

**Development of a Comprehensive State Monitoring and
Assessment Program for Wetlands in Massachusetts**

Appendix S

**Assessment of Wetland Communities:
Ground-Dwelling Bryophyte Identification**

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Prepared by:

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Assessment of Wetland Communities: Ground-Dwelling Bryophyte Identification

Background (2008 Bryophyte Samples)

In 2008, ground-dwelling bryophytes were sampled from 68 forested wetland sites in the Chicopee watershed in Massachusetts. This field study was part of the program to develop a site-level assessment method for forested wetlands and the calibration of the CAPS landscape assessment method that will be used to assess and monitor the condition of MA wetlands. This SOP is for identification of bryophytes collected in 2008. A decision on whether to identify bryophytes collected in 2009 will depend on the results of 2008 data analysis.

Bryophyte Sample Collection (summarized from Appendix H)

Two sampling methods were used to collect bryophytes in forested wetlands: quadrat sampling and an area search. Both methods were used at all 68 sites.

In 2008 two subplots were sampled at each 25-meter radius plot (Appendix H figure 1). A 1m² quadrat frame was placed on the ground 15 meters from plot center, one along the north transect and one along the south transect. If no soil with bryophytes existed at this point, we moved the quadrat in a clockwise location to find the next best available spot within one meter. A sample of each bryophyte species within the frame was collected into a plastic sample tray with pre-numbered compartments, one species per compartment. The corresponding number was listed on the datasheet and a percent cover value was assigned. If no ground-dwelling bryophytes were found within the quadrat a value of 0 was assigned. Following quadrat sampling a 20-minute area search of the rest of the 25m-radius plot was conducted to collect any ground-dwelling species not found in the quadrat sample. These species will be assigned an arbitrary cover value of 0.01% to distinguish it from species found in subplots.

In the lab at the end of each field day all samples were removed from the plastic trays and placed in individual paper packets to dry and for short-term storage. Each packet was labeled with the PlotID, Subplot ID, and Date. If the sample was from the area search “Area” was listed in place of subplot ID (see field data form).

Bryophyte Sample Identification

Individual species will be analyzed to elucidate any dose-dependent relationships that may exist with the stressors modeled in CAPS.

Specimen identifications will facilitate development of Indices of Biotic Integrity (IBIs). These IBIs will be incorporated into a Site Level Assessment Method (SLAM) for forested wetlands. The IBIs will also be used to calibrate the CAPS landscape-based models for assessing ecological integrity in wetland and aquatic ecosystems.

Bryophyte specimens collected in the 2008 field season will be sent to taxonomic experts for identification (Table 1). Identifications will be to the species level whenever possible

(depending on the availability of suitable keys, life stage and condition of specimens). Specimens that cannot be identified to species will be identified to the lowest taxonomic level possible. All samples will be returned to UMass for storage.

General Laboratory protocols

Voucher specimens will be transferred from temporary packets to standard-size, acid-free archival quality herbarium packets and labeled with geographic and basic habitat information (Fig. 1).

Figure 1. Voucher packet label (example)

<p style="text-align: center;">Herbarium of the University of Massachusetts, Amherst</p> <p style="text-align: center;"><i>Bryophytes of Chicopee Watershed, MA</i></p> <p><i>Sphagnum warnstorffii</i> Russow</p> <p>E side of U.S. Route 202, 500m from intersection with Pelham Rd., 42°23'26.97"N, 72°23'52.22"W.</p> <p>CAPS PlotID: 731</p> <p>On dry soil in red maple swamp, understory dominated by cinnamon fern, New York fern, witch hazel, and sphagnum.</p> <p>Coll. By: K. Rolih Coll. No. 1234 Date: July 19, 2008 Det: Susan A. Williams</p>
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Bryophytes will be identified using dissecting and compound microscopes and taxonomic keys. In some cases identification to species will require research papers specific to genus, or in some cases, individual species.

Taxonomic References:

Mosses

Allen, B. 2005. Maine Mosses: Sphagnaceae-Timmiaceae. Memoirs of the New York Botanical Garden Vol. 93. The New York Botanical Garden Press.

Andrus, R.E. 1980. Sphagnaceae (peat moss family) of New York State. Bull. New York State Mus. Sci. Serv. 442.

Anderson, L.E., H.A. Crum, and W.R. Buck. 1990. List of the mosses of North America north of Mexico. The Bryologist 93:448-499.

Anderson, L.E. 1990. A checklist of *Sphagnum* in North America north of Mexico. *The Bryologist* 93:500-501.

Crum, H.A. & L.C. Anderson. 1981. *Mosses of Eastern North America*. Columbia University Press, New York.

Flora of North America Editorial Committee, eds. 1993+. *Flora of North America North of Mexico*. Vol 27. New York and Oxford.

http://www.efloras.org/volume_page.aspx?volume_id=1027&flora_id=1

Ireland, R.R. 1982. *Moss Flora of the Maritime Provinces*. Ottawa. [Natl. Mus. Canada Publ. Bot. 13.]

Liverworts

Hicks, M.L. 1992. *Guide to Liverworts of North Carolina*. Duke University Press.

Hepatics

Schuster, R. *The Hepaticae and Anthocerotae of North America*. All volumes. Columbia University Press.

Quality Control and Assurance

The sample information will be recorded on data sheets to be entered into an Access database. A Taxonomist will record the plot ID of the sample and the identity and counts of individuals in the sample. The data entered into the database will be double checked by a reviewer for mistakes. Ten percent of the samples will be verified by an expert taxonomist (see Table 1). The samples that are sent out for validation will be recorded. Once the validated sample identifications are returned corrections (if any) will be made to the data sheets and entered into the database. Corrections will be labeled on the data sheets with an asterisk. Verified specimens will be stored in a reference collection.

Data Analysis

The overarching goal of the data analysis is to determine whether CAPS IEI and the component ecological integrity metrics (e.g., habitat loss, connectedness, etc.) are related to observed ecological conditions, and to further quantify the magnitude and nature of those relationships. To accomplish this goal, we will use a variety of statistical methods including principally Threshold Indicator Taxa ANalysis (TITAN) (King and Baker, In revision) and quantile regression (Cade et al. 1999). The data input for both analytical methods will be a list of the sample points and the corresponding values for each of the CAPS metrics and a suite of variables representing the presence or standardized abundance of each species or group of species and/or one or more derived biotic indices (e.g., Simpson's diversity index). For more information on data analysis see section 2.4 Analytical Method in the QAPP.

Table 1. Taxonomists for Bryophyte Samples

Taxonomist	Number	ID Level	QA/QC 10%
Susan A Williams	68 plots (1294 samples) ~20 samples per plot*	Species	Nancy Slack, Russell Sage College

*The number of samples per plot varies depending on the number of bryophyte species that occur within the plot

Qualifications

Susan A. Williams: see attached resume.

Dr. Nancy G. Slack is Professor of Biology at the Sage Colleges (NY), an ecological consultant, and is currently President of the American Bryological and Lichenological Society. She conducts bryophyte workshops for Natural Heritage and Nature Conservancy ecologists. She has published extensively on bryophyte ecology, species diversity, and community structure and also on old growth forests, bogs and fens, and epiphytes. She is the author of 85 Acres: A Field Guide to the Adirondack Alpine Summits and Field Guide to New England Alpine Summits, (new edition, May 2006).

A t t a c h m e n t 1 :

S U S A N A . W I L L I A M S

EDUCATION

1979 Springfield College Springfield, MA B.S. Biology
Summa cum laude

PROFESSIONAL EXPERIENCE

2008-09 – Study of the importance of substrate and old growth characters to
bryoflora in old growth forests of the Catskills for NY Natural Heritage Program.
- Herbarium Intern. Royal Botanic Gardens, Kew, UK. Assisted in all aspects of
herbarium techniques in curation of plant material from Cameroon.

2005-2006 – Updated NY State rare moss list and documented diversity and
abundance data for bryophytes in cliff communities for NY Natural Heritage
Program, Biodiversity Research Initiative

2004 – Bryophyte inventory of Camp Curtis Guild, Reading, MA for MA Natural
Heritage Program & Military.

- Bryophyte inventory of summit of Mt. Mansfield, Vt. For Colocation
Association and Natural Heritage Program

2003 – Bryophyte inventories of high elevation ponds in Vermont with Jerry
Jenkins for Wildlife Conservation Society

- Bryophyte inventory of Bartholomew's Cobble, Sheffield, MA for Trustees of
Reservations
- Bryophyte workshop for NY Natural Heritage personnel with Nancy Slack

1998, 2001-2006 – Co-taught Field Bryology Class with Jerry Jenkins of the White
Creek Field School. Responsibilities included fieldwork, identification, key-making
and illustrating.

3/2001 – 11/2001 Inventoried sites in Western MA as part of MA NHESP Grant
for bryological abundance and distribution. Prepared voucher specimens

7/2000 – Weeklong bryophyte survey in Adirondacks with Jerry Jenkins

11/1993, 2, 11/1995 – Assisted Kew Gardens with plant inventories around Mt.
Kupe, Cameroon. Observations of saprophytic plants around Mt. Kupe.
Collection and illustration of bryophytes.

1989-1999 – Population studies on *Triphora trianthophora* in Rowe, MA, partially
funded by MA NHESP.

PUBLICATIONS

- Cheek, M., Williams, S.A., & Etuge, M. 2003. *Kupea martinetugei*, a new genus and species of *Triuridaceae* from western Cameroon. Kew Bulletin 58:225-228
- Cleavitt, N.L., Williams, S.A. and N.G. Slack, *in press*. 'Relationship of Bryophyte Occurrence to Rock Type in Upstate New York and Coastal Maine.
- Cleavitt, N.L., Williams, S.A. and N.G. Slack. 2006. "Updating the Rare Moss List for New York State: Ecological, Community and Species-centered Approaches." Final Report for the Biodiversity Research Initiative. NY State Museum, Albany, NY
- Williams, S.A., Cleavitt, N.L. and N.G. Slack. *in press*. 'Revision of New York Rare Moss List with Important New State Records'
- Williams, S., Townsend, C., Magill, R., Cheek, M 2004, "Bryophytes & Water Culture", *in The Plants of Kupe, Mwanenguba and the Bakossi Mountains, Cameroon. A Conservation Checklist.* Royal Botanic Gardens, Kew
- Williams, S. 2009. 'The Importance of Substrate and Old-Growth characters to Bryoflora in Old Growth Forests of the Catskills'. Final Report for the Biodiversity Research Initiative. NY State Museum, Albany, NY
- Williams, S. 2000. 'New State & County Mosses for Massachusetts' *Evansia*, Vol. 17, No. 2
- Williams, S. 2000. 'Rare and Unusual Liverworts in Western Massachusetts' *Evansia*, Vol. 17, No. 1
- Williams, S. 1998. 'Portrait of a Rare Plant. . .Three-Birds – *Triphora trianthophora* (Orchidaceae), *Northeastern Naturalist* 5 (1): 25-27
- Williams, S. 1995. '*Corallorhiza odoratior*' *Maine Naturalist* 3(1): 45-46, 1995
- Williams, S. 1994. 'Observations of Reproduction in *Triphora trianthophora* (Orchidaceae)', *Rhodora*, Vol. 96, No. 885, pp 30-43, 1994.
- Williams, S. 1991. Wildflowers of Rowe, MA. Rowe Historical Society, Rowe, MA.

OTHER EMPLOYMENT

9/2008 – present Office manager, Arcadian Shop, Lenox, MA

9/2006 – 5/30/2008 Running Specialist, Dicks Sporting Goods, Pittsfield, MA

5/1997 – 8/2006 – Town Treasurer, Rowe, MA

Standard Operating Procedures: Assessment of Wetland Communities: Bryophyte
Identification April 11, 2010

REFERENCES:

Jerry Jenkins
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UMASS CAPS Ground-Dwelling Bryophyte Sampling 2008 – Forested Wetlands

Plot ID:			Date:
Surveyor:			
Subplot	Species #	% cover*	Comments
A	1		
	2		
	3		
	4		
	5		
	6a		
	6b		
B	7		
	8		
	9		
	10		
	11		
	12		
Area Search, number of samples:			

*Give percent cover of each species to nearest 1% of area within 1-meter quadrat.