The Bryological Times

Volume 146

President's Message

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Every day important contributions to our understanding of the biology of bryophytes are disseminated through peer-review publications. Although bryology could benefit from more researchers devoted to it, bryophytes are not understudied per se, but are widely overlooked or one could say transparent to a large part of the public and also our fellow colleague botanists. Hence it is important that bryologists engage in activities promoting an awareness of bryophytes and advances unraveling their evolutionary history and diversity, the genetic networks underlying their ontogeny, their unique physiological properties and their interactions with other (micro) organisms. The sexennial International Botanical Congress offers a unique gateway to reintroduce the community of plant biology researchers to bryophytes and bryology as integral parts of the plant kingdom and of botany, respectively. At the most recent congress, the XIX International Botanical Congress held in Shenzhen, China in July, 2017, advances in bryology were highlighted in talks composing five symposia organized by IAB.

– In This Issue –

Exhibit entitled "The Magic and Enchantment of Bryophytes" at the XIX International Botanical Congress in Shenzhen, China, July 2017. Lower left, Dr. Qin Zuo and Mr. Paul Chua who welcomed and guided visitors through the diorama and exhibit. Lower right, Ms Shihua Li and Ms Lili Xu, the artists whose paintings and sculptures were featured.

Bryophytes were also prominently featured in an exhibit entitled "The Magic and Enchantment of Bryophytes". The exhibit was composed of an extensive diorama assembled by Dr. Li Zhang, and of sculptures and paintings of various mosses, liverworts and hornworts by Ms Shihua Li and Ms Lili Xu (**photo**). Visitors were graciously led through the exhibit by Dr. Qin Zuo and Mr. Paul Chua. The XIX International Botanical Congress was a great success for botany and for bryology (see article on page 10 by Liu et al). On behalf of IAB and all attendees of the meeting, I thank Drs. Rui-Liang Zhu, Li Zhang and Yang Liu for their dedication in organizing a successful meeting, for welcoming bryologists from over 15 countries, creating opportunities for them to meet, interact and celebrate bryology, and for developing a wonderful exhibit showcasing bryophytes to the thousands of botanists from around the world.

An under-explored region of the world: Fieldwork in the Cook Islands of the South Pacific

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Sitting in a deck chair enjoying the sun whilst contemplating going for a snorkel in the azure tepid waters of the lagoons is the usual way people spend their time on Rarotonga, the largest island in

the Cook Islands group. However, an international team of botanists headed to the central mountains and their peaks to find possible elusive new species to science and other discoveries. The team, led by Assoc. Prof. Peter J. de Lange (Department of Natural Sciences, Unitec Institute of Technology, Auckland, New Zealand) including Matt von Konrat (Head of Botanical Collections, Field Museum) Mereia Tabua (Scientific Officer, University of the South Pacific, Suva, Fiji),

Peaks to coast. Photo: Matt von Konrat.

Gerald McCormack (Cook Islands Biodiversity and Natural Heritage, Cook Islands Government), as well as Theo J.P. de Lange, Gillian M. Crowcroft and Finn J.T. de Lange (Natural Resource Assessors, Auckland, New Zealand) surveyed the coast and mountains of Rarotonga in late September and early October, 2017. The Cook Islands Early Land Plant survey is very kindly supported by Mary and Bruce Feay.

The Cook Islands are also part of over 4,500 islands of the Polynesia-Micronesia biodiversity hotspot and widely considered as the epicenter of the current global extinction crisis (**http://www.cepf.net/resources/hotspots/Asia-Pacific/Pages/Polynesia-Micronesia.aspx**). The island is an estimated 2.68 million years old. The vascular flora of the Cook Islands has been comprehensively documented. However, the bryophyte flora (mosses, liverworts and hornworts) of the Cook Islands group has received scant attention. Virtually nothing has been published about the islands' hornworts and liverworts. During the survey, a range of habitats was targeted including coral cay, coastal and lowland forest, stream catchments, valley head and upland cloud forest and rock outcrops. Over 500 specimens were collected from these habitats, carefully packeted, air dried and shipped to The Field Museum and University of the South Pacific where they are being critically examined, identified and selectively DNA sequenced. Whilst on Rarotonga portions of fresh specimens were mounted on slides, examined by microscope, and their critical features, such as leaf oil bodies, imaged using a computer-camera-microscope set-up. Although labor intensive, this process is critical because the oil bodies of liverworts deteriorate rapidly on drying and are soon lost, yet oil bodies are a key character enabling family, genus and even species recognition. Apart from their taxonomic significance, interestingly, oil bodies also harbor chemical compounds that have biologically active properties, for example, activity against microbes.

The bryophyte flora of Rarotonga is very conspicuous to those who know what to look for and it is full of surprises. The team estimates that they collected at least 50 new species records for the Cook Islands that have never been reported before. The team also suspects some possible new species to science, but that will take ongoing investigation. Already, von Konrat and his team have made some interesting discoveries. A minute liverwort was originally described from the northern North Island of New Zealand as *Rectolejeunea denudata* and has been discovered on Rarotonga - providing one of several cryptogamic plant links to New Zealand some 3,200 km away in the south-western Pacific. Other linkages across the Pacific include a species called *Plagiochila pacifica*, previously regarded as endemic to Raoul Island in the Kermadec group.

Bryophyte covered tree limbs. Photo: Matt von Konrat.

The cloud forest of Rarotonga, at 150 ha, occupies only a fraction of the island's 67.39 km^2 yet it supports the greatest number of endemic vascular plants (12 of the 18 endemics currently accepted for Rarotonga). Access to these fragile forests is not easy, requiring a good head for heights and plenty of blind faith as one typically uses aged fixed ropes and steel pins hammered into the often-vertical rock and clay walls leading up to the razor-back summits of the central Rarotongan mountains. Of course, that is when these are provided; when they are not, one then has to 'trust' the spindly roots and trunks of neinei (*Fitchia speciosa*), or more reliable root stocks of mato (*Homalium acuminatum*) and pua (*Fagraea berteroana*). As mountain trials are generally not maintained on the island, track clearance with a machete is often required, adding to the strain of field work. Accessing these forests makes for a very long day, particularly as camping high up in the clouds is judged potentially too damaging to this fragile ecosystem. So a bryological survey of Rarotongan cloud forest necessitates early morning starts. Once the cloud forest is reached, strict discipline is then necessary to ensure that the full range of microhabitats is covered before the light falls. Because of this, the survey succeeded in surveying only one cloud forest that found on Te Kou, a 588 m tall peak, whose jagged summits enclose a deep forested basin, complete with small stream draining down into the Avana headwaters. Several hours were spent on Te As as a guide to the time needed to complete this survey, the few hours spent on Te Kou resulted in a near night forest exit and a further 18 hours of specimen sorting, processing, interim labeling and imaging. It was a very tired team indeed that completed the first phase of the island survey and headed back to Fiji, New Zealand and the USA on the 6th October 2017.

Although the study is still in its early days, it looks like the bryophyte flora (hornworts, liverworts and mosses) of Rarotonga may exceed 150 species. Less than 30 had been ever recorded so this is quite a leap! The study will also investigate the conservation status of these little plants, their ecological and cultural significance, and the status of those species that have been described as endemic.

News from the Hattori Botanical Laboratory

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Hattori Botanical Laboratory is a bryological and lichenological research center located in Nichinan, southern Kyushu, Japan. In April 2017, the laboratory underwent a change in staffing. Tomoyuki Katagiri was appointed the director of the laboratory, while Yuya Inoue was added to the research staff. The laboratory's herbarium, NICH, is the repository for the bryological collections, approximately 480,000 specimens including 240,000 exotic and 240,000 Japanese specimens, and approximately 4,100 type specimens. The herbarium also houses approximately 13,000 lichen specimens, including about 10 type specimens. The main building contains displays on the history of the laboratory and bryological and lichenological topics for interested citizens. The laboratory also maintains a reasonably priced housing accommodation (one single room next to the herbarium) that is available for visiting researchers.

Hattoria is a peer-reviewed, international journal published by Hattori Botanical Laboratory. The first volume was printed in 2010 subsequent to *The Journal of the Hattori Botanical Laboratory* (1947–2006, Nos. 1–100). *Hattoria* appears annually (1 volume per year) and is an open access journal, free to readers and authors. International bryologists and lichenologists are invited to publish original research from any field of bryology and lichenology.

We invite all readers to visit the webpage of the Hattori Botanical Laboratory:
http://hattorilab.org/en/ and *Hattoria*:
https://www.jstage.jst.go.jp/browse/hattoria
where you can find more detailed information.

Bryophytes at the International Botanical Congress in Shenzhen, China (23–29 July 2017)

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The International Botanic Congress of 2017, held in Shenzhen in Guangdong Province of China from 23-29 July, was unprecedented in many ways. It was the first time that an IBC has been held in China and it was the biggest congress ever, with a record 6,850 participants. The organizers offered five public lectures, 12 plenary lectures, 34 keynote lectures, 49 training lectures and 212 symposia on a wide array of plant-related topics. The congress was organised into 6 major themes: 1: Biodiversity, Resources & Conservation (**T1 – sessions 01–38**); 2: Taxonomy, Phylogenetics & Evolution (**T2 – sessions 01–68**); 3: Ecology, Environment & Global Change (**T3 – sessions 01–26**); 4: Development & Physiology (**T4 – sessions 01–39**); 5: Genetics, Genomics & Bioinformatics (**T5 – sessions 01–33**); 6: Plants & Society (**T6 – sessions 01–15**).

Bryophytes were well-represented during the IBC in Shenzhen with 5 sessions specifically dedicated to bryophytes or early land plants taking place over the course of the congress. Contributions on bryophytes were given within a further 10 sessions on plant origins and evolution, phylogenetics, functional traits, diversity and conservation (see **Tables 1 and 2**) that were not focused specifically on bryophytes. The contributed papers originated from over 79 different institutions in the following countries (Australia, Belgium, Brazil, China, Estonia, Finland, France, Germany, Japan, Malaysia, the Netherlands, Portugal, Russia, Singapore, Spain, Sri Lanka, Sweden, Switzerland, Thailand, the UK and the USA).

The traditional and electronic poster sessions also contained a good representation of research on bryophytes. A total of 51 posters were presented during the congress on subjects as wide ranging as taxonomy or sex expression to floristics, conservation or the raising of public awareness of plants using bryophytes (see **Table 3**). The contributed posters originated from over 66 different institutions. Asian bryologists, bryology students and research groups were well-represented during the congress, with encouraging signs that bryological research and bryophyte taxonomy is alive and are flourishing on the Asian continent, especially in China, India, Japan, Malaysia, Singapore, Sri Lanka and Thailand.

XX International Botanical Congress – IBC 2023 will be held in Rio de Janeiro, Brazil.

Table 1. List of symposia dedicated to bryophytes or early land plants and those with contributions on bryophytes given during the IBC in Shenzhen, China, with the theme and symposium code.

Bryophyte and Early Land Plant sessions

T2-02. The moss tree of life: phylogenomic approaches to reconstruct moss evolution, diversification, biogeography and biotic interactions

T2-04. Phylogenomic perspectives on flagellate plant evolution

T2-17. Biodiversity and phylogeography of bryophytes

T2-27. Asian and Chinese bryology (two sessions)

T6-06. Early land plants: from early adopters to transformative models for citizen science engagement connecting natural history collections to biodiversity research and education

Sessions with contributed papers on bryophytes

T1-36. Plant diversity and conservation in Southeast Asia.

T2-24. The Origin of Plants: rocks, genomes and Geochemistry

T2-38. Plant DNA barcoding in evolution, ecology, and conservation (two sessions)

T2-44. Building and exploring the green plant tree of life (two sessions)
T3-06. Functional traits explaining plant responses to past and future climate changes
T4-08. Development and genetics of dioecy and sex chromosomes in plants (two sessions)
T4-39. Novel insights into wood research – from evolution to developmental genetics and functional traits
T5-05. Plant genome evolution from the very beginning (two sessions)
T5-09. Plant organellar genomics and phylogenomics, driven by the NGS approaches (two sessions)
T5-18. Bioinformatics resources for comparative functional and phylogenetic analysis of plant genomes, pathways and diversity

Table 2. An alphabetical list of titles of the contributed papers on bryophytes given at the IBC in Shenzhen, with the theme and the assigned presentation code.

T1-36-02. Bryology in Borneo: A review from 1996 to 2016
T2-02-01. Phylotranscriptomics reveals widespread gene duplication associated with the diversification of pleurocarpous mosses
T2-02-02. Do moss host phylogenetics shape microbiome composition and function?
T2-02-03. The Carboniferous set the stage for the major moss lineages which later experienced multiple independent rate shifts
T2-02-04. Sex-specific gene expression in the pleurocarpous moss species *Brachythecium rivulare*
T2-02-05. The origin of the model taxon *Physcomitrella patens*: Resolving a rapid diversification using a phylogenomic approach based on enriched genomic libraries
T2-02-06. Resolving the backbone phylogeny of mosses, using targeted NGS data from plastid, mitochondrial and nuclear genomes
T2-04-01. Can ancestral state reconstructions of dioecy in mosses be independently confirmed using coalescence of sex linked genes?
T2-04-02. GoFlag: A next generation sequencing perpective on flagellate plant phylogeny
T2-17-01. Combining ecological niche models and dispersal simulations to predict bryophytes dynamic response to climate changes in Europe
T2-17-03. Taxonomy and diversity of Lejeuneaceae (Marchantiophyta): Past, present and future
T2-17-04. How molecular evidence transformed our understanding of bryophyte diversity and phylogeography in Europe, the bryologically best known continent
T2-17-05. Diversity, biogeography and conservation of the thalloid liverworts and hornworts of Sri Lanka
T2-17-06. Inferring species delimitation of the problematic *Riccia fluitans* species complex (Ricciaceae, Marchantiidae) with integrative taxonomy
T2-24-01. Resolving the phylogeny of early land plants by integrating phylgenomics and fossil evidence using morphological evidence
T2-24-02. Latest approaches in establishing early land plant phylogeny and a time scale for plant evolution
T2-24-04. On the monophyly of bryophytes; Evidence based on organellar and nuclear protein-coding gene data
T2-27-01. Systematic study of the genus *Yakushimabryum* and related genera in the Pylaisiadelphaceae (Musci)
T2-27-02. Phytogeographic affinities of the moss flora of China relative to those of North America, Japan, and mainland Southeast Asia
T2-27-03. All is about *Herbertus aduncus* (Dicks.) Gray, Species Delimitation in *Herbertus* (Marchantiophyta)
T2-27-04. Phytogeography of East Asian mosses with special emphasis on the East Asian element
T2-27-05. Dr. Benito C. Tan 1946 to 2016 — The pillar and legacy of bryology in Asia
T2-27-06. Moss Flora of Russia project
T2-27-07. Taxonomy and phylogeny of *Leptolejeunea* (Spruce) Schiffn.
T2-27-08. Generic delimitation and biogeography of *Meteorium* and *Papillaria*, focusing on Asian species
T2-27-09. A taxonomic study of family Bryaceae *s.l.* (Musci) in China
T2-27-10. Molecular phylogeny and subfamilial classification of the family Pottiaceae (Bryophyta)
T2-27-11. Regeneration and vegetative proliferation of peat moss (*Sphagnum squarrosum*)
T2-27-12. Stress imprint of two moss species

T2-38-08. DNA barcoding reveals cryptic lineages of *Schistidium* at the interface between the natural and the anthropogenic environment

T2-38-11. Evaluation of DNA barcoding markers for Thai Epiphyllous Bryophytes

T2-44-09. Revisiting the relationships among bryophyte lineages with increased taxon and gene sampling, and phylogenomic approaches

T3-06-04. Water relations are coupled with photosynthetic light- and water-response functions across 12 mosses

T4-08-07. Using common garden and transcriptomics to understand the genomic architecture of sexual dimorphism

T4-39-04. Paving the road to land: gene diversification and arise of water-conducting cells in land plants

T5-05-03. Insights into land plant evolution garnered from the *Marchantia* genome project

T5-05-04. Hornworts, a missing link to study fundamental questions of plant biology

T5-05-12. Functional ecology of mycobiome shifts associated with plant senescence – linking environmental and experimental re-synthesis metatranscriptomics

T5-09-11. The evolution of liverwort mitochondrial genomes

T5-18-06. Phylogenetic structure (Rc, Rc, fix, Rc, fix (S)) and microstructural evolution of organellar markers

T6-06-01. A three-tier citizen science monitoring scheme for the distribution of plants, bryophytes and lichens

T6-06-02. Crowd sourced science: A transformative model of engagement connecting natural history collections to biodiversity education and conservation

T6-06-03. Bryophytes in Australian ecosystems-opportunities to educate the wider community

T6-06-04. Bryophytes: Easily over looked but unique plants for public awareness of natural beauty and biodiversity conservation

Table 3. The list of the titles of the posters on bryophytes presented at the IBC in Shenzhen, listed by the poster code.

L0064. Jasmonic acid in the Play of Wound-induced Regeneration in the liverwort, *Marchantia polymorpha* L.

P0048. Distribution pattern of epiphytic mosses from Orthotrichaceae family in China.

P0058. Exploration of moss flora along an altitudinal gradient at selected areas in the Central Province, Sri Lanka – preliminary survey.

P0062. Metro moss: Integrating ecology and physiology to study the effects of urbanisation on plant diversity.

P0076. Bryophyted diaspore bank of peatlands.

P0099. Preliminary investigation of bryophytes in Xizang, China

P0181. Impacts of REE'S Enrichment on growth and anatomy of eight common mosses from Baiyun Obo

P0204. Moss genera *Leratia, Lewinskya, Nyholmiella* and *Orthotrichum* in China

P0287. Do males and females in Pleurocarpous mosses differ in their environmental niches?

P0298. Guizhou Province—A holy land of musci flora

P0304. An account of Hornwort (Anthocerotophyta) in Malay Peninsula

P0307. Bryophytic diversity in the agricultural landscapes of Pantnagar located in the terai of Kumaun Himalayas, India

P0315. Taxonomy of *Plagiochila* in China

P0328. Diversity and habitat analysis of the family Lejeuneaceae (Marchantiophyta) in the State Assam, India

P0437. Effect of forest fragmentation on epiphyllous liverworts presence in China

P0449. Taxonomic Studies of the family Trichocoleaceae (Marchantiophyta) in Central and South America; *Trichocolea sprucei*, *Trichocolea floccosa*, and *Leiomitra flaccida*

P0457. Genetic variation and evolution of *Filibryum* in Yakushima Island

P0471. A panmictic Amazonian world?

P0475. Evidence for narrow species concepts in the subcosmopolitan leafy liverwort genus *Lejeunea*

P0497. Drought memory of moss. Poster changed to: Genome-wide Analysis of Drought Memory Transcriptome in *Physcomitrella patens*

P0501. Nitrogen resorption and release by understory mosses in an old-growth fir forest

P0514. Peristome patters and spore morphology of *Bryum* Hedw. (Bryaceae) from the Altun Mountain National Nature Reserve in Xinjiang, China

P0547. A new delimitation of the species *Chionolomabom bayense* (Müll. Hal.) P. Sollman (Pottiaceae, Bryophyte) based on molecular and morphological data

P0548. The genus *Sciuro-hypnum* (Hampe) Hampe (Brachytheciaceae, Bryophyta) in Japan

P0558. Bryophytes gemmae biodiversity and related environmental adaptability studies in different vegetation communities of dolomite subtropical

P0570. Trends in peristome architecture in the Dicranales (Dicranidae)

P0571. Techniques for exploring peristome architecture in haplolepidous mosses: Reviving old innovations

P0575. An overview of the genus *Radula* subgenus *Amentuloradula* Devos *et al.* (Radulaceae, Marchantiophyta)

P0599. Taxonomical identity of *Encalypta* species with gemmae and genetic diversity in Japan

P0608. Physiological and biochemical study of *Racomitrium canescens* under extreme high temperature stress

P0616. Diversity, vertical distribution patterns and drivers of epiphytic bryophytes in tropical and subtropical forests, SW China

P0623. *Udaria* – A new liverwort genus of Lophocoleaceae from Eastern Himalaya, India

P0629. Biodiversity, distributions, and adaptations of epiphytic bryophytes in the context of global changes in Yunnan, SW China

P0631. A phylogeny of *Mastigolejeunea* (Marchantiophyta: Lejeuneaceae) - Evidence for reduction of *Mastigolejeunea* to subgeneric rank in *Thysananthus* and transferring *M. florea* to *Spruceanthus*

P0637. R. M. Schuster'stheory on the origin and biogeography of liverworts tested

P0639. A preliminary study of the genus *Calymperes* Sw. (Calymperaceae, Bryophyta) in Thailand

P0663. A systematic revision of pantropical genus of *Caudalejeunea* (Lejeuneaceae, Marchantiophyta)

P0684. On the generic circumscription of the complex thalloid liverwort family Corsiniaceae (Marchantiophyta) based on molecular and morphological evidence

P0702. *Gaolejeunea*, a new genus of subtribe Echinolejeuneinae (Lejeuneaceae, Marchantiophyta) from China

P0710. Diversity and ecology of bryophytes in the headwaters region of Urumqi River, Xinjiang, China

P0717. A taxonomic revision of *Radula* in china based on molecular and morphological evidence

P0725. Morphological study on the asexual reproduction by deciduous leaves of *Takakia lepidozioides*

P0783. Convergence of carbon and nitrogen isotopes in terrestrial bryophytes across global nitrogen deposition and climate gradients

P0790. Bryophytes in field culture as excellent model organisms for ecological experiments

P0791. The effect of soil copper on moss patches of *Ptychostomum capillare*, a resistant moss species

P0880. Bryophyte preferences in bryophagous insects – What matters?

P1049. Centrin in *Marchantia polymorpha*: characterization, localization, and implications in the evolution of microtubule system in land plants

P1190. Sequencing genomes of *Blasia* and *Coleochaete* to discover keys to embryophyte success

P1243. Comparative organellar genomics of the European Calypogeiaceae

P1314. Origin and diversity of *WRKY* gene family in green plants

P1347. Conservation and public education about *Fissidens macaoensis*

Acknowledgment: SM presented one traditional poster at the IBC in China. His travel and congress participation was supported by the ITS-SERB, New Delhi. He is also thankful to Director, Botanical Survey of India for encouragement.

MP participated in the Nomenclature Sessions and presented two electronic posters at the IBC in China. Her travel and congress participation was supported by the Conservatoire et Jardin botaniques de la Ville de Genève.

Paroicous inflorescence of a liverwort, *Liochlaena lanceolata* Nees.

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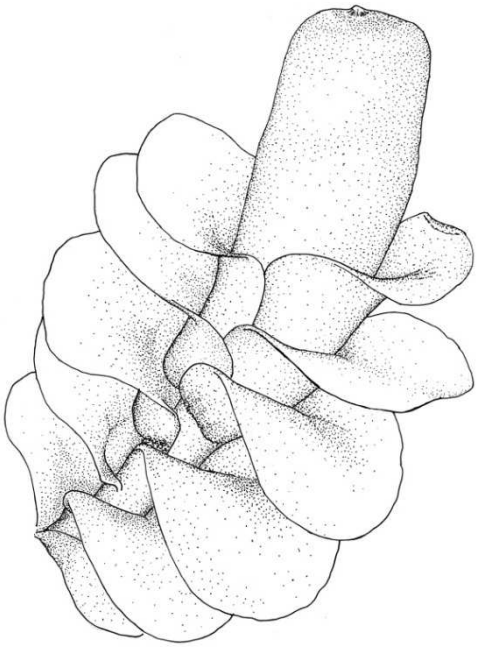

***Liochlaena lanceolata* on log, Lane County, Oregon, U.S.A. Photo & illustration: David Wagner**

Here are two illustrations of a fertile shoot of *Liochlaena lanceolata* that was found on a log in Lane County, Oregon, U.S.A. The digital image was prepared on a Nikon Eclipse E2000 with a Nikon Coolpix 8800 mounted on the trinocular head. Lighting was provided by a combination of transmitted and reflected light, as described in *The Bryological Times* (Wagner 2011b). A series of 20 images was taken using the focusing dial described in an earlier issue (Wagner 2011a). These were assembled with Zerene Stacker software. The stacked image was cleaned up with Adobe PhotoShop Elements 12.

The pen and ink illustration was created by printing the digital image on thin paper, coating the reverse with a 6B graphite stick, and transferring the outlines onto a piece of art paper by tracing directly on the printed image. The resulting graphite template was rendered with a fine pointed Micron technical pen.

Literature cited:

Wagner, D. H. 2011a. Tips, Tools, and Techniques: Standardizing Focus Increments for Image Stacking Photomicrography. The Bryological Times 132: 2, 12.

Wagner, D. H. 2011b. Tips, Tools, and Techniques: new light source for the lab and field. The Bryological Times 134: 8.

News from the IAB council

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The IAB council met on July 25th, 2017 at the Fairy Lake Botanical Garden, Shenzhen, China, during the IAB meeting held in conjunction with the XIX International Botanical Congress. Present were Hiroyuki Akiyama, Alison Downing, Dietmar Quandt (Editor of *Bryophyte Diversity and Evolution*), Bernard Goffinet (President), Matt von Konrat (Secretary/Treasurer), Noris Salazar Allen and Rui-Liang Zhu. Excused were C. Ah-Peng, J. Atwood (Editor of *The Bryological Times*), D. Costa, I. Draper, J. Duckett, S. Huttunen, J. Larrain, B. Malombe, J. Martinez, S. Pressel, C. Reeb, J. Rosa,

Michel Stech, J. C. Villarreal and K.-T Yong. All excused members delegated their vote to one of the attendees. A full report from the council is available upon request from the president. Some of the main highlights and noteworthy decisions by the council are as follows.

The council accepted the proposal by Drs. Jesus Muñoz and Vicente Mazimpaka to hold the next IAB meeting in 2019 in Madrid, Spain, jointly with the annual meeting of the International Molecular Moss Science Society (iMOSS; see **www.imoss.org**).

Regarding membership, the society has grown to nearly 240 members. To further enhance our membership, IAB now offers a membership rate of 50% of the regular membership (i.e., $USD 8.00) to bryologists from developing countries, based on an approved list of countries by the World Bank (as of 2017).

IAB encourages bryological research through its Stanley Green Award, and will, beginning in 2019, offer opportunities to its members to compete for five instead three awards.

IAB is currently in good financial health. To sustain its growth the council calls on all members to renew their membership and encourage their colleagues and students to join the Society.
To establish closer connections between the IAB and the International Association of Plant Taxonomists (IAPT) and the bryophyte nomenclature committee, the council approved a motion to nominate Micelle Price as a representative of the IAPT Bryophyte Nomenclature Committee to the IAB council.

Following the dissolution of the IAB bryophyte conservation committee in 2015 given its redundancy with the IUCN Bryophyte Specialist Group steering committee, the council nominated two council members, Lars Söderström and Denise da Costa, to formally represent IAB on the IUCN Bryophyte Specialist Group.

Thanks to all council members for their service. I look forward to working with them to further strengthen the society and its ability to serve its members.

The joint social event of IAB and the Bryological Society of China in Shenzhen, China

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The XIX International Botanical Congress was hosted at Shenzhen, China during July 23rd to 29th, 2017. More than 6,800 botanical researchers and students participated in the meeting, which is the largest congress in the IBC's history. The meeting published 3,519 abstracts and 1,723 posters, as well as hosted 1,479 oral presentations in 300 symposia and satellite meetings. There were five bryological symposia: **1**) The Moss Tree of Life: Phylogenomic approaches to reconstruct moss evolution, diversification, biogeography and biotic interactions chaired by Bernard Goffinet and Dietmar Quandt; **2**) Biodiversity and phylogeography of bryophytes by Lars Söderström; **3**) Early Land Plants: From early adopters to transformative models for citizen science engagement connecting natural history collections to biodiversity research and education by Matt von Konrat; **4**) Asian and Chinese bryology by Rui-Liang Zhu and Boon-Chuan Ho; and **5**) Plant organellar genomics and phylogenomics, driven by the NGS approaches by Yang Liu and Bernard Goffinet. The IBC provided a stage for botanists from all over the world to present their research results, and a platform for people to communicate and collaborate.

Shenzhen is a neighbor city to Hong Kong. It grew from a small fishing village and developed to one of the largest cities of China in less than 40 years. The Fairy Lake Botanical Garden was established in 1983, and today has more than

12,000 plant species in 21 specific gardens and conservative bases. The National Cycad Germplasm Conservation center in the garden has 240 cycad species, accounting for 80% of the Cycad diversity, and is one of the world's leading cycad living conservation centers. The garden has more than 800 living fern species, and is the largest fern collection center in China. The Fairy Lake Botanical Garden herbarium (SZG) houses 120,000 plant specimens and has the largest bryophyte collection from Hong Kong and the Macao area.

On the evening of July 27th, the Fairy Lake Botanical Garden (**Figure A**) hosted a joint social event for the International Association of Bryologists (IAB) and the Bryological Society of China (BSC). Approximately 130 participants from the XIX International Botanical Congress (IBC), including about 30 IAB members and 100 Chinese bryology researchers and students from about 30 Chinese universities or institutes participated in the event.

Bryologists from around the world enjoyed chatting with each other, as it provided a chance for many Chinese and international bryological researchers to communicate face to face.

The event began with a social gathering and dinner followed by addresses in the auditorium (**Figure B–E**). Dr. Li Zhang, Fairy Lake Botanical Garden, and Dr. Rui-Liang Zhu, East China Normal University, delivered a welcome speech on behalf of the Fairy Lake Botanical Garden and the BSC president, respectively. Dr. Bernard Goffinet, president of IAB, awarded the Hedwig Medal for outstanding contributions to bryology to Dr. Rod Seppelt from Australia, the Hattori Prize for best publication in the previous two years to Dr. Juan Carlos Villarreal from Canada, and the Grolle Award for outstanding contributions in bryodiversity in developing countries to Dr. Wagieh El-Saadawi from Egypt. Dr. Matt von Konrat summarized IAB activities over the past several years, and the launch of the new IAB website. Dr. Dietmar Quandt introduced *Bryophyte Diversity and Evolution*, the IAB journal.

A. View of the Fairy Lake at the Botanical Garden, the venue for the IAB social event. B. Dr. Rui-Liang Zhu. C. IAB members attending addresses. D. Dr. Bernard Goffinet. E. Dr. Dietmar Quandt

Book Review: *Bryophyte Ecology, Vol. 1*

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I first came across a copy of *Bryophyte Ecology* by Janice Glime while taking Robin Kimmerer's Ecology of Mosses course at SUNY-ESF as a graduate student in the spring of 2002. At the time, Janice was in the midst of writing her book and my copy was simply a bound 1993 draft of her text that she had provided to Robin. Several years later, I had discovered *Bryophyte Ecology* as an open access eBook on the Michigan Technological University website, with the option to download the entire text as a PDF. Given the rapid growth in our knowledge regarding bryophyte ecology and the desire to reach a greater audience, Janice made the decision to publish her text online. With input from friends and colleagues, *Bryophyte Ecology* has expanded, now containing four volumes (with a fifth on its way!), and continues to evolve as we learn more about the fascinating world of bryophytes.

Each of the volumes in *Bryophyte Ecology* is divided into several chapters, which are subsequently broken up into several subchapters, allowing the reader to access a tremendous breadth of information under each topic in a clear and organized manner. For example, Volume 1: Physiological Ecology contains a total of 13 chapters and 65 subchapters covering a number of topics including taxonomy, life-cycles, morphology, reproduction, phenology, dispersal, physiology, water and nutrient relations, photosynthesis, and decomposition. Each of these subchapters contains numerous color images that help the reader to grasp the plethora of bryological terms, which are highlighted in bold throughout the text. Each subchapter then ends with a summary and a list of references so the reader can dig deeper into each of the topics discussed. Additionally, Glime does a nice job of not only providing information regarding what is known about bryophyte biology, but also informs the reader of current hypotheses, and questions/topics that have yet to be explored.

In addition to traditional topics in bryophyte biology/ecology, Glime's eBook includes a volume titled Methods and one titled Uses. The Methods volume covers field collection techniques and tools, laboratory techniques and equipment to help with identification, and how to properly accession and store bryophyte collections. In the Uses volume, Glime discusses both the historical and contemporary ethnobotanical uses of bryophytes. This includes both utilitarian and aesthetic uses. There is even a list of all known moss gardens in the world. These two volumes in particular provide a unique quality not seen in most other bryology texts and makes this eBook a must read for the budding bryologists amongst us.

Overall, *Bryophyte Ecology* by Janice Glime is a well-organized comprehensive text on bryophyte biology. No other text provides such a vast amount of information on the world of bryophytes in one place. In addition, the well-written text, beautiful photographs, and exploration of so many topics make this book accessible to people of all levels. With a large push in higher education towards the development and use of Open Education Resource (OERs), Glime's text serves as an excellent example of how OERs can be a powerful educational tool through the free dissemination of information. It is for these reasons that I have used *Bryophyte Ecology* as the primary textbook for my Bryology class for the last six years. As one of my students put it, "The *Bryophyte Ecology* text by Janice Glime is a meaningful and dedicated work of art."

Peru bryology travel log

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Before travelling to Peru in January and February with my wife, Benita, I arranged to meet a Peruvian bryologist, Bryan Espinoza. Despite communicating early in the trip, it wasn't until the

last few days that I managed to meet up with him and his bryology colleague, Katherine Zevallos, at a film screening on the life of the amazing botanical artist, Margaret Mee, at the Natural History Museum (Museo de Historia Natural) in Lima. We briefly introduced ourselves before the show and afterwards had a chance to talk and plan a bryophyte outing for early the following morning. My sister-in-law, Marita, provided excellent Spanish language support which helped to remove the burden for Bryan and Katherine of struggling to understand my protonemic Spanish. On a page torn from Katherine's notebook, Bryan wrote down the location of our meeting place at the north end of Lima: La Comisaria de El Progreso.

Among the post movie chatter of people in the lobby, the details of the proposed excursion emerged as a two hour drive, a four hour walk in the mountains at 4,000 m, two hours of collecting and the four hour walk out and a two hour drive back. With an hour and a half from the north end of Lima to my brother- and sister-in-law's place that made for a 15 hour day, only two hours of which were collecting. Was Bryan super-human? Was he mad? Could I, at twice his age, handle such a marathon at 4,000 m? We would see. I slept restlessly while nurturing the thought at the back of my mind that something – possibly common sense – had been lost in translation.

My brother-in-law, Jean-Louis, got up at 0500 to call the cab and see me off, possibly thinking that if things turned out badly for me or he never saw me again, he would have at least done his part to start my day off right. Traffic across Lima wasn't bad and I arrived at our meeting point about a half hour before the scheduled meeting time, just as darkness began to lift. The taxi driver seemed reluctant to let me out and called Marita, woke her and asked if it was advisable to leave me here. They decided that this was the spot. Had I insulted her cooking the night before? Unbeknownst to me at that time, as soon as she got off the phone with the taxi driver she called Bryan to let him know I was already there, waiting, and that he ought to get over there before something bad befell me. Her words were likely stern and graphic. Poor Bryan must have scrambled out of bed and rushed over immediately, probably fearing her words more than my dire predicament.

Before Bryan arrived I parked myself on the large terrace in front of the police station and enjoyed watching the neighborhood rouse before me. I slowly began to understand why the police station was chosen. However, I felt completely comfortable. I exchanged smiles with passing pedestrians and police officers and gained the trust of the local welcoming committee, two street dogs, one of which showed no hesitation in placing its chunky head upon my shoe. Then, as at no other time during this vacation, I felt Peruvian.

Bryan had scrambled from his home without grabbing any food for the trip. Ten hours of hiking and collecting would make some demands on energy reserves, so we visited a nearby street market where the vendors were just setting up. Bryan purchased some sustenance.

We made our way back to the main street and boarded a collectivo which is a shared taxi. In our case it was a van, packed with seats and as many people as the driver could get to fill them. We waited for some time while the driver had breakfast. This allowed us to get to know each other a little better.

Bryan is studying *Frullania* for a paper to supplement his degree in biology from the National University of San Marcos (Universidad Nacional Mayor de San Marcos) in Lima. It was there that he had taken a course in non-vascular plants taught by Professor Jasmín Opisso Mejía, a biologist championing bryophytes in Peru and producing enthusiastic young bryologists eager to tackle this group in this hugely diverse country. Bryan works full time at the museum of natural history which is associated with San Marcos University, commuting three to four hours every day. Both Bryan and Katherine's work at the museum is entirely voluntary with no compensation other than the opportunity to study bryophytes and to promote the world of bryophytes to the public.

Finally, with a few empty spaces still available in the van, we set out. It wasn't long before we were out of Lima and into the dry countryside and

mountains. Lima is situated in the driest desert in the world and only areas along rivers or creeks that flow from the distant mountains and special geographic formations (lomas) that trap the moisture-laden cloud (la garúa) that hovers off the coast are green and suitable for bryophytes. Vast expanses along the coast show no signs of life even on close inspection.

We turned off the main highway and climbed slowly along a narrow road up the side of the mountain, stopping in the small village of San Jose in the District of Buenaventura and province of Canta for a brief washroom and refreshment break before continuing for another half hour. It took a total of two hours to travel the 83 km to reach our destination, a creek in a sharp bend of a narrow one-lane road on a precipitous slope at 3,800 m. Bryan had chosen an area inland from the coastal desert, its landscape more green than near the coast. That four hour hike never transpired and we stayed pretty close to our drop-off point, content as only bryologists can be, to spend four hours exploring the wonderful world of boulders, cliff faces, seeps and shrubs. While Bryan concentrated on the moist habitats near the creek for his chosen group of bryophytes, the liverworts, I examined the cliffs, boulders and seeps at the edge of the gully away from the creek where I found many Grimmiacae and liverworts I did not know (*Plagiochasma rupestre*) and did not expect to find (*Porella sp.*).

Our discoveries included the mosses *Grimmia* (Grimmiaceae), other Grimmiaceae, *Fissidens* (Fissidentaceae), *Leptodontium* (Pottiaceae), other Pottiaceae, *Bryum argenteum* (Bryaceae), and the liverworts *Metzgeria* (Metzgeriaceae), *Frullania* (Frullaniaceae), Lejeuneaceae, *Porella* (Porellaceae), *Lunularia cruciata* (Lunulariaceae), *Plagiochasma rupestre* (Aytoniaceae), *Marchantia* (Marchantiaceae) and *Aneura* (Aneuraceae).

Further determinations will be made when Bryan examines the specimens in the herbarium of the Natural History Museum.

Bryan Espinoza examining liverworts on a boulder beside a creek. Photo: Phil Henderson

***Lunularia cruciata* on soil atop a boulder near a creek. Photo: Bryan Espinoza**

Dry *Plagiochasma rupestre* on a partially shaded vertical rock face. Photo: Phil Henderson

We examined and collected as many specimens as we could until hours later our collectivo returned and stopped on the narrow road in front of our sanctuary. We were forced to emerge from our miniature world of green and pile back into the van to share space, smiles, banter, food and Peruvian fiddle music with the other welcoming occupants.

View out the back of our collectivo on our return trip. Photo: Phil Henderson

Back in Lima I re-packaged and labeled the specimens I had collected and met Bryan briefly at the museum's bryology department the day before our vacation ended, to pass them along. We had no time to spend identifying them and Bryan has had no time in the interim and they await his attention. They remain important pieces of the biodiversity puzzle for that area, a small sample from Peru's immense and diverse landscape that is truly an exciting prospect for present and future Peruvian bryologists nurtured and encouraged by Professor Jasmín Opisso Mejía. The future of Peruvian bryology looks bright, indeed.

Phil Henderson and Bryan Espinoza outside the Natural History Museum's bryology department. Photo: Bryan Espinoza

Mosses as a complementary technique for surveying atmospheric metals (quantitative, seasonal, annual and retrospective): A conceptual approach

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Atmospheric pollutants, such as metals, are extremely variable in time and across landscapes. Obtaining detailed information for an area using traditional instruments can be difficult, expensive and cumbersome. Instrumental monitoring often requires an un-interrupted power supply to run the instrument, as well as manpower to operate the instruments and deploy them at the numerous monitoring sites.

Several plant groups such as: lichens (Sloof 1993), mosses (Glime and Saxena 1991), ferns (Ho and Tai 1985) and angiosperms (Ho and Tai 1988) have been used to monitor atmospheric pollutants, such as heavy metals (Retka et al. 2010). Mosses have the advantage of being widespread and available throughout the year. Mosses can be easily moved or transplanted, and since they lack roots and water conducting tissues, their analysis does not reflect the soil metal load. Furthermore, since mosses lack cuticles, a thick epidermis, they are in direct contact with the atmosphere. This enables them to take up nutrients and moisture directly from ambient air, and retain them. Therefore, using mosses in an analysis is a direct reflection of the atmospheric metal load (Frahm 1998). 'Bryo'-monitoring has the added advantage of being relatively simple and inexpensive, and can be used as both active (Fernández et al. 2004) and passive acceptors (Saxena et al. 2008a). Active biomonitoring using the moss bag transplant technique (Rivera et al. 2011) provides considerable flexibility in choosing sampling sites and excludes the effect of lifetime metal history on

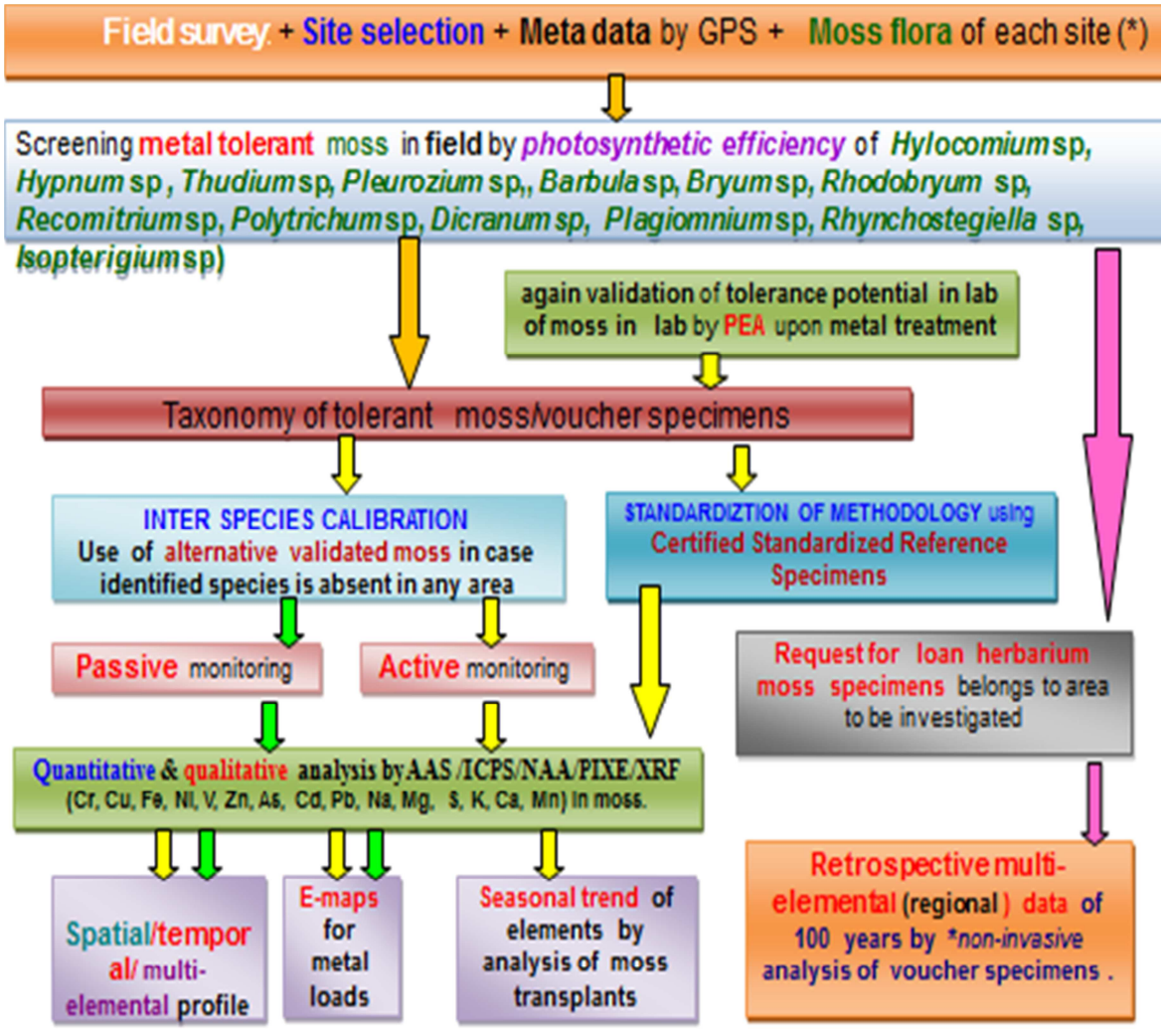
test plants, which is an important limitation in passive biomonitoring. Currently, mosses provide the only plant monitoring technique for retrieving the atmospheric elemental profile of the past (Saxena et al. 2008b).

The low cost and ease of carrying out atmospheric monitoring with mosses allows for multi-elemental surveys (Steinnes et al. 1992) with numerous sampling sites covered simultaneously (Steinnes 1995). Metals have been shown to be deposited at very high concentrations in the mosses *Hylocomium splendens* and *Pleurozium schreberi* due to their active absorption from relative to absolute deposition (Berg and Steinnes 1997). Mosses have therefore received increased attention as a suitable tool for monitoring regional patterns of elemental deposition from the atmosphere in various countries in urban, rural (Capozzi et al. 2016) and industrial areas (Zechmeister et al. 2004).

Mosses can be used to: **1**) quantitatively and qualitatively characterize the load of atmospheric metal deposition in temporal and spatial analyses (Harmens et al. 2010; Michaela et al. 2014); **2**) assess the gradient of metal deposition in relation to important metal emission sources and to identify the polluted areas; **3**) produce maps of regional deposition patterns; **4**) evaluate seasonal and annual trends of the atmospheric metal load.

Proposed conceptual approach.

A protocol has been developed for monitoring atmospheric metals (**Figure**), with the methodology detailed here.



A protocol for monitoring atmospheric metals.

Step 1: Field and site selection, meta data by GPS and identification of the moss flora. The site to be surveyed for the atmospheric metal load should be identified by GPS based data so that the exact location can be planned and studied in successive years. A GPS based survey allows for a high quality, precise picture of the area through a common reference system. Upon comparison with the past data on a flora, a GPS based study can provide information about the loss/change of species composition due to atmospheric metals. Moss genera previously used in atmospheric metal studies include: *Barbula*, *Bryum*, *Dicranum*, *Hylocomium*, *Hypnum*, *Isopterygium*, *Plagiomnium*, *Pleurozium*, *Racomitrium*, *Rhodobryum*, *Rhynchostegiella* and *Thudium*.

Step 2: Screening for metal tolerance in the field and laboratory by using a Photosynthetic Efficiency Analyser. For the purpose of biomonitoring, mosses can be categorized into two groups: (**1**) disappeared mosses that can act as indicators, and (**2**) mosses growing in polluted zones that act as tolerant species. These species can be tested and validated in the field and in the laboratory by measuring their chlorophyll fluorescence signals with a Photosynthetic Efficiency Analyser, a non-invasive tool (Schreiber et al. 1995).

Step 3: Taxonomy of the tolerant species to be included in the monitoring program. Knowing the taxonomy of the mosses in the study is useful for record keeping. Vouchered specimens should be utilized in monitoring as well as for the retrospective metal analysis**.**

Step 4: Inter species calibration of mosses. This step is optional. If one of the selected monitoring species is absent in any of the monitoring areas, an alternative calibrated species can be used as a substitute.

Step 5: Passive Monitoring. Native, widely distributed, pleurocarpous mosses are preferred and are analysed for metals to get a qualitative overview of the area contaminated by atmospheric metals (Steinnes 1995; Saxena et al. 2010).

Step 6: Active monitoring. Validated tolerant mosses (5–10 gm) are placed in nylon bags of 6 × 8 in. Spherical nylon balls, 6 in. in diameters have also been used in large scale metal monitoring programs. The nylon bags (in triplicates) are then exposed for periods of (**1**) 4 months, representing seasonal atmospheric data or (**2**) 12 months for measuring annual atmospheric metal load (Okan 2006). The placed height of the moss transplant bags are suggested to be between 12–18 ft. from the ground (Tretiach et al. 2011). After the exposure period, the transplants are harvested from the monitoring sites, and replaced by fresh transplants for the same time duration. Harvested moss samples are then brought back to the laboratory in polythene bags for analyses.

Step 7: Metal analysis of native or transplants moss samples (analytical approach nearly identical).

7a: Standardization of methodology using CSRS. The sample preparation and analyses include the usual quality assurance protocols, including repeated measurements of a sample during the analysis runs, reagent blanks, and use of procured Certified Reference Plant material (Steinnes et al. 1997), obtained from the National Institute of Standard Technology-Denmark. This certified material is used to validate the results of the analyses and for inter-laboratory comparisons, as well as to certify the methodology.

7b: Digestion of moss samples. It is advised to digest moss samples that have been obtained for metals analysis in a dia-acid mixture of perchloric and nitric acid (wet digestion) or alternatively in HNO_3 and H_2O_2 at 120°C (dry digestion). Foreign particles and debris should be removed beforehand.

7c: Metal Analysis of native and transplant moss samples. For the analysis of digested moss samples (native or transplanted), any of the following available methods can be used to obtain the concentration of the metal in the samples: Atomic absorption spectrophotometer, ICP, NAA, PIXE or XRF (Retka et al. 2010). ICP, NAA, PIXE involve an invasive approach for metal analysis, while XRF is a non-invasive approach. The amount of metal analysed in a native or transplanted samples is a reflection of the atmospheric metal load, accumulated by the moss during the exposed period.

S.No	instrument	detection limit	duration	reference
1	ICP-MS	1--10 ppt	in less than 1 min.	Berg et al. 1995
2	NAA	sub--ppb range	3--4 min per element	Anicic et al. 2007
3	ICP-AES	1--10 ppb	1--60 samples per min	**www.labtesting.com/**
4	FAAS	greater 1µg ml−1	0--15 second	**chem.science.unideb.hu/Pharm/FAAS.pdf**
5	XRF	ppb--ppm range	3--8 minutes	Klockenkämper 1997

7d: Retrospective atmospheric metal data. It is possible to retrieve the atmospheric metal load from the past by analysing moss samples from that particular time period (Herpin et al. 1997). Moss herbarium specimens deposited in museums, laboratories and institutes are valuable records of the past, provided that they are well labelled. However, these specimens cannot be analysed for metals with an invasive analytical approach. Instead, the specimens must be examined by non-invasive tools. Analytical data retrieved from herbarium voucher specimens using non-invasive technique reflect the past metal load of an area from where the samples were collected.

7e: Statistical analysis. It is advised to collect samples in triplicate for the statistical analysis. Concentration values should be presented as the mean, plus standard error (Snedecor and Cochran 1967).

Presentation of data. 1: Biomonitoring with mosses is useful for obtaining quantitative and qualitative data on the atmospheric deposition of metals, as well as seasonal and annual trends (Salo et al. 2016). **2:** Atmospheric metal surveys using mosses can assess the gradient of metal deposition in relation to metal emission sources, and to identify polluted areas. **3:** Data retrieved from the analyses of moss samples can produce maps of regional deposition patterns. **4:** The analytical study of moss samples can provide temporal trends and elements from emission of vehicular traffic (Adamo et al. 2011).

Literature cited:

Adamo, P., S. Giordano, A. Sforza & R. Bargagli. 2011. Implementation of airborne trace element monitoring with devitalised transplants of *Hypnum cupressiforme* Hedw. Assessment of temporal trends and element contribution by vehicular traffic in Naples city. Environmental Pollution 159: 1620–1628.

Aničić, M, M. Frontasyeva, M. Tomašević & A. Popovic. 2007. Assessment of atmospheric deposition of heavy metals and other elements in Belgrade using the moss biomonitoring technique and neutron activation analysis. Environmental Monitoring and Assessment 129: 207–219.

Berg, T., O. Royset, E. Steinnes & M. Vadset. 1995. Atmospheric trace element deposition: principal component analysis of ICP-MS data from moss samples. Environmental Pollution 88: 67–77.

Berg, T. & E. Steinnes. 1997. Use of mosses (*Hylocomium splendens* and *Pleurozium schreberi*) as biomonitors of heavy metal deposition: from relative to absolute deposition values. Environmental Pollution 98: 61–71.

Capozzi, F., S. Giordano, A. Di Palma, V. Spagnuolo, F. De Nicola & P. Adamo. 2016. Biomonitoring of atmospheric pollution by moss bags: Discriminating urban-rural structure in a fragmented landscape. Chemosphere 149: 211–218.

Fernández, J. Á., J. R. Aboal & A. Carballeira. 2004. Identification of pollution sources by means of moss bags. Ecotoxicology and Environmental Safety 59: 76–83.

Frahm, J. P. 1998. Moose Bioindik. 187 pp. Quelle & Meyer, Wiesbaden.

Glime, J. M. & D. K. Saxena. 1991. Uses of Bryophytes. Today and Tomorrow Printers, 120 pp. New Delhi.

Harmens, H., D. A. Norris, G. R. Koerber, A. Buse, E. Steinnes, J. Pisspanen, L. Alber, Y.

Aleksiayenak, O. Blum, M. Coskun, M. Dam, L. De Temmerman, J. Á. Fernández, M. Frolova, M. Frontasyeva, L. Gonzalez Miqueo, K. Grodzinska, Z. Jeran, S. Korzekwa, M. Krmar, K. Kvietkus, S. Leblond, S. Liiv, S. H. Magnusson, B. Mankovska, R. Pesch, Å. Rühling, J. M. Santamaria, W. Schröder & Z. Spiric. 2010. Mosses as biomonitors of atmospheric heavy metal deposition: spatial patterns and temporal trends in Europe. Environmental Pollution 158: 144–156.

Herpin, U., B. Markert, V. Weckert, J. Berlekamp, K. Friesed, U. E. Siexers & H. Lieth. 1997. Retrospective analysis of heavy metal concentrations at selected locations in the Federal Republican of Germany using moss material from a herbarium. The Science of the Total Environment 205: 1–12.

Ho, B. & K. U. Tai. 1985. Potential use of roadside fern (*Pteris vittata*) to biomoniter Pb and other metal deposition. Bulletin of Environmental Contamination and Toxicology 35: 430–433.

Ho, B. & K. U. Tai. 1988. Elevated levels of lead and other metals in roadside soil and grass and their use to monitor aerial metal depositions in Hong Kong, Environmental Pollution 49: 37–51.

Klockenkämper, R., 1997 Total-Reflection X-Ray Fluorescence Analysis, 552 pp. John Wiley & Sons, New York, NY, USA.

Michaela, M., R. Pesch, W. Schröder, E. Steinnes & H. T. Uggerud. 2014. Spatial patterns and temporal trends of heavy metal concentrations in moss and surface soil specimens collected in Norway between 1990 and 2010. Environmental Sciences Europe 26:27.

Okan, A. 2006. Biomonitoring and annual variability of heavy metal concentration changes using moss (*Hypnum copressiforme* L. ex. Hedw.) in Canakkale Province. Journal of Biological Science 6: 38–44.

Retka, J., A. Maksymowicz & D. Karmasz. 2010. Determination of Cu, Ni, Zn, Pb, Cd and Hg by AAS in plant sample. Pages 373–376. In: Ż. Bargańska et al. (eds.) Proceedings of the 15th International Conference on heavy metals in the environment. Gdańsk University of Technology (GUT), Polish Academy of Sciences (PAS). 19–23 September 2010. Gdańsk, Poland.

Rivera, M., H. Zechmeister, M. Medina-Ramón, X. Basagaña, M. Foraster & L. Bouso. 2011. Monitoring of heavy metal concentrations in home outdoor air using moss bags. Environmental Pollution 159: 954–62.

Salo, H., A. Berisha & J. Makinen. 2016. Seasonal comparison of moss bag technique against vertical snow samples for monitoring atmospheric pollution. Journal of Environmental Science 41: 128–137.

Saxena, D. K., K Srivastava & S. Singh. 2008a. Atmospheric heavy metal deposition in Garhwal Hill Area (India): Estimation based on native moss analysis. Aerosol and Air Quality Research 89: 94–111.

Saxena, D. K., K. Srivastava & S. Singh. 2008b. Retrospective metal data of the last 100 years deduced by moss *Barbula sp* from Mussoorie city, Garhwal Hills. Current Science 94: 901–904.

Saxena, D. K., Z. Tuba & M. S. Arfeen. 2010. Seasonal passive metal monitoring during year 2003 to 2006 in Nainital of Kumaon hills (INDIA) by moss *Racomitrium crispulum*. Acta Botanica Hungarica 52: 399–423.

Schreiber, U., W. Bilger & C. Neubauer. 1995. Chlorophyll fluorescence as a non-intrusive indicator for rapid assessment of in vivo photosynthesis. Pages 49–70. In: Schulze, E. D. & M. M. Caldwell (eds.) Ecophysiology of photosynthesis. Springer-Verlag, Berlin.

Sloof, J. E. 1993. Environmental lichenology: biomonitoring trace element air pollution. Ph.D. thesis. 191 pp. Delft, University of Technology, Interfaculty Reactor Institute, Def.

Snedecor, G. W. & W. G. Cochran. 1967. Statistical methods. 593 pp. Iowa State University, USA. Oxford and I. B. H. Publishing Co., New Delhi.

Steinnes, E., J. P. Rambæk & J. E. Hanssen. 1992. Large scale multi-element survey of atmospheric deposition using naturally growing moss as biomonitors. Chemosphere 25: 735–752.

Steinnes, E. 1995. A critical evaluation of the use of naturally growing moss to monitor the deposition of atmospheric metals. Science of the Total Environment 161: 243–249.

Steinnes, E., Å. Rühling, H. Lippo & A. Mäkinen. 1997. Reference materials for large-scale metal deposition surveys. Accreditation and Quality Assurance 2: 243–249.

Tretiach, M., E. Pittao, P. Crisafulli & P. Adamo. 2011. Influence of exposure sites on trace element enrichment in moss-bags and characterization of particles deposited on the biomonitor surface. Science of the Total Environment 409: 822–830.

Zechmeister, H. G., A. Riss & A. Hanus-Illnar. 2004. Biomonitoring of atmospheric heavy metal deposition by mosses in the vicinity of industrial sites. Journal of Atmospheric Chemistry 49: 461–477.

Taxonomy and biology of tropical bryophytes workshop, Smithsonian Research Station, Bocas Del Toro, Panama, August 14–26, 2017

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During the year of 2016 and, as part of the educational program by the Research Station of Smithsonian Tropical Research Institute (STRI) in Bocas del Toro Province, Panama, Dr. Rachel Collin (Director of the Station) proposed to do an international workshop on bryophytes to Dr. Noris Salazar Allen. Organizers of the workshop were Dr. Rachel Collin, Maycol Madrid and, Dr. Noris Salazar Allen with the aid of her technician José Gudiño L.

The research station is located in Colon Island in the Bocas del Toro Archipelago. Bocas del Toro is the most northwestern province of the Isthmus of Panama. The Caribbean coast of Bocas del Toro is characterize by extensive mangrove forests dominated by the red mangrove, *Rhizophora mangle* L., and few individuals of the white mangrove, *Avicennia germinans* (L.) Stearn and *Laguncularia racemosa* (L.) C.F. Gaertn. (Lovelock et al. 2005). It was a unique opportunity to do a survey of the bryophytes that grow on these mangroves and in some remnants of forest in the islands. This was also a perfect occasion to joint efforts to have three bryologists involved in the workshop. Thus, Drs. Gregorio Dauphin (liverworts) and Juan Carlos Villarreal (hornworts) were invited to join Noris as instructors. Twelve students (undergraduates, B.Sc., Master, Ph.D.) from 9 countries (Canada, Costa Rica, Colombia, Latvia, Mexico, Panama, Peru, United States and Venezuela) participated.

Participants in the 2017 'Taxonomy and biology of tropical bryophytes workshop', Bocas Del Toro, Panama.

Participants in the 2017 'Taxonomy and biology of tropical bryophytes

The objectives of the workshop were: **1)** To learn to identify, describe and compare the most common bryophytes growing on mangroves, forested islands and continental forests. **2)** Learn about the evolution of the three taxa of bryophytes in their adaptation to terrestrial environments. **3)** Get experience with the bryophyte components of the various Tropical ecosystems and, **4)** to add to the knowledge of the bryophyte diversity in Bocas del Toro. The workshop included lectures on the history of Bocas del Toro and its human environment, the sites to be visited during the field trips and the biology and taxonomy of the three taxa of bryophytes. Additionally, each professor and student gave a talk on the work they are doing in their countries. All bryophytes identified and the sites of collection were registered in a database.

There were six field trips. Two were in the Bocas del Toro archipelago (two in mangroves, and one in the island forest of Isla Bastimentos), two in coastal mainland (cacao plantations of different age) and, one in the Fortuna cloud forest in the Province of Chiriquí. A total of 126 species of bryophytes were recorded, many of these new reports for Central America and Panama, including a new locality for the charismatic *Leiosporoceros dussii* (Steph.) Hässel. At the end of the workshop, groups of four students analyzed the data jointly with their instructors in relation to the composition and diversity found in the different ecosystems studied (mangrove, cacao plantation and forests). Also, Gregorio Dauphin provided participants with additional bibliography on liverworts to those given at the workshop. This will be of great help to those students in countries where access to bryological literature is limited. Students made duplicate of collections for the University of Panama herbarium (PMA) as required by law. Various publications are being prepared with the authorship of all participants.

Literature cited:

C. E. Lovelock, I. C. Feller, K. L. McKee & R. Thompson. 2005. Variations in mangrove forest structure and sediment characteristics in Bocas del Toro, Panama. Caribbean Journal of Science 41: 456–464.

Theses in Bryology 35

William R. Buck
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As reported in a previous issue of *The Bryological Times* (99: 17. 1999), the International Association of Bryologists has decided to begin a repository of bryological theses. These theses are being housed in the Library of The New York Botanical Garden. They are available via interlibrary loan. The NYBG Library online catalog (CATALPA) may be viewed at: **http://www.nybg.org/library/**. As theses arrive, bibliographic data and a brief synopsis will be published in this column (see examples below). Bryological theses for any degree, covering any aspect of bryology, in any language, will be included. Please send theses to Bill Buck at the address above. Please refer to the preliminary notice (cited above) for information on financial assistance from IAB for reproduction of theses. The current IAB Treasurer is Matt von Konrat (**iab@fieldmuseum.org** or **mvonkonrat@fieldmuseum.org**).

Phephu, Nonkululo. 2013. A taxonomic revision of Thuidiaceae (Bryophyta) in Africa and the East African Islands. M.S. thesis, University of Pretoria, South Africa. xiv + 68 pp. In English. E-mail of author: unknown.

This master's thesis examines three genera in Africa and its adjacent Indian Ocean islands, *Pelekium*, *Thuidiopsis* and *Thuidium*. A total of 16 species are accepted. Keys to genera and species, descriptions, illustrations and distribution maps are included. New nomenclature was published separately in an article in Phytotaxa 84(2): 60–64 [2013], which is included in the thesis as pages 164–168.

Ussher, María Silvina. 2016. Comunidades de musgos en cumbres del páramo altoandino venezolano: línea base para monitorear el impacto del cambio climático. Master's thesis, Universidad de Los Andes, Mérida, Venezuela. 173 pp. In Spanish. E-mail of author: unknown.

This master's thesis was undertaken as part of a global network of climate monitors dealing with vegetation in high mountains, i.e., GLORIA (Global Observation Research Initiative in Alpine Environments). In this particular study, moss communities in permanent plots at three high-elevation páramo sites (4200 m, 4400 m, 4600 m) in the Venezuelan Andes were monitored. The presence vs. absence of mosses as well as their abundance were recorded, along with substrate, life form and growth habit. This resulted in both a floristic analysis as well as an ecological analysis. The data were analyzed using multivariate analyses. A total of 53 taxa of mosses were used in the study, 13 of which were new to Venezuela. The goal was to come up with a list of mosses which could be used as bioindicators of climate change. Both richness and cover diminished with altitude, and acrocarps were more dominant than pleurocarps. Because this study was conducted in permanent plots, it will allow for the first time for climate change in high-elevation Andean sites to be monitored for both vascular plants and bryophytes.

Vilas Bôas-Bastos, Silvana Brito. 2014. Pterobryaceae Kindb. (Bryophyta) no Brasil. Ph.D. thesis, Universidade Estadual de Feira de Santana, Bahia, Brazil. 117 pp. In Portuguese with English abstract. E-mail address of author: silvana_vbbastos@yahoo.com.br.

The moss family Pterobryaceae was studied for Brazil. The family was defined using morphological characters, especially the presence of numerous filamentous pseudoparaphyllia. Fifteen species in ten genera are recognized. Special attention was given to how to separate similar taxa, such as *Squamidium* (Brachytheciaceae) and *Orthostichella* (Neckeraceae). Recognized are: *Calyptothecium duplicatum* (includes previous

misdeterminations as *C. acutifolium*), *Henicodium geniculatum*, *Jaegerina scariosa*, *Orthorrhynchidium planifrons*, *Orthostichidium quadrangulare*, *Orthostichopsis praetermissa*, *O. tenuis*, *O. tetragona*, *O. tijucae*, *O. tortipilis*, *Pireella cymbifolia*, *P. pohlii*, *Pterobryon densum*, *Pterobryopsis stolonacea* and *Spiridentopsis longissima*. New synonymy is proposed.

Yousefi, Narjes. 2017. Genetic divergence and speciation in northern peatmosses (*Sphagnum*). Ph.D. thesis, Norwegian University of Science and Technology, Trondheim, Norway. 23 pp. + 4 manuscripts (independently paginated). E-mail of author: unknown.

This doctoral thesis was published in the series Doctoral Theses at NTNU (Norwegian University of Science and Technology) as vol. 364. It examines, using molecular techniques, species complexes in Sphagnum. The four manuscripts are: Yousefi et al. 2017. Divergent evolution and niche differentiation within the common peatmoss *Sphagnum magellanicum*. Amer. J. Bot. 104: 1060–1072; Yousefi, N., P. Szövény, K. I. Flatberg, K. Hassel, H. K. Stenøien & GSP Consortium. Genetic basis of niche differentiation within the common peatmoss *Sphagnum magellanicum* (58 pp.); Hassel, K., M. O. Kyrkjeeide, N. Yousefi, T. Prestø, H. K. Stenøien, A. J. Shaw & K. I. Flatberg. *Sphagnum divinum* (sp. nov.) and *S. medium* Limpr. and their relationship to *S. magellanicum* Brid. (56 pp.); Yousefi, N., E. Mikulášková, H. K. Stenøien, K. I. Flatberg, A. Košuthová, M. Hájek & K. Hassel. Genetic and morphological variation in the circumpolar distribution range of *Sphagnum warnstorfii*: indications of vicariant divergence within a common peatmoss (47 pp.). From a Northern Hemisphere prospective, the most interesting aspect is that *S. magellanicum* is restricted to the Southern Hemisphere and material from the north is a mixture of *S. medium* (long-synonymized with *S. magellanicum*) and *S. divinum* Flatberg & Hassel.

Stronger visibility and increased access for Lindbergia through BioOne

Nils Cronberg | Lund University| Sandy Bay, Tasmania, Australia | *Nils.Cronberg@biol.lu.se*

Lindbergia is a scientific journal issued by the Nordic Bryological Society (NBS) and the Dutch Bryological and Lichenological Society (DBLS) since 1971. The journal became an exclusively net-based open access journal in 2011. This worked well and the journal has continued to serve the bryological and lichenological communities as a significant communication channel for scientific research.

Thanks to our authors, subject editors, reviewers and not the least the professional services of the *Oikos* editorial office we keep a high standard in the published material. Net visibility and credibility is important. To increase the exposure of the journal we have for example introduced a twitter account @Lindbergia that informs about new published contributions.

However, the digital standard for scientific publication has developed rapidly and in order to keep up with this changing environment, the owners of *Lindbergia* have decided to associate *Lindbergia* with a publishing house called BioOne, starting 2018. BioOne is a non-profit publisher specialized in biology, with a strong reputation.

In practice, this means that the editorial routines will stay the same with respect to the manuscript reviewing process. Thanks to the economic support from the NBS and DBLS, *Lindbergia* will continue to be open access and continue to be free of charge for the authors who publish in *Lindbergia*. After finished editorial processing, the articles will be handed over to BioOne for publishing. The association of *Lindbergia* with BioOne will mean several improvements for *Lindbergia* and its authors and readers.

– *Lindbergia* gets a higher net exposure through all the channels that BioOne brings access to (libraries, various databases and indexes).

– Articles in *Lindbergia* will receive DOI-number, i.e. each article will get a unique digital object identifier, which is increasingly important for digital access and database indexing of articles.

– Besides the pdf-format, which hitherto has been the prevalent distribution format for *Lindbergia*, articles will also be converted to xml-format for the convenience of our readers.

– Various services for authors and readers will be available, such as the possibility to download article reference information to citation managers and the option to sign up for E-alerts when an article is cited.

– *Lindbergia* receives the quality stamp that follows from being a part of the BioOne portfolio. This is increasingly important in a world full of fake and predator journals with inferior or missing peer review processes.

Just as before, old articles will be available through JSTOR.

Web addresses for Lindbergia: **http://www.bioone.org/loi/lnbg**; **http://www.lindbergia.org**

Manuscripts are submitted to: **lindbergia@oikosoffice.lu.se**

We welcome old and new authors and readers to *Lindbergia* – A journal opposing the tracheophytocentric conception of the world!

On behalf of IAB and its council we thank you for your dedicated service

Efrain De Luna (Mexican Institute of Ecology) served as webmaster of IAB's website for six years. He actively posted about significant bryological advances, workshops and courses, and other events. In his announcement that he was stepping down from his position, Efrain thanked the council for the opportunity to serve IAB in this function. Clearly, it is IAB that owes Efrain much gratitude for his commitment to his position, which was essential to maintaining IAB's web-presence, and provided an essential resource to its members. His service is inspiring and I am deeply thankful for all he has done. I wish Efrain much continuous success with his career and bryological (and other) research.

John Atwood (Missouri Botanical Garden, USA) has served as editor of *The Bryological Times* for two years. During this time, John composed and released five issues, introducing a new overall format and new columns. Professional societies like ours cannot persist without the dedication of its members, committed to serve in positions critical to their mission. When the council nominated John as the next editor of the society's newsletter, he gladly accepted, committing to further promote the content of the newsletter, which he saw as "an effective platform for publicizing news about bryophytes and bryologists". John has held his word, and did a fantastic job. On behalf of the council and its members, I know that we are all truly sorry to see him vacate the position, but thank him wholeheartedly for his engaged editorship and wish him well with his career and upcoming adventures. John will be succeeded by Patrick Dalton, of the University of Tasmania, Australia. We take this opportunity to welcome and thank Patrick for accepting the position and invite all members to help Patrick by submitting news and reports to be shared through our newsletter.

Announcement of upcoming conferences, forays and workshops

XIV Australian Bryophyte Workshp, 23 –28 September 2018

Australian Bryophyte Workshops are generally held every two years and aim to present opportunities for those interested in learning about bryophytes to meet and exchange knowledge in different environments. This year, the XIV Australian Bryophyte Workshop will be held in the Big Scrub region of north-eastern New South Wales, based at Dorroughby, about 200 km (125 miles) south of Brisbane, and 120 km (76 miles) south of the regional Gold Coast Airport.

Big Scrub region of north-eastern New South Wales.

Dorroughby Environmental Education Centre, location of XIV Australian Bryophyte Workshop.

The Big Scrub was the largest area of subtropical lowland rainforest in eastern Australia until it was intensively cleared for agricultural use in the 19th century. Only a few remnants survive, and less than 1% of the former extent remaining. The core Big Scrub areas consisted of an estimated 900km2 of subtropical rainforest on fertile basalt and floodplain derived soils. The area lies within the lands of the Bundjalung Aboriginal Nation.

One of New South Wales' greatest authorities on moss, W. W. Watts (1856 – 1920), collected prodigiously in the Big Scrub while based at Ballina from 1896 – 1903, and the workshop will commemorate his pioneering spirit as it is almost a century since his death.

Daily field trips will include a variety of ecosystems, including remnants of the Big Scrub and wet and dry sclerophyll forest. Collecting will be permitted with approval from NSW National Parks and Wildlife Service regional managers.

Accommodation will be at the Dorroughby Environmental Education Centre, 2101 Dunoon Road, Dorroughby, from Sunday 23rd, departing Friday 28th September, 2018.

For further information, please contact: Andrew Franks (**andrew@oberonia.com.au**) and Alison Downing (**alison.downing@mq.edu.au**)

Black Forest Flagellated Plant Workshop September 17th – 20th, 2018

Details about the venue, registration, meeting program and social events are at: **http://plantco.de/BFW2018/**

The annual meeting of iMOSS (**http://imoss.org/index.php**) will take place at the Vinoy Hotel in St Petersburg, Florida, from June 3-6, 2018. Members of the IAB are encouraged to attend and present work on mosses, liverworts, or other flagellate plants. Register: **http://reg.conferences.dce.ufl.edu/MOSS/Register**

The international molecular moss science society (iMOSS) aims to foster research on and scientific exchange among biologists working with flagellate plants (i.e. bryophytes, ferns, and lycophytes). The MOSS meeting started out in 1998 as a meeting of the *Physcomitrella* community. iMOSS now encompasses experimental research involving all flagellate plants, including laboratory model systems like *Physcomitrella* and *Marchantia*, ecologically important communities such as peatlands or desert crusts, and comparative genomics across land plants and green algae. In essence, the concept of "Koke" - the Japanese word applied to tiny plants and plant-like organisms - is what we see as "moss". We hope that you will be able to join us in St. Petersburg!

Field Bryology Workshop: September 24–28, 2018

David Wagner, Northwest Botanical Institute, is offering a three and a half day, intensive bryophyte identification workshop at the Andrews Experimental Forest, Blue River, Oregon (**http://andrewsforest.oregonstate.edu**). This workshop is designed for those with a strong botany background and basic knowledge of bryophyte structure and life cycles. Folks with previous experience studying bryophytes can expect to increase their familiarity with the regional flora. The class involves integrated lectures, field study and lab practice. The classroom has good microscope bench space for 12, which limits the size of the class. Participants must bring their own microscopes, personal dissecting tools, and laptop computers.

The focus is on practice with contemporary identification keys pertinent to the Pacific Northwest: **1**) *Contributions Toward a Bryoflora of California: II A Key to the Mosses* (D. Norris and J. Shevock, Madroño 2004) with attention also given to Elva Lawton's 1971 *Moss Flora of the Pacific Northwest* and the moss volumes (v. 27 & 28) of the *Flora of North America*. **2**) Identification of liverworts and hornworts emphasizing Contributions toward a Bryoflora of California: III Keys …for Liverworts and Hornworts (W. Doyle and R. Stotler, Madroño 2006). **3**) Using the digital Guide to the Liverworts of Oregon (D.H. Wagner, Northwest Botanical Institute, 2018 version), supplemented by online treatments of the as yet unpublished liverwort volume of Flora of North America.

Participants will receive:

- Practical tips for hand lens identification in the field.
- Supervised training in lab techniques needed to observe features used in keying.
- A selection of archival and unpublished material (some printed but mostly digital format).
- A comprehensive review of online resources.
- Review of the most useful current literature from other parts of the world.
- A selection of study specimens for microscopy, including prepared slides.

Arrival and microscope set up in the laboratory will take place Monday morning, September 24. The first classroom session begins at 1 pm. The classroom will be available at all times from Monday through Friday. Evening sessions are designed for individual, supervised study.

Lodging check in will take place on Monday, September 24, either during an afternoon break in the class or in the evening after the class session. All participants are encouraged to use the H. J. Andrews Experimental Forest housing. Staying on site allows evening sessions in the classroom and socializing in the apartment common area. Participants find themselves in a kitchen furnished with pots and pans and utensils. A small grocery is located a few miles away. We'll work together and eat together. The apartments have 4 bedrooms, each with 2 single beds (including bed linens, pillow, blanket and towel), and a communal kitchen. The reservation is for four nights; rooms must be vacated Friday morning, September 28.

Space is limited; early inquiry is recommended. Please contact me directly at **davidwagner@mac.com** for registration instructions.

Exploring the Magical World of Moss Gardening
US Botanic Garden Lecture/Workshops, Annie Martin, May 4–5, 2018

Explore the magical world of moss gardening with nationally-recognized expert and author, Annie Martin aka Mossin' Annie, owner, Mountain Moss Enterprises, and author of the 2015 *The Magical World of Moss Gardening* (Timber Press). Besides providing year-round green beauty, mosses offer environmental benefits in today's landscapes – moss lawns, water features, moss/stone patios, green roofs and living walls. Impressive photographs provide design inspiration. An exhibit of shade and sun moss species allows participants to experience the various nuances of green, textures, and colony shapes. Topics include selection of appropriate moss species, planting techniques, and maintenance methods for aspiring DIY moss gardeners to achieve long-term success.

Cashiers ZenGarden, Mountain Moss. Photo. Annie Martin.

Workshop #1: Moss Magic in Miniature – Creating Your Own Moss Dish Garden.

Mosses are the world's oldest living land plants, yet the year-round green beauty of mosses has appeal for today's gardeners. Workshop participants will be introduced to the benefits of eco-friendly mosses and their variety of textures and colony shapes. Annie Martin discusses landscape design concepts providing step-by-step instructions and creative approaches for making your own miniature moss dish garden to take home. This fun-filled moss workshop is appropriate for all ages. Bring a gardening buddy, best friend, children and/or grandchildren to make your own moss memory together.

Workshop #2: Awesome Moss – Creating Your Own Moss Dish Garden.

Experience the magic of moss gardening in miniature as you create your own moss dish garden to take home. Annie Martin shares her passion for mosses emphasizing year-round green beauty and the environmental benefits of these tiny plants in today's landscapes. All mosses, lichens, decorative rocks, and other supplies provided. Appropriate for all ages; bring a gardening buddy, best friend, children and/or grandchildren for a fun-filled and informative hands-on workshop.

Administrative Information

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Association Objectives

The objectives of the International Association of Bryologists (IAB) is to promote international co-operation and communication among persons interested in bryophytes.

Next Meeting

The next IAB meeting will be held jointly with the XX International Botanical Congress meeting in Rio de Janeiro, Brazil, in 2023.

Call for Submissions

The Bryological Times was founded in 1980 by S. W. Greene (1928--1989) as a newsletter published for the IAB. *The Bryological Times* welcomes announcements and summaries of bryological conferences, workshops, and fieldtrips; book reviews and notices of publications; and original articles, artwork and photography. Please send submissions to the editor: ***john.atwood@mobot.org.*** All submissions will be acknowledged by email. Contributors will be asked to review their submissions before publication.

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