

The Bryophyte Flora of the Big Thicket National Preserve: Hardin, Tyler, and Polk Counties, Texas

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ABSTRACT

The Big Thicket region is a complex mix of terrestrial and aquatic ecosystems which produce a very diverse flora and fauna. A floristic inventory of the bryophyte flora in the Big Thicket National Preserve, Hardin, Polk, and Tyler Counties, Texas, was conducted from January 2007 to September 2011. This inventory resulted in an updated checklist of 179 species of hornworts, liverworts, and mosses, in 98 genera and 54 families. Thirteen potentially new state records, twelve (12) liverworts and one (1) moss, are reported.

INTRODUCTION

The “*big thicket*” region of southeast Texas has long been referred to as a biological crossroads. Situated as the intersection of several distinct eco-regions; the area harbors a unique mix of plants and animals indicative of the southeastern swamps, eastern forests, central plains, and the southwestern United States. Its biota includes species from tropical and subtropical biomes, as well as those characteristic of the arid west (Gunter 1993). The region also represents the western-most extension of the southeastern evergreen forests (McCleod 1971), and is the western boundary for distributions of many aquatic insects with largely eastern affinities (Abbott et al. 1997). The Big Thicket National Preserve (BITH), founded in 1974, seeks to preserve the fragmented remnants of a once much larger and contiguous region of natural ecosystems. Comprising nearly 105,000 acres in a disparate mix of land units, and several inter-connecting water corridors, BITH was the first unit of the National Park Service (NPS) to be set aside with the expressed intent of protecting biodiversity.

Surveys of vascular plants have been reported for most regions of Texas, and in particular, east Texas. However, many of the earliest east Texas reports (Gow 1904, Parks and Cory 1938) made no mention, or only a passing reference to bryophytes, and none provide real inventories or checklists of these groups. Even reports from surveys conducted much later (McLeod 1971) neglect to include bryophytes as part of their inventories. Following the establishment of the BITH, a broad survey of plant and fungal groups within the newly established preserve was initiated (Schedlbauer 1974). This report included what could be considered the first inventory of bryophytes within the legal confines of the BITH. Mueller 1974, reported 77 species in 49 genera as occurring in selected units of the preserve. Following these initial reports, additional authors have supplemented the known bryophyte flora of the BITH (Stoneburner and Wyatt 1979, Lodwick and Snider 1980, Bazan 1980, Wyatt, et al. 1980, Reese 1984). Despite these subsequent reports, a number of BITH’s operational units have limited, or no, reports of bryophytes.

The objective of this inventory was to provide an overall inventory of extant bryophyte taxa within the entirety of the BITH. In the context of this inventory, bryophytes include taxa from the Bryophyta (moss), Marchantiophyta (liverwort), and Anthocerotophyta (hornwort) phyla.

METHODS

Field surveys were conducted in each of the nine (9) land units: Beaumont, Beech Creek, Big Sandy Creek, Canyonlands, Hickory Creek Savannah, Jack Gore Baygal, Lance Rosier, Loblolly, and Turkey Creek. Due to continuing access problems following Hurricane Rita in 2005, most the length of the corridor units (Upper and Lower Neches River, Big Sandy Creek, Menard Creek, Pine Island Bayou) was excluded from this survey. While in the field, surveys were conducted utilizing a modified floristic habitat sampling method. This method as described by Newmaster, et al. 2005, focuses on a stratification of different mesohabitats into their component microhabitats for sampling bryophytes and was shown to produce a significant increase (>50%) in the number of taxa documented over the standard plot sampling method. Marks and Harcombe 1981, defined the vegetation types within the Big Thicket region of east Texas based generally on topographic position and the dominant over-story vegetation. Each of these is further subdivided into a number of communities such as: sandhill pine forest, upland pine forest, wetland pine savannah, upper slope pine-oak forest, wetland baygall shrub thicket, swamp cypress tupelo forest. Within each of these communities, bryophytes inhabit a variety of substrates such as: soil and rock along stream banks, decaying or living tree bases, specialized soil types, specific tree species, etc.

Sampling locations were spatially distributed to include a minimum of one (1) location within each mesohabitat and microhabitat encountered in each of the individual land units. Within each microhabitat the various substrates were sampled for bryophytes. Sampling trips were conducted throughout the year, with an increased emphasis in the late fall and early spring to document taxa which are typically ephemeral in nature. Collections were transported to the S. M. Tracy Herbarium (TAES) for processing, identification, and vouchering. Identifications were made using various references, however, the primary sources utilized were Briel 1970, and Schuster 1966, 1969, 1974, 1980, 1992, 1992a for the Anthocerotophyta and Marchantiophyta; Crum and Anderson 1981, and Reese 1984 for the Bryophyta. Nomenclature follows ITIS 2011 for all taxa with the following exceptions: *Scapania nemorosa* fo. *whitehouseae* R.M. Schust., follows Schuster 1992a; *Ctenidium molluscum* (Hedw.) Mitt. and *Riccia stenophylla* Spruce, follow USDA 2011. Identifications were made by Dale A. Kruse and Paul V. Roling. A limited number of specimens were sent to Paul G. Davison for identification as indicated in the accompanying database files. Identifications from previously published reports were not independently verified. All data has been entered into a project data file which has been submitted to the NPS. Vouchers are deposited at TAES under an existing NPS repository agreement. Specimens are stored in archival quality bryophyte packets with an accompanying label containing all relevant collection information.

In addition to field collections, a survey of selected state and regional herbaria was conducted to determine where additional BITH collections may be housed. Appropriate specimen data was obtained from five (5) herbaria: ASTC, BRIT, SHST, TEX/LL, and MO (W.R. Reese's collections transferred from LAF). Specimens from BAYLU were not made available for inspection (acronyms follow Thiers, continuously updated). Specimen identifications obtained from these herbaria were not verified. The data acquired from these herbaria is included in a second historical records data file.

RESULTS

Field work was conducted from January 2007 through September 2011 and resulted in the accumulation of approximately 693 voucher samples from the BITH. Historical data, obtained from searches of the herbaria listed in the previous section, added another 730 records for Hardin, Polk, and Tyler Counties. However, only 217 could be reliably attributed to the BITH, the remainder could not be verified as BITH collections and are provided as additional county records.

A cumulative checklist of bryophytes within the BITH was compiled from collections made in the course of this inventory, records from previously published reports of taxa not found in this inventory, and additional records obtained from the search of herbaria. The current checklist of bryophytes in the BITH

comprises 179 species, in 98 genera and 54 families. The total reported taxa consist of 3 hornworts, 69 liverworts, and 107 mosses. The families with the most species were Lejeuneaceae (16 spp.), Fissidentaceae (9 spp.), Hypnaceae (8 spp.), Polytrichaceae, Pottiaceae, Ricciaceae, Sphagnaceae (each with 7 spp.), and Funariaceae, Jubulaceae (each with 6 spp.). Species-rich genera included *Fissidens* (9 spp.), *Sphagnum* (7 spp.), *Frullania*, *Riccia* (each with 6 spp.), *Cololejeunea* (5 spp.), and *Funaria*, *Lejeunea*, *Leskea*, *Leucolejeunea*, *Riccardia* (each with 4 spp.).

The current checklist includes several possible new records for the state of Texas. Based on the current inventory, and previously published reports, thirteen (13) taxa are potentially new to the state. Four (4) of these (*Cololejeunea biddlecomiae* (Aust.) Evans, *Cylindrocolea rhizantha* (Mont.) Schust., *Jungermannia gracillima* Sm., *Metzgeria uncigera* A. Evans) were added to the checklist based on records from a Master's Thesis (Bazan 1980). At this time no reports have been found of these taxa in the literature and vouchers for these specimens have not been located. Therefore, the listing of these taxa is considered tentative until vouchers can be located and identifications verified. The remaining eleven (11) taxa are anticipated new records for the state (*Cephaloziella hyalina* Douin, *Ceratolejeunea laetefusca* (Aust.) Schust., *Cololejeunea contractiloba* Evans, *Cololejeunea setiloba* Evans, *Dumortiera hirsuta* (Sw.) Nees, *Jamesoniella autumnalis* (DeCandolle) Steph., *Micromitrium austinii* Sull. in Aust., *Notothylas breutelii* (Gottsche) Gottsche, *Riccardia multifida* (L.) Gray ssp. *synoica* R.M. Schust.). Further investigation is required to verify the status of these identifications and current known distributions. Although not new to the state, the collections of *Anacamptodon splachnoides* (Froel. ex Brid.) Brid., *Pogonatum pensilvancium* (Hedw.) Paris, and *Syrrhopodon parasiticus* (Sw. ex Brid.) represent one of the few (< 5) vouchers of these species in the state.

None of the taxa on the current checklist are listed as endangered or threatened in Texas (TPWD 2011). NatureServe places several taxa in the "imperiled" or "vulnerable" categories at the global level (NatureServe 2011). However, a strict interpretation of these rankings is premature since assignment of these rankings is complicated by uncertainty in the currently accepted taxonomy, and insufficient distribution data. As a result, several of the taxa are assigned a status which varies widely from "vulnerable" to "secure." The only taxon that would appear to be truly imperiled is *Riccardia cf. jugata* R.M. Schust., and this identification is at this point considered tentative.

DISCUSSION

Public interest in the flora of a region is often focused on the more obvious components of the vegetation - the vascular plants. These organisms, generically referred to as trees, wildflowers, weeds, etc., typically dominate the landscape in most ecosystems in Texas. In contrast, the lower plants, the group to which bryophytes are assigned, are often less conspicuous members of many ecosystems. Eula Whitehouse, in her brief synopsis of the state of bryology in Texas (Whitehouse 1952), references statements by early bryologists suggesting Texas was "almost unexplored" relative to bryophytes. Although the ensuing decades have increased our knowledge of these groups in the state, there is ample evidence to suggest there is more to be discovered.

The total number of species in this inventory represents a 57% increase in reported taxa since the initial BITH investigations completed by Mueller in 1974. The reasons for this increase are not clearly known. Additional collecting effort, defined as time spent in the field, coupled with a structured sampling scheme is one potential reason. Another possible explanation is an actual shift in species distributions resulting from changes in environmental conditions within a given region. The addition of the new species to the Texas bryoflora may be indicative of a shift in local conditions, albeit the directional nature of that shift is not clear. With only a few collections of specific taxa, the shift could be interpreted as immigration, or just as easily, as remnant species assemblages existing in highly specialized niches.

With little if any commercial value in Texas, bryophytes do nonetheless provide a number of important ecological benefits ranging from soil stabilization and nitrogen fixation, to bio-indicators of air and water

pollution. As non-vascular plants, bryophytes are highly susceptible to changes in environmental conditions. This characteristic has led to a relatively recent utilization of bryophytes as early indicators of climate change (Tuba et al., 2011). In addition to movement of species to higher elevations, there is also an anticipated shift in species ranges toward the poles as the Earth's climate warms. Due to the position of the BITH at the confluence of multiple eco-regions, and its location near the Gulf Coast of Texas, BITH could prove to be a natural laboratory for observing species, and community, distributional changes at both local and regional scales.

PRODUCTS

Two specimen record database files were developed and both have been forwarded to the NPS as part of this inventory. These two files contain records of specimens collected by the authors and also relevant records obtained in the herbaria search funded by the BTA. It is anticipated the results from this research will be published in the Journal of the Botanical Research Institute of Texas. The results of this inventory will also be included as part of a Ph.D. Dissertation by the first author.

ACKNOWLEDGEMENTS

This research was supported by a grant from the Western National Parks Association and the Big Thicket Association's, All Taxa Biodiversity Inventory. Supplemental funding was provided by the Big Thicket Association for a search of historical records at selected state and regional herbaria. We wish to acknowledge the logistical support and technical assistance of the Big Thicket National Preserve staff, and The Big Thicket Association for their assistance and the use of the Big Thicket Field Research Station for the duration of this project. A special thanks is extended to Paul V. Roling, who donated countless hours in the field and lab toward the completion of this inventory.

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Checklist of Bryophytes in the Big Thicket National Preserve, Texas

All taxa in this checklist were collected and identified by Dale A. Kruse or Paul V. Roling with the following exceptions. Taxa reported by previous authors and not collected in the current inventory are indicated as follows: (1) Bazan, 1980; (2) Mueller, 1974; (3) Stoneburner and Wyatt, 1979. Specimens located in herbaria and not collected in the current inventory are indicated using the appropriate herbarium acronym. Tentative state records are indicated with an asterisk. NatureServe rankings are included for taxa with a sole ranking of G3 or lower.

ANTHOCEROTOPHYTA

Anthocerotaceae

Anthoceros adscendens Lehm. & Lindenb.⁽¹⁾

Anthoceros carolinianus Michx.

Notothyladaceae

Notothylas breutelii (Gottsche) Gottsche*

MARCHANTIOPHYTA

Adelanthaceae

Odontoschisma denudatum (Nees Ex. Mart.)
Dum.^(TAES)

Odontoschisma prostratum (Sw.) Trev.

Aneuraceae

Aneura pinguis (L.) Dumort

Riccardia cf. *jugata* R.M. Schust. (G2)

Riccardia latifrons (Lindb.) Lindb.⁽¹⁾

Riccardia multifida (L.) Gray

Riccardia multifida (L.) Gray ssp. *synoica*
R.M. Schust.*

Aytoniaceae

Asterella elegans ssp. *echinella* (Gott.) del
Rosario^(TAES)

Asterella tenella (L.) P. Beauv.⁽¹⁾

Reboulia hemisphaerica (L.) Raddi

Calypogeiaceae

Calypogeia fissa (L.) Raddi

Calypogeia sullivantii Austin

Cephaloziaceae

Cephalozia catenulata (Hüb.) Lindb.

Cephalozia connivens (Dicks.) Lindb.

Cephalozia lunulifolia (Dum.) Dum.

Cephaloziellaceae

Cephaloziella hyalina Douin*

Cylindrocolea obliqua (Douin) Schust. (G1Q)

Cylindrocolea rhizantha (Mont.) Schust.^{(1)*} (G3?)

Fossombroniaceae

Fossombronia brasiliensis Steph.

Petalophyllum ralfsii (Wilson) Nees & Gottsche ex
Lehm.⁽²⁾

Geocalycaceae

Lophocolea heterophylla (Schrad.) Dum.

Jubulaceae

Frullania brttoniae Evans⁽¹⁾

Frullania eboracensis Gott.

Frullania inflata Gott.

Frullania kunzei Lehm. & Lindenb.

Frullania obcordata Lehm. & Lindenb.

Frullania squarrosa (Reinw., Blume & Nees) Dum.

Jungermanniaceae

Jamesoniella autumnalis (DeCandolle) Steph.*

Jungermannia gracillima Sm.^{(1)*}

Jungermannia hyalina Lyell⁽¹⁾

Lejeuneaceae

Ceratolejeunea laetefusca (Aust.) Schust.*

Cheilolejeunea rigidula (Nees et Mont.) Schust.

Cololejeunea biddlecomiae (Aust.) Evans^{(1)*}

Cololejeunea cardiocarpa (Mont.) Schust.

Cololejeunea contractiloba Evans*

Cololejeunea minutissima (Sm.) Schiffn.

Cololejeunea setiloba Evans* (G2?)

Lejeunea cladogyna Evans (G3?)

Lejeunea flava (Sw.) Nees

Lejeunea laetivirens Nees et Mont.

Lejeunea ulcinia (Tayl.) Gott.

Leucolejeunea clypeata (Schwein.) Evans

Leucolejeunea conchifolia Evans

Leucolejeunea unciloba (Lindenb.) Evans

Leucolejeunea xanthocarpa (Lehm. et

Lindenb.) Evans⁽²⁾

Rectolejeunea maxonii Evans

Lepidoziaceae

Kurzia sylvatica (Evans) Grolle

Telaranea nematodes (Gottsche ex Austin.)

M. A. Howe

Marchantiaceae

Dumortiera hirsuta (Sw.) Nees*

Metzgeriaceae

Metzgeria furcata (L.) Dumort.

Metzgeria uncigera A. Evans ^{(1)*} (G3)

Pallaviciniaceae

Pallavicinia lyellii (Hook.) Carruth.

Plagiochilaceae

Plagiochila dubia Lindenb. et Gott. ⁽¹⁾

Plagiochila ludoviciana Sull.

Plagiochila miradorensis Gott.

Porellaceae

Porella pinnata L.

Porella platyphylla (L.) Pfeiff.

Porella platyphylloidea (Schwein.) Lindb. ⁽²⁾

Radulaceae

Radula australis Aust.

Radula obconica Sull.

Ricciaceae

Riccia curtisii (Aust.) James ⁽¹⁾

Riccia fluitans L. ⁽²⁾

Riccia membranacea Gott. et Lindenb.

Riccia sorocarpa Bisch.

Riccia stenophylla Spruce

Riccia sullivantii Aust.

Ricciocarpos natans (L.) Corda

Scapaniaceae

Scapania nemorosa (L.) Dum.

Scapania nemorosa fo. *whitehouseae* R.M.

Schust.

Sphaerocarpaceae

Sphaerocarpos texanus Aust.

BRYOPHYTA**Amblystegiaceae**

Amblystegium serpens (Hedw.) Schimp. in B.S.G.

Amblystegium varium (Hedw.) Lindb.

Campylium chrysophyllum (Brid.) J. Lange

Leptodictyum riparium (Hedw.) Warnst.

Anomodontaceae

Anomodon attenuatus (Hedw.) Hüb.

Anomodon minor (Hedw.) Fürnr.

Bartramiaceae

Philonotis longiseta (Michx.) E. Britton

Brachytheciaceae

Brachythecium acuminatum (Hedw.) Aust. ^(TAES)

Brachythecium biventreosum (Müll. Hal.) A. Jaeger ⁽²⁾

Bryoandersonia illecebra (Hedw.) Robins.

Eurhynchium hians (Hedw.) Sande Lac.

Steeerleus serrulatus (Hedw.) Robins.

Bruchiaceae

Bruchia brevifolia Sull.

Bruchia drummondii Hampe ex Britton

Trematodon longicollis Michx.

Bryaceae

Bryum cf. *radiculosum* Brid.

Bryum pseudotriquetrum (Hedw.) Gaertn.,
Mey. & Scherb.

Calymperaceae

Syrrhopodon parasiticus (Brid.) Besch.

Syrrhopodon texanus Sull.

Climaceaceae

Climacium americanum Brid.

Cryphaeaceae

Cryphaea glomerata Bruch & Schimp. ex Sull.

Dicranaceae

Dicranella heteromalla (Hedw.) Schimp. ⁽²⁾

Dicranella varia (Hedw.) Schimp. ⁽²⁾

Dicranum condensatum Hedw. ⁽²⁾

Ditrichaceae

Ceratodon purpureus (Hedw.) Brid. ^(TAES)

Ditrichum pallidum (Hedw.) Hampe

Entodontaceae

Entodon macropodus (Hedw.) C. Müll.

Entodon seductrix (Hedw.) C. Müll.

Ephemeraceae

Ephemerum spinulosum Bruch & Schimp. in
Schimp.

Micromitrium austinii Sull. in Aust.*

Fabroniaceae

Anacamptodon splachnoides (Fröl. ex Brid.)
Brid.
Clasmatodon parvulus (Hampe) Hook. & Wilson
ex Sull. in Gray
Fabronia ciliaris (Brid.) Brid.

Fissidentaceae

Fissidens adianthoides Hedw.
Fissidens bryoides Hedw.
Fissidens bushii (Card. & Thér.) Card. & Thér.
Fissidens dubius P. Beauv.
Fissidens fontanus (B. Pyl.) Steud.
Fissidens polypodioides Hedw.
Fissidens ravenelii Sull.
Fissidens subbasilaris Hedw.
Fissidens taxifolius Hedw.

Fontinalaceae

Fontinalis filiformis Sull. & Lesq. In Aust.
Fontinalis novae-angliae Sull.

Funariaceae

Funaria americana Lindb. in Sull.⁽²⁾ (G3?)
Funaria flavicans Michx.
Funaria hygrometrica Hedw.
Funaria serrata Brid.
Physcomitrium immersum Sull.
Physcomitrium pyriforme (Hedw.) Hampe

Hypnaceae

Ctenidium molluscum (Hedw.) Mitt.
Herzogiella turfacea (Lindb.) Iwats.⁽²⁾
Homomallium adnatum (Hedw.) Broth.
Hypnum lindbergii Mitt.
Isopterygium tenerum (Sw.) Mitt.
Platygyrium repens (Brid.) Schimp. in B.S.G.⁽²⁾
Pseudotaxiphyllum homomallifolium (Redf.)
Irel.⁽²⁾ (G2G4)
Taxiphyllum taxirameum (Mitt.) Fleisch.^(SHST)

Leptodontaceae

Forstroemia trichomitria (Hedw.) Lindb.

Leskeaceae

Bryohaplocladium microphyllum (Hedw.)
Wat. & Iwats.
Leska australis Sharp
Leska gracilescens Hedw.
Leska obscura Hedw.
Leskea polycarpa Hedw.

Leucobryaceae

Leucobryum albidum (Brid. ex P. Beauv.) Lindb.
Leucobryum antillarum Schimp. ex Besch.⁽²⁾
Leucobryum glaucum (Hedw.) Ångstr. in Fries.

Leucodontaceae

Leucodon julaceus (Hedw.) Sull.

Mniaceae

Mnium affine Bland. ex Funck.
Plagiomnium ciliare (C. Müll.) T. Kop.
Plagiomnium ellipticum (Brid.) T. Kop.⁽²⁾
Rhizomnium punctatum (Hedw.) T. Kop.

Myriniaceae

Schwetschkeopsis fabronia (Schwägr.) Broth.

Orthotrichaceae

Orthotrichum diaphanum Brid.⁽²⁾
Orthotrichum obtusifolium Brid.⁽²⁾
Schlotheimia rugifolia (Hook.) Schwägr.

Polytrichaceae

Atrichum angustatum (Brid.) Bruch & Schimp. in
B.S.G.
Atrichum tenellum (Röhl.) Bruch & Schimp. in
B.S.G.
Atrichum undulatum (Hedw.) P. Beauv.
Pogonatum brachyphyllum (Michx.) P. Beauv.
Pogonatum pensilvanicum (Hedw.) P. Beauv.
Polytrichum commune Hedw.
Polytrichum ohioense Ren. & Card.⁽²⁾

Pottiaceae

Astomum ludovicianum (Sull.) Sull.
Barbula indica (Hook.) Spreng. in Steud.
Barbula unguiculata Hedw.
Tortella fragilis (Hook. & Wils. in Drumm.)
Limpr.⁽²⁾
Tortella humilis (Hedw.) Jenn.
Tortula pagorum (Milde) De Not.
Weissia controversa Hedw.

Ptychomitriaceae

Ptycomitrium drummondii (Wils.) Sull.

Sematophyllaceae

Brotherella recurvans (Michx.) Fleisch.⁽³⁾
Sematophyllum adnatum (Michx.) Britt.

Sphagnaceae

Sphagnum affine Ren. & Card.

Sphagnum henryense Warnst.

Sphagnum lescurii Sull. in Gray

Sphagnum macrophyllum Brid.

Sphagnum molle Sull.

Sphagnum palustre L.

Sphagnum perichaetiale Hampe

Theliaceae

Thelia hirtella (Hedw.) Sull. in Sull. & Lesq.

Thelia lescurii Sull. in Sull. & Lesq.

Thuidaceae

Cyrto-hypnum minutulum (Hedw.) Buck & Crum

Thuidium allenii Aust.

Thuidium delicatulum (Hedw.) Schimp. in B.S.G.

Thuidium recognitum (Hedw.) Lindb.⁽²⁾