Bryophyte Diversity of On-campus Old-growth and Secondary-growth Forests in Montgomery County, Virginia

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Abstract - The bryophyte flora of Virginia is vastly understudied compared to its vascular flora. Few instances of bryological investigation occurred in the state until interest rose in the 19th and 20th centuries. The full distribution of many common bryophyte species in the state remains incomplete due to a lack of field investigation. Here, we add to the knowledge of Virginia's bryophytes by documenting 39 total species of bryophytes from our study sites, including 15 new records of bryophyte species for Montgomery County. We made collections in an urban old-growth forest fragment and a secondary-growth forest on the campus of Virginia Tech. We devote special discussion to observations of 2 hepatic species and their ecological significance.

Introduction: History of Bryology in Virginia

Little attention was given to the bryophyte flora of Virginia until the turn of the 19th century (Patterson 1949). Below, we provide a partial summary of Virginia's more influential bryological investigations, with a focus on southwestern Virginia. Though it deals primarily with the Southern Blue Ridge Province that lies south of Virginia, Anderson and Zander (1973) provided a thorough investigation containing much information on early bryological work in Virginia.

The majority of the investigations of Virginia's bryophytes have been focused on the Piedmont and Coastal Plain physiographic regions (Fig. 1A) in the central and southeastern portions of the state. In the 18th century, Virginia's esteemed botanist J. Clayton collected a handful of moss specimens from the Coastal Plain that were later published in *Flora Virginica* (Clayton and Gronovius 1739, 1743). M.L. Fernald made botanizing trips to Virginia nearly 2 centuries later in the 1930s and 1940s, focusing on southeastern Virginia (Breil 1996). His regular companion, B.H. Long, collected a number of bryophytes including 34 liverworts not known at the time to occur north of South Carolina (Breil 1996, Patterson 1951). B. Mikula, again mainly interested in flowering plants, made ~600 collections of bryophytes from 36 counties in Virginia while he was conducting graduate work at the College of William and Mary during the summers of 1949 and 1950 (Patterson 1953). D.A. Breil (1977, 1996, 2003) furthered our modern understanding of both the liverworts and mosses of the piedmont region with his papers and keys on these subjects. Others have given special consideration to these plants in the Blue Ridge Mountains of Shenandoah National Park (Forman and Sierk 1970, Prior 1959, Schnooberger and Wynne 1945).

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William S. Sullivant and Asa Gray's exploration of the Allegheny Mountains in 1843 is one of the earliest examples of bryological collection and investigation in southwestern Virginia (Anderson and Zander 1973). While Asa Gray was focused on the vascular plants, Sullivant had a keen interest in the bryological flora. However, the main purpose of this expedition was to relocate André Michaux's *Shortia galacifolia* Torr. & A. Gray (Oconee Bells) in the Blue Ridge of North Carolina (Anderson and Zander 1973). When they traveled through Virginia, they passed principally between Tazwell, Giles, and Smyth counties (Patterson 1949). Sullivant (1845, 1846) later published his bryophyte collections from this expedition in his *Musci Alleghanienses.* Other noteworthy investigations of bryophytes from southwestern Virginia were conducted by Blomquist, Patterson, and Sharp in Giles County (Patterson 1949). Additionally, various researchers have conducted bryological research while visiting Mountain Lake Biological station in Giles County, including A.J. Sharp, P.M. Patterson, R.M. Schuster, D.A. Breil, and Susan Studler. The latter 4 considerably expanded our knowledge of southwestern Virginia's Hepaticae (Breil 1996). J.K. Small and A.M. Vail (1893) made major contributions on the subject in 1892 when they explored the area surrounding Marion in Smyth County, including the state's 2 highest points, Mt. Rogers (elevation of 1743 m) and Whitetop Mountain (elevation of 1730 m). Small and Vail were not bryologists but they amassed a large collection of bryophytes during this expedition. The specimens were later identified by Elizabeth Britton and Alexander W. Evans, respectively (Patterson 1949). Similarly, Douglas W. Ogle was primarily interested in vascular plants but collected bryophytes extensively in southwest Virginia while teaching at Virginia Highlands Community College in Washington County (T.F. Wieboldt, VPI, Blacksburg, VA, pers. comm.). His bryophyte collections were identified by D.A. Breil and later deposited in the Virginia Tech Massey Herbarium (VPI) where they became the basis for the herbarium's bryophyte collection, marking a large step forward for bryology in this part of the state (T.F. Wieboldt, pers. comm.). Current efforts to document bryophytes in the southwest are in progress by J.F. Townsend, T.F. Wieboldt, Allen Risk, and Ralph Lutts (T.F. Wieboldt and R. Lutts, Virginia Tech, Blacksburg, VA, pers. comm.).

Methods and Study Sites

Our sampling effort on Virginia Tech's campus addressed the collecting need in the southwestern part of the state by targeting bryophytes in Virginia's Montgomery County located along the boundary of the Northern Ridge and Valley and Blue Ridge Mountains ecoregions (Fig. 1A). We collected during June–December 2018. Collections in each study site were made primarily by the first author using a meandering survey method intended to maximize area covered and distinct habitats sampled within the study sites (Appendix 1). Specimens were later identified to species by the first author with the help of T.F. Wieboldt and H. Hamilton using regional and national keys. Voucher specimens were prepared and accessioned into the Virginia Tech Massey Herbarium (VPI). We sampled 2 sites: an old-growth

forest fragment named Stadium Woods (SW) and a second-growth forest named Center Woods (CW) (Fig. 1).

SW is an urban old-growth forest fragment that covers 4.6 ha in the southeast corner of Virginia Tech's Blacksburg campus, directly adjacent to the school's football stadium. This forest fragment has an all-aged, balanced structure made up of an assemblage of hardwood species (Walters 2016). SW has been persistently forested

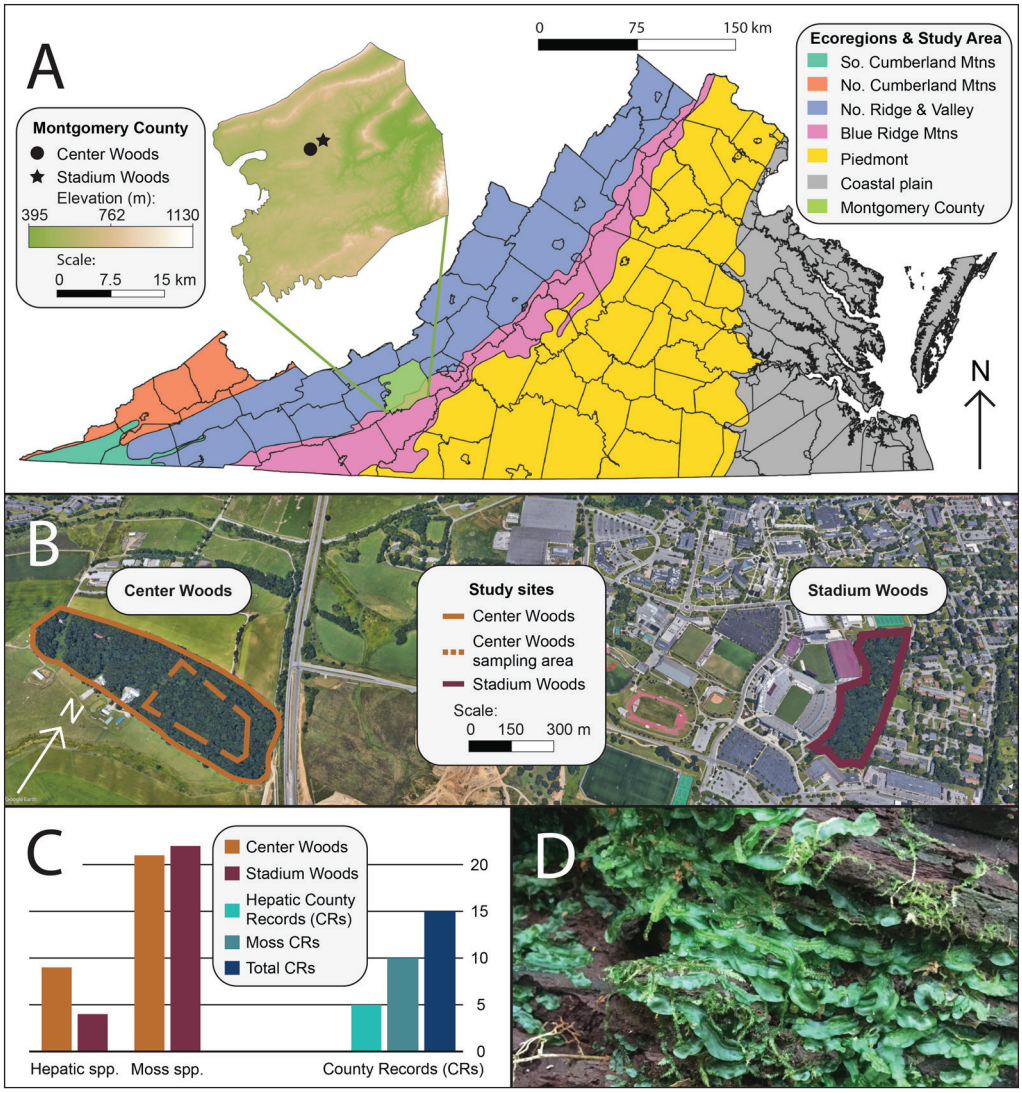

Figure 1. (A) County map of Virginia indicating the state's ecoregions and study site location. Inset: Montgomery County is enlarged to show location of study sites with the county's elevational gradient depicted to aid visualization. (B) Map depicting location of Center Woods and Stadium Woods with orange and maroon outline respectively. Dotted outline shows location of Center Woods study plot. (C) Bar graph showing breakdown of taxa per forest and county records per taxonomic group. (D) *Pallavicinia lyellii* photographed by A.W. Milby in Center Woods, Blacksburg, VA, on a decorticated log.

for over 3 centuries (Copenheaver et al. 2014). Large *Quercus alba* L. (White Oak), many of which date to older than 340 years, dominated the stand, while other major components were *Quercus velutina* Lam. (Black Oak), *Prunus serotina* Ehrh. (Black Cherry), *Prunus avium* (L.) L. (Sweet Cherry), *Acer rubrum* L. (Red Maple), *Viburnum prunifolium* L. (Blackhaw), and *Sassafras albidum* (Nutt.) Nees (Sassafras) (Walters 2016).

The secondary-growth forest tract, CW, is located on the southwestern border of the school's campus and covers roughly 16 ha (Ramsey and Wright 2019). It is surrounded largely by agricultural fields and is dominated by an oak–hickory cover type (Ramsey and Wright 2019). Large White Oaks are present in this forest but are less frequent compared to SW. This forest consists principally of Black Oak, Red Maple, *Carya tomentosa* (Poir.) Nutt. (Mockernut Hickory), *Carya ovata* (Mill.) K. Koch. (Shagbark Hickory), and *Quercus rubra* L. (Northern Red Oak). We also observed Black Cherry, *Acer saccharum* Marshall (Sugar Maple), *Fraxinus pennsylvanica* Marshall (Green Ash), and *Carpinus caroliniana* Walter (Hornbeam) in CW. Within CW, we created a sample plot of equal size to SW (4.6 ha) to standardize our collecting (Fig. 1B). We situated the plot at least 50 m from the forest edge to minimize the effect of edge (Fig. 1B; Matlack 1994).

Results and Discussion

We collected a total of 105 bryophyte specimens from SW and 96 bryophyte specimens from CW. We identified 39 species of bryophytes growing among the 2 study sites (Appendix 1). Twenty-five species of bryophytes were documented in SW, with 4 liverwort species and 21 mosses (Appendix 1). CW was marginally more species-rich, with 31 total bryophyte species comprising 9 liverworts and 22 mosses (Appendix 1). Our collections in CW and SW increased the knowledge of the distribution of southwestern Virginia's bryophyte flora, as we identified 15 species new to Montgomery County (Appendix 1). Of these 15 county records, liverworts comprise 5 species, and mosses comprise 10 species (Fig. 1C).

The 2 sample sites shared 18 species (4 liverworts and 14 mosses), but each contained some species not detected in the other. CW contained 13 species that were not detected in SW, whereas SW only possessed 7 species not shared with CW. Interestingly, all 9 liverworts identified in this study could be found in CW, but only 4 were detected in SW. This result could be due to a number of factors present unique to CW including adjacency to water, topography, and fragmentation/stand size. Epixylic liverworts in particular seem to respond negatively to smaller stand sizes where the edge effect has greater influence throughout the habitat (Moen and Jonsson 2003). Our findings will be considered further in a comprehensive review and ecological assessment of Stadium Woods (J.S. Metzgar, unpubl. data).

Among our collections from SW was *Fissidens bushii* (Cardot & Thér.) Cardot & Thér. In Virginia, this species has typically been found in the Coastal Plain and Piedmont regions and was only previously detected in 5 counties west of the Blue Ridge. We also documented *Taxiphyllum taxirameum* (Mitt.) M. Fleisch. from SW, previously only known from 10 counties in Virginia. The distribution

of *T. taxirameum* is scattered, with the majority of occurrences in the eastern and central portions of the state. Similarly, *Isopterygium tenerum* (Sw.) Mitt. is well known from the Coastal Plain into the Piedmont with somewhat remote occurrences in Giles and Roanoke counties, and is now known from neighboring Montgomery County. Lastly, we identified a small amount of *Blepharostoma trichophyllum* (L.) Dumort. from one of our collections. This liverwort is not well known in the state, only being documented in 7 counties previously (Virginia Botanical Associates 2021).

Our collections also include 2 species of liverworts from CW that were surprising finds because of their habitat preference. These were *Aneura pinguis* (L.) Dumort., represented by a single specimen found on a fallen Northern Red Oak, and *Pallavicinia lyelli* (Hook.) Gray (Fig. 1D), found on decorticated logs in multiple locations throughout the collection area. Both species are characteristic of moist or wet habitats.

The presence of these species is especially surprising given that CW is an oak–hickory secondary-growth forest surrounded by agricultural fields. The typical habitat for *A. pinguis* is "on humus and logs in swampy and seepage areas" (Hicks 1992:175). The Bryophyte Flora of North America (BFNA) offers a similar, but broader, habitat preference for *A. pinguis*: "... wet peaty soil, bogs and fens, seepage areas on rock faces, alluvial deposits, damp litter, rotting logs …" continuing later to say, suggestively, "it is to be found in a vast array of habitats" (Faubert 2015). Surprisingly, our specimen of *A. pinguis* was collected on a downed and substantially exposed Northern Red Oak.

The typical habitat for *P. lyellii* is described as "in very moist or wet places on humus and soil along creeks and bogs in wet woods and swamps" (Hicks 1992:172). The BFNA comments that its typical habitat is "wet and shady places along banks of ponds, stream[s], lakes, or in swamps associated with flowing water…" (Bakalin 2016). Our specimen of *P. lyellii* was collected from a soft, moist, decorticated log under dense cover. For both liverworts discussed, the habitat descriptions indicate situations that usually have high moisture levels, especially in the case of *P. lyelli*. Incongruently, we observed no major wetland habitats on the site during field work.

Though not observed firsthand, we hypothesize that these 2 hepatic species are present in CW due to seasonal moisture in some sporadic shallow depressions. Throughout the collection site in CW, there were small areas of slightly lower elevation that were moister than the rest of the terrain, creating muddy depressions. These areas were by no means "swampy" but appeared to retain small amounts of water for longer periods of time, potentially acting as seasonal puddles and allowing just enough moisture and humidity for these species to survive, especially where these areas are deeply shaded. Our observations in CW were limited to the fall and winter of 2018, leaving the possibility that these depressions could hold water into the growing season and exsiccate later in the season. Additionally, Stroubles Creek and some smaller feeder creeks are found in the agricultural land directly adjacent to the tract. It is possible that these wetter habitats served as a source population for the modern forest where these species now persist.

Conclusions

The present study showed that a second-growth forest (CW) may possess a higher diversity of bryophyte species than a typically richer habitat such as an old-growth forest (SW). Disturbance history and variability of habitat types may have had a role in these results. Our addition of 15 bryophyte county records to Virginia's flora also shows that there is much more to learn regarding the distribution, richness, and habitats of the state's bryophyte flora. We hope that our study will highlight the need, and provide motivation, for future bryological investigations in the state.

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Literature Cited

Anderson, L.E., and R.H. Zander. 1973. The mosses of the Southern Blue Ridge Province and their phytogeographic relationships. Journal of the Elisha Mitchell Scientific Society 89:15–60.

Bakalin, V. 2016. Pallavaciniaceae Migula. *In* Bryophyte Flora of North America, Provisional Publication. Missouri Botanical Garden. Available online at http://www.mobot.org/plantscience/bfna/V3/PallPallavicinia.htm. Accessed 29 December 2020.

Briel, D.A. 1977. Bryophytes of the Virginia Piedmont floodplains. Castanea 42:308–315.

Briel, D.A. 1996. Liverworts and hornworts of the Virginia Piedmont. Banisteria 8:3–28.

Briel, D.A. 2003. Common and occasional bryophytes of the Virginia Piedmont. Banisteria 21:2–27.

Clayton, J., and J. F. Gronovius. 1739, 1743. Flora Virginica, Part 1 and Part 2. Leiden, Holland. 210 pp. Available online at https://www.biodiversitylibrary.org/item/188073#page/8/mode/1up.

Copenheaver, C.A., J.R. Seiler, J.A. Peterson, A.M. Evans, J.L. McVay, and J.H. White. 2014. Stadium Woods: A dendroecological analysis of an old-growth forest fragment on a university campus. Dendrochronologia 32:62–70.

Faubert, J. 2015. Aneuraceae H. Klinggräff. *In* Bryophyte Flora of North America, Provisional Publication. Missouri Botanical Garden. Available online at http://www.mobot.org/plantscience/bfna/V3/Aneuraceae.htm. Accessed 29 December 2020.

Forman, R.T.T., and H.A. Sierk. 1970. Bryophytes and lichens of the Shenandoah National Park, Virginia, Collected on the 1966 foray of the American Bryological Society. The Bryologist 73:82–92.

Hicks, M.L. 1992. Guide to the Liverworts of North Carolina. Duke University Press, Durham, NC. 239 pp.

Matlack, G.R. 1994. Vegetation dynamics of the forest edge-trends in space and successional time. Journal of Ecology 82:113–123.

Moen, J., and B.G. Jonsson. 2003. Edge effects on liverworts and lichens in forested patches in a mosaic of boreal forest and wetland. Conservation Biology 17:380–388.

Patterson, P.M. 1949. The bryophytes of Virginia. I.-bryophytes reported in the literature. Castanea 14(1):1–49.

Patterson, P.M. 1951. Bryophytes of Virginia, III. Collections made in Southeastern Virginia by Bayard Long. Rhodora 53(629):117–128.

Patterson, P.M. 1953. Virginia bryophytes collected by Bernard Mikula. Virginia Journal of Science 4:125–128.

Prior, P.V. 1959. Further bryophytes from Shenandoah National Park, Virginia. The Bryologist 62(1):41–45.

Ramsay, S., and E. Wright. 2019. Center Woods Forest: A report on stand characteristics and ecology. Special technical report. College of Natural Resources and Environment, Department of Forest Resources and Environmental Conservation, Virginia Tech, Blacksburg, VA. 31 pp.

Schnooberger, I., and F.E. Wynne. 1945. The bryophytes of Shenandoah National Park, Virginia. Bulletin of the Torrey Botanical Club 72:506–520.

Small, J.K., and A.M. Vail. 1893. Report of the botanical exploration of southwestern Virginia during the season of 1892. Memoirs of the Torrey Botanical Club 4:93–201.

Sullivant, W.S. 1845, 1846. Musci alleghanienses, sive enumeratio muscorum atque hepaticarum quos in itinere a Marylandia usque ad Georgiam per tractus montium a.d. mdcccxliii decerpserunt Asa Gray et W.S. Sullivant (interjectis nonnullis aliunde collectis). Concinnavit et exposuit. Columbus, in Ohione. 87 pp.

Walters, R. 2016. Stewardship plan for Virginia Tech's old-growth forest near Lane Stadium. M.Sc. Thesis. Virginia Tech, Blacksburg, VA. 377 pp.

Virginia Botanical Associates. 2021. Digital atlas of the Virginia Flora. Available online at http://www.vaplantatlas.org. Accessed 20 January 2021.

Appendix 1. Bryophyte species Collected in Stadium Woods and Center Woods in Montgomery County, VA. Collected between June 2018 and Dec 2018. AWM = Allen W Milby, HT = Hyla Taylor, EQ = Erin Quesenberry, JR&AR = Jake Riney & Amber Reaney, JM = Jordan Metzgar, JCB = Joseph C. Barron; CR = County record

Taxa	Family	Collection No.	Collection date	Habitat	SW	CW	CR
Hepatics							
Aneura pinguis (L.) Dumort.	Aneuraceae	AWM 420	02 Dec 2018	On a large, rotting Northern Red Oak.		x	*
Blepharostoma trichophyllum (L.) Dumort.	Blepharostomataceae	AWM 295	25 Aug 2018	Growing on a decaying log in patchy sun. Concentrated on south side.		x	*
Frullania brittoniae A. Evans	Frullaniaceae	AWM 136	08 July 2018	Growing on decaying Sugar Maple bark.	x		
		AWM 315	23 Sept 2018	On Shagbark Hickory bark.		x	
Frullania eboracencis Lehm.	Frullaniaceae	AWM 84	02 July 2018	Growing on a Sweet Cherry.	x		
		AWM 370	07 Oct 2018	Found on a small, standing snag.		x	
Lophocolea heterophylla (Schrad.) Dum.	Lophocoleaceae	AWM 207	25 July 2018	Growing on a decaying log.	x		*
		AWM 400	19 Oct 2018	Growing on southern side of a dead tree. Early stages of decay, still hard to the touch.		x	
Metzgeria conjugata Lindb.	Metzgeriaceae	AWM 409	30 Oct 2018	Growing on maple bark. Concentrated on NW side of tree.		x	
Nowellia curvifolia (Dicks.) Mitt.	Cephaloziaceae	AWM 417	02 Dec 2018	On a decaying log, growing among moss in dappled sun.		x	*
Pallavicinia lyellii (Hook.) Gray [also: TFW13861b, 8/06/2019 VPI]	Pallaviciniaceae	AWM 397	19 Oct 2018	On a log in late stages of decaying holding a significant amount of moisture. (Seasonal inundation?)		x	*
Porella platyphylla (L.) Pfeiff.	Porellaceae	AWM 281	03 Sept 2018	Growing on la arge Black Cherry.	x		
		AWM 421	02 Dec 2018	Growing on a large, decaying Northern Red Oak.		x	

Taxa	Family	Collection No.	Collection date	Habitat	SW	CW	CR
Mosses							
Anomodon attenuatus (Hedw.) Huebener	Thuidiaceae	AWM 127	05 July 2018	Moss growing on soil at cusp of a soil pit.	x		
		EQ 2	06 Oct 2018	Moss on a small Sugar Maple.		x	
Anomodon rostratus (Hedw.) Schimp.	Thuidiaceae	AWM 354	06 Oct 2018	Moss growing on base of a large Northern Red Oak. Also seen growing on soil.		x	
Anomodon tristis (Ces.) Sull.	Thuidiaceae	HT 25	04 Nov 2018	Fluffy moss on a live hickory.		x	*
Atrichum crispulum Schimp. ex Besch.	Polytrichaceae	AWM 76	02 July 2018	Moss on a mound of soil with westerly aspect.	x		*
		AWM 363	06 Oct 2018	On soil at base of a maple.		x	
Brachythecium laetum (Brid.) Schimp.	Brachytheciaceae	AWM 53	07 June 2018	On soil at base of a tree.	x		
Brachythecium rotaeanum De Not.	Brachytheciaceae	AWM 50	07 June 2018	On a fallen White Oak, at a corner of the training facility.	x		
		JR&AR 18	07 Oct 2018	On dead wood.		x	
Dicranum flagellare Hedw.	Dicranaceae	AWM 403	30 Oct 2018	Moss on a rotting stump, growing among other mosses.		x	
Ditrichum pallidum (Hedw.) Hampe	Ditrichaceae	AWM 49	07 June 2018	Root ball of a wind-thrown Black Cherry.	x		
		AWM 319	30 Sept 2018	Mosses on bare mineral soil.		x	
Entodon seductrix (Hedw.) Müll. Hal.	Entodontaceae	AWM 22	07 June 2018	Plant growing on base of a White Oak in partial shade, at the edge of Stadium Woods and a grassy area.	x		
		AWM 376	07 Oct 2018	Moss on a dead cherry tree. Relatively open canopy.		x	
Fabronia ciliaris (Brid.) Brid.	Fabroniaceae	EQ 15	06 Oct 2018	Moss on base of a Black Cherry tree.		x	

Taxa	Family	Collection No.	Collection date	Habitat	SW	CW	CR
Fissidens bushii (Cardot & Thér.) Cardot & Thér.	Fissidentaceae	AWM 58	27 June 2018	Growing on decaying log in the forest edge, ~3 m from a parking lot.	x		*
		AWM 313	23 Sept 2018	Fissidens on soil directly adjacent to a metal pin.	x		
Fissidens taxifolius Hedw.	Fissidentaceae	AWM 206	25 July 2018	Plants growing in soil along a gravel road.	x		
Homalotheciella subcapillata (Hedw.) Broth.	Amblystegiaceae	AWM 40	07 June 2018	On a dead White Oak branch.	x		*
Hygroamblystegium varium (Hedw.) Mönk.	Amblystegiaceae	AWM 199	25 July 2018	Pleurocarpous moss growing at the edge of the forest and a gravel road.	x		
Hypnum curvifolium Hedw.	Hypnaceae	AWM 85	02 July 2018	Moss growing on a Sweet Cherry root among acrocarpous moss.	x		
Hypnum imponens Hedw.	Hypnaceae	AWM 240	25 Aug 2018	Moss on a downed log in dappled sun, among other mosses.	x		
		AWM 403	30 Oct 2018	Moss on a rotting stump, among other mosses.		x	
Isopterygium tenerum (Sw.) Mitt.	Hypnaceae	AWM 412	04 Nov 2018	Moss on a decaying log in shade.		x	*
Orthotrichum ohioense Sull. & Lesq.	Orthotrichaceae	AWM 139	08 July 2018	Moss on a young *Cornus florida* L. (Flowering Dogwood) branch in dappled sun.	x		
		AWM 359	06 Oct 2018	Moss on Hornbeam bark.		x	
Oxyrrhynchium hians (Hedw) Loeske	Brachytheciaceae	AWM 72	02 July 2018	Large patch of moss growing on soil under dense undergrowth, in shade.	x		*
		AWM 285	Sept 2018	Moss growing on a very decayed stump.		x	
Plagiomnium ciliare (Müll. Hal.) T.J. Kop.	Hypnaceae	AWM 188	18 July 2018	Moss in sizable patch at base of tree growing on soil.	x		*

Taxa	Family	Collection No.	Collection date	Habitat	SW	CW	CR
Plagiomnium cuspidatum (Hedw.) T.J. Kop.	Mniaceae	AWM 37	07 June 2018	On soil next to a fallen log, mostly shaded.	x		
		AWM 382	16 Oct 2018	Moss on soil, very close to the base of a Black Cherry.		x	
Platygyrium repens (Brid.) Schimp	Hypnaceae	AWM 109	05 July 2018	Moss on a decomposing log in shade, near a freshly cut down tree.	x		*
		JCB 6	04 Nov 2018	Moss on fallen bark in sun.		x	
Polytrichastrum ohioense (Renauld & Cardot) G.L. Sm.	Polytrichaceae	AWM 368	06 Oct 2018	Moss at the base of a Sugar Maple; acrocarp with old sporophytes.		x	
Ptychostomum pseudotriquetrum (Hedw.) J.R. Spence & H.P. Ramsay ex Holyoak & N. Pedersen	Bryaceae	AWM 302	23 Sept 2018	On gravelly soil, growing against a metal pin.		x	
Rhynchostegium serrulatum (Hedw.) A. Jaeger	Bracytheciaceae	AWM 171	17 July 2018	On a large White Oak at SE corner of training tower, growing among other mosses.	x		*
		JM 360	07 Oct 2018	On a dead birch.		x	
Taxiphyllum taxirameum (Mitt.) M. Fleisch.	Hypnaceae	AWM 231	31 July 2018	Moss on a smooth, exposed rock.	x		*
Thelia asprella (Schimp.) Sull.	Theliaceae	AWM 362	06 Oct 2018	Pleurocarp on young Hornbeam.		x	
Thuidium delicatulum (Hedw.) Schimp.	Thuidiaceae	AWM 123	05 July 2018	Moss on a large decaying log in partial shade.	x		
		AWM 328	30 Sept 2018	Moss growing along a base of a decaying tree.		x	
Weissia controversa Hedw.	Pottiaceae	AWM 158	10 July 2018	Moss on soil in dense shade, among other mosses.	x		
		AWM 371	07 Oct 2018	Moss on dead cherry bark with sporophytes, in high sun exposure.		x	