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**A Vegetation Study of the Musci of the Niobrara River Valley of
Nebraska.**

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A Vegetation Study of the Musci of the
Niobrara River Valley of Nebraska

A Thesis
Presented to the
Biology Department
and the
Faculty of the Graduate College
University of Nebraska at Omaha

In Partial Fulfillment
Of the Requirements for the Degree
Master of Arts.

by
Donald E. Jacobson
January 1979

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THESIS ACCEPTANCE

Accepted for the faculty of the Graduate College,
University of Nebraska, in partial fulfillment of the
requirements for the degree Master of Arts, University
of Nebraska at Omaha.

Thesis Committee

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<u>David M. Sutherland</u>	<u>Biology</u>
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Chairman

March 15, 1979
Date

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I am also thankful for the constructive criticism rendered by Dr. David Sutherland.

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Table of Contents

	Page
List of Maps	iv
List of Tables	v
Introduction	1
Study Area.	1
Geology	2
Climate	3
Method of Collection	3
Results and Discussion	4
Summary and Conclusions.	6
Specimen List.	15
References	19

List of Maps

Map	Page
1. Location of Forest Ecosystems in the Niobrara River Valley	8
2. Approximate Precipitation in the Niobrara River Valley	9

List of Tables

Table	Page
1. Family Representation and Number of Species	10
2. Forest Type and Corticolous Affinities of the Acrcarpous Species	11
3. Forest Type and Corticolous Affinities if the Pleurocarpous Species.	12
4. Tree Type affinities of the Corticolous Mosses of the Niobrara River Valley	13
5. Western Range by Forest Type of the Mosses of the Niobrara River Valley.	14

A VEGETATION STUDY OF THE MUSCI OF THE
NIOBRARA RIVER VALLEY OF NEBRASKA

INTRODUCTION

Since the 1890 publishing of Webbers "Catalogue of the Flora of Nebraska," very little has been written about the moss flora of this state. From Webbers original list of 47 species, the number increased to 75 in 1924 (Wolf) and finally to 99 species in 1977 (Churchill and Redfearn). Also, in 1975 Koch has written about the occurrence of the family Pottiaceae in Nebraska.

Other prairie locale studies show that the moss flora of Nebraska is possibly more extensive than it now appears. Smith (1966) reported 117 species of which 23 were new to Kansas. Similarly, Conard (1956) has reported 90 to 100 species in some single counties of Iowa.

This study was proposed to add to the existing information on the moss flora of the state. It was also intended to shed some light on their distribution in the Niobrara River Valley.

Study Area

In this project, 105 samples were collected in 11 counties adjoining the Niobrara River. This valley offers a wide range of ecological, geographic, and climatic conditions.

The Niobrara flows almost 540 Kilometers west to east across the northern part of the state. The river courses through three major forest systems. An Eastern Deciduous Forest dominates the area from the Niobrara State Park west approximately 80 Km. From there to the eastern border of Dawes and Box Butte counties is a distance of about 390 Km. that is a mixture of Eastern Deciduous and Rocky Mountain Coniferous Forest. The final 70 to 80 Km. of the valley, ending at the Wyoming state border, contains portions of Rocky Mountain Coniferous Forest. This is the Pine Ridge of Nebraska. Any of these systems may also contain pockets of Floodplain Forest. (Map 1)

This high degree of variation of forest types gives the valley a wide range of bryophyte habitats. The plains that dominate Nebraska and intrude into this study area provide many places suitable for the growth of mosses but not for a wide variety of them. The forest areas mentioned and many bare places, ravines, sand dunes, or hillcrests offer more suitable habitat on the plains. (Conard, 1956)

Many species that exist in the study area exhibit xeric features. Such changes as dwarfing to pygmy size, development of water retention structures, and leaf "rolling" may help a moss plant live in the dry areas of the plains. (Smith, 1966)

Geology

The Niobrara River Valley lies in the Central Lowlands

of the Great Plains of the United States. The Eastern fifth of the valley is described as a dissected till plain, developed by Pleistocene glaciers and covered in places by eolian loess clay. This topsoil is easily eroded, and, along with the till, is continuously dissected by the river and its tributaries. The differing speeds of these waters account for varying degrees of bluffing in the valley. The western four-fifths of the valley is composed of sand hills. The highly basic soils are accompanied by scattered "blowout" lakes.

In the far west of the valley is a high plains escarpment that reaches nearly 1600 meters in elevation. This "Pine Ridge" includes the highest points of elevation in the study. The eastern border of the study area is only about 500 meters in elevation. (Morton, 1913)

Climate

The variations in climate coincide with the east to west increase in elevation. Rainfall averages 69 cm. yearly in the east and only 46 cm. per year in the west. (Map 2)

As one moves east to west there is a similar decrease in sunny days and a decrease in growing season from 165 days to 120 days.

METHOD OF COLLECTION

A non-random method of collection was used in this study. The specimens were collected anywhere along the

river where there appeared to be suitable moss habitat. Collections were made in State Parks and Recreation Areas that did not lie directly on the river because of their tree populations.

Date, township, pertinent habitat comments, substrate, and generation were recorded for each sample. Tree types and forest associations were determined by leaf examination in the laboratory and comparison with known species according to Kaul, 1975.

RESULTS AND DISCUSSION

The mosses identified in this study are represented by family and growth habit in Table 1. From this information it is seen that the acrocarpous mosses, with 12 of the 14 families, greatly outnumber the pleurocarps. However, the 23 acrocarpous species are only 58% of the total species. The Pottiaceae, commonly called the pygmy mosses, are the most abundant of these acrocarps with seven species represented. These pygmy mosses are followed by the Bryaceae with four species. The significance of these two families being so abundant could lie in the fact that both are well adapted to life in water stress habitats. The Pottiaceae, which exhibit reduced body size, leaf awns or bristles, and papillose leaves, are examples of mosses with the modifications spoken of earlier. The Bryaceae, with papillose leaves and bristles, are also capable of sustaining them-

selves in areas where water retention is closely related to survival. Species of only two families of pleurocarps were collected, but they comprise 42% of the total. The Hypnaceae is a family that is known for its large size and close relationship with the Leskeaceae. The Hypnaceae includes nearly all of the pleurocarps with elongated, smooth leaf cells. The thickness of these cell walls allow the plant to retain water and, therefore, inhabit the arid niches of the Niobrara River Valley.

The 16 species of the Hypnaceae identified in this study are nearly evenly distributed among 12 genera, none of which has more than two species in the list of specimens included here.

The family Leskeaceae is represented by one species, Leskea gracilescens. This moss is well known for its papillose, costate, sometimes revolute leaves. The mosses of the Niobrara are divided by their terrestrial or corticolous growth habit (Table 2). The acrocarpous species are listed alphabetically. They are described by simple percentages according to the forest system they were found to inhabit.

These data show that the acrocarpous mosses are mostly terrestrial. More than 40% of all species identified were found to be terrestrial acrocarps.

Conversely, the pleurocarps show a tendency to be corticolous. In Table 3, note that 11 of the 17 species are

found on some type of tree bark. This means the 64% of the creeping and branching mosses found in this study were corticolous.

Also significant is the fact that these pleurocarpous mosses are better able to inhabit all four forest systems than are the acrocarps. The only pleurocarp found on both trees and the soil was Leskea gracilescens.

In Table 4, the 14 species of corticolous mosses are arranged opposite the trees they were collected on. Only Amblystegium juratzkanum, Dicranella heteromalla, and Leskea gracilescens were found to live on more than one tree species. The latter two species are found on dead trees that could match the living ones they were collected on. This seems to suggest a specific relationship. However, the number of specimens and the fact that other factors like pH or mineral content of the substrate might be involved, tend to make such a conclusion premature.

In Table 5, the species are related to western range according to their forest preference. The Eastern Deciduous, Rocky Mountain and Deciduous Mixed, Rocky Mountain Coniferous, and pockets of Floodplain Forest extend west in the dimensions given in the introduction.

It is seen that very few of the mosses are able to span the entire study area. Only Funaria hygrometrica, and once again, Leskea gracilescens were found throughout the valley. Only seven species were identified in the arid sand hills,

and none were found in association with Rocky Mountain Coniferous Forest. The only species collected at or near the 1600 meter elevation were in mature floodplains.

SUMMARY AND CONCLUSION

Acrocarpi and pleurocarpi show a definite relationship to terrestrial and corticolous habits respectively. The acrocarps slightly outnumber the pleurocarpous species in this study.

The pygmy mosses of the family Pottiaceae are the largest acrocarpous family found in the valley. The Hypnaceae are the largest family of pleurocarps. Both families share the ability to exist in moderate to severe habitats because of either their size or leaf adaptations. For these reasons, it is evident why they appear so abundantly throughout the valley.

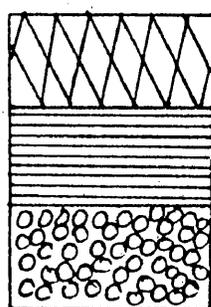
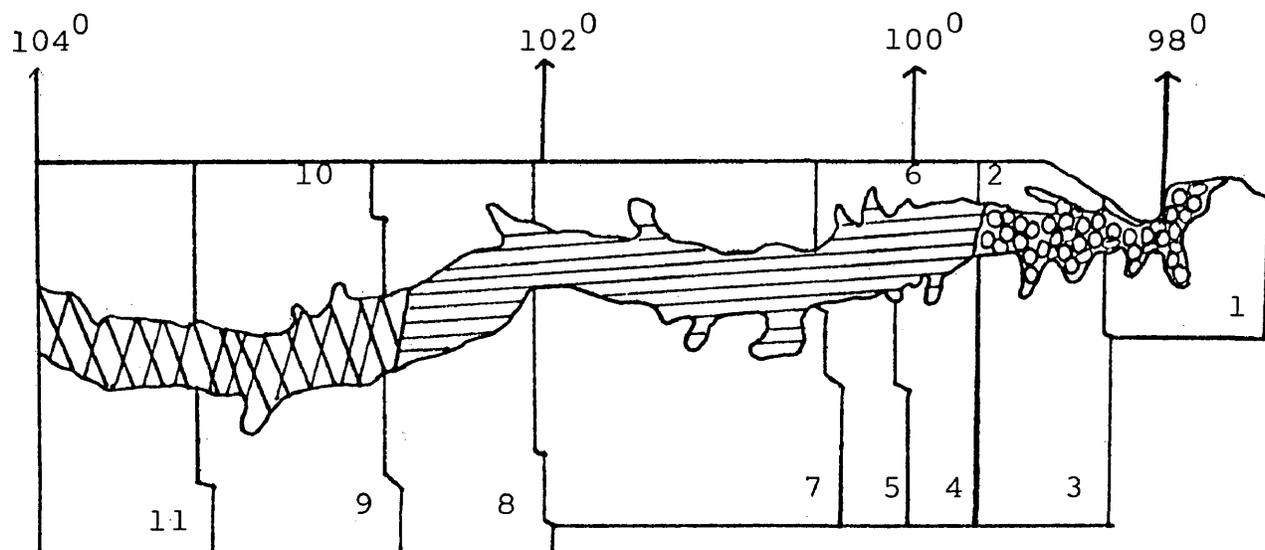
This study does not point out that a given moss will be species specific to the tree it grows on.

Low moisture and extremes of temperature in the sandhill regions between 101° and 103° latitude are not suitable for extensive bryophyte growth.

Finally, this research adds 13 new species to the existing moss flora for the state as compiled by Churchill in 1976.

It is hoped that this work will provide more of the information needed to bridge the gap between the known bryophytes of Nebraska and their relationship to the vascular flora of the state.

Map. 1 Location of Forest Ecosystems in the Niobrara River Valley (adapted from Searcy, 1961)



- Rocky Mountain Coniferous
- Mixed Conifer and Deciduous
- Eastern Deciduous

County

- 1-Knox
- 2-Boyd
- 3-Holt
- 4-Rock
- 5-Brown
- 6-Keya Paha
- 7-Cherry
- 8-Sheridan
- 9-Box Butte
- 10-Dawes
- 11-Sioux

Map 3 Approximate Precipitation in the Niobrara River Valley (adapted from Searcy, 1961)

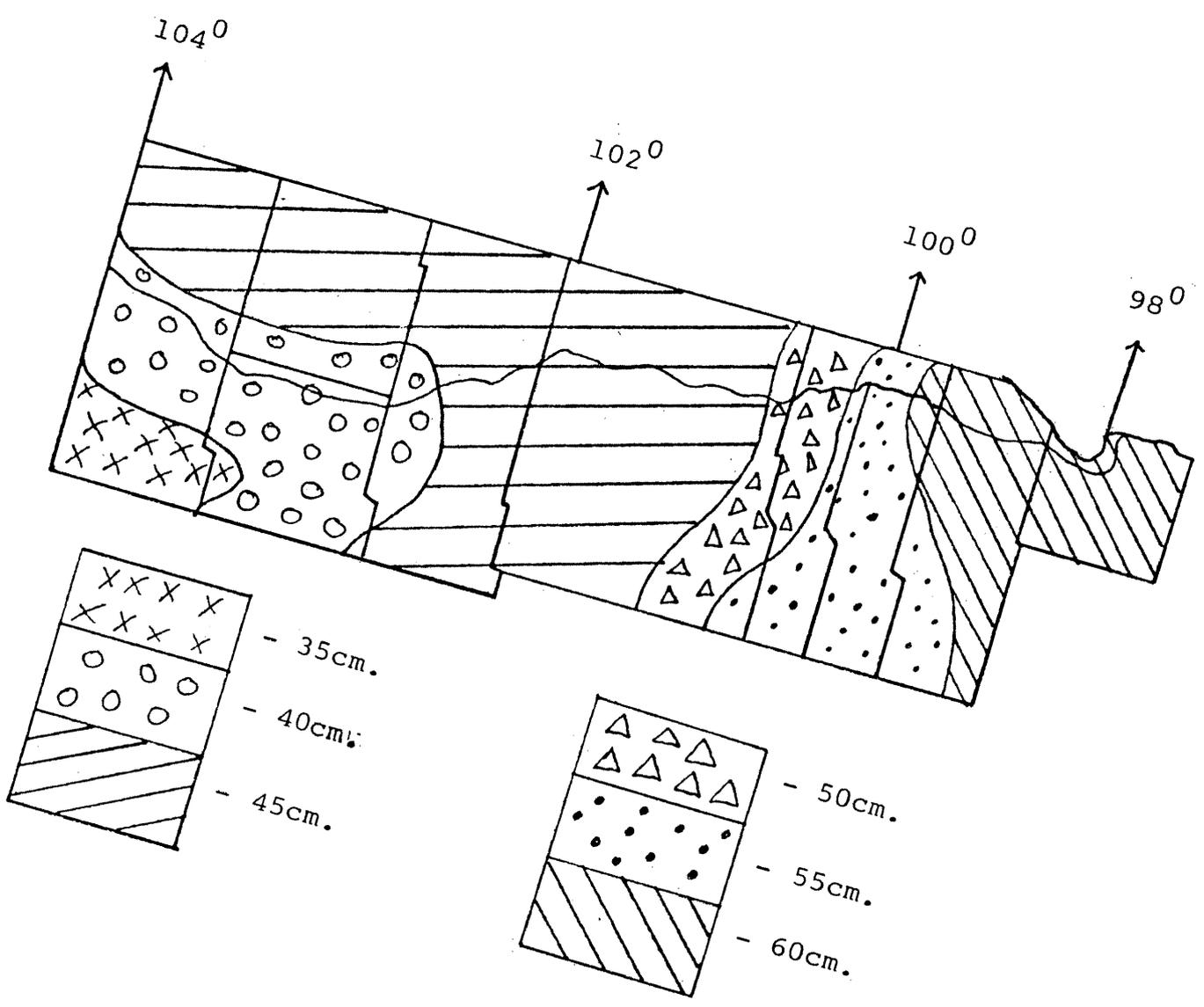


Table 1. Family Representation and Number of Species

Acrocarpous Families	Number of Species
Polytrichaceae	1
Ditrichaceae	1
Dicranaceae	1
Encalyptaceae	1
Pottiaceae	7
Grimmiaceae	1
Ephemeraceae	1
Funariaceae	2
Orthotrichaceae	1
Bartramiaceae	1
Bryaceae	4
Mniaceae	2
Pleurocarpous Families	Number of Species
Hypnaceae	16
Leskeaceae	1

Table 2. Forest Type and Corticolous Affinities of the Acrocarpous Species

Species	Forest Type							
	I		II		III		IV	
	C	T	C	T	C	T	C	T
<i>Atrichum undulatum</i>		3						x
<i>Barbula fallax</i>		x						x
<i>Barbula unguiculata</i>							2	
<i>Bryum argenteum</i>				4				
<i>Bryum caespiticium</i>		x		3				
<i>Bryum pendulum</i>		x						
<i>Ceratodon purpureus</i>		2						
<i>Desmatodon obtusifolius</i>				2				
<i>Dicranella heteromalla</i>			2					
<i>Encalypta ciliata</i>		4		2				
<i>Ephemerum spinulosum</i>				3				
<i>Funaria hygrometrica</i>		2				x		x
<i>Grimmia apocarpa</i>				2				
<i>Gymnostomum calcareum</i>				3				
<i>Mnium affine</i>						x		x
<i>Mnium cuspidatum</i>	3						2	
<i>Orthotrichum strangulatum</i>				x				
<i>Philonotis fontana</i>						x		
<i>Physcomitrium hookeri</i>		2						
<i>Rhodobryum roseum</i>		2		2				
<i>Tortula pagorum</i>				3				
<i>Tortula ruralis</i>						x		
<i>Weissia viridula</i>		4						

Note: The numbers for each species are approximate percentages of the total number of species collected accurate to the nearest integer.

- I - Eastern Deciduous
- II - Mixed
- III - Rocky Mountain Coniferous
- IV - Floodplain
- x - 1 specimen
- C - Corticolous
- T - Terrestrial

Table 3. Forest Type and Corticolous Affinities of the Mosses of the Niobrara River Valley with a Pleurocarpous Growth Habit

Species	Forest Type							
	I		II		III		IV	
	C	T	C	T	C	T	C	T
<i>Amblystegiella subtilis</i>	2							
<i>Amblystegium juratzkanum</i>	2						2	
<i>Amblystegium serpens</i>							2	
<i>Brachythecium oxycladon</i>		2						
<i>Brachythecium salebrosum</i>		2		5				
<i>Campylium chrysophyllum</i>			2					
<i>Climacium americanum</i>		x						
<i>Drepanocladus aduncus</i>			x					
<i>Entodon compressus</i>	x							
<i>Entodon seductrix</i>					x			
<i>Eurynchium hians</i>						x		
<i>Leptodictyum riparium</i>		2						
<i>Leptodictyum trichopodium</i>			5					
<i>Leskea gracilescens</i>	2						3	x
<i>Platygyrium repens</i>					x			
<i>Pylaisia selwinii</i>					2			
<i>Sematophyllum adnatum</i>	x							

Note: The numbers for each species are approximate percentages of the total number of species accurate to the nearest integer.

- I - Eastern Deciduous
- II - Mixed
- III - Rocky Mountain Coniferous
- IV - Floodplain
- x - 1 specimen
- C - Corticolous
- T - Terrestrial

Table 4. Tree Type Affinities of the Corticolous Mosses of the Niobrara River Valley

Corticolous Species	Tree Type
Amblystegiella subtilis	Quercus macrocarpa
Amblystegium juratzkanum	Quercus macrocarpa, other
Amblystegium serpens	Populus deltoides
Barbula unguiculata	Other*
Campylium chrysophyllum	Populus deltoides
Dicranella heteromalla	Populus deltoides, other*
Entodon compressus	Quercus macrocarpa
Entodon seductrix	Other*
Leptodictyum riparium	Fraxinus sp.
Leskea gracilescens	Ulmus americanum, P. deltoides
Mnium cuspidatum	Ulmus americanum
Platygyrium repens	Other*
Pylaisia selwinii	Populus deltoides
Sematophyllum adnatum	Fraxinus sp.

* - dead or fallen

Table 5. Western Range by Forest Type of the Mosses of the Niobrara River Valley

Acrocarpous Species	Pleurocarpous Species
<p>Atrichum undulatum - I Barbula fallax - I Barbula unguiculata - II Bryum argenteum - I Bryum caespiticium - II Bryum pendulum - I Ceratodon purpureus - I Desmatodon obtusifolius - I Dicranella heteromalla - II Encalypta ciliata - II Ephemerum spinulosum - II Funaria hygrometrica - I, II Grimmia apocarpa - I, II Gymnostomum calcareum - II Mnium affine - III Mnium cuspidatum - I Orthotrichum strangulatum - I Philonotis fontana - III Physcomitrium hookeri - I Rhodobryum roseum - I Tortula pagorum - II Tortula ruralis - III Weissia viridula - I, II</p>	<p>Amblystegiella subtilis - I Amblystegium juratzkanum - I Amblystegium serpens - II Brachythecium oxycladon - I Brachythecium salebrosum - I Campylium chrysophyllum - I Climacium americanum - I Drepanocladus aduncus - II Entodon compressus - II Entodon seductrix - III Eurynchium hians - III Leptodictyum riparium - I Leptodictyum trichopodium - II Leskea gracilescens - I, III Platygryium repens - III Pylaisia selwinii - III Sematophyllum adnatum - I</p>

Note: I - Eastern Deciduous (0-80 Km.)

II - Mixed (80-470 Km.)

III - Floodplain (0-540 Km.)

(No species of moss was found to live in a strict Rocky Mountain Coniferous Forest)

Specimen List

The specimens listed below are given with the collection numbers of the author by which they will be found in the herbarium at the University of Nebraska at Omaha. They are also given with the county they were collected in as well as a brief description of habitat. The counties are abbreviated as follows:

Kn. - Knox	Br. - Brown
Bo. - Boyd	Ch. - Cherry
Ho. - Holt	Sh. - Sheridan
K.P. - Keya Paha	Da. - Dawes
Ro. - Rock	B.B. - Box Butte
Si. - Sioux	

Unless otherwise stated, the specimens were collected and determined by the author. All specimens were verified by Dr. Paul V. Prior, Department of Biology, University of Nebraska at Omaha.

All specimens marked with an asterisk are found for the first time in Nebraska.

*Amblystegiella subtilis (Hedw.) Loeske, Kn. 1, 58, growing on the bark of a Quercus macrocarpa

*Amblystegium juratzkanum Schimp., Kn. 2, 49, Si. 64, 66, growing on Quercus macrocarpa

Amblystegium serpens (Hedw.), Si. 3, 89, growing on Populus deltoides

- Atrichum undulatum (Hedw.) Beauv., Kn. 4, 43, 47, Si. 100,
found on moist clay soil
- Barbula fallax (Hedw.), Kn. 5, Si. 56, growing on moist
clay soil east, and sandy soil west
- Barbula unguiculata (Hedw.), Sh. 6, 93, found on a fallen
log well shaded and decomposing
- Brachythecium oxycladon (Brid.), Kn. 7, Bo. 87, growing
on sandy clay soil in dense shade
- Brachythecium salebrosum (W. & M.), Kn. 8, 95, Bo. 102, 105,
80, 77, 71, growing on mostly clay soils throughout
- Bryum argenteum (Hedw.), Bo. 9, 45, 46, 57, Si. 99, found
on mostly dry clay soils, sometimes calcareous substrate
- Bryum caespiticium (Hedw.), Bo. 10, 55, 63, 78, growing in
shaded river shed and moist clays
- *Bryum pendulum (Hornsch.) Schimp., Kn. 11, growing on
lakeside soil among dense vegetation
- Campylium chrysophyllum (Brid.) Bryhn., Bo. 12, Ho. 85,
found on the bark of a Populus deltoides and on fallen
log
- Ceratodon purpureus (Hedw.) Brid., Kn. 13, 79, found on
moist clay
- *Climacium americanum (Brid.), Kn. 14, growing on a soft stream
bed in a wooded area
- Desmatodon obtusifolius (Schw.) Jur., Ho. 15, 86, growing
on and near a limestone outcrop in moderate shade

- Dicranella heteromalla (Hedw.) Schimp., K.P. 16, 104, growing on a dead tree overhanging water
- Drepanocladus aduncus (Hedw.) Warnst., Ch. 17, collected on rocks near water by P. V. Prior
- Encalypta ciliata (Hedw.), Ch. 18, 74, Kn. 44, 53, 83, 84, found on sandy loess clay mixture
- Entodon compressus (Br.), Br. 19, growing on bark of Quercus macrocarpa
- *Entodon seductrix (Hedw.), Si. 20, growing on the bark of a fallen log
- Ephemerum spinulosum (Schimp.), K.P. 21, 60, 61, growing on wet clay
- *Eurynchium hians (Hedw.), Da. 22, growing on sandy soil in reservoir backwater
- *Funaria hygrometrica (Hedw.) Da. 23, Kn. 59, Si. 88, 92 growing on moist and dry clays and sandy soils in the west
- *Grimmia apocarpa (Hedw.), Ch. 24, 97, growing on limestone outcrop collected once by P. V. Prior
- *Gymnostomum calcareum N. & H., Ch. 25, 61, 76, growing on sandy soil and on sandstone outcrop
- Leptodictyum riparium (Hedw.) Warnst., Bo. 26, 91, growing on the bark of a Fraxinus sp.
- Leptodictyum trichopodium (Schultz.) Warnst., Ch. 27, 65, 75, 94, 98, growing on various sandy soils

- Leskea gracilescens (Hedw.), Ho. 28, Bo. 62, Si. 82, 90, 103, 101, growing on moist soils and the bark of a Populus deltoides in a mature western floodplain
- Mnium affine (Bland.), Si. 29, 72, found on moist sandy soil along flowing creek in moderate light
- Mnium cuspidatum (Hedw.), Kn. 30, 50, 51, Si. 73, 96, found on two different Ulmus americana
- Orthotrichum strangulatum (Schw.), Ho. 31, found on very rocky soil in dense shade
- *Philonotis fontana (Hedw.), Brid., Si. 32, on very dry soil in moderate to bright light
- Physcomitrium hookeri (Hampe.), Ho. 33, 41, growing on loess in medium light
- Platygyrium repens (Brid.), Si. 34, growing on a fallen log
- Pylaisia selwinii (Kindb.), Si. 35, 68, on the bark of a Populus deltoides
- Rhodobryum roseum (Hedw.) Limpr., Bo. 36, 42, Ch. 67, 69, found on moist clay east and sandy clay west
- *Sematophyllum adnatum (M.X.), E.G.B., Kn. 37, found on base bark of Fraxinus sp.
- *Tortula pagorum (Tayl.), Ch. 38, 70, 81, found on an exposed rock face and on the soil beneath
- Tortula ruralis (Hedw.) Smith, Si. 39, found on sandy soil
- Weissia viridula (Hedw.), Ho. 40, 48, 52, 54, found on sandy soils only

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