americanus*, *Viola conspersa*, *Arctostaphylos uva-ursi*, *Gaultheria procumbens*, *Asclepias tuberosa* ssp. *interior*, and *Prenanthes alba*.

VASCULAR PLANTS OF THE CEDAR CREEK FOREST

Note. The following list incorporates evidence drawn from:

- (1) specimens largely in the Herbarium of the University of Minnesota, which are referred to by name of collector and his field number or date of collection;
- (2) photographic records, the present location of the photo being indicated in each instance;
- (3) literature records, which are cross-referenced with "Literature Cited."

Ferns and Fern Allies

- Equisetum sylvaticum* L.—Moore, Forbes & Forbes, May 20, 1933.
Botrychium virginianum (L.) Sw. var. *europaeum* Angstr.—Buell & Buell 695.
Osmunda cinnamomea L.—Buell & Buell 696.
O. Claytoniana L.—Buell & Buell 699; Malone, July 3, 1946.
O. regalis L. var. *spectabilis* (Willd.) Gray—Buell & Buell 705; Malone, 21, July 7, 1946.
Athyrium angustum (Willd.) Presl.—Buell & Buell 710.
Dryopteris spinulosa (O. F. Mull.) Watt.—Malone, 22, July 7, 1946.
D. Thelypteris (L.) Gray, var. *pubescens* (Lawson) Prince and Weatherby—Buell & Buell 614 (*sub* *Thelypteris palustris*).

Conifers

- Taxus canadensis* Marsh.—Moyle 2760.
Larix laricina (DuRoi) K. Koch—Lindeman (1941a); Buell & Buell (1941).
Picea mariana (Mill.) B.S.P.—Schuster, May 28, 1950.
Pinus Banksiana Lamb.—Buell & Buell (1941).
P. Strobus L.—Lindeman (1941a).
Thuja occidentalis L.—Buell & Buell 691; Buell & Buell (1941); Lindeman (1941a.)

Flowering Plants**Typhaceae**

- Typha latifolia* L.—Cooper (photo of 1931 in Lindeman, (1941a); Buell & Buell (1941); Lindeman (1941a).

Potamogetonaceae

- Potamogeton pusillus* L.—Lindeman (1941b) (*sub* *P. panormitanus*).
P. zosteriformis Fern.—Lindeman (1941a, 1941b).

Najadaceae

- Najas flexilis* (Willd.) Rost. & Schmidt—Buell & Buell 712; Lindeman (1941a).

Gramineae

- Agrostis alba* L.—Buell & Buell 708.
Bromus ciliatus L.—Buell & Buell 651.
Calamagrostis canadensis (Michx.) Beauv.—Buell & Buell 649.
Muhlenbergia glomerata (Willd.) Trin.—Buell & Buell 620; Buell & Buell (1941) (*sub* *M. racemosa*).
Phragmites communis Trin.—Buell & Buell 659.
Zizania aquatica L. var. *augustifolia* Hitchc.—Buell & Buell 668; Buell & Buell (1941).

Cyperaceae

- Carex Bebbii* Olney—Buell & Buell 652.
C. disperma Dewey—Moyle & Rosendahl 6637; Buell & Buell 682.
C. hystericina Muhl.—Buell & Buell 640 & 654.
C. lasiocarpa Ehrh. var. *americana* Fern.—Buell & Buell 664; Buell & Buell (1941) (*sub* *C. filiformis*).
C. leptalea Wahl.—Buell & Buell 653.
C. paupercula Michx. var. *pallens* Fern.—Buell & Buell 632; Moyle 3077.
Cyperus filiculmis Vahl.—Moyle 3097.
Dulichium arundinaceum (L.) Britt.—Buell & Buell 650.
Eriophorum viridi-carinatum (Englm.) Fern.—Buell & Buell 684.
Eleocharis calva Torr.—Buell & Buell 658; Buell & Buell (1941) (*sub* *E. palustris*).

Araceae

- Arisaema atrorubens* (Ait.) Blume forma *zebrina* (Sims) Fern.—Moore, Forbes & Forbes, May 20, 1933.
Calla palustris L.—Buell & Buell 638.

Lemnaceae

- Lemna trisulca* L.—Buell & Buell 655, in part.
Spirodela polyrhiza (L.) Schleid.—Buell & Buell 655, in part.

Liliaceae

- Oakesia sessilifolia* (L.) S. Wats.—Moore, Forbes & Forbes, May 20, 1933.
Maianthemum canadense Desf.—Buell & Buell 681, in part; Nielsen 2420.
M. canadense Desf. var. *interius* Fern.—Buell & Buell 662.
Smilacina trifolia (L.) Desf.—Buell & Buell 681, in part

Orchidaceae

- Cypripedium arietinum* R. Br.—Buell & Buell 692.
C. reginae Walt.—Buell & Buell 704.
Goodyera repens (L.) R. Br. var. *ophioides* Fern.—Rosendahl 6523.
Habenaria hyperborea (L.) R. Br.—Buell & Buell 630.
H. obtusa (Pursh.) Richards.—Cooper, July, 1931.
Liparis Loeselii (L.) Richard.—Buell & Buell 673; Moyle 3082.
Malaxis unifolia Michx.—Cooper, July 1931; Buell & Buell 679.

Salicaceae

- Populus tremuloides* Michx.—Moore, Forbes & Forbes, May 20, 1933; Buell & Buell 628.
Salix Bebbiana Sarg.—Buell & Buell 627; Buell & Buell (1941).
S. candida Flugge var. *denudata* Anderss.—Lakela 780 (*sub S. humilis*).
S. discolor Muhl.—Moore, Forbes & Forbes, May 20, 1933.
S. gracilis Anderss.—Buell & Buell 629; Buell & Buell (1941) (*sub S. petiolaris*).
S. pedicellaris Pursh var. *hypoglauca* Fern.—Rosendahl 6184.
S. serissima (Bailey) Fern.—Cooper & Butters, July 11, 1931

Betulaceae

- Alnus rugosa* (DuRoi) Spreng. var. *americana* (Regel) Fern.—Buell & Buell 707.
Betula lutea Michx.f.—Lindeman (1941a).
B. pumila L. var. *glandulifera* Regel—Buell & Buell 670; Lindeman (1941a).
X *B. Sandbergi* Britt.—Buell 1808a.

Fagaceae

- Quercus alba* L.—Nielsen 2941.
Q. ellipsoidalis E. J. Hill—Nielsen 2943; Buell & Buell (1941).

Ulmaceae

- Ulmus americana* L.—Lindeman (1941a).

Urticaceae

- Pilea pumila* (L.) Gray—Buell & Buell 624.

Polygonaceae

- Polygonum Hydropiper* L.—Rosendahl 6426b.
P. punctatum Ell.—Buell & Buell 681; Rosendahl 6426a.
P. sagittatum L.—Buell & Buell 703.
Rumex orbiculatus Gray—Buell & Buell 637.

Ceratophyllaceae

- Ceratophyllum demersum* L.—Lindeman (1941a, 1941b).

Nymphaeaceae

- Nuphar variegatum* Engelm.—Buell & Buell 665; Moyle 2763.

Ranunculaceae

- Anemone quinquefolia* L. var. *interior* Fern.—Moore, Forbes & Forbes, May 20, 1933.
Coptis groenlandica (Oeder) Fern.—Moore, Forbes & Forbes, May 20, 1933; Buell & Buell 683.

Cruciferae

- Arabis lyrata* L.—Rosendahl 6181.

Sarraceniaceae

- Sarracenia purpurea* L.—Huff, verbal report (1939).

Droseraceae

- Drosera rotundifolia* L.—Buell & Buell 694.

Saxifragaceae

- Mitella nuda* L.—Buell & Buell 685; Nielsen 2419.
Parnassia palustris L. var. *neogaea* Fern.—Buell & Buell 713.
Ribes hirtellum Michx.—Rosendahl 6182.
R. triste Pall.—Lakela 1117.

Rosaceae

- Amelanchier humilis* Wieg.—Nielsen 2413.
A. humilis Wieg. var. *compacta* Nielsen—Nielsen 2411.
A. intermedia Spach—Nielsen 2413, 2415, 2416, 2417.
A. laevis Wieg.—Nielsen 2411A, 2412, 2944.
Potentilla argentea L.—Nielsen 2945.
P. palustris (L.) Scop.—Buell & Buell 635.
Rubus pubescens Raf.—Buell & Buell 674.
Spiraea tomentosa L. var. *rosea* (Raf.) Fern.—Buell & Buell 644.

Polygalaceae

- Polygala paucifolia* Willd.—Humphrey, May 22, 1930; Moore, Forbes & Forbes, May 20, 1933; Rosendahl 6177.

Anacardiaceae

- Rhus Vernix* L.—Lindeman (1941a); Buell & Buell (1941); Huff (photo in private collection of Prof. N. L. Huff).

Aquifoliaceae

- Ilex verticillata* (L.) Gray—Buell & Buell 700.

Aceraceae

Acer rubrum L.—Lindeman (1941a).

Balsaminaceae

Impatiens capense Meerb.—Buell & Buell 611 (*sub* *I. biflora*).

Rhamnaceae

Ceanothus americanus L.—Moyle 2759.

Rhamnus alnifolia L'Her.—Buell & Buell 701; Buell & Buell (1941).

Guttiferae

Hypericum virginicum L. var. *Fraseri* (Spach) Fern.—Buell & Buell 617.

Violaceae

Viola conspersa Reichenb.—Moore, Forbes & Forbes, May 20, 1933; Lakela, May 26, 1935.

V. incognita Brainerd—Moore, Forbes & Forbes, May 20, 1933; Rosendahl & Moyle 6639.

V. pallens (Banks) Brainerd—Moore, Forbes & Forbes, May 20, 1933; Buell & Buell 622; Nielsen 2421; Rosendahl & Moyle 6638.

V. renifolia Gray—Buell & Buell 678; Rosendahl & Moyle 6640A.

V. renifolia Gray var. *Brainerdi* (Greene) Fern.—Moore, Forbes & Forbes, May 20, 1933.

Lythraceae

Decodon verticillatus (L.) Ell. var. *laevigatus* Torr. & Gray—Cooper (photo of 1931 in Lindemann 1941a); Rosendahl 625; Buell & Buell 608; Buell & Buell (1941); Lindeman (1941a).

Onagraceae

Epilobium coloratum Muhl.—Moyle 3079.

E. palustre L.—Buell & Buell 671.

E. strictum Muhl.—Buell & Buell 612.

Araliaceae

Aralia nudicaulis L.—Buell & Buell 686.

A. racemosa L.—Buell & Buell 697.

Umbelliferae

Cicuta bulbifera L.—Buell & Buell 641.

Cornaceae

Cornus canadensis L.—Buell & Buell 672.

C. rugosa Lam.—Lakela 791.

C. stolonifera Michx.—Buell & Buell 631; Lindeman (1941a).

Pyrolaceae

Pyrola asarifolia Michx.—Huff (photo in private collection of Prof. N. L. Huff).

Ericaceae

- Andromeda glaucophylla* Link.—Buell & Buell 661; Buell & Buell (1941).
Arctostaphylos uva-ursi (L.) Spreng.—Rosendahl 6183.
Gaultheria procumbens L.—Buell & Buell 676; Moyle 2761.
Ledum groenlandicum Oeder.—Buell & Buell 633; Buell & Buell (1941).
Vaccinium oxycoccus L.—Buell & Buell 711.

Primulaceae

- Lysimachia thyrsiflora* L.—Huff (photo in private collection of Prof. N. L. Huff).
Trientalis borealis Raf.—Buell & Buell 687.

Oleaceae

- Fraxinus nigra* Marsh.—Lindeman (1941a).

Gentianaceae

- Bartonia virginica* (L.) B.S.P.—Buell & Buell 702; Rosendahl 6427.
Menyanthes trifoliata L. var. *minor* Raf.—Lakela 1110.

Asclepiadaceae

- Asclepias incarnata* L.—Buell & Buell 669.
A. tuberosa L. ssp. *interior* Woodson—Huff (photo in private collection of Prof. N. L. Huff).

Labiatae

- Lycopus uniflorus* Michx.—Buell & Buell 610.
Mentha arvensis L. var. *villosa* (Benth.) Stewart—Buell & Buell 657
 (*sub* *M. canadensis*).
Scutellaria lateriflora L.—Buell & Buell 639.

Lentibulariaceae

- Utricularia vulgaris* L. var. *americana* Gray—Buell & Buell 642.

Rubiaceae

- Galium labradoricum* Wieg.—Buell & Buell 621.
G. triflorum Michx.—Buell & Buell 675.
Mitchella repens L.—Moyle 2762.

Caprifoliaceae

- Linnaea borealis* L. var. *americana* (Forbes) Rehder—Buell & Buell 688.
Lonicera dioica L. var. *glaucescens* (Rydb.) Butters—Rosendahl 6179; 6180.
L. villosa R. & S. var. *solonis* (Eat.) Fern.—Rosendahl 6178; Moore, Forbes & Forbes, May 20, 1933; Buell & Buell 648; Lakela 1124.

Campanulaceae

- Campanula aparinoides* Pursh—Buell & Buell 613 (*sub* *C. uliginosa*).
Lobelia siphilitica L. var. *ludoviciana* A. DC.—Buell & Buell 714.

Compositae

- Bidens cernua* L.—Buell & Buell 643.
B. coronata (L.) Britt.—Huff (photo in private collection of Prof. N. L. Huff); Buell & Buell 660.
Eupatorium maculatum L.—Buell & Buell 623.
Helianthus giganteus L.—Rosendahl 6421.
Lactuca biennis (Moench.) Fern.—Buell & Buell 706.
Prenanthes alba L.—Buell & Buell 698.
Solidago gigantea Ait.—Rosendahl 6428 (*sub S. canadensis*); Buell & Buell 626 (*sub S. serotina*).
S. uliginosa Nutt.—Buell & Buell 690.

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INDICATOR VALUE OF PLANTS IN JACK PINE STANDS

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For several hundred years foresters have been classifying forests and forest lands. This classification has been along several different lines and for several different purposes. The most obvious system of classification is one which is based on the species of trees actually occupying the area at the time of classification. This has been commonly referred to as the "cover type" system of classification, and gives primary consideration to the practical and immediate problems of the forester in managing the forest.

This cover type system of classification fulfills quite adequately the need for simple, reasonably homogeneous units into which the forest can be classified. However, although the cover type classification serves some of the practical management needs of the forester in dealing with his forest, it fails in several respects. For example, two areas having identical