

The Bryological Times

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Newsletter of the International Association of Bryologists

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Dear bryologists,

First of all, I wish you all the best for 2008. I have succeeded with your help to publish this issue of our newsletter in 2007 – another newsletter with a wide array of contributions – and have already received contributions for the next issue. So thank you for your support!

I have one particular request and this is that I would welcome well in advance announcements of bryological workshops, symposia and conferences be it at the country or regional level. I was only at the latest minute informed of the redlist workshop that will take place in February/March in Singapore – and I am sure that more noteworthy bryological events are planned in the near future.

Finally, I want to point out that my email address will change in 2008 – so please send contributions (including announcements of upcoming meetings) to this address (Geert.Raeymaekers@skynet.be)

Geert Raeymaekers

IAB



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The **International Association of Bryologists (IAB)** is an organisation open for all interested in bryophytes. For membership, contact Geert Raeymaekers or Blanka Shaw. Visit the IAB web site: <http://bryology.org> for further information. The Bryological Times is issued 3 to 4 times per year.

Dr. Creu Casas (1913-2007). The tribute of an ecophysiologicalist

Dr. Creu Casas has been the unquestionable leader of Spanish bryology for decades. Here I pretend to give, from my admiration and deep respect, just a personal point of view about this outstanding figure of bryology. I met Dr. Casas for the first time at the VI Cryptogamic Symposium in Granada (Spain) in 1985. Then I was a Ph.D. student and it was my first congress. I delayed some days to greet Dr. Casas probably for the shyness typical of a beginner. When I was encouraged enough, I went and introduced me to her, apologising for my delay. She smiled and answered: "Do I provoke fear to you?". Certainly not. Since then, our relationship, although not very intense, was based on respect and (I want to think mutual) affection. Now I have compiled all our correspondence, not more than a dozen letters and notes, mostly manuscript. I specially want to remark one of her letters when I was a novice in the study of bryophyte ecophysiology. She congratulated that at last bryophytes had arisen interest under a physiological point of view in Spain, and strongly persuaded me to go on. At that time, her decided impulse was very important for me. She also invited me to visit the library of the Bryology Laboratory at the Autonomous University of Barcelona (UAB) to consult all the papers they had collected about pollution bioindication, one of my topics of research. Since then, I have felt in debt with her and this sensation still remains with me and probably it will never fade away.

My last encounter with Dr. Casas took place in a "domestic" homage paid to her by the Spanish Bryological Society (SEB) in Barcelona in 2002. At that time she had had to renounce attending any more congresses because of her advanced age, but she was still active and she went daily to the Bryology Laboratory at the UAB. In fact, her most comprehensive projects, like the Red Book of Iberian Bryophytes, and The Mosses and Liverworts Florae of Catalonia and Spain, have come to light along these last years. That "domestic" homage of SEB was absolutely surprising for her because it had been maintained in secret by her colleagues of the UAB, and included the gift of a special number of the *SEB Bulletin* dedicated to her. In spite of the humble character of Dr. Casas, somewhat reluctant to this type

of events, my impression was that she felt joyful and proud because of the improvised nature of this act. After cheering with Catalonian cava, Dr. Casas invited several of us to have lunch and we all departed friendly about "the divine and the human".

I will not extend here about her life and essential scientific achievements, but it deserves to be highlighted her hard life since being the daughter of a gardener to become a professor of Botany at the Spanish university, passing through the Spanish Civil War. Her career was a model of courage and patient work, especially considering her female condition in the traditionally man-dominated Spanish academic summits. She received the most important honours of Catalonia, being supported by her more than 50 years of bryological dedication.

An obituary written by Dr. Casas's two most direct disciples and friends (Drs. Montserrat Brugués and Rosa M. Cros) has been recently published (*Cryptogamie, Bryologie, 2007, 28:294*), and probably some other obituaries will appear soon. I also recommend to all the people interested to read her biography in Duran, X. 2004. Creu Casas. Fundació Catalana per a la Recerca. Barcelona. ISBN: 84-89570-31-0 [in Catalan]. I guarantee the reader will find lots of bryological knowledge, but specially lots of humanity.

I have deliberately tried that this tribute is short and humble, like Dr. Casas herself, and I would also say that no other botanist in Spain has been homaged so unanimously like her. Finally, I will do mine the words of Montserrat Brugués and Rosa M. Cros: "we hope that those of us who have enjoyed the satisfaction of working with her will be able to follow the example she has set". Until always Dr. Casas!

Javier Martínez Abaigar

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LITERATURE COLUMN

Interactive guides to the identification of mosses: the flora of the Karst of Trieste and Gorizia (Friuli-Venezia Giulia, NE Italy)

Project Dryades (<http://www.dryades.eu>), financed by the Italian Ministry of University and Scientific Research and coordinated by Prof. P.L. Nimis (Dept. of Biology, University of Trieste), aims at producing new and original interactive guides to the flora of Italy. In the framework of this project I worked to a research project entitled "An information system on the bryoflora of the Italian Karst". The result is a checklist of bryophytes, and an interactive guide accessible in the web, which permits the identification of the 264 taxa presently known for the area.

The guide was developed using FRIDA (FRiendly IDentificAtion), an original package of software, patented by the University of Trieste since 2003. Using FRIDA it is possible to produce national, regional and local floras (for a natural park, an interesting biotope, etc.), guides devoted to educational purposes, etc. They are accessible in the Web, and/or run on different media, such as Personal Data Assistants, smartphones, CD- or DVD-ROMs. The guides can also be printed on paper as illustrated dichotomous keys.

The following interactive guides are freely accessible from the Web site of Dryades: 1) interactive guide to the mosses of Monte Valerio (77 taxa, Trieste, Friuli-Venezia Giulia, NE Italy), 2) guide to the bryoflora of the whole Italian Karst (264 taxa, Friuli-Venezia Giulia, NE Italy). Both guides are enriched with original iconography of characters and their states. For each taxon, descriptions, ecological information, distribution and original iconography are provided.

Corrections and suggestions to the keys are welcome.

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Bryophytes as bioindicators

Frahm, J.-P., Stapper, N.J., Franzen-Reuter, I. 2007: Epiphytische Moose als Umweltgütezeiger. Ein illustrierter Bestimmungsschlüssel. - Kommission Reinhaltung der Luft im VDI und DIN - Schriftenreihe Band 40. Düsseldorf, 152 p., incl. 80 colour plates. ISBN 3-931384-62-4. 29,50 Euro.

Bryophytes as bioindicators are almost forgotten today. Thirty, forty years ago there were numerous publications in Europe, Canada and Japan dealing with the effects of bryophytes to indicate polluted areas, based on the fact that bryophytes (like lichens) take up water, nutrients and by this way also pollutants over the whole surface. Although sulphur dioxide and acid rain are actually no longer problems in Europe, this does not mean that we have clean air everywhere. At present nitrogen emissions are a special (and widely overlooked) problem. As a possible result, saxicolous species such a *Grimmia pulvinata*, *Tortula muralis*, *Orthotrichum anomalum*, even *Hedwigia albicans* are found increasingly on bark of trees, an effect which was not observed within the 200 years before. As our studies revealed, nitrogen dioxide is not the problem for bryophytes and lichens but ammonia, which originates from the agriculture but also from catalysators (!). Thus bioindication especially with epiphytic bryophytes is not old fashioned but actual as ever, but with changed pollutants.

The use of bryophytes as bioindicators requires standardized methods that the results can be compared (not as in the sixties and seventies, when every author developed his own method). In Germany, committees of specialists within the Verein Deutscher Ingenieure develop thousands of such methods mainly for industrial, technical standards. We are proud that also biological methods are equally developed and accepted and thus regarded as equivalent to technical measurements. These activities are now continued by CEN within the European Community.

During the past, we developed a method to determine environmental quality by epiphytic bryophytes, raised the known sphagnum bag technique to determine atmospheric heavy metal pollution into a standard, and developed a method to determine nitrogen deposition with moss samplers.

The guideline for epiphytic bryophytes as indicator of environmental quality comes with a CD, which allows the determination of all epiphytic bryophytes in Central Europe. This selection of eighty species excludes for instance the more than thousand non-epiphytic

species and makes the identification a lot easier. The CD includes interactive keys, black and white drawings and descriptions of species with each a picture.

Since the use of keys on CDs is not so widely accepted and people still prefer to have a book in their desks, we proposed to publish a book with the contents of the CD, to add some chapters about bioindication with bryophytes, an explanation of the VDI-method, and to update the pictures. Each single species is now illustrated on one plate with

microscopic and macroscopic details. The photographs so far are not of top quality, because they are stacked, that means composed from a dozen or more single pictures. By this way, the depth of field is increased and the pictures are completely sharp.

This book may help to remind us of the potential of bryophytes for bioindication and stimulate their use also outside from Germany or Europe, where the some or even more serious environmental problems exists.

To order: contact steen@vdi.de

M O Hill, C D Preston, S D S Bosanquet and D B Roy. 2007. Attributes of British and Irish Mosses, Liverworts and Hornworts

This is a companion volume to PLANTATT, and provides for all British and Irish species a codified set of attributes for use in ecological analyses. These include information on native status, size, life form, life history, altitudinal and geographical range and habitat of 1057 British and Irish bryophyte species and a further 134 aggregates and infraspecific taxa. Much of the information is newly compiled, or generated afresh for this publication. Ellenberg values for Light, Moisture, Reaction, Nitrogen and Salt tolerance are provided for all taxa. A new classification of the life

forms is proposed and applied to all taxa. Their substrates and EUNIS habitats in Britain and Ireland are also tabulated. There is also a book, an A4 paperback of 88 pages with laminated cover, which was published in late October 2007. The price is 8 GBP incl. p&p. To order after Easter 2008, please see <http://www.ceh.ac.uk/products/publications/index.html> for ordering arrangements.

Dr Mark O Hill
E-mail moh@ceh.ac.uk

Publications from the China Scientific Book Services

Flora Muscorum Chinae Boreali-orientalis (Used)
Flora Bryophytorum Intramongolicarum
Flora Bryophytorum Sinicorum
Vol.1: Sphagnales Andreaeales Archidiales
Dicranales
Vol.2: Fissidentales, Pottiales
Vol.4: Eubryales
Vol.6: Hookeriales, Hypnobryales
Vol.7: Hypnobryales
Vol.8: Hypnobryales, Buxbaumiales, Polytrichales
Takakiales
Vol.9: Takakiales, Calobryales, Jungermanniales

Chemistry and Biology of Bryophytes
Spore Morphology of Chinese Bryophytes
Bryological Biology, introduction and Diverse Branches
Illustrations of Bryophytes of China
Flora Bryophytorum Shandongicorum
Genera Muscorum Sinicorum (2 Volumes Set)
Moss Flora of Heilongjiang Province and Da Xinganling Mountains
Flora Tsinlingensis (Tomus III) Bryophyta (Pars I)
Bryoflora of Xizang
CHENIA-Contributions to Cryptogamic Biology (Volumes, 2, 3-4, 5,6,7,8 an 10)

Moss Flora of China
Vol. 1: Sphagnaceae-Leucobryaceae
Vol. 2: Fissidentaceae- Ptychomitriaceae
Vol. 3: Grimmiaceae-Tetraphidaceae
Vol. 6: Hookeriaceae-Thuidiaceae
Vol. 8: Sematophyllaceae —Polytrichaceae

Bryoflora of Hengduan Mts(Southwest China)
Flora Yunnanica (Tomus 17) Bryophyta: Hepaticae, Anthocerotae
Flora Yunnanica (Tomus18) Bryophyta: Musci
Flora Yunnanica-Tomus 19 Bryophyta: Musci
Bryophyte flora of Hunan Province, China. 11. Orthotrichaceae (Musci)

To order: send order form to: China Scientific Book Services, Jian Nei Da Jie Post Office, 100001-88, Beijing, China
Or: Email to: order-csbs@94book.com.cn. Online order: <http://www.hceis.com>
Fax order : +86-10-58930116, +86-1088510673; Tel: +86-10-58930115

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More details please visit: <http://www.hceis.com>

Mosses and other bryophytes – an illustrated glossary

Malcolm, Bill and Nancy. 2007. Mosses and other bryophytes, an Illustrated Glossary. Second Edition. Micro-optics Press. 336pgs. ISBN 0-9582224-7-9. Price: 98 NZ\$

This 2nd edition of the illustrated glossary of mosses and liverworts is described on the inside cover of the book as a "illustrated glossary of terms that are used to describe mosses, liverworts, and hornworts". As indicated, it is an illustrated glossary with a focus on morphological terms and with gorgeously detailed microscopic photographs and diagrams. Rarely has the variability in leaf shape, cell shape, leaf border etc been shown. But the glossary covers so much more!

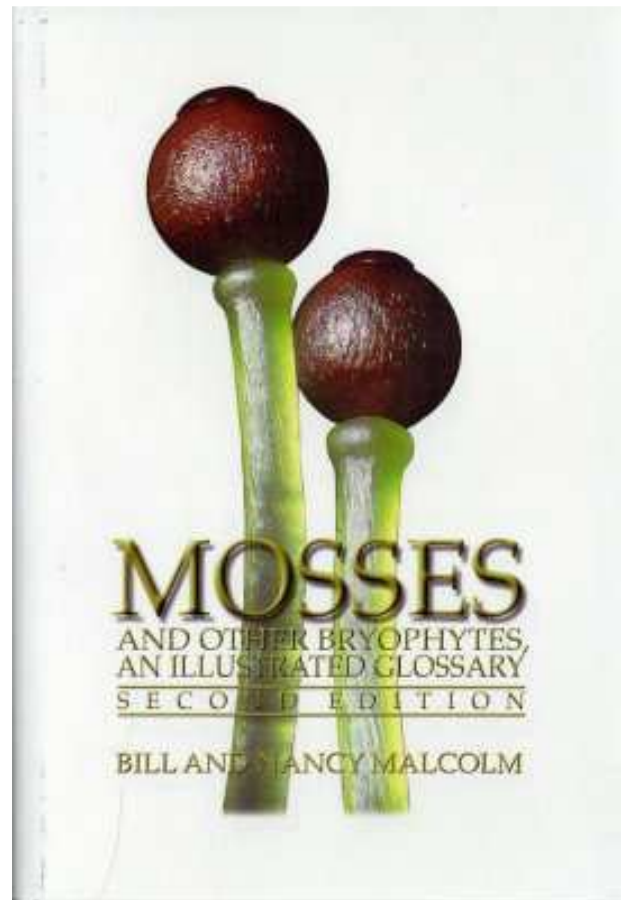
It also provides a wealth of information on bryophyte chemistry (with molecular models of various organic compounds, ecological information ranging from absorption and adsorption to wall mosses and basic terms of botanical nomenclature.

The second edition has half again as many pages (over 330) and illustrations (nearly 1400) as the first edition did, and two-thirds of those illustrations are new. Over 530 species of bryophytes are illustrated and are referred to in the index at the end of the book. Additionally, an appendix also provides information on how to photograph bryophytes by means of a flatbed scanner.

This book should be made available in all plant biology departments and should be used by all of those involved in teaching bryology be it in colleges, universities or to amateur botanists.

The price is NZ\$98 worldwide plus shipping (add GST for sales inside New Zealand). Copies can be purchased from the sole distributor Manaaki Whenua Press in New Zealand. The book is described on Manaaki Whenua Press' web-site <www.mwpress.co.nz> along with directions on how to order and the cost of shipping.

web-site: www.mwpress.co.nz
e-mail address: mwpress@landcareresearch.co.nz
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Lincoln 8152,
Canterbury, New Zealand
telephone: +64-3-321-9749 or +64-3-321-9662
facsimile: +64-3-321-9997



New and upcoming publications

Colorado bryophytes

Weber, William A. and Ronald C. Wittmann. Bryophytes of Colorado. 238 pp. 8 plates. Keys, notes on field recognition, microhabitats, herbarium records, historical and other chapters. July 2007. Pilgrims Process, Inc. (price not yet available).

Picture Book of Bryophytes in Germany

Bildatlas der Moose Deutschlands, Michael Lüth (Hrsg.). Photographic picture plates with habit and macroscopic and microscopic details of each taxa in Germany. Faszikel 4:

Bryaceae - M. Lüth & M. Ahrens: 80 photographic picture plates with nearly all species (Germany) of the genera: Anomobryum, Bryum, Leptobryum, Mielichhoferia, Orthodontium, Plagiobryum, Pohlia, Rhodobryum

Funariales - M. Lüth: 28 picture plates with the species (Germany) of the genera: Discelium, Entosthodon, Ephemerum, Aphanorrhagma, Funaria, Micromitrium, Physcomitrium, Pyramidula, Tayloria, Tetraplodon, Splachnum

More information, sample pictures and a list of threatened taxa under: www.milueth.de/Moose/
Orders can be directed to: Michael Lüth, Emmendinger Str. 32, D-79106 Freiburg, Germany or at: mail@milueth.de. Delivery comes just with advance payment! Price: 70 Euro incl. Taxes and shipping

(normal way). Payments are possible by remittance to a bank account (from a country with Euro currency), Sparkasse Freiburg IBAN: DE44 6805 0101 0001 8244 05 SWIFT-BIC: FRSPDE66XXX cash in a letter or with PayPal (address: mail@milueth.de)

mail@milueth.de

Catalogue des bryophytes du Québec et du Labrador

This is the second edition of Catalogue bibliographique des bryophytes du Québec et du Labrador, Marc Favreau and Guy R. Brassard published in Memorial University of Newfoundland, Occasional Papers in Biology n° 12, 1988.

The present catalogue is a list of known records of bryophytes of Québec and Labrador, Canada. The total bryological flora of the area includes four hornworts comprising three species and one infraspecific taxon, 231 liverworts comprising 207 species and 24 infraspecific taxa and 657 mosses comprising 632 species and 25 infraspecific taxa, totalling 892 taxa. The area was divided into 23 regions for Québec and five regions for Labrador, and for each taxon, bibliographic references are provided by region.

To obtain a copy of the Catalogue des bryophytes du Québec et du Labrador, Provancheria No. 30 contact Mme Sylvie Fiset.
Email: herbier@herbier.ulaval.ca

RESEARCH OPPORTUNITIES

Augustin-Pyramus de Candolle Prize

The Geneva Société de Physique et d'Histoire naturelle (SPHN) is pleased to announce that in 2008 it will award the Botany Prize, named the AUGUSTIN-PYRAMUS DE CANDOLLE PRIZE which will recognize the author or co-authors of the best monograph of a genus or family of plants. Monographs to be considered should be unpublished or published after 31st December 2005). The monograph should be a complete coverage of the group considered and include its arrangement in a system of hierarchical classification. It should also contain descriptions of external morphological characters and internal characters - anatomical, caryological, physiological and molecular - as far as they can be used to distinguish the sub-groups.

A complete bibliography, critical synonymy, and identification keys are requested, and the work should comply with the International code of Botanical Nomenclature. Partial treatments, i.e. a monograph of a sub-family, tribe, sub-genus or section, would be acceptable provided that the group is defined clearly with respect to its neighbours.

The Prize is open to authors of any nationality or domicile. The text may be written in Latin, French, German, English, Italian, Spanish or Portuguese. A summary, restricted to a maximum of 4000 words, must be provided in French or English. Two copies of the manuscript, along with author's curriculum vitae, must be submitted to the following address before 31st March 2008:

Augustin-Pyramus de Candolle Prize
Conservatoire et Jardin botaniques de la Ville de
Genève
Case postale 60
1292 Chambésy-GE
Switzerland

The award is CHF 5000.00. The reward may be reduced, or not awarded, if insufficient works are received or those received do not fulfil the criteria of this notice. The Prize will be awarded in October, 2008. The selected monograph remains the property of the author; a copy will be kept at the SPHN.

For any further information, please contact: prix-candolle.cjb@ville-ge.ch

The President of the SPHN
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michelle.price@ville-ge.ch

CONFERENCE ANNOUNCEMENTS

Bryophyte Identification Workshops in Oregon, USA

David Wagner will teach two intensive, 4-day bryophyte workshops in April, 2008. They will take place on the University of Oregon campus. Both workshops combine hands-on experience with detailed lectures. Practice material and copious handouts provided, including the current draft of my "Liverworts of Oregon" on CD.

Bryophytes I: All the Basics. April 6-7-8-9. The first day is Sunday, so we can start with a field trip. The idea is to get direct experience with the common species in their natural habitat and make observations about bryophyte ecology. Then three subsequent classroom days will involve study of about 70 important species. Emphasis in this workshop is on hand lens recognition of the species covered, their habitat characteristics, learning the basic terminology to describe them, and characteristics of the major families.

Bryophytes II: Advanced Techniques. April 23-24-25-26. Three days of classroom work and one field day; the second day of the workshop will be spent in the field. Inserting the field day between the classroom periods permits close integration of field and lab. This workshop emphasizes developing microscope skills and mastering the specialized terminology necessary to use technical keys to identify bryophytes. It is designed for people who have had Bryophytes I or similar training. Keying liverworts will focus on Doyle

David H. Wagner, Ph.D. Eugene, Oregon

and Stotler's 2006 keys to California liverworts, supplemented by my CD, Liverworts of Oregon. Norris and Shevock's 2004 keys will be emphasized for mosses.

Travel and lodging are the responsibility of the participants; David will offer suggestions. Sandwich lunches are provided during the classroom days. Participants are responsible for lunches and transportation on field days; carpools encouraged. A dissecting microscope recommended for Bryophytes I; both dissecting and compound microscopes required for Bryophytes II.

Fee: \$400.00 for each workshop. Class size is limited. To reserve a space, send \$25 deposit (non-refundable processing fee). The \$375 balance is due twenty days before the workshop. Cancellations after the balance due deadline will be refunded only if waiting list alternates can be substituted.

Please send check or money order (payable to Northwest Botanical Institute) to NW Botanical Institute, P.O. Box 30064, Eugene OR 97403-1064. Note that credit cards cannot be processed. A receipt will be provided at the workshop. An invoice can be provided upon request ahead of time, if needed. I will supply my tax ID Number and DUNS Number for electronic payment on agency purchase orders.
email: davidwagner@mac.com

Bryophyte courses taught in the Jepson Herbarium Public Programs

The mission of the Jepson Herbarium, one of six natural history museums on the University of California, Berkeley campus, is to understand and conserve the California flora through systematic, floristic, and conservation biology studies and to communicate knowledge of the flora through publications and instructional programs.

The public programs, supported by the Friends of the Jepson Herbarium, provide members of the systematics, ecological, floristic, and conservation communities access to specialists and current knowledge in a variety of subjects. Participants in our classes gain a unique perspective on the flora of California as they learn from experts and interact with fellow botanists. The classes are designed to accommodate botanical enthusiasts from beginners to professionals.

The 2008 season again includes a series of short courses on bryophytes to be held on the UC Berkeley campus and taught by renowned bryologists from across the country. For more information about the program and registration information, visit the Jepson Herbarium Public Programs website: <http://ucjeps.berkeley.edu/workshops/> or call or email Anna Larsen: alarsen@berkeley.edu to request a program brochure.

Introduction to Bryophytes

March 1 - 2, 2008

Brent D. Mishler and Ken Kellman

Location: UC Berkeley and East Bay Regional Parks

Course fee \$225/\$250

The bryophytes are a diverse group of land plants of small stature but large ecological impact. There are some 23,000 described species worldwide, making it the largest group of land plants except for the flowering plants. The group includes three phylogenetically distinct lineages: mosses, hornworts, and liverworts.

The bryophytes are generally considered a "key" group in our understanding of how the modern land plants (the embryophytes) are related to each other phylogenetically and how they came to conquer the hostile land environment. Although the bryophytes display much species diversity, a major limitation in the use of bryophytes as study organisms has been the lack of basic floristic, ecological, and alpha-taxonomic knowledge of the plants in many regions, of which California and the southwestern United States are the most poorly known in North America.

The first day, participants will learn about basic bryophyte biology, some simple but necessary microtechniques in the lab, and look at the basic

structure of bryophytes along with taxonomically useful characteristics. The second day, after a morning lab session, the class will caravan to a field site and learn to identify at least major bryophyte groups and discuss and observe their general ecology and evolutionary features. Participants should be prepared to hike up to 4 miles on Sunday.

Bryophyte Inventory and Sampling Techniques

March 15 - 16, 2008

Jim Shevock

Location: UC Berkeley and East Bay Regional Parks

Course fee \$225/\$250

This weekend workshop is specifically designed for those who (1) engage professionally in conducting inventories, (2) want to expand their floristic skills to include surveys for bryophytes, and (3) want to develop checklists or bryofloras at either physiographic (e.g. mountain range, river basin) or administrative units (National Parks, National Forests, State Parks, counties, etc.). The field component of this workshop will focus on a variety of team and individual exercises specifically designed to train non-bryologists how to "see, sample, and document" the diversity of bryophytes in a selected geographical area. Exercises will focus on documentation techniques for bryophytes, recognition of micro-habitats, and determination of how to find rare taxa at any given location. Lab and lecture activities will concentrate on techniques used to sample bryophytes, how to succinctly capture the ecological data at the time of collection, and how to process specimens efficiently for identification. Bryophyte herbarium specimen preparation, adequate bryophyte label data, specimen gift-for-determination procedures, and record keeping for documentation purposes of inventory results will also be provided and discussed. At the conclusion of this course, participants will be better prepared and skilled at conducting bryophyte inventories and sampling activities.

Orthotrichum

February 2 - 3, 2008

Dale H. Vitt

Location: UC Berkeley, and field sites in the greater Bay Area

Course fee \$225/ \$250

The genus *Orthotrichum* is one of the larger genera of mosses in North America and its species are diverse and abundant in the dryer parts of western North America. Members of the genus are especially common in California where they form an important component of the epiphytic bryoflora. Traditionally *Orthotrichum* has been regarded as one of the more difficult moss genera to recognize, partially because

the morphological characteristics used for identification are microscopic. However, there are many useful field characteristics that make their identification possible using a hand-lens and habitat features. This workshop

will focus on learning the intricacies of peristome morphology and field characters useful for species identification and will include both microscope sessions and field experience.

The Physcomitrella genome Workshop – March 17-18, 2008.

The genome of the moss *Physcomitrella patens* has been sequenced in 2005 and released to the public in 2007. The moss genome has been made available as the fifth land plant genome and the first genome of a non-seed plant. The phylogenetic position of *Physcomitrella* makes it an ideal candidate for evo-devo studies, enabled by the large and growing tool kit of lab methods, as well as for comparative genomic analyses.

This workshop is aimed at PhD students and other young researchers who work in the field of plant biology and evolution. The workshop will give an introduction to the *P. patens* genome and will teach in-depth sequence analysis skills using www.cosmoss.org sequence analysis resources (e.g., genome browser and BLAST tools).

If you are interested to join, or have questions, please register by sending an e-mail to: physco-workshop@uhura.biologie.uni-freiburg.de The number of participants is limited to 50. Places will be assigned on a first-come-first-serve basis.

Venue: Freiburg is located in the south-western corner of Germany, very close to France and Switzerland and in the immediate vicinity of the Black Forest with its skiing slopes. The city is known for its gothic cathedral, the "Münster", the scenic city centre with its "Bächle" and its temperate climate. The areas surrounding Freiburg is renowned for its excellent wine. The nearest international airports are Frankfurt (2h), Zürich (2h) and Basel/Mulhouse (40 min).

COUNTRY REPORTS

Bryological Research Activities at Shanghai Normal University in 2007

A bryological research group and laboratory with a herbarium has been formed during the past few years at Department of Biology, Shanghai Normal University. The members include Prof. Cao Tong, Dr. Guo Shuiliang (Prof.), Dr. Yu Jing (Associate Prof.), Dr. Zuo Benrong (Lecture), with two PhD students and ten Master students. The main activities of bryological researches at the university in 2007 are reported as follows. For more information, please contact with Cao Tong (ct1946@263.net).

Research Projects

The following projects have been conducted under the financial support from the Nature Science Foundation of China (NSFC): Taxonomic revision and phylogenetic analyses on Chinese Scapaniaceae (Cao Tong, 2004-2006), Taxonomic revision and cladistical analyses on Chinese Orthotrichaceae (Shuiliang Guo, 2006-2008), Morphology and structure of the spores of Chinese liverworts and their systematic significances (Yu Jing,

2006-2008). A new project "On molecular geography and phylogeny of genus *Ptychomitrium* in the world" also supported from NSFC, will be conducted by Cao Tong in the following three years (2008-2010). There are some other projects supported by the local governments and university: Biological indication of bryophytes to quality and changes of environments in Yangtze Delta area (Cao Tong 2006-2008) and Utilization of some bryophytes on city virescence (Yu Jing, 2007-2009) supported by Shanghai Educational Committee; Utilization of medicinal bryophytes from Xishuangbanna, Yunnan Province (Guo Shuiliang, 2007-2009) supported by Shanghai Scientific and technological committee and Molecular geographical study on Chinese Scapania (Zuo Benrong, 2007-2008) supported by Shanghai Normal University.

Publications

About 18 papers on taxonomy, ecology and culture *in vitro* of bryophytes were published in the following

journals, including: "Cryptogamie Bryologie", "Annual Botanica Fennica", "Acta Phytotaxonomica Sinica", "Garden's Bulletin Singapore", "Bulletin of Botanical Research (Chinese)", "Journal of Shanghai Normal University (Natural Science Edition)", "Guihaia", "Acta Botanica Boreali-Occidentalia Sinica", "Chenia", "Spectroscopy and Spectral Analysis" and "Journal of East China Normal University (Natural Science Edition)". The papers are listed in the Appendix.

International cooperation

Cao Tong, with Dr. Zhang Yuanming of Xinjiang Institute of Ecology and Geography, CAS, and Dr. Sha Wei, Qiqihar University, attend the World Conference of Bryology 2007 in Kuala Lumpur, Malaysia, July 23-27 this year, in which he gave two presentations on the taxonomical revision of Chinese Scapaniaceae and the Monitoring of the environments of Shanghai City using bryophytes, respectively. Before the meeting, Cao Tong also visited the National University of Singapore and Singapore Garden (Dr. Benito C. Tan). Cao Tong, with a delegation of College of Life and Environmental Sciences, Shanghai Normal University, paid a visit to some bryological institutions in Europe, including British Nature History Museum (London, Dr. Newton), Edinburgh Royal Botanical Garden (Edinburgh, Dr. D. Long), Albrecht von Haller Institute of Plant Sciences, Göttingen University (Göttingen, Dr. Gradstein) during 3-14, November. Guo Shuiliang paid a visit to Missouri Botanical Garden cooperating with Dr. Si He on the taxonomical revision of Asian *Macromitrium* from December 2006 to March 2007. Yu Jin as a visiting scholar is now working and studying at Duke University on molecular systems of moss in Shaw's Lab, USA supported by Shanghai Normal University. During 23 June to 8 July, Guo Shuiliang did field work with Dr. He Si of Missouri Botanical Garden, in East China.

Students

Zuo Benrong (supervised by Cao Tong) obtained his PhD degree at the Institute of Applied Ecology in June this year, his thesis is "Studies on Chinese Scapaniaceae (Hepaticae)". An Li, Li Yan and Xu Chengchong, three students of Prof. Cao Tong, received their Master Degree in June. Lou Yuanxia and Liu Yan began their PhD courses supervised by Cao Tong and another five students began their Master courses supervised by Cao Tong, Guo Shuiliang and Yu Jing, from September 2007.

Appendix: list of publications in 2007.

Guo, S. L., Cao, T. & B. C. Tan. 2007. Three new species records of Orthotrichaceae (Bryopsida) in China with comments on their type specimens. *Cryptogamie Bryologie*, 28(2): 149-158.

Guo, S. L. Cao, T. & Tan, B. C. & G. Y. Song. 2007. Taxonomic notes on Asian species of Orthotrichaceae (Bryopsida): *Macromitrium* with gymnostomous capsules. *Garden's Bulletin Singapore* 58(2): 155-178.

Guo, S. L., Muo, Y. Y. & T. Cao. 2007. *Orthotrichum courtoisii* (Bryophyte): a new synonym of *O. consobrinum* Card. *Acta Phytotaxonomica Sinica* 45(3): 405-409.

Guo, S. L., Enroth, J. & T. Koponen. 2007. Bryophyte flora of Hunan province, China. – Orthotrichaceae. *Annual Botanica Fennica* 44: 1-34.

Liu, Y. & T. Cao. 2007. Advances on the study of the moss *Physcomitrella patens*, a potential model plant, *Guihaia* 27(1): 90-94. (Chinese with English abstract)

Liu, Y. & T. Cao. 2007. New records of mosses from Zhenjiang Province. *East China Normal University (Natural Science)*, 6(6): 131-134.

Liu, Y., Cao, T. & J. Wang. 2007. Preliminary report of bryoflora from urban areas of Hangzhou, Zhejiang province, China. *Journal of Shanghai Normal University (Natural Science edition)*, 36(2): 82-89. (Chinese with English abstract)

Shi, C. L., Cao T., Wang, D. S., Liu, F. & B. R. Zuo. 2007. *Daltonia aristifolia*, a new record of bryophytes to the mainland of China. *Journal of Shanghai Normal University (Natural Science Edition)*, 36(2): 90-92. (Chinese with English abstract)

Song, G. Y., Cao T. & C. C. Xue. 2007. Present situation of the plant community succession on Alluvial islands at the mouth of Yangtze River. *Chinese Bulletin of Botanical Research*, 27(1): 2-11. (Chinese with English abstract)

Wang, J., Cao, T., Wang, M. & H. Chen. 2007. Biodiversity and its characteristics of Bryophytes in Suzhou Gardens. *Acta Botanica Boreali-Occidentalia Sinica*, 27(6): 1239-1246. (Chinese with English abstract)

Wang, M., Cao T. & Yu Y. H. *et al.* 2007. Comparison study of adsorptive ability to different chemical elements between some bryophytes and seed plants, *Journal of Shanghai Normal University (Natural Science)* (5): 67-73. (Chinese with English abstract)

Wu, Y. H., Gao C. & T. Cao. 2007. A preliminary review of Chinese Amblystegiaceae *Chenia* 9: 327-337.

Xu, C. C., Cao, T & N. Ming. 2007. FTIR spectroscopy analysis of mosses with different kinds of peristomes and its systematic significance. *Spectroscopy and Spectral Analysis*, 27(9): 1710-1714.

Yang, W., Guo S. L. & F. Fang. 2007. Comparison of leaf structures among seventeen moss species collected from different habitats, *Acta Botanica Yunnanica* 29(04): 409-417. (Chinese with English abstract)

Yang, W. Guo S. L. & F. Fang 2007. On morphological and anatomical adaptation of mosses to water Environments. *Journal of Teachers' College of Anging (Nature Science edition)* 3: 56-60 (Chinese with English abstract)

Zuo B. R., Cao, T., S. L. Guo. 2007, Comparison and assessment of three East-Asian species of the genus *Scapania* (Hepaticae: Scapaniaceae). *Acta Phytotaxonomica Sinica* 45(5): 742-750

Zuo B. R., Cao, T., Gao, C. & J. Sun. 2007. *Scapania paraphyllia* T. Cao, C. Gao, J. Sun & B.R. Zuo, a new

species of Hepaticae (Scapaniaceae) from Zhejiang, *Acta Phytotaxonomica Sinica* 45(3): 311-314.

Zuo, B. R. & T. Cao. 2007. *Scapania ampliata*, a hepatic species new to China, *Chinese Bulletin of Botanical Research* 27(2): 135-138. (Chinese with English abstract)

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On the Research Group for Bryology of the Hungarian Academy of Sciences at the Eszterházy College, Eger, Hungary

Two years ago (*Bryol. Times* 116: 6, June 2005) we were able to give an account on the different activities of the Group, focused on tropical bryophytes. Regrettably, in the meantime, by the 31st of December 2006, the Research Group for Bryology ceased to exist due to the lack of further funding.

The group was established by Tamás Pócs in the January of 1999, with the support of the Hungarian Academy of Sciences, supplying the wages of two group members, Gabriella Kis and Andrea Sass-Gyarmati and financing all the research costs, including basic instruments (modern photographing microscopes, etc.), literature resources and some travel funds. There was a mutual agreement with Eger College, who provided the working place with all logistics, including the Bryophyte Herbarium of the College, counting some 140,000, mostly tropical specimens. In 2003, by the full retirement of Prof. Pócs, the group leadership was handed over to Prof. Sándor Orbán. In the same year a third member joined to the staff, Katalin Molnár, a PhD student. A very fruitful cooperation was established among the group members and leaders, having two muscologists, two hepaticologists and one lichenologist. During the eight years of activities the group members and leaders participated in several collecting expeditions in Romania, Bulgaria, Tunisia, Kenya, Tanzania, Réunion, Sao Tomé, Vietnam, Australia and Fiji Islands and lastly in the Venezuelan Andes, guided by Ricardo Rico, in cooperation with the Universidad de los Andes, Mérida. The bryological research was focused on the Hookerioid mosses of Africa with special emphasize on *Daltonia* (G. Kis), on the *Ptychanthoid Lejeuneaceae* of the Indian Ocean and Pacific islands (A. Sass-Gyarmati), on the *Calymperaceae* of Africa and the Indian Ocean Islands (S. Orbán) and on the former *Cololejeuneoideae* of the world (T. Pócs), but many other subjects were investigated too. Our lichenologist after re-establishing the lichen herbarium, studied the lichens of the Carpathian Basin and worked on the effect of air

pollution on the secondary metabolites of lichens in industrialized towns of Hungary.

After the Research Group has broken up, Prof. Pócs and Prof. Orbán still can continue their bryological activities at the Botany Department of Eger College, as it was before. Luckily, the bryological laboratory with all equipments remained in the property of the Botany Department of Eger College and the Cryptogamic Herbarium was declared to be a protected national heritage. But the former group members lost their research posts, except for Katalin Molnár, who is able to continue her work at Duke University, with the guidance of Prof. François Lutzoni and the support of Dr. Chicita Culberson.

We would like to document the eight years of bryological and lichenological activities of the former Research Group by the selected publication list below:

Ahonen I., A. Sass-Gyarmati, & T. Pócs. (2005): Molecular, morphological, and taxonomic evaluation of the *Ptychanthus striatus* (Lejeuneaceae, Marchantiophyta) complex. *Acta Botanica Hungarica* 47(3-4): 225-246.

Bálint, L. & S. Orbán (2003): Bryofloristical researches of Harghita Mountains. *Contributii Botanice* XXXVIII, (1). *Gardina Botanica „Alexandru Borza” Cluj-Napoca*, 13-18.

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Chuah-Petiot, M.S. & Pócs, T. (2003): East African Bryophytes XIX. A contribution to the bryoflora of Kenya. *Acta Botanica Hungarica* 45: 53-64.

Dulai, S., Csizi, ..., Sass-Gyarmati, A. & Molnár, I. (2004): Combined effects of Thylakoid Energisation Level and Water Deficit on Thermal Stability of Photosystem II in a Desiccation Tolerant Moss. *Acta*

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- Kis, G. (2003): Type catalogues about Bryophytes in Herbaria. *The Bryological Times* 110: 4-6.
- Kis, G. (2004). Non European Bryophyta types and list of exsiccata in the Eger Cryptogamic Herbarium (EGR). *Folia Historico Naturalia Musei Matraensis*. 28: 5-52.
- Kis, G. (2007): Observations on Hookeriales, II. *Daltonia prorata* Kis (Hookeriales, Daltoniaceae), a new species from the Venezuelan Andes. *Acta Botanica Hungarica* 49(1-2): (in press).
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- Kürschner, H. & Pócs, T. (2002): Bryophyte communities of the loess cliffs of the Pannonian basin and adjacent areas, with the description of *Hilpertia velenovskii* – *Preygoneuretum compacti* ass. nov. – Studies on the cryptogamic vegetation of loess cliffs, VI. *Nova Hedwigia* 75 (1-2): 101-119.
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Report from the Ahmadu Bello University – "Our insight into the world of bryophytes"

Part of our students' basic requirement for a Bachelor of Science degree in Botany and Biology is the study of bryophytes, first as a course named 'Cryptogamic Botany' and later at a much higher level. In the first place, many of our students have a natural curiosity of their surrounding environment and want to know the familiar plants around their confinements, including the mosses and their relatives. Occasionally, some

postgraduate students use these beautiful plants in ecological studies particularly in monitoring environmental pollution. However, the first step to enable these research interests is the correct taxonomic identification of these plants; later other research efforts can be logically pursued.

Unfortunately at this moment our herbarium collection cannot support this need, as even the most commonly seen epiphytic mosses (on many tree barks) are not present in our herbarium. With my present dispensation as a botany lecturer in my alma mater I took it a duty in giving out my contribution towards solving this problem. Last year I engaged one of my undergraduate students to identify part of our collection. Only five samples were identified! This year also, I involved two of my students in the same effort and try to enlarge our herbarium by collecting beyond our university campus. This implies more challenge towards the taxonomy of these plants!

Our present hope is to establish a reference moss and liverwort collection to know the bryophytes in our surrounding areas. It would be a great tool to study the ecology these plants in their natural environment.

Recently I was given the opportunity to be involved in a special course programme for our 400 level students, and immediately proposed a course 'Advanced Bryology', which was accepted! The Bryophyte Ecology course that the IAB has put on its website has been of great use. I use this occasion to express my appreciation for the magnanimous gesture of accessing the Bryoecology online book of Prof. J

Glime that is of great help in the theoretical aspect of the course.

I intend to teach the course through both theoretical approach and fieldwork with emphasis on the later. Based on this, we intend to extend our taxonomic research on these so that it may be possible to publish a check list of Northern Nigeria mosses and liverworts.

Finally, I wish to use this forum to extend our invitation to prospective collaborators particularly in developing the 'advanced bryology' curriculum and in molecular analysis of our collection

I have a special request to IAB-members: in order to build up our bryophyte herbarium, I would be pleased if I could receive collaboration in identifying collected specimens. Please contact me.

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VACANCIES

Faculty positions: Biochemistry/Molecular Biology, Ecology, Health Sciences

The Department of Biological Sciences at Michigan Technological University invites applications for **two or more positions** in the first round of an anticipated series of hires highlighting the integrative future of biology. One position will be in **Biochemistry/Molecular Biology**; the other position(s) will be in **Ecology** or **Health Sciences** complementing current departmental strengths and goals. Appointments are at the Assistant Professor level however, exceptionally qualified applicants may be appointed at the Associate Professor level. For all these hires, **we are particularly interested in individuals who conduct research at the interfaces of ecology, biochemistry/molecular biology, and/or human health**. Successful applicants will be expected to establish a vigorous, externally funded research program involving graduate and undergraduate students and to have a strong commitment to undergraduate and graduate instruction in their areas

of expertise. Additional information is available at <http://www.bio.mtu.edu>. Applicants should submit a curriculum vitae, statements of research and teaching interests and three letters of recommendation to Chair, Faculty Search Committee, Dept. Biological Sciences, Michigan Technological University, Houghton, MI 49931; Email: biosearch@mtu.edu. Review of applications will begin Dec. 15th and continue until all positions are filled. *Michigan Technological University is an equal opportunity educational institution/equal opportunity employer.*

At Michigan Technological University, Sustainability informs research at a university-wide scale. Candidates who are also interested in research that fits within the theme of "Sustainability" should send a separate application for one of the ten growth positions in that area as described at www.mtu.edu/sfhi."

WORKSHOP REPORTS

Indo-Hungarian bilateral scientific workshop

An Indo-Hungarian bilateral scientific workshop with indoor lecture session at Botany Department of College, Bareilly and field course at Nainital and Pune was arranged by the support of D. S. T., Govt. of India and N. K. T. H., Hungary from 16th March to 24th March

on the topic "*Ecology and Mechanism of desiccation tolerant mosses and vegetation in tropical Inselbergs.*"

Prof. S. P. Singh an eminent ecologist and Hon'ble Vice Chancellor, H. N. B. University, Srinagar, Garhwal inaugurated the workshop. The scientific programmes of workshop focused on physiology and mechanism of tolerance. The impact of the presentations

and interaction has cultivated into bilateral sharing of the data research findings between sixteen Hungarian and Indian scientists along with participation of Prof. Tamas Pócs, Prof. Zoltan Tuba, Dr. Zsolt Csintalan, Dr. Dinesh K. Saxena, Saiful Arfeen and Kajal Srivastava.

Desiccation tolerant (DT) mosses grow on out rocks on very extreme conditions. Same are represented by Phylogenetically diverse species of *algae*, *lichens*, *ferns* and *flowering plants* mostly members of



monocotyledons and has remarkable ability to survive extremely desiccated state 90 – 95 % loss of their cell water content. Mosses exhibited an incredible potential to resume normal metabolism when hydrated. Their importance could be understood by that they help in

retaining the moisture and provide the biomass on barren out rock, which act as seedbed for the other plants including the seed plants to survive. The study was also conducted on distribution, floristic, morphological range, ecological adaptations, photosynthetic efficiency and water conserving mechanism of DT

plants in extremely harsh climatic conditions.

Drought tolerance mosses are ecologically important constituent of the ecosystem, adapted beautifully for the extreme environment. Scientific knowledge on these groups of plants will have wide applicability in natural conservation management.

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CONSERVATION COLUMN

On the distribution and ecology of the extraordinary hepatic *Myriocolea irrorata* (Lejeuneaceae)

In The Bryological Times 107: 16 (2002), Robbert Gradstein and Nicole Nöske reported the rediscovery of the South American liverwort *Myriocolea irrorata* Spruce (Lejeuneaceae) along the Rio Topo in eastern foothills of the Ecuadorian Andes, the site where the species had originally been collected by Richard Spruce in 1857. The species had not been seen for 150 years and was considered lost. Spruce was particularly attracted to this species, which he considered perhaps the most interesting bryophyte that he had ever found and also the only agreeable souvenir (!) preserved of this river (Spruce, 1884-1885, 1996). Currently, *Myriocolea irrorata* is only known from the Topo and nearby Zuñac rivers and is considered critically endangered (CR B1 + 2c) (Tan et al., 2000; Gradstein et al., 2004). The species is an isolated member of the Lejeuneaceae, distantly related to *Myriocoleopsis* and *Cololejeunea*, and usually robust for a member of this family (Gradstein et al., 2004). Because of its threat status and because of plans for a hydroelectric project in the river, a detailed study on the ecology and distribution of *Myriocolea* was undertaken by the author in the framework of his study at the Pontificia Universidad Católica del Ecuador in Quito, financially supported by the IAB (Yandún, 2007). The field study, carried out in the fall of 2006, confirmed that *Myriocolea irrorata* occurs only along Topo River (Figure 1) and a restricted part of the Zuñac River. Along the Topo River the species ranges from 1200 to 1700 m and is surprisingly common there. The optimum of the species is at about 1400 m. *Myriocolea* grows exclusively epiphytic on the small woody subshrub *Cuphaea bombonazae* (Lythraceae) and, rarely, on *Liabum kingii* (Asteraceae) (Figures 2 & 3), and is restricted to the outer edge of the river bank adjacent to the torrential water currents. The species grows submerged at least during part of the year and becomes emerged only during spells of dry weather. The riparian community in which *Myriocolea* occurs is composed of 26 bryophyte species, including the aquatic *Platyhypnidium riparioides* and *Fissidens* sp., the riparian *Myriocoleopsis gymnocolea*, *Lejeunea topoensis*, *Kymatocalyx dominicensis*, and *Sematophyllum* sp., and others such as *Plagiochila* area, *Marchantia chenopoda*, *Phaeoceros* sp., etc.

The Topo River valley apparently creates an optimal mesoclimate for the development of *Myriocolea irrorata*, and unique conditions not found in other river valley in the Upper Pastaza region. This may explain why the species has not been found anywhere else expect for a small population in the neighbouring Zuñac River. Important ecological factors determining the occurrence of the species include elevation, temperature, biochemical oxygen (DBO5), and water conductivity. Physical and chemical analyses of water

samples showed the high quality of the river water and



Fig. 1. Topo River (by S. Yandún)



Fig. 2. *Myriocolea irrorata* on *Cuphaea bobonazae*. By. S. Yandún

suggest that *M. irrorata* may be extremely sensitive to environmental pollution. The construction of dams and dykes in Topo River, proposed in the framework of a hydroelectric project, will alter the changes in the

amount of the water flow and quality, and flood regime, and almost certainly result in a drastic diminution of the populations of *Myriocolea irrorata*.

Acknowledgments. I am grateful to Robbert Gradstein for encouragement and linguistic help, to Susana León- Yáñez for helpful in this study, to Andres Bastidas and Augusto Sola for help in the fieldwork, and to the International Association of Bryologists for financial support.

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Santiago YANDÚN, Pontificia Universidad Católica del Ecuador, Quito, Ecuador.

Mosses as killer of particulate matter

The commercial use of bryophytes includes the production of moss mats (Frahm 2004). They are designed to cover vegetation free areas such as roofs, and to establish nature in cities. Their advantage is that they are pre-cultivated, and simply rolled and fixed on the substrate, have high water retention, and balance the air humidity as well as the temperature. In these respects they are comparable to vegetation mats consisting of higher plants (succulents such as *Sedum* spp.), but have a lower weight and a higher water storing capacity. By this way, a living surface can be established in cities, inhabited by animals (mainly invertebrates) and bacteria.

The advantage of such projects to grow green on roofs is especially realized in North America, where "green roof initiatives" promote to cover cities with vegetation. Plans for greening complete suburbs exist also in China. No biologist would doubt the efforts of these tasks. The structure of the moss mats (patent pending) even allows to cover vertical walls.

Beside of the known efforts of moss mats, a new attribute has been discovered at the University of Bonn: moss mats are able to reduce particulate matter.

Particulate matter is a micro dust which floats in the air. Especially dangerous are particles < 10 µm (PM 10), because they are inhaled and pass into the lung alveoles in the body. By this way, dangerous (cancerogenous) substances can get into the blood system. In the European Union, there are limits for the contents of particulate matter in the air. They are exceeded especially in cities, where part of PM 10 originates from traffic.

The effect of absorbing particulate matter became clear when an analysis of the composition of micro dust was studied: about 50% consists of ammonium nitrate (and -sulphate to a lower extent). This

substance originates in cities and along highways from ammonia (produced by catalysts (!) of cars) and nitrogen oxide (produced by diesel engines). Ammonium nitrate is a fertilizer, which can be bought in every garden centre. It originates as "dry deposition", which is micro dust (PM 1). For bryophytes it is a nutrient. The problem is, that particulate matter floats in the air and if it is washed down on the leaf of a flowering plant, it is washed off. If it lands on a bryophyte, the cations (e.g. NH₄⁺) are exchanged against H⁺ ions, an effect which we know under the name ion exchange and the negative loaded particles are attracted by the H⁺ ions. The cation exchange is usually attributed to peat mosses in the literature, but happens in all bryophytes (with slightly less effectiveness due to the lack of the large surface provided in the peat mosses by the hyalocysts. As figured out in my textbook, the purpose of hyalocysts is not to store water - which would ridiculous for a plant growing in the wet - but to provide a larger surface for cation exchange in a nutrient poor habitat).

By this way a bryophyte works like a micro fibre dust cloth. The effect is even intensified by the enormous surface of a moss turf, which is raised by the factor 30.

Experiments by Dr. Marko Sabovljevic showed that the capacity of micro dust attraction in a single test is much higher than all natural deposits over a year. This mechanism works, however, only if the bryophytes are humid, almost not if they are dry and less if the plants are wet throughout. Small differences in the effectiveness between species depends on the growth form and foliation.

Except for ammonium nitrate, there are about 25% of organic matter in the PM 10 (originated from tyres, soot etc). It can be supposed that his part is "eaten up" by bacteria, which live in abundance of the leaves

(they were the food for ciliates, which were trapped by the zoophagous hepatics *Colura* and *Pleurozia*). The remaining 25% are composed of insoluble inorganic matter (mineral particles), which are sedimenting between the moss plants.

A year ago, a patent was applied for the moss mats, and the producer of the mats was selected as one from many environmental novelties for an exhibition during the "week of environment" by the federal president. Following a press release, many communities were interested to establish such moss mats in Germany, especially



Moss mats along highway in Bonn.

along roads in cities with high traffic. Most recently, the moss mats were mounted for the first time along a highway in Bonn (see illustration). Highway officials appreciate the reduction of particulates not as much (in fact the ratio moss mats : traffic is not optimal) but the fact that such vegetation cover needs absolutely no care, in contrast to flowering plants. In 2008, 100.000 square meters of moss mats will be produced.

Frahm, J.-P. 2004. Recent developments of Commercial Products from Bryophytes. *The Bryologist* 107: 277-283.

Biennial report from the Bryophyte Conservation Committee members

In 2007 the joint IAB/IUCN committee consisted of René Belland (Canada), Jaime Aguirre Ceballos (Colombia), Min Chuah-Petiot (Kenya), Denise Pinheiro da Costa (Brazil), Uwe Drehwald (Germany), Allan Fife (New Zealand), Tomas Hallingbäck (Sweden), Zen Iwatsuki (Japan), Nadeyda Konstantinova (Russia), David Meagher (Australia), Nat Cleavitt (USA), Ron Porley (United Kingdom), Geert Raeymaekers (Belgium), Margaret Ramsay (United Kingdom), Noris Salazar Allen (Panama), Cecilia Sérgio (Portugal), Kimmo Syrjänen (Finland), Lars Söderström (Norway), Benito C Tan (Singapore), Jiri Váňa (Czech Republic), Edi Urmi (Switzerland), and Yelitza León Vargas (Venezuela). Below are the members reports for each country.

Australia

Overview

The conservation status of bryophytes in Australia has been assessed at the national level (1997), but at the state or territory level this has been done only in Victoria (2005) and Tasmania (1996). Legal protection of rare or threatened species is extremely poor. Only one species is protected nationally. Species have been protected under state or territory legislation only in Victoria (12 species) and Tasmania (one species).

TAXON	STATUS
Bryophyta	
<i>Anoetangium bellii</i> Broth. ex Dixon	L
<i>Bartramia subsymmetrica</i> Cardot	L
<i>Brachydontium intermedium</i> I.G.Stone	R
<i>Breutelia elongata</i> (Hook.f. & Wilson) Mitt.	X
<i>Calomnion complanatum</i> (Hook.f. & Wilson) Lindb.	L
<i>Climacium dendroides</i> (Hedw.) Weber & Mohr	R
<i>Drepanocladus polygamus</i> (Schimp.) Hedenäs	L
<i>Leptodon smithii</i> (Hedw.) F.Weber & D.Mohr	R
<i>Orthotrichum cupulatum</i> Hoffm. ex Brid. var <i>cupulatum</i>	L
<i>Orthotrichum hortense</i> Bosw.	L
Marchantiophyta	
<i>Bazzania hochstetteri</i> (Rchdt) E.A.Hodgs.	L
<i>Colura pulcherrima</i> Jovet-Ast	L
<i>Pedinophyllum monoicum</i> (Steph.) Grolle	L
<i>Pseudocephalozia paludicola</i> R.M.Schust.	L
<i>Riella spiculata</i> J.Taylor	L
<i>Riccardia eriocaula</i> (Hook.) Besch. & C.Massal.	L
<i>Treubia tasmanica</i> R.M.Schust. & G.A.M.Scott	N
<i>Triandrophyllum subtrifidum</i> (Hook.f. & Wilson) Fulforc & Hatcher	R

Table 1. Status of nominations of bryophytes for listing under the Victorian *Flora and Fauna Guarantee Act 1988*. Key: L = listed, R = recommended for listing, N = nominated for listing, X = rejected for listing.

In all states and territories a permit or license is required to collect or otherwise interfere with native plants, including bryophytes. However, timber harvesting and other large-scale operations and developments are generally exempt from these requirements.

National

A list of bryophytes considered to be rare or threatened nationally was published in 1997. However, this did not give legal protection to the species, and it has not been updated.

To be legally protected nationally, taxa must be listed under the Australian *Environment Protection and Biodiversity Act 1999*. At present only one bryophyte, *Pseudocephalozia paludicola*, has been nominated and listed. In 2003 a proposed ski-field development near the only known locality of this taxon on mainland Australia was delayed while an assessment of the impact on the population was made by a bryologist. The assessment found that the population would not be affected by the development.

At least 200 taxa would qualify for listing under the Act, but there is no coordinated program for nominating bryophytes. A proposal for such a program will be discussed at the Australasian Bryological Workshop in Tasmania in December 2007.

Victoria

The conservation status of all bryophytes that occur in the state was assessed in 2005 by David Meagher (University of Melbourne) and David Cameron (Department of Sustainability & Environment). In 2006 this information was added to the State Government's Flora Information System (an electronic database). This is a very useful resource for managers of public lands (national parks, state forests, etc.) but has no legal status.

To obtain legal protection, taxa must be listed as threatened in the state under the state's *Flora and Fauna Guarantee Act 1988*. Nominations for listing are assessed by an Scientific Advisory Committee appointed by the State Government. To date 18 bryophyte taxa have been nominated for listing (Table 1). 12 have been subsequently listed, 4 have been recommended for listing by the Scientific Advisory Committee, 1 is yet to be assessed by the Committee, and 1 has been rejected for listing because records turned out to be another species. Many other species would qualify for listing under the Act.

Tasmania

Species may be listed as rare or threatened in Tasmania under the state's *Threatened Species Protection Act 1995*. Although many species would qualify for listing under the Act, only one is listed: *Ambuchanania leucobryoides* Yamaguchi et al. (status: rare). The conservation status of bryophytes in Tasmania was assessed in 1996, but has not been updated.

Other States and Territories

Species may be declared to be rare or threatened in other states or territories under the following legislation:

Australian Capital Territory — *Threatened Species Protection Act 1995*

New South Wales — *Threatened Species Conservation Act 1995*

Northern Territory — *Territory Parks and Wildlife Conservation Act 1979*

South Australia — *National Parks and Wildlife Act 1972*

Queensland — *Nature Conservation Act 1992*

Western Australia — *Wildlife Conservation Act 1950*

However, no bryophytes have been listed under any of these Acts, and the conservation status of bryophytes in these states and territories has not been assessed.

Recent developments

The first draft of a list of rare or threatened liverworts and hornworts in Australia is well advanced. The list will be circulated to interested bryologists for comment before the Australasian Bryological Workshop in Tasmania in December 2007. We hope that the final list will include both national and state/territory conservation status. The preparation of a similar list for mosses will be discussed at the Workshop.

David Meagher, MELU

Brazil

In 2005 Dr. Denise Pinheiro da Costa and three other Brazilian bryologists (Dr. Olga Yano the coordinator, Dr. Kátia Cavalcanti Porto and Msc. Denilson Peralta) were involved in the Brazilian red listing of plants (including 17 bryophytes). However, this list is not yet official by the environment Brazilian Ministry. In this list a total of 1500 plants were indicated by the 40 taxonomists present in the workshop.

In 2006 Denise with three Brazilian bryologists (Dr. Olga Yano, Dra. Kátia Cavalcanti Pôrto and Nivea Dias dos Santos) was involved in the coordination of the revision of the red list from Minas Gerais. Until now the BIODIVERSITAS has finished the work and the result will be published on the web in 2007 (26 bryophytes are included in this list).

Denise and two students have also published a similar evaluation from Rio de Janeiro state (155 spp are considered threatened in the state). See also da Costa *et al.* (2005).

Recently seven Brazilian bryologists (Denise Pinheiro da Costa, Kátia Cavalcanti Pôrto, Anna Luiza Ilkiu-Borges, Andréa Luizi-Ponzo, Paulo Eduardo Aguiar Saravia Câmara, Cid José Passos Bastos, Silvana Vilas Boas-Bastos) and Steven Churchill begun to work on a Guide to Brazilian mosses and they hope to finish this work in 2009. This will help the Brazilian

bryologists to better evaluate the conservation status of the Brazilian mosses.

Canada

René Belland reports that the COSEWIC, the Canadian committee charged with assessing status of species at the national level, is still actively listing mosses for legal protection. In the two years 2005-06, six mosses were assessed and listed by this national committee. You can view details of all the species at http://www.cosewic.gc.ca/eng/sct1/searchform_e.cfm (just search for mosses in the taxonomic group box). Also visit: http://www.speciesatrisk.gc.ca/default_e.cfm The province of Newfoundland and Labrador also has an endangered species program (<http://www.releases.gov.nl.ca/releases/2006/env/1218n03.htm>) and listed *Bryum porsildii* in late 2006. *B. porsildii* now receives legal protection in that province. The province of Alberta also had a status report produced for *Bryum porsildii*, but assessment has been delayed because of changes in the government committee.

A new volunteer organization was started in Alberta called **Adopt-A-Plant Alberta**. The goal of this organization is to train volunteers to search for rare plants in the province and gather the data needed for writing status reports on the species. The volunteers "adopt" plants from a pre-determined list, and experts train the volunteers on the species' habitat, morphology, taxonomy etc. Year 2006 was the inaugural year for the program and had 33 keen volunteers join. They were able to locate numerous sites for rare species. Preparations are underway for the 2007 season.

Czech Republic

The latest version of the Red List of Czech republic (Kučera & Váňa 2005) used the latest IUCN category system (Kučera & Váňa 2005).

In 2007, the Czech Agency for the conservation of nature will initiate a monitoring programme of some critically endangered species of bryophytes. Projects of monitoring of some species (for example *Meesia triquetra*, *Paludella squarrosa*, *Oxymitra incrassata*, *Mannia triandra* etc are being prepared and reviewed, and monitoring intensity will be dependent on the amount of money available.

The Agency also prepared the first report according to Article 17 of 92/43/EHS (from 21.5.1992), it should be reviewed in early May 2007 and 6 bryophytes are included: *Buxbaumia viridis*, *Dicranum viride*, *Hamatocaulis vernicosus*, *Mannia triandra*, *Leucobryum glaucum* and *Sphagnum* ssp. (the last two are from our point of view not threatened, but the European Commission asked for it). Jiri Váňa was asked by the vice-director to review this report.

Europe (ECCB, Lars Söderström)

ECCB (European Committee for Conservation of Bryophytes) has this last year concentrated its work on updating the Red List of hepatics. First, an updated checklist for Europe and Macaronesia with all new Red List treatments in different countries is ready and will be published this year. ECCB has also organized a workshop on Red Listing of Hepatics in Uppsala. There a number of specialists worked actively with evaluating many species. The evaluation for the species treated so far can be found on www.bio.nt.ntnu.no/ECCB/. However, a number of species remains to evaluate.

Less work has been done for mosses, but a European checklist is published (Hill *et al.* 2006). This will form the basis for Red List evaluation of the mosses.

There are seven new national Red Lists published the last 5 years, all with the new IUCN Categories. This is for Luxembourg (Werner 2003), for Switzerland (Schnyder *et al.* 2004), Serbia and Montenegro (Sabovljević *et al.* 2004), the Czech Republic (Kučera & Váňa 2005), Sweden (Gärdenfors 2005) and Norway (Kålås *et al.* 2006). They, together with earlier published ones, form a solid base for our work.

ECCB will have its next conference in Cluj, Romania, September 2007, in connection with the Planta Europa conference. There issues of bryophyte conservation will be discussed, with a focus on South-eastern Europe.

The work in Europe has during the last two years been successful with implementation of the habitat directive of European Union, which include a number of rare bryophyte taxa as well as habitats important for bryophytes. The work of the Natura 2000 network of protected sites is proceeding.

Germany (Hessen)

Uwe Drehwald report from southern Germany (Hessen) that he has mapped a number of bryophytes and lichens in numerous block fields and rocks in contribution to the Natura 2000 Program. He has also been walking through many forests looking for *Dicranum viride* and he has installed many permanent plots for long term studies. For this year some block fields are still left to assess (Meissner and others) and for autumn he has the *Notothylas* in the Vogelsberg on his program.

Japan

Revised red list of Japanese bryophytes has been much progressed by five bryologists, Z. Iwatsuki, H. Kanda, and M. Higuchi for mosses, and T. Furuki and J. Hasegawa for liverworts. We made a data base of the specimens of endangered species located in major herbaria in Japan, such as The Hattori Botanical Laboratory, Hiroshima University, National Science Museum, Tsukuba, etc. Total number of specimens in this data base are some 8000. Considerable revision will be made in our new red list which will be open by the summer of 2007.

New information on endangered species of bryophytes were reported in *Bryological Research* published by the Bryological Society of Japan.

Information reported in 2006 includes *Clastobryopsis robusta*, *Leptodontium pergemascens*, *Luisierella barbula*, *Oedipodium griffithianum*, *Podperaea krylovii*, *Symphiodon perrottetii*, *Syrrophodon yakushimensis*, *Taxiphyloopsis iwatsukii*, *Zygodon viridissimus* var. *rupestris*, and *Radula chinensis*.

Kenya

Min Chuah-Petiot is in the process of creating a bryological laboratory, a working laboratory where all her publications, reprints, papers on bryological interests will be arranged properly, specimens will be kept there with laboratory equipment including a compound and dissecting microscope, so that students, staff and visitors can have a working space with all the specimens and literature are close at hand.

New Zealand

Dr Allan Fife report from New Zealand that this area is arguably the most important "hotspot" of liverwort diversity in the world when considered from the perspectives of species density, degree of endemism, and the presence of a strong archaic element in the flora. New Zealand has more species than the whole of Europe, and has the highest density of species for any country for which a recent checklist is available (Glenny & Fife 2005).

New Zealand Dept. of Conservation has just published (both on line and in hard copy) a list of Threatened species (including both mosses and hepatics) in New Zealand. Twenty-one species of mosses are listed there in the highest threat category ("nationally critical"). The list attempts to be all-inclusive because it is based on DOC's precautionary approach to species conservation. Hence there are a large number of undescribed liverworts, particularly in the Data Deficient category. The list, as a result, also indicates priorities for taxonomic research.

The threat categories and their criteria are explained in detail in Molloy *et al.* (2002). The criteria are in two parts: status (current numbers and numbers of separate populations) and trend (decline in the last 100 years and predicted decline in the next 10 years). The categories that have bryophytes assigned to them are briefly described below.

Nationally critical: very small population or a very high predicted decline.

Nationally endangered: small populations and moderate to high recent or predicted decline.

Nationally vulnerable: small to moderate population and moderate decline.

Sparse: naturally or unnaturally rare and not restricted to a small geographical area.

Range restricted: naturally or unnaturally rare, restricted to a small geographic area, a very specific habitat or substrate.

Data deficient: species for which information is too poor to assign them to one of the categories above.

No New Zealand bryophytes have been assigned to the "extinct" category. Although a few bryophyte species (e.g., *Bartramia alaris* or *Isotachis westlandica*) have not been observed for many decades it is difficult to be certain of their absence. This is particularly so when the localities and habitats of early collections are poorly documented or where the original collections are from areas that have received little subsequent bryological attention.

The most subjective part of the assessment for a species is estimating past and future decline, since collections of rare species are too infrequent to allow the documentation of a progressive loss of habitat.

The habitats where losses have been greatest are lowland forests, particularly in Northland and the eastern North and South Islands. There are few liverwort collections from these habitats and estimations of decline of species confined to these habitats must be made on the basis of the known decline of the habitat itself.

There are species on the list which are rare in New Zealand but common outside of New Zealand, for example *Dumortiera hirsuta* and *Goniomitrium acuminatum*, and these have a qualifier "Secure Overseas" added. There is some uncertainty whether to add this qualifier to some species shared with Australia or other regions. For example, is *Brevianthus flavus* "secure" in Tasmania? It is not listed in Scott (1997). Is *Erpodium glaucum* "secure" in any portion of its widely scattered range? Stone (1997) recorded single localities in both N. S. W. and Queensland as well as occurrences in Argentina, Brazil, Mexico, and Sri Lanka. Is *Macromitrium angulatum* "secure" in Samoa (see Vitt and Ramsay, 1985, p. 411)? We are unable to answer these questions.

It became apparent at the 2004 meeting that considerable effort has gone into searching for most of the species on the list in the last 10 or so years. This effort has confirmed in some cases (particularly in the case of mosses) that the species are indeed rare, while in other cases, more localities have been found and the threat category can be set more accurately. Where the threat category is least likely to be correct is for species that have been recently described or recently found in New Zealand. A good example of the latter is the hepatic *Mnioloma fuscum*, found first in New Zealand in 2003 (Renner, 2003) and now known from three widely spread localities (Fiordland, central Westland, Coromandel Peninsula). It is rated as Sparse, but further searching is likely to result in the species being deleted from the list.

There were relatively few changes to the moss list (10 were added and 12 deleted), while there were 75 additions and 14 deletions from the liverwort list. This reflects a much better knowledge of the mosses than the liverworts, but it has to be admitted, there is a difference in attitude among the bryologists. The muscologists are disinclined to admit a species to the

list unless reasonably sure of its rarity, while the hepaticologists take the precautionary approach more seriously and put any species on the list that on current evidence are rare, but are likely to turn out to be merely uncommon.

The function of this list needs to be made clear. In contrast to the situation in Australia and the United States, these listed species and varieties do not have any legal protection. The list is equivalent to the Australian State threatened plant lists. The function of the list is to help DOC manage threatened species on the conservation estate that it administers, and to advocate their protection on other land. DOC has a mandate to advocate conservation on all land in New Zealand. Whenever permission is sought to develop land under the Resource Management Act (RMA), if there is any threat to conservation interests, DOC makes submissions to a regional council, and if the development is opposed, to the Environment Court. The presence of a species on the threatened plant list ensures that it won't be overlooked by DOC staff preparing RMA submissions, or by anyone proposing or opposing a development on the land.

Panama and Central America

Dr. Noris Salazar Allen and bryologists from **Central America and the Caribbean** are submitting a proposal to the Secretariat of Science and Technology (SENACYT) of Panama to hold a meeting of CA and Caribbean bryologists to work on the list of bryophytes of the region and elaborate the first red list of bryophytes and their endangered habitats.

Activities developed by Dr **Noris Salazar Allen** during the last years, include her teaching of a one-week seminar on bryophytes at the Museum of Natural History in San Salvador, El Salvador. Personnel from herbaria in El Salvador (ITIC, LAGU), Nicaragua (ULE) and Guatemala (BIGU) attended as well as personnel from the Ministry of the Environment and professors of the University of El Salvador. There were two field trips related to this seminar. The first one was to collect samples for the seminar. The second, to botanize in Parque Nacional Montecristo (750-1000 m). The seminar was financed by the NORAD project, to develop expertise and infrastructure for Central American herbaria. The grant for this project came from the Norwegian government.

A second project developed after a seminar that took place in Guatemala under the sponsorship of the NORAD project. The project aim was to gather all information on the mosses of Guatemala. This was a joint project with the Universidad del Valle de Guatemala and the University of San Carlos. Two publications have appeared in the book *Biodiversidad de Guatemala*, Vol. 1. These are: *Introducción a las briofitas de Guatemala* (Virginia Freire & Noris Salazar Allen) and *Aporte al catálogo de musgos de Guatemala* (Noris Salazar Allen, José E. De Gracia & Clementina Chung). Five hundred and eighty species are reported with their synonyms, sexual condition,

bibliographic references and distribution in Guatemala and worldwide. A catalogue of the Types is also provided with their protologue, synonyms and herbaria in which they are deposited. For each family the number of genera, species and infraspecific taxa are given in parenthesis besides the name.

A third project involves the incorporation of the databases on bryophytes and lichens in the Web site of the University of Panama. This is the first herbarium in Central America that includes bryophytes in its Web site. This project is a joint effort by NORAD, the University of Panama and the Smithsonian Tropical Research Institute. Liverwort and lichen databases are complete but the moss part is still under construction since digitalization of the herbarium has not been completed.

In February 5-9 (2007) Noris Salazar attended the First Congress on the Biodiversity of Western Panama sponsored by the Autonomous University of Chiriquí (UNACHI). Noris presented a talk on the "Diversity of the bryophyte flora of Panama, a preliminary report". Also one of her students presented jointly with Noris a poster on the diversity of lichens in Western Panama. She also made some botanizing during the last days of the symposium and collecting *Dumortiera* with one of her undergraduate students who is working on the morphology and distribution of species of *Dumortiera* in Panama. She is in conversations with Mgstr. Clotilde Arrocha, the resident bryologist in Chiriquí, to develop joint projects.

From the 5-7 of March (2007), Noris participated in a workshop for park rangers of Campana National Park. There were two days of conferences and one day of field trip. She was in charge of the bryophytes and lichens sections of the workshop. This is the **second** group of rangers that receive training on bryophytes and lichens of any park in Panama. This is also the second workshop given to park rangers of Campana National Park. In 1996 there was a joint project with vascular plant professors of the University of Panama (Prof. Mireya Correa and Claudia de Peralta) to make a field guide for a nature trail and the Park. This project was financed by the Women's Committee of the Smithsonian Institution. This is the first field guide for any park in Panama that has bryophytes as one of its major components.

Russia

Dr Nadya A. Konstantinova reports from Russia that the 61 threatened bryophyte species were included in the list of species protected in Russia by law. The list was confirmed by Russian Government in October 2006. The data sheets of 61 bryophytes for Red Data Book of Russia were prepared by a group of bryologists. The Red Data Book of Russia should be published 2007. A number Red Data Books for different Republics and Provinces of Russia were published in the last 2 years particularly a Red Data Book of Lipetsk Province, Red Data Book of Belgorodskaya Province, Red Data Book of Tatarstan

Republic, Red Data Book of Volgograd Province, Red Data Book of Kamchatka Peninsula, Red Data Book of Krasnoyarskii Krai, Red Data Book of Nenetskiy Autonomous Okrug (Archangelsk Province). All of them were included Bryophytes. The new edition of Red Data Book of Komi Republic and Red Data Book of Kareliya are now in preparation, as well as first edition of Red Data Book of Krasnodarskiy Krai. There is some progress in the study of the bryophyte flora of Strict Nature Reserves of Russia. At the beginning of 2005 "The present-day state of Biological Diversity within protected areas. Issue 3. Lichens and Bryophytes (2004)" was published. It includes 2 species of Anthocerotae and 325 species of Hepatics reported from 46 Nature Reserves of Russia (Konstantinova, 2004) as well as 907 species of Mosses reported from 63 Strict Nature Reserves (Ignatov & Ignatova, 2004). After publication of this list annotated lists of hepatics were prepared for Strict Nature Reserves "Kerzhenskii" (Middle of European part of Russia), "Bol'shaya Kokshaga" (Middle of European part of Russia), "Volzhsko-Kamskii" (Middle of European part of Russia), "Visherskii" (Urals), Basegi (Urals), "Komandorskii" (Far East). Some bryologically interesting areas in Murmansk Province were studied and proposed for protection. Description and other necessary papers were forwarded to the authorities of Murmansk Province. See also Konstantinova (2002).

Sweden

During the last three years the conservation efforts in Sweden involving bryophytes have mainly been focused on four projects: New Red List, Natura 2000, Species Action Plans and field studies.

The latest Swedish Red List (Gärdenfors 2005; www.artdata.slu.se) classified 216 out of the 1000 known Swedish bryophyte species as Red Listed. Fourteen of the Red Listed species are included in EU Habitat and Species directive. The Natura 2000 network includes not only protection of a great number of sites, but also a baseline survey. The aim of this survey is to check the current status of the species on the EU Directive inside the Natura 2000 network. The work is quite laborious and includes, first of all, estimating the respective population sizes of the annex 2 species, as well as the occurrence of two kinds of other species: so called 'Typical' species and 'Character' species for the listed habitats. These two categories are often good indicators of a high habitat quality. The main conservation goal with this work is that all listed species should regain a favourable population size, a size that indicate a long-term viability of the species, at least recover to the size of the population when the Directive came in into force. This survey includes 382 sites scattered all over Sweden.

Thirdly the Swedish Environmental Protection Agency has requested a number of National Species Action Plans to meet the environmental quality objectives defined and stated by the Swedish government. The following species will receive a National Species Action

Plan: *Bryhnia novae-angliae*, *Dichelyma capillaceum* (already published: Wetterin 2004), *Dicranum viride*, *Hookeria lucens*, *Pterogonium gracile*, *Scapania massalongi*, *Scapania apiculata* and *Scapania glaucocephala*.

Fieldwork is needed in order to improve our knowledge of current trends better and actual status of the flora. Specifically more precise monitoring of population sizes and fertility is slowly being built up, not only for the annex 2 species, but also for less threatened taxa. Also skilled amateurs participate in this work. They frequently report their findings to the Species Information Centre, thereby contributing useful site information. Since 2006, this can be done through the Internet. Up till now c. 13,000 findings of bryophytes have been reported directly to the web site called ArtPortalen (www.artportalen.slu.se). A longer review of current conservation work in Sweden can be found in Hallingbäck 2007, as well as in Hylander & Jonsson 2007.

United Kingdom

Ron Porley is currently writing up his *Didymodon glaucus* work for Field Bryology, which serves an example where conservation action is directed at a specific bryophyte (some details already published in Bol. Soc. Esp. Briol. 26-27: 55-58 (2005)). Another currently active project in the UK is translocation of *Leptodontium gemmascens* and *Bryum schleicheri* (see Field Bryology 90). Other work includes the 3-yr Survey of Bryophytes of Arable Land project which is currently being written up, and Ron Porley is producing a 'popular' arable bryophyte booklet to complement the more technical papers. Also important in UK work is the *ex situ* project based at Kew (Margaret Ramsay *et al.*) although this has temporarily been suspended because of funding issues. The CBD (what is the CBD?) has also focused the UK government on producing Biodiversity Action Plans and as a result we have found resources to assess the status of many of our rarest and elusive species. The last BAP review has recommended the addition of many more bryophytes to this programme (essentially adopting the new Red List as the BAP list) - how we can increase our work output however to take on even more species is a challenge: the rarity of competent bryologists to do all that is needed is an issue. Much progress is also being made to incorporate bryophyte monitoring in Natura 2000 sites and our own SSSIs, and over the years Ron Porley has been developing the use of microchips, GPS & digital images to monitor a selection of rare bryophytes such as *Zygodon forsteri* and *Orthodontium gracile*. These are all very positive developments/results of work directed towards bryophyte conservation work in the UK.

Margaret Ramsay reports that the second phase of the *ex situ* bryophyte project came to an end in December 2006. The steering group of the UK conservation agencies and RBG-Kew submitted a proposal to

continue the work for a further 3 years but unfortunately funding is very tight at present. Both Natural England and Kew receive a large proportion of our funding from the government department DEFRA which has made substantial cuts. Our cryopreservation specialist also left in the summer and we have been unable to recruit this post.

However the good news is that overall the *ex situ* project has been a great success thanks to the work of Bryophyte Conservation Officers Dr Jane Burch and Dr Jennifer Rowntree. It has certainly raised the profile of bryophytes, particularly to garden visitors. Novel techniques for initiation and growth in aseptic culture have been developed and 22 species, most of high conservation concern, are now stored in cryopreservation and will continue to be maintained in storage. DNA from all cultures has been extracted and stored in Kew's DNA bank. Voucher specimens of the *ex situ* collection are now stored at the Herbarium of the National Museum of Wales

Several scientific papers in respected journals have been published outlining the methods developed for aseptic culture and cryopreservation (Burch & Wilkinson 2002, Burch 2003, Sarasan *et al.* 2006, Rowntree 2006). Further papers on the effect of cryopreservation on tissue and on molecular fingerprinting of *Orthodontium gracile* have been submitted in preparation. In terms of more general literature, a Kew information sheet was prepared http://www.kew.org/ksheets/pdfs/k32_bryo.pdf and there is information on the BBS site <http://rbg-web2.rbge.org.uk/bbs/Learning/exsitu/exsitu.htm>

A second reintroduction trial of *Orthodontium gracile* did not take place as planned. Cryopreserved material was transferred to sandstone chips and moved to glasshouse and then to a cold frame when conditions proved too hot. Prior to introduction, the chips were examined and it was found that other bryophyte species have established (from spore or fragments in rain) and so it was decided it would not be good practice to place these mixed colonies at Wakehurst Place. Instead the weaning and suggested reintroduction methods are to be written up.

In regard to the future of *ex situ* bryophyte conservation, there is still much to be done in expanding the number of species that are stored in cryopreservation (most species worked on are mosses, thallose liverworts have not been studied) and attempting some more reintroduction trials. I recently reported back on progress for the Global Strategy for Plant Conservation and the European Plant Conservation Strategy. Although we do have species of European conservation concern in our collections, this is because they are present in the UK. I would have liked to include species of European importance that are not necessarily of UK origin and had hoped that potential candidates for inclusion in *ex situ* conservation could be highlighted through the red listing process. Obviously we cannot do that at present

but would wish to make that a component of any future work.

USA

Dr. Nat Cleavitt (USA) has sent out email surveys to both Heritage botanists and bryologists in US. The replies have been compiled and can be found at <http://www.fingerlakesnativeplantsociety.org/>. Nat Cleavitt has also set up a space on the local Native Plant Society website to allow exchange on bryophyte conservation issues and to make common names available. Common names were one of the main requests from the Heritage Offices in the US. They feel common names help to make the bryophytes more accessible and endearing to the general public. Nat Cleavitt has also been working with Nancy Slack and Sue Williams on revising the rare moss list for NY State. They presented a poster on this at the NY Natural History conference in April 2006. They plan to submit an *Evansia* article soon wherein they summarize this work, but also make a request for bryophyte nominations for the IUCN world list.

Venezuela

The bryology group lead by Dr Yelitza León Vargas in Mérida Botanical Garden started an educational campaign in 2004 to preserve bryophyte diversity. She collaborated with the environmental Direction of the State and many other organizations as (State government, City mayor office, National Park office etc). That year they accomplished a National governmental law that prohibits the extraction of bryophytes for a year. They also continued with a new effort in 2005 and 2006 and this law was extended for three years. The bryologists produced educational material that was distributed for free and raised a team of environmental educators to spread the message in páramo towns and villages. They associated the idea of bryophyte preservation to water conservation, so the case that bryophytes affects rural populations got attention.

In 2007 there are several research projects on cloud forest and páramo bryophytes growth (monitoring) together with the Environmental Direction of the State, survey of páramo ecosystems and páramos wetland bryophyte communities. In addition they are doing research in vitro culturing of bryophytes (mosses) to study germination patterns and requirements and in vitro asexual propagation of some species of mosses (*Neckera*, *Pterobryon*, *Calyptothecium*, *Hypopterygium*, *Cryphaea* and *Schoenobryum*). They continue to show the government officials the need of an extended conservation effort.

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RESEARCH NEWS

The interactions of bryophytes with pathogens

Until some years ago it seemed that pathogens do not matter to populations of bryophytes, although a variety of bryophytes prefer habitats which facilitate the infection and growth of pathogens on plants. This outlook is changing based on the detection of

bryophyte-pathogenic micro-organisms. (e.g. for fungi reviewed by Davey and Currah, 2006). By now it is known that all typical classes of pathogens (viruses, bacteria, protista, fungi) are able to infect bryophytes. Because of these findings the question arises, how do bryophytes defend against pathogens. In this regard,

one must bear in mind that the structural defence of bryophytes is in comparison to tracheophytes less evolved. Hence, the multiplicity of highly effective chemical compounds of bryophytes, which are particularly highly effective in an antimicrobial, antifungal and antiviral manner, are reckoned as important parts of the pathogen defence in bryophytes.

An important question is: are biologically active substances in bryophytes synthesised before and independent of an infection (Phytoanticipine) and part of the preformed plant defence or are substances synthesised in succession to a pathogen attack (Phytoalexine). In the latter the case, it is necessary that the plant has several mechanisms to discern a pathogen specifically and to convey information? An established concept characterising the interaction of plant resistance-genes (R-genes) and so called avirulence-genes (Avr-genes) of the pathogen is the gene-for-gene hypothesis (Flor, 1942; description in principle of involved processes in Ellis *et al.*, 2000). In *Physcomitrella patens*, genes have been identified with a degree of homology to an R-Gene in *Arabidopsis thaliana* and these proteins have presumably comparable functions in *P. patens* (Akita and Valkonen, 2002)

The hitherto identified pathogens bring about dying of the infected cells and subsist on dead cellular material. So such pathogens are called necrotrophic. In tracheophytes, the resistance to a broad spectrum of pathogens increases in succession of an infection with a necrotrophic pathogen accompanied by the expression of specific genes (e.g. pathogenesis-related, PR-genes) and in most cases to an accumulation of salicylic acid (SA). Likewise, in *P. patens* a PR-1-gene homologue has been detected and cloned and the influence of salicylic acid on the progress of infection was proven. (Andersson *et al.* 2005)

Reactive oxygen species (ROS) are known for bryophytes to play a role in stress-response, for example in drought or heavy metal stress. Contingently, ROS are of extreme importance for effective pathogen-defence as in "higher" plants. Also programmed cell-death programmes are important to defend pathogens.

It seems that the processes are comparable in pathogen-defence and resistance in bryophytes and angiosperms. Nevertheless, the story is as yet far from clear. It will be essential to identify more, above all biographic, pathogens of bryophytes and to compare the mode of infection and response to the attack with the angiosperm plants. Furthermore, most cognition is achieved on the basis of *P. patens*; what the situation is in other mosses, in liverworts and hornworts, is still in the dark. Additional genes have to be identified, especially in regard to signal-transductions, which

relay the transduction starting in pathogen recognition to defence.

Much has been described about the morphological and cytological aspect of pathogens with flowering plants; a current study accomplished by me about the interaction of several bryophytes with the pathogen *Botrytis cinerea* can yield comparison aspects concerning this matter and will hopefully result in increased knowledge of host-specificity in these pathosystems. This might be the basis for further research on this topic.

New insights about the processes occurring in the course of host-pathogen-interaction are relevant for urological ecology and consequent phenomena. The ecological importance of the rate of absorption of radiofrequency (SAR) is known for higher plants (e.g. Heil 1999). Is SAR ascertainable in bryophytes or are statements possible about the effectiveness of resistance and defence mechanisms? This might help to clear up a multiplicity of ecological problems.

Mosses are early land plants; this makes it possible to study the evolution of host-pathogen interaction. The last, but also important, point is that in the case of commensurability of pathogen defence in bryophytes and "higher plants", the bryophytes present advantages as biochemical and molecular-biological model-organisms (above all *Physcomitrella patens* and *Ceratodon purpureus*; see Schäfer and Zryt), which are currently already used for developmental and metabolic physiological studies to clarify signal cascades and biochemical, molecular- and cell biological processes regarding host-pathogen interactions. This might be of importance also for plant breeding research and give bryological research a new applied aspect.

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UPCOMING MEETINGS

2008

February 28 – March 2: Workshop Red list of bryophytes of East, South and Southeast Asia. Singapore Botanical Gardens. Contact: Tomas.Hallingback@ArtData.slu.se

March 15-18: The Physcomitrella Genome Workshop. Freiburg, Germany. Information at: physco-workshop@uhura.biologie.uni-freiburg.de.

April 10-11: Environmental changes in Biological assessment. Ostrava, Czech Republic. Contact Vita Plasek at vitezslav.plasek@osu.cz

May 15-18: Crum Bryological Workshop. Northeastern Vermont, USA. Info: Dorothy Allard at dallard@aol.com.

August 15-18: MOSS 2008. Tampere, Finland. In conjunction with the XVIth Congress of Federation of European Societies of Plant Biology (FESB2008). [FESPB meeting](#)